MILK INSUFFICIENCY IN ESMERALDAS, ECUADOR:

A MULTIDISCIPLINARY APPROACH

by

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ABSTRACT

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Adviser: Professor Sara Stinson

Perceived milk insufficiency, a widespread breastfeeding problem, affects women of many cultures, social strata, ages, and stages of lactation. The literature shows an association between maternal perceptions of insufficient milk supply and low breastfeeding confidence, maternal anxiety, family advice and professional advice. Milk insufficiency can trigger a chain of events that ends in early weaning, early supplementation, and infant obesity.

This study combined biological and cultural anthropology, test-weighing, creamatocrit analysis, anthropometry, and ethnographic observations; these disparate strategies facilitated an investigation of how cultural and biological factors interact with breastfeeding behavior. This longitudinal study was carried out among 72 Esmeraldan mother-infants pairs during 1998-1999, with a second component in 2001.

Beginning in March 1999, Ecuador underwent an economic crisis with massive inflation, political turmoil and most industry brought to a virtual standstill for months. This crisis created severe hardships for the people of Esmeradas city, leading to widespread despair and anxiety among the participating mothers of this research, with negative consequences for breastfeeding. Reports of milk insufficiency increased during the economic crisis. In other words, severe financial stress was associated with greater prevalence of breastfeeding difficulty.

One goal of this research was to learn whether reports of milk insufficiency correlated with measured levels of milk production. Behavioral variables affected milk production. Results also showed that mothers who complained of milk insufficiency produced less milk than mothers who did not complain of this problem. There were no significant relationships between biological variables such as age, parity, body mass index (BMI) and milk production.

With this research, I have developed methods and theory to understand the milk insufficiency question. By integrating biological and ethnographic methods, this study contributes to multidisciplinary approaches to lactation. I hope that the results of this research will be useful to health professionals in Esmeraldas and elsewhere who work with new mothers and their infants.

DEDICACIÓN

Esta tesis esta dedicada a la memoria de mi padre Gonzalo E. Herrera
21 de junio 1928 -19 de enero 2000

Mi Padre	**My Father**
La memoria de mi padre -esta dentro de mí- Envuelta en papel blanco, como de esos que se envuelve un sanduche antes de ir a la escuela,	The memory of my father is wrapped up in white paper, like sandwiches taken for a day at work,
El era como un mago que saca conejos de su sombrero…El emanaba amor de su pequeño cuerpo,	Just as a magician takes towers and rabbits out of his hat, he drew love from his small body,
Y los ríos de sus manos inundaban con buenos deseos todo lo que el tocaba.	And the rivers of his hands overflowed with good deeds.

Yehuda Amichai (1924-2000). Translated from the Hebrew to the English by Azila T. Reisenberger (1997), and from the English to the Spanish by Milton Herrera (2008).

A mi madre, Lilia Sánchez que tuvo tantos hijos que no se acuerda cuanto dio de lactar a cado uno de nosotros. Ella siempre atenta de cómo me iba con mis esfuerzos académicos, ella siempre presente.

A mi hijo, Conrad Gerónimo Herrera-Chamberlain, sol de mi vida.

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Segundo, quiero agradecer en especial a las asistentes del proyecto; Lorena Ballesteros, Jessica Castillo, Silvia Charcopa, María Meza, Jenny Micolta, Maira Montaño, Rosita Proaño, Silvia Quinto y Esiva Vernaza, por su trabajo, interés, esfuerzo y cooperación con el proyecto. A los señores taxistas Robert Gonclavez (*Hey Robert…algún día nos iremos juntos a la mar en un barco*), Pedro Mojarango y Alberto Pinargote. Y por ultimo quisiera agradecer en especial a Johanna Rodríguez que a más de ser una excelente asistente ella es una visionaria que a contribuido enormemente con esta investigación (*que suerte que nos encontramos*).

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All these years many people have asked me why I quit medicine (the most pure of the professions), and I said to them that I never quit medicine. While I do not work at a hospital or clinic, I have always worked on health issues in the field with people. I also tell them that I do research rather than have patients. Moreover, I think that on a meta-level all sciences are congruent and converge to answer the big questions of life – about existence, survival and change. In the end, all scientific disciplines are just a philosophical exercise of our brains, always trying to explain phenomena, really trying to explain ourselves. This philosophical exercise can become a life long journey, a journey like the one recounted in Cavafy's poem about the mythical journey to Ithaca, and that is what has happened to me.

ITHACA

When you start on your journey to Ithaca,
then pray that the road is long,
full of adventure, full of knowledge.
Do not fear the Lestrygonians
and the Cyclopes and the angry Poseidon.
You will never meet such as these on your path,
if your thoughts remain lofty, if a fine
emotion touches your body and your spirit.
You will never meet the Lestrygonians,
the Cyclopes and the fierce Poseidon,
if you do not carry them within your soul,
if your soul does not raise them up before you.

Always keep Ithaca fixed in your mind.
To arrive there is your ultimate goal.
But do not hurry the voyage at all.
It is better to let it last for long years;
and even to anchor at the isle when you are old,
rich with all that you have gained on the way,
not expecting that Ithaca will offer you riches.

Ithaca has given you the beautiful voyage.

C.P. Cavafy (translated by Rae Dalven 1961)

I did meet the Cyclopes, Lestrygonians, and even the angry Poseidon a few times during this trip; if you think that you are one of them, you may be; thank you for making my trip richer. At the CUNY Graduate Center, I shared the corridors with many people, whether at the old building on 42nd Street or at the new building on Fifth Avenue, that made my student life more enjoyable. I would like to say to each one of you, it was a real pleasure to meet you: Leon Aredondo, Hugo Benavidez, Linda Brown, Ana Bueno, Alcira Forero, Karen Frojen, Reiko Matsuda, Maureen O'Dougherty, Arthur Rostoker, Ligia Simonian, Arhonto Terzi, Patricia Tovar, and Rosamel Villamar. There were many other friends here in the streets of New York and outside of New York that gave me company many times, and some of them helped me with this work, even if just a little bit by asking me when I was going to finish with this dissertation; and with some we just drank wine. Thank you, Konrad Aeschbacher (*who I met in the same ship to Ithaca*), Angelo Cobo, Nora Cobo, Lucho Carrera, Milton Gross, Stephan Mischler (help me with some photos), Sebastian Perret, Barbara Price, Rafael del Rosario, and my dear brother and friend Claudio Herrera. I also thank the rest of my family, especially my late father Gonzalo Herrera and my mother Lilia Sánchez who is still with me, always asking me how I am doing with this exam or that exam at the school, and when am I going to finish with this dissertation. Also, in memory of her young life to my beautiful niece Carolina Herrera, I will always have her in my heart. And to my big sister, Rocio Herrera, my tremendous gratitude for her faith in me and her emotional support.

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At City College, I want to thank the students and staff of the Sophie Davies School of Biomedical Education, especially Professor Joao Nunes, Chair of the Behavioral Medicine Department, and Professor George Brandon, for their kind collegiality and generous hospitality. It was wonderful to be there many Saturdays and Sundays working at Harris Hall while the afternoon was touching the grass and the sunlight was enjoying Shepard Hall. It took me two years to sort out and analyze all of the data that I brought from the field. When I reached the point that I could not go further without the assistance of a statistician, again, lucky me, I found Hamidat Abdul-Wahab at City College – I want to give her my deepest thanks for her professionalism and seriousness helping me with the data analysis. In addition, I want to thank Desmond Fonji for his help with gadgets, scanning and photos. Also, thanks to Jay Guevarra, Helen Huang and Eduardo Morales who helped me with the bibliography.

I was privileged to receive many grants during my graduate career. During my school years completing course work, I had grants of support from the CUNY Graduate Center and from the Organization of American Sates (OAS, or OEA in Spanish) and The Leo S. Rowe Fund. The research in Ecuador in 1998-1999 was supported by grants from the National Science Foundation and the Pan-American Health Organization (PAHO/WHO). Back in New York, I was again lucky to receive a dissertation writing award from The Ralph Bunche Dissertation Fellowship at the CUNY Graduate Center.

In academia, I have also been lucky to meet the right people at the right time, and doubly lucky that they agreed to be on my dissertation committee. First, I want to give my greatest gratitude or, as we say in Ecuador, *muchas gracias* (many thanks) to Professor Sara Stinson, my first professor of human biology and then my dissertation advisor. She read everything that I wrote many times. Her advice always pushed me to the highest academic standards. My gratitude also goes to Professor Shirley Lindenbaum, for believing in me. She was my first inspiration to get into medical anthropology. She brought me from the New School for Social Research to the CUNY Graduate Center and she gave me generous theoretical advice on this project as well. And to Professor Marc Edelman, who very kindly became part of my committee at the last minute, and who gave me much kind and good advice, and it was a real pleasure to have him on my committee. I am grateful to have had the privilege to have Professor Peter E. Ellison from Harvard University as my outside reader.

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At this point, I also want to thank two other original members of my "second exam" advisory committee at the CUNY Graduate Center. First, to Professor Pat Bridges, a brilliant scholar of paleoanthropology, who was taken from us too soon. Second, thanks to Professor Warren DeBoer, from whom I learned first hand about fieldwork and anthropology during our "Santiago-Cayapas Rivers Research Project" in Ecuador. There were so many early evenings that became late nights sitting with a candle talking about life… Warren, Sara, Arthur and me… while in silence the Cayapas River was passing by… listening to us.

Also, in grateful memory of another great teacher, thanks to Professor Eric Wolf – I cannot convey how much I enjoyed his teachings, and how lucky I feel to have had him as one of my teachers. In the last talk that I heard from him (he was dressed all in black) about the future of anthropology, he said two things that stay in my mind; first that "Life is short," and second, about anthropology, that we have to look for the "unforeseen" – two simple statements, but coming from him they were very deep.

Last but never least, thanks to my beloved child Conrad, for understanding me when I had to work on my "book" and we could not go to the rings.

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LIST OF ABBREVIATIONS

AC:	Average Creamatocrit = %
ACTH:	Adrenocorticotropic hormone
AMPPAS:	Average Milk Produced Per Average-Session: Average of minutes suckling = g
AMS:	Average Minutes Suckling = minutes
BCS:	Breastmilk Consumption Structure
BF:	Breastfeeding or Breast Feeding
BL:	Blue Line
BM:	Breastmilk or Breast Milk
BMI:	Body Max Index
BMI:	Basic Metabolic Index
BS:	Breastfeeding Structure
C:	Creamatocrit = %
CDC:	Center for Disease Control
CRF:	Corticotropin-releasing Hormone
HA:	Height for Age
HC:	Height for
HPA:	Hypothalamus Pituitary Axis
LATCH:	Latch/Audible swallowing/nipple Time/Comfort level/How much help
LMM:	Linear Mixed Models
MIC:	Milk Insufficiency Complaint
MID:	Mean Intercession Duration = minutes
MMI:	Measured Milk Insufficiency
MPPM:	Milk Production Per Minute = g/minutes
MUAC:	Mid Upper Arm Circumference
NSS:	Number of Suckling Sessions = times
O:	Observation/ Observations I, II, III, IV, V, VI, VII
OL:	Onset Lactation =hours
SCPM:	Supplements Consumption Per Minute = g/minutes
TSD:	Total Suckling Duration = minutes
TSS:	Times of Suckling Sessions = times
12h:	Twelve Hours = 720 minutes
T-W:	Test Weighing = grams
TT-W:	Total Test Weighing = grams/minutes
(C#):	Case number
WA:	Weight for Age
WH:	Weight for Height

CHAPTER 1

INTRODUCTION

Breastfeeding is an important part of the human life cycle, requiring a complex, continuous interaction of behavior and physiology. Although breast milk has been "the sole source of infant nutrition" through human history and "historically and culturally most of the world's children have been breastfed *ad libitum*" (Dykes 2002:493; Minchin 1999:191), today, the phenomenon of mothers' milk insufficiency[1] has become a health threat to mothers and their infants. The problem of milk insufficiency is the primary focus of this dissertation. This problem affects the health future of the mother-infant dyad, the surrounding community, and thus entire populations.

Since Neolithic times, humans have changed their environment through the use of technology. Human populations have dramatically increased and endured many diseases, leading to three major epidemiological transitions, as Armelagos et al. (1996) grade them. The same authors argue that the emerging of new diseases influences those changes. Today we know that genes and the brain possess extraordinary structural and functional plasticity, allowing the environment and culture to exert influences on them (Li 2003). For Li, this modeling and remodeling, tuning and adaptation occur both throughout human phylogeny and individual ontogeny (life span) moment-to-moment through microgenesis.

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[1] A discussion of the theoretical distinctions between concepts of breast milk insufficiency as a cultural syndrome, mothers' perception, biomedical and/or research problem is included in the next chapter reviewing the literature on the phenomenon and outlining my own theoretical positions and approach.

Exploration of milk insufficiency requires an understanding of the processes, cultural as well as biological, in which breastfeeding operates and the implication of such a dynamic for our health. The main thrust of this thesis is to understand the dynamic interplay between culture and biology as they influence milk insufficiency. Plasticity is a feature of both culture and biology; we humans are constantly changing.

The significance of this research is therefore threefold: first, to contribute to understanding milk insufficiency and therefore, I hope, to help breastfeeding mothers learn more about the causes and sources of perceived milk insufficiency (especially mothers of the study population, who will be very much interested in the results of this research). Second, the biocultural model presented in this thesis as a combination of theory and methods, will hopefully contribute to the biocultural approach within anthropology. And third, this thesis constitutes an instance of a multidisciplinary approach, exploring the linkages among biology, culture and social problems.

THE MILK INSUFFICIENCY QUESTION

I define milk insufficiency as the mother's perception that she does not have enough milk for her infant at any moment during lactation. According to the literature, mothers see "frequent infant crying" as an indicator that the infant does not feel full. Mothers with milk insufficiency complain and believe that they are not producing enough milk to satisfy their babies' hunger (Dykes and William 1999; Kerr et al. 2007; Hewat and Ellis 1984; Hill and Aldag 1991; McCann and Bender 2005; Perez-Escamilla et al. 1992; Segura - Millan 1994; Tully and Dewey 1985).

Milk insufficiency is a major developmental problem because of its economic and health implications. Milk insufficiency is one of the major reasons that women stop breastfeeding prematurely (Bailey and Sherriff 1992; Cooke et al. 2003; Hailes and Wellard 2000; Stamp and Crowther 1995). It is important because the effects of breastfeeding problems on child health and survival are far greater in poor countries than in rich countries (UNICEF, WHO 1996, 1997). Early weaning is common in Latin America (Popkin et al. 1982).

Cunningham (1995:244-245) asserts that in Latin America alone there are more than 500,000 deaths annually from gastrointestinal infections in preschool children, because of the microbial contamination of water supply and feeding utensils. The author also cites respiratory illness, otitis media and bacterial meningitis as other diseases related to infants that are not breastfed. For Cunningham, bottle-feeding carries a mortality risk at least 10 times higher than the risk for breastfed infants and the relative risk of fatal and nonfatal respiratory infections is two- to five-fold higher among bottle-fed infants. In a review of 22 studies conducted in large Ecuadorian cities from 1960 to 1982, Sempértegui et al. (1983) conclude that breastfeeding problems in Ecuador were due to aggressive marketing of infant formula by Mead-Johnson, which increased its sales by 500% in that period.

The literature also shows that there is an association between maternal perceptions of insufficient milk supply and breastfeeding confidence (Dennis, 2006). Confidence could be associated with the mothers' perception of their own milk production and consumption by the infant. Milk insufficiency is a phenomenon that is as mysterious to breastfeeding mothers as it is to researchers, since the amount of milk an infant consumes when breastfeeding is generally impossible for the breastfeeding mother to know exactly.

Vitzthum (1994) points out that many studies seek to ascertain the prevalence of breastfeeding, but lack details on various aspects of breastfeeding structure. One problem with not having a well defined description of local breast feeding structure is the resulting difficulty of comparison across studies. In sum, there is a need to examine variation in breastfeeding patterns in different cultures.

Biocultural Model

Human behavior is recognized as a major force that acts on human biology (Schell et al. 2007). Therefore, biocultural approaches offer a holistic/eclectic view because they recognize the dynamic interactions among humans as biological beings and the social, cultural and physical environments that we humans inhabit (Dufour, 2006). Anthropology has a powerful tool, ethnography.

The methodology of this dissertation, draws on methods and theory from several disciplines. It was derived from the literature on breast milk research from both within and outside anthropology. I have tried to determine, from both cultural and biological perspectives, whether there is a “measurable” phenomenon that we can label as milk insufficiency, corresponding to mothers’ perceptions and if so, what it means. Theoretically, the significance of this research will be to link boundaries between cultural and biocultural scopes through the development of theory and methods that join biological and cultural variables, thus helping us to understand the “natural” balance between their influences. Undoubtedly, building biocultural theory and methods necessarily requires crossing boundaries between disciplines.

Today we are talking about cognition or metacognition that connects knowledge among many distinct fields. Anthropologists should be aware of developments in neuroscience and biomedicine and vice versa. Neuroscience and biomedicine are among the new sciences coming to fill the vacuums of knowledge regarding health and illness by recognizing the equal importance of behavior and biology. Finally, with this dissertation I hope to contribute to the human biology and medical anthropology literatures on the milk insufficiency phenomenon within cultural and physical anthropology, but not less to the geographic, demographic, medical, physiological and psychological fields as well.

WHY ESMERALDAS

This study on milk insufficiency was based on field research in Esmeraldas City, Esmeraldas Province, Ecuador from September 1998 through November 1999, and incorporates one additional season during April-May of 2001 (with follow-up trips in July of 2004, and December 2006). Why did I choose Esmeraldas? I have worked in the region since 1984-1985, when I interned in the Social Security Clinic of Esmeraldas City. Then I worked for a year as a physician in a remote rural clinic in the southern coastal village of Galera.

In the summer of 1992, I had the opportunity to be part of the Santiago Cayapas Project 1992 Season, in the northern region of the province, under the direction of Warren DeBoer. During that period I worked as a research assistant with Sara Stinson on her project, “Early Childhood Growth and Nutritional Status in the Cayapas River Drainage, Ecuador” (DeBoer 1992; 1996; Stinson 1996, Stinson et al. 1994). Within the context of this research, the problem of milk insufficiency was often raised by mothers breastfeeding their babies. When Sara Stinson suggested this might be an interesting dissertation topic, I started to explore it. It was during that period that I decided my future research site would be in Esmeraldas.

Breastfeeding problems are quite common in the Esmeraldas area. Current literature showed that although the initiation of breastfeeding in Ecuador as a whole was improving from the 1970s to 1990s (from 92% in 1979 to 95% in 1994 according to CEPAR 1994b), the practice of supplementation also began quite early, with an average of only two months of exclusive breastfeeding (Roloff et al. 1992, CEPAR 1994b, Acosta and Grijalva 1995). In Esmeraldas, according to CEPAR (1994b), the period of exclusive breastfeeding was even shorter, namely, about one month, with on average full weaning at eight months. In Esmeraldas City, according to Acosta and Grijalva (1995), 12% of mothers never breastfeed their children.

In 1995 I conducted a preliminary cultural assessment of the milk insufficiency phenomenon in Esmeraldas City and found out at that time that the views, complaints, perceptions and reports on milk insufficiency, and, in general, problems associated with breastfeeding, were widespread and complex. Thus, I concluded that the city of Esmeraldas would indeed be the right place to conduct this research, due to the prevalence of the problem I perceived in my preliminary review detecting signs of early weaning. The research was funded by dissertation support grants from the Pan American Health Organization (PAHO) and the National Science Foundation (NSF) and later by the CUNY Graduate Center Writing Fellowship.

ORGANIZATION OF THIS THESIS

This thesis is organized into nine chapters and contains five appendices. The information presented here weighs more heavily on the biological than cultural. Nevertheless I am presenting enough information to make the connections to demonstrate how culture and biology interact. I have put together different kinds of information that in one way or another pertain to milk insufficiency's scope.

Chapter 1 presents the rationale for this research, and lays out the organization of the thesis.

Chapter 2 presents a detailed review of the literature on the issue of milk insufficiency. It begins with the description of what anthropologists in the early 1980s called the "insufficient milk syndrome." This opened a discussion among mostly cultural anthropologists that rejected the structural formulation of such a phenomenon. Then I present the discussion of cultural, biological and biocultural approaches explaining milk insufficiency. After the first articles on Milk Insufficiency Syndrome (MIS), many other scholars from fields other than anthropology started to write about MIS and/or perceived milk insufficiency. Hence in this chapter I describe literature on how milk insufficiency is perceived by anthropological research, and continue with the role of the cultural beliefs and attitudes to the phenomenon (i.e., the cultural approach). Subsequently, it presents the biological approach, and, finally, its evolution to the biocultural approach.

Chapter 3 refers to the setting of the study. The setting for the study reported in this dissertation is Esmeraldas city, a medium-sized city with a majority population of Afro-Ecuadorians. It describes the historical explanations for the presence of Afro-Ecuadorians in the province. I focus here on long-standing power relations between Esmeraldas and the national/regional governments and on the racial discrimination by the *mestizo* dominated society towards the Afro-Ecuadorian minority. Then within a political economic context, I describe what happened during this field research, when Ecuador suffered a major economic crisis that reached its peak in March 1999. This crisis marked the beginning of a major change in the lives of all Ecuadorians. The economic crisis was particularly severe in Esmeraldas. I end this chapter describing the social structure of the participating families and the daily lives of Esmeraldan mothers.

Chapter 4 discusses materials and methods used in this thesis. The structure of these methods was based on the literature of milk insufficiency and a combination with ethnography and physiological data. In this chapter I present the question that I am going to try to answer in chapter seven and eight, based on the collected data. The field study reported here was a longitudinal study. It was carried out from September 1998 to November 1999 with one additional follow-up visit in 2001. The universe was seventy-two (N=72) breastfeeding women, twenty to forty years old and seventy-two (N=72) infants, up to 11 months of age during the fieldwork period and up to 26 months old during the follow-up visit in April 2001. The data collected was: 1. Interviews, 2. Structured twelve-hour observations, 3. Anthropometry, 4. Test-Weighing 5. Creamatocrit. Also in this chapter I describe the analysis used for the data collected during the fieldwork. At the end of the chapter I discuss methodological problems.

Chapter 5 discusses childbirth in Esmeraldas. I present here some statistics on childbirth in Esmeraldas. Then I describe three sectors of its health care system: popular, folk and professional. Health indicators are presented here as well. This chapter also covers cultural beliefs of Esmeraldan mothers regarding childbirth. In Esmeraldas being sick or having some illness is not just a biological state, but rather a cultural and biological construction of reality – biological by the professional health care providers and their explanatory models, and cultural by the local, popular or folk explanatory models of illnesses. In the end, illness and disease are cultural events with explanations that could be biological or cultural. As an introduction to the structure of breastfeeding in Esmeraldas, I close this chapter with a mother's life history and her quest for survival including the story of her breastfeeding experience.

Chapter 6 presents the summary statistics of all of the breastfeeding data collected. It begins with a description of the pattern of breastfeeding structure in Esmeraldas. Breastfeeding structure is comprised of number of suckling session, total suckling duration, mean intersession duration, and average minutes suckling. I look at the breastmilk production/consumption using the technique called test weighing. Then I combine the data from breastfeeding structure and test weighing, and create a new category called breastmilk consumption structure (BCS). Next I present data on creamatocrit, the fat content of breastmilk. The combination of breastfeeding structure, test weighing and creamatocrit is a good method to elucidate breastfeeding patterns from both a cultural as well as a biological perspective. Finally, I present the anthropometry of mothers and children.

The nine research questions posed in chapter 4 are answered in Chapter 7 (questions 1-5) and Chapter 8 (questions 6-9) respectively. I use a combination of ethnographic data and inferential statistics to answer the questions, which consist of both biological and cultural components. In Chapter 7, I answer the following questions: 1. What are the mothers' explanations of milk insufficiency? 2. How do socioeconomic status and work status of the mother influence breastfeeding behavior and reports of milk insufficiency? 3. How did the economic crisis of 1999 affect reports of milk insufficiency and how did mothers manifest the crisis in breastfeeding behavior? 4. What is the relationship among onset of lactation, milk insufficiency complaints and early supplementation? 5. How is supplementation related to biological data and behavioral data?

Chapter 8 continues answering the questions described in Chapter 4: 6. How do biological factors like parity and age of the mother related to milk insufficient complain and milk production? 7. Is there any correlation between nutritional status (BMI) and MIC, and what is the relationship of nutritional status and milk production and fat? 8. Are mothers who complain of milk insufficient actually producing less milk? How is the perception of milk insufficient related longitudinally to an actual reduction in milk supply? 9. Is there a measurable phenomenon that we can label as MI independent of a mother's perception?

Chapter 9 presents discussion and conclusions I draw from this research and from the analysis of the data collected.

The last part of this dissertation consists of five appendixes and the bibliography. Appendix A is a list of all foods or supplements that mothers gave to their infants during the field work research (linked to chapter 3). Appendix B presents the full questionnaires used in the field plus the consent form. It also includes some recommendations for future research (linked to chapter 4). Appendix C contains photographs of plants that mothers used for childbirth. Those plants were collected by the mothers for the delivery of their children (linked to chapter 5). Appendix D shows photographs of different volume/containers, to give the reader an idea of the volume of breastmilk consumed by the infant (linked to chapter 6 and 8). Appendix E presents data for the infants' Z-score reports, as well as percentile figures representing age, weight-for-length, length-for-age, weight-for-age, and head circumference. Figures for the infants are presented here in Z Scores and percentiles. The data collected in this study are analyzed using the 2000 CDC Growth Reference Curves. At the end I provide a statistical report for each infant case by case (linked to chapters 5, 6, 7, and 8).

CHAPTER 2

MILK INSUFFICIENCY:

RESEARCH, RESEARCHERS AND APPROACHES

The following is a review of the relevant literature on the phenomenon of milk insufficiency, offering a multidisciplinary approach to the issue. I will first review the identification of milk insufficiency in the medical anthropology literature on breastfeeding in the early 1980s and subsequent cultural/biological responses debating whether the milk insufficiency phenomenon is real or perceived. I will then review more recent cultural, biological and biocultural approaches to the milk insufficiency (MI) or milk insufficiency question. There are no clear dividing lines among cultural, biological and biocultural approaches. The divisions are often ambiguous as we try to separate interdependent variables (such as supplementation and perception of milk insufficiency). Many researchers who adhered to a strictly biological or cultural approach in the 1980s and 1990s have now adopted a biocultural approach.

Research on milk insufficiency in particular (as a specific topic within the breastfeeding research literature) is scarce. Perhaps this is because people think that milk insufficiency is not a real problem, or is not very important, or because people have accepted milk insufficiency as a medical problem, and, as such, that it has to be treated by biomedical doctors. This is not the case with the bibliography on breastfeeding. The study of breastfeeding has produced an incredibly rich literature, and I will not be able to do justice to that detail and complexity here.

"INSUFFICIENT MILK SYNDROME"

Gussler and Breisemeister's (1980) important[2] article on what they termed "insufficient milk syndrome" (IMS), was the first to offer a biocultural explanation of the MI phenomenon. They argue that, rather than being merely a culturally appropriate excuse to stop breastfeeding, milk insufficiency is "real" and associated with extended periods of separation between mothers and infants, and scheduled rather than on-demand patterns of breastfeeding in Western urban settings. They assert that cultural sanctions against breastfeeding patterns also affect milk production. A scheduled pattern, in which infants are fed on a regular schedule and feedings are often widely spaced, may result in milk insufficiency; in contrast, on-demand breastfeeding patterns appear to stimulate milk production.

Greiner et al. (1981) and Van Esterik (1981) refuted Gussler and Breisemeister's assertion that urban patterns of breastfeeding cause milk insufficiency, citing instances where mothers and infants with limited contact are able to breastfeed successfully. They, like most other critics of Gussler and Breisemeister, suggest that the real problem is the widespread use of infant formula. For them, the problem is the process of medicalization[3] of the insufficient milk phenomena and the commoditization of infant formula. Van Esterick (1988, 1989) argues that calling milk insufficiency a biomedical problem medicalizes the phenomenon, and legitimizes the marketing of infant formula.

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[2] This was the first article that focuses on milk insufficiency within and outside anthropology. It was a departing point for the controversy on the rationalization of the problem.

[3] Medicalization could be defined as the way in which the jurisdiction of modern medicine has expanded in recent years and now encompasses many problems that formerly were not defined as medical entities (Helman 2001:114). To Moffat (2002:167), calling milk insufficiency a "syndrome" and explaining it as a physiological malfunction of lactation, effectively medicalizes MI.

For Greiner et al. (1981), milk insufficiency is a culture-bound syndrome rather than a biomedical syndrome, contrary to Gussler and Breisemeister’s assertions. Greiner et al. worry that Westernized health workers who labeled milk insufficiency as a problem could become part of a wider cycle whereby reports of insufficient milk syndrome are confirmed by doctors, who then prescribe drugs to promote letdown reflex [milk-release] along with milk supplements, actually worsening the problem through a defeating cycle. Along with Van Esterick, Greiner et al. focus on the marketing and distribution of formula. They find that in those countries where consumer recall of formula brand names is high, insufficient milk is a problem. According to Segura-Millan et al. (1994), “syndrome” is not the right term for the problem; they argue it should be called “perceived” milk insufficiency. They posit that milk insufficiency is “not real,” but rather a false perception by the mother.

To Quandt (1986:451), low breastfeeding frequency predicts early weaning, but high breastfeeding frequency does not necessarily predict longer full breastfeeding due to confounding cultural factors. Quandt extrapolates that mothers who perceive their infant to be satisfied will probably have a good milk supply (she did not measure volume). She states that those who perceive the baby to be not satisfied include both mothers with truly insufficient milk and those with adequate supplies, but does not state how she determined this. Quandt points out that her findings differ from those of Gussler and Breisemeister, who would label most of the breastfeeding problems as “non-biologic breastfeeding” factors due to scheduling, whereas for Quandt it is important to distinguish cultural from biological factors. Quandt also argues that not all non-intensive breastfeeding styles cause insufficient milk, and mentions a study of women who used only breast pumps and had normal breastmilk production, so emptying the breast can be as important as stimulation of the breast from suckling.

Twenty years after the first article by Gussler and Breisemeister (1980), Dykes (2000) discussed the history of the two suggested main reasons for "inadequate milk syndrome" in Western society. Dykes argued that the influence of technocracy at the turn of the twentieth century led to the rise of two major factors: the medicalization and commercialization of the infant feeding. First, the influence of Cartesian dualism on Western medicine led to the medical perception of the woman's body as an imperfect machine. Regimes that were implemented emphasized the principles of separation and the control of natural processes, stating that feedings should be controlled and often supplemented with formula. Second, the commercialization of infant feeding was brought on by an increase in cow's milk availability and its low cost due to increased efficiency in the dairy industry. Infant formula companies rolled out highly effective marketing campaigns that depicted bottlefeeding as a measure of Western affluence and that depicted breastfeeding as outdated and possibly insufficient for optimal growth in the baby. Hence, for the author, the insufficient milk syndrome was constructed as a Western phenomenon related to non-exclusive breastfeeding or "insufficient contact between mothers and babies and rigid feeding patterns." The shift toward non-exclusive breastfeeding resulted from the successful "marketing and availability of infant formulas" and "inadequate and unhelpful health care practices" in Western communities (2000:494). For Dykes (2000), what was missing in the early discussions of IMS was the importance of the mother's confidence in breastfeeding, where lack of confidence can lead to a "self-fulfilling prophecy" (2000:495). Thus in Dykes' study the most common reason given by women who stopped breastfeeding was insufficient milk, which will be discussed later in this section.

CULTURAL FACTORS

While studies of symbolic meanings attached to the body cross-culturally have mentioned breastfeeding as a locus of cultural production of meaning (Scheper-Hughes and Lock 1987; Wright et al. 1993; Zeitlyn and Rowshan 1997), Dettwyler and Fishman (1992) and Vitzthum (1988, 1994a) point out that cultural beliefs about infant feeding have been explored thoroughly only in a few cultures and very little basic research has been directed towards problems mothers report with respect to their milk production and difficulties in breastfeeding their infants. Cultural sanctions related to breastfeeding have been featured anecdotally in guides to breastfeeding (Riordan 1991) and in ethnographic studies of gendered health issues (Farmer 1988).

Today, studies that address insufficient milk all conclude that cultural practices, psychosocial factors, and breastfeeding behavior or style are directly linked to what is "perceived" as milk insufficiency (Chan et al. 2000; Dykes and William 1999; Forman et al. 1992; Hill and Aldag 1991a, 1991b; Hillervik-Lindquist et al. 1991; Obermeyer and Castle 1996; Pérez-Escamilla et al. 1993, 1999; Pisacane et al. 2005; Segura-Millán et al. 1994; Shirima et al. 2000; Quandt 1995; WHO 2007; WHO-UNICEF 1996, 1997). Factors such as non-supportive hospital environment (for example, not allowing rooming-in), mother's lack of confidence, maternal stress, employment, advice by professionals or relatives including husbands or mothers-in-law, excuses for early weaning, use of infant formula, early supplementation, level of education, socioeconomic status and lack of practical and precise information about breastfeeding, were the critical factors associated with insufficient milk. Many of these studies are based on surveys, some others on interviews and follow-up with mothers after delivering their infants in hospitals, examining demographic, sociocultural, economic and psychosocial variables, while a few of these studies employ an ethnographic approach.

The Role of Cultural Beliefs, Mother's Confidence and Attitudes

In some societies, milk insufficiency is a socially accepted excuse used by mothers for early weaning (Chan 2000; Ramos and Almeida 2003). Ramos and Almeida (2003) conducted a study of 24 women who decided to wean their babies before the fourth month of life in Teresina, Brazil. They concluded that milk insufficiency is a "latent cry for help" from mothers who do not know how to cope with breastfeeding difficulties due to lack of instruction and support from health care workers. Chan et al. (2000) state that it may be easier for mothers to explain their failure to breastfeed as being due to insufficient milk rather than to blame the lack of support they received from doctors, nurses, husbands, family and society.

Akre (1991) asserts that lack of confidence may cause women to misinterpret events. Mothers who lack confidence may interpret their baby's crying as a sign of milk insufficiency. Association made by mothers between frequent crying and inadequate milk is widely reported (Hewat and Ellis 1984; Tully and Dewey 1985; Hill and Aldag 1991; Pérez-Escamilla et al. 1992, Segura-Millán 1994). In Malawi, the crying of a baby was perceived as a sign of hunger and an indication that the baby was not getting enough food from breastmilk (Kerr et al. 2007). Western culture emphasizes individualism and being in control of one's life. In a longitudinal phenomenological study involving in-depth interactive interviews with ten women in the UK conducted by Dykes and William (1999), the researchers found that some women felt the need to control feeding behavior by, for example, imposing restrictions on the time, duration and frequency of feedings and by the use of pacifiers, which eventually lead to milk insufficiency due to inadequate emptying of breastmilk from the breasts. Some women felt that when there were problems with breastfeeding their partners readily suggested the bottle as the solution. Father's lack of confidence in or knowledge of the breastfeeding process as well as father's desire to feed his own baby with bottle and "have his wife's body back" can contribute to MI [perception] (Dykes and William 1999:239).

Pisacane's (2005) study in Naples, Italy, found fewer milk insufficiency complaints (8.6%) in women whose husbands were taught how to prevent and to manage common lactation difficulties. Perceived milk insufficiency was significantly more common (27%) among mothers whose husbands were not educated about breastfeeding. In some cases, women were told by family members that they were not producing enough milk to keep the babies full and supplementation were introduced as a consequence. In Ramos and Almeida's study (2003), women in Teresina, Brazil, were told by grandmother and aunts that their milk didn't keep the babies full and they were told to introduce supplemental food.

Tully and Dewey (1985) interviewed a total of 217 mothers from four ethnic groups, Anglos, Mexican American, and Mexicans in Davis-Sacramento, California and Jamaican mothers in Kingston, finding that 35% to 40% of all mothers reported milk insufficiency within the first 6 weeks. These reports were first associated with psychosocial factors like inappropriate hospital practices and infant characteristics rather than with biological inability to produce an adequate breastmilk supply (1985:241). But cultural responses could lead to actual reduction in milk supply; for example, the use of pacifiers, introducing bottles, or decreasing nursing frequency so the breasts feel more "full" before feeding. Among the ethnic groups, the Mexican mothers associate milk insufficiency with breasts not being full enough. In Jamaica, mothers believe breast milk is inherently inadequate and supplements are necessary. The Anglo Americans perceive breastfeeding in public as embarrassing and inconvenient. The major issue associated with breast milk insufficiency among Mexican American migrants was lack of confidence in breastfeeding. The authors conclude that IMS is solely psychological.

For Hill and Aldag (1991) mothers with reported or perceived "insufficient milk supply syndrome" (IMS) complement with formula because of anxiety about their babies, while non-IMS mothers supplement with formula occasionally for convenience. Hill and Aldag (1991) and Hill (1991) report a survey of 384 U.S. mothers that found the best predictors of reported milk insufficiency during the first 8 weeks postpartum were fussy infant behavior, low maternal confidence, poor maternal health, mother-in-law disapproval, and early introduction of solid foods and formula.

Studies in public hospitals in Hermosillo, Mexico, where 73 mothers were interviewed (Perez-Escamilla et al. 1992a, 1992b), found that adverse hospital environment was associated with high rates of formula use and reports of milk insufficiency at sixteen days postpartum (46%). In a second study (Perez-Escamilla et al. 1993, Segura-Milan et al. 1994), 165 mothers were interviewed, 107 from a hospital with an innovative rooming-in and education programs promoting breastfeeding. While 80% of mothers (in both settings) reported milk insufficiency at some point during the study, reports within eight days (n= 75), were most related to maternal confidence, maternal education, and whether the hospital allowed rooming-in and provided breastfeeding information. Breastmilk arrived earlier for rooming-in than for non rooming-in women; breastmilk also arrived earlier if no supplements were given. Early milk arrival was associated with longer term breastfeeding, full and partial. Determinants of lactation success changed as the infant grew older, but sociocultural determinants were always more important than biological factors like infant birth weight, sex, parity, maternal age, weight, height and triceps skinfold.

In a study by Segura-Millan et al. (1994), 80% of low-income Mexican mothers report perceived MI at some point in lactation. Factors correlated with the reports were lack of confidence in breastfeeding, delayed onset of milk production, maternal education, multiparity, sore nipples, early introduction of formula to the previous child and mother breastfed as a child.

In Nepal, culturally, breast milk is thought to be pure, so an exclusively breastfed infant is considered to be unpolluted and the breast is always readily available to the infant (Moffat 2002). Nevertheless, in a study on milk insufficiency among mothers in Nepal, Moffat found that even though Nepalese culture fully encourages breastfeeding, mothers still reported suffering from milk insufficiency. This study recruited mothers who were urban migrants in peri-urban areas, suffering from a dearth of basic services. Mothers who worked at home were compared to those who worked in a factory. Most women had no formal education, more than half of them were under 25, and they were ethnically diverse. Nepalese mothers did believe in exclusive breastfeeding until breastmilk is deemed to be insufficient. Exclusive breastfeeding, however, based on the interviews, appears to be very infrequent after three months. Those who were better off were able to afford commercial weaning cereal and infant formula. This, however, was rare for most of the women in the sample, who could not afford such luxury. Moffat concluded that the assumption in the 80s and 90s that decrease in breastfeeding, urbanization and wage labor were associated with each other was simply wrong. In Nepal, mothers who worked in factories and those who worked at home carried their baby on their backs; as a consequence, breastmilk was available to all infants at all times. Though mothers in this study did report suffering from milk insufficiency, they did not explain how they knew they were not producing enough milk. More important, while mothers in this study did report suffering from insufficient milk, they continued breastfeeding.

In a study conducted by Dennis (2006) in British Columbia, Canada, 522 breastfeeding mothers were surveyed at 1, 4 and 8 weeks postpartum. The survey measured breastfeeding status by the receipt of the infant of any breastmilk within the past 24 hours. The authors introduce a variable breastfeeding self-efficacy (BSE) or the ability to breastfeed and its initiation and duration. It is measured via breastfeeding confidence and maternal characteristics which the author’s divided into psychological variables assessing maternal personality traits, stressors and social support. The results show higher BSE scores came from women who were older, more educated, and multiparous. High BSE scores also correlated with: higher job satisfaction, higher perceptions of social support, higher satisfaction with perinatal health care, a history of vaginal birth without intervention, and low maternal anxiety. The factors that were most strongly correlated with maternal perception of breastfeeding progress were whether the mother was feeding her infant as planned and satisfaction with infant feeding method. Mothers with low BSE scores were mothers with higher levels of perceived stress.

Early Supplementation

Early[4] supplementation is a common practice around the world, especially in Africa and Latin America (Ergenekon et al. 2006; García de Lima Parada 2007; Kakute et al. 2005; Ly et al. 2006). In Getahum et al.'s (2004) study in Tigray and Gonder, Ethiopia, the main reasons for offering pre/postlacteal food or fluid before age 6 months were perceived lack of breastmilk or milk insufficiency after delivery (63.5% in Tigray and 31.3% in Gonder). In a ritual feeding after birth, 76% of Gonder mothers offer unsalted butter to the newborn in the belief that it will clean the stomach from its first stool (meconium) and prevent constipation and abdominal cramps.

In the Guerrero et al. (1999) study in San Pedro Martir, Mexico City, the authors reported that mothers held a strong belief that supplementation of tea, water, or bottled milk helped the baby grow better. The dominant infant feeding practice among mothers was mixed breast and bottle feeding, and the supplementation of tea, water, and other solutions to treat childhood ailments. In addition, due to existing postpartum policies and practices in hospitals, mothers in the study tended to delay the start of breastfeeding and supplied their infants with clear fluids until the flow of milk postpartum increased. Mothers doubted their ability to breastfeed or the adequacy of their milk supply. They stopped breastfeeding when they perceived an "insufficiency" of milk or poor quality of

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4 I define early supplementation as any intake by the infant other than breastmilk from as soon as after birth until the third month; based on transcultural practices today around the world the most frequent supplementation is with formula and there is local cultural variation in other types of supplementation.

milk – or when confronted with diseases such as *susto* ("startle illness") or *coraje* (when a mother gets upset) maternal illness, or use of medication.

According to McCann and Bender (2005), a maternal "perception" of inadequate milk supply is often the leading reason that many mothers may not follow the WHO recommended breastfeeding guidelines. They compared data from two studies collected more than a decade ago of mothers in two Bolivian cities—Cochabamba, a city with many poorly educated migrants from rural areas, more amarindian culture and Santa Cruz, a more modern city, where most mothers are literate and better educated, more mestizo culture. The results from Cochabamba and Santa Cruz differed dramatically. Most infants were breastfed in Cochabamba (98.8%) and Santa Cruz (95.4%). In Cochabamba, about half (47%) of infants younger than four months of life were exclusively breastfed, 33% were breastfed with supplementary liquids, 19% were breastfed with supplementary bottled milk, and only 1% were breastfed with supplementary solid food. Among older infants, most were still being breastfed though they received supplementary foods. The two most common reasons for stopping breastfeeding or supplementing breastfeeding with liquids were that the infants were old enough and because the mother thought she had insufficient milk. In Santa Cruz, most of the infants younger than four months were breastfed with the addition of other milk (52%), 16% were exclusively breastfeeding, and 9% were breastfeeding with supplementary solids. As the infants grew older, the rate of breastfeeding dramatically decreased. The most common reason for stopping breastfeeding and supplementing breastfeeding with other liquids was perceived insufficient milk. Half of the mothers believed that powdered milk should be given to infants younger than three months. The results showed that maternal perception of milk insufficiency was more common among mothers from Santa Cruz, and they were more likely to stop breastfeeding for this reason.

Professional Advice

Contradictory professional advice about breastfeeding by health care providers is one of the major problems related to breastfeeding uncertainty cited in the literature (Chan 2000; Dykes and William 1999: Guerrero et al.. 1999; Walker 2000; Mathur et al. 1992; Woolridge 1995a). Professional advice to mothers has led to changes in breastfeeding behaviors. In the 1940s and 1950s, for example, pediatricians started to recommend that mothers breastfeed their infants every 4 hours, perhaps leading to introduction of supplements between the recommended feeds (see, for instance, Dr. Spock's early books and recommendations on breastfeeding; for example, the book "Dr. Spock's Baby and Child Care" 1946). In the 1970s and 1980s dentists advised that children should not breastfeed during the night because it could cause tooth decay (Minchin 1985). Therefore, we could say that advice given by health care professionals influences cultural patterns of breastfeeding behavior.

In a critique of pediatric advice about breastfeeding found in texts and journals for pediatricians, Millard (1990:211-219) pointed out that "the sources all criticize biomedical tendencies toward excessive rigidity and call for attention to individual variation, but they continue to structure their advice with timetables, inherently contradicting the principal of flexibility." They give a "factory model of physiology," emphasizing cultural themes of scheduling, timetables and time discipline. Earlier texts implied that infants must be trained to feed on schedule as a matter of discipline for the infant (211). Then in the 1980s feeding schedules were viewed as biologically innate to normal infants and to breastmilk production.

Millard points out that breastfeeding on demand is never clearly defined in texts and journals that advocate for demand feeding. While demand feeding has been characterized as “innately chaotic,” it has also been characterized as the source of the most natural schedule. “The issue of control has been disguised as advocacy [by pediatric texts and journals] of what is normal for infants and for maternal lactation. In a sense, the clock has moved from the realm of culture, including science, training, and discipline, to that of nature and organic processes – from outside to inside the human body. The absence of a regular schedule is thus still taken as a sign of abnormality on the part of the infant, the mother, or both (219).” I will add that contemporary texts imply that scheduling is not innate and that it is unnatural for normal infants—see recent literature on lactation by Lawrence 1994, Riodan and Auerbach 1999, WHO 2001, 2002 and the vast amount of information by La Leche League 2007.

In a rapid ethnographic study conducted in San Pedro Martir, Mexico City, Guerrero et al. (1999) identified major influences affecting infant feeding practices. The survey sample consisted of 150 randomly selected mothers whose youngest child was under 5 years old. The results revealed that doctors were considered by the mothers as the most important source of breastfeeding advice about exclusive breastfeeding. A majority of the mothers did reduce or stop breastfeeding their babies when they encountered problems, which included infant’s illness, maternal illness, doctor’s advice, and insufficient or poor quality of breast milk. Guerrero et al. concluded that doctors need to be trained to promote exclusive breastfeeding because they have a strong influence on mothers, of whom half complied when they were advised to stop breastfeeding.

Two ethnographic studies were conducted in Bangladesh by Zeitlyn and Rowshan (1997). The first study was conducted in 1987-1988 on 100 rural and urban mothers, all of whom breastfed, with children under the age of two. The second study was conducted in 1992 on 122 Dhaka mothers (all but 16 were breastfeeding) whose children (under two years old) were admitted to a treatment center for moderate diarrhea. These authors report that health professionals often claim privileged knowledge about breastfeeding and the "right to define what is 'natural' for infants and their mothers" to boost their own legitimacy (66). Echoing traditional beliefs that blame a child's illness on the mother, medical professionals in Bangladesh often blame the mother's behavior for problems in breastfeeding. According to the authors, health professionals who are involved in the promotion of breastfeeding assume that there is only one correct and scientific way to breastfeed, often using religious quotations to justify their reasoning. Many mothers felt a lack of power and thus resented the way health professionals lectured to them about breastfeeding.

The same authors also showed that what they called "insufficient milk syndrome" is a growing phenomenon, especially among the middle class and in urban areas. In Bangladesh, breastmilk is believed to be vulnerable to evil forces (*batash*) that spoil breastmilk, and physicians actually give legitimacy to the syndrome by classifying "spoiled breastmilk" as a diagnostic category, often prescribing bottle milk for newborn infants. Thus the professional discourse on breastfeeding, including spoiled breastmilk, and MIS, legitimized the authority of health professionals over the breastfeeding mothers in Bangladesh. So this is a case where it is perceived milk insufficiency.

In an epidemiological study by Peat et al. (2004), measuring factors for breastfeeding, the authors suggest that even though mother's intention to breastfeed is often cited as a predictor to breastfeeding success or failure, it is just “a factor that is in the casual decision making pathway” (1033), meaning it is unlikely and therefore meaningless to posit that someone would engage in breastfeeding without the intention to do so. Therefore, for the authors, a mother's intention is not a valid risk factor for breastfeeding cessation. And supplementation is not a risk to breastfeeding cessation factor either but rather a symptom. The real risk factors would be bad advice from health practitioners or infants that are difficult feeders according with their conclusions.

According to Dykes and Williams (1999), women's perceptions of their milk were influenced by health professionals' comments and advice. They found that professionals' input can have a negative impact on breastfeeding and subsequently lead to perceived milk insufficiency (In this study, the health advisor advocated a regimen that limits the frequency and duration of feeding for 10 minutes on each breast). In Chan's (2000) study in Hong Kong, midwifery staff advise early supplementation with infant formula when mothers complain of milk insufficiency. In Walker's (2000) study in sub-Saharan Africa, negative and discouraging influences on breastfeeding and promotion of breast milk substitutes by health staff affect the practice of breastfeeding among women in the region. All of these studies show how professional advice can influence breastfeeding, some negatively leading to the acceptance of milk insufficient. On the other hand, teaching proper breastfeeding techniques, including information about baby's need to suck as an urge separate from hunger, enabled women with reported milk insufficiency to resume breastfeeding (Mathur et al. 1992, Woolridge 1995a).

Perceived Milk Insufficiency and Early Weaning

Cooke et al. (2003) found perceived inadequate milk was a significant predictor for early weaning (in the first 6 weeks after birth) in Australia. In their study, 12-17% of women reported inadequate milk supply, with the highest level occurring at 6 weeks after birth. This supports the findings of other researchers who have found low supply as one of the most common reasons for the early cessation of breastfeeding (Bailey and Sherriff, 1992; Hailes and Wellard, 2000; Stamp and Crowther 1995).

BIOLOGICAL CONSIDERATIONS

Most scholars who cover the biological aspects of breastfeeding are physicians or biomedical researchers, physiologists, neonatologists, endocrinologists, biologists or nutritionists. The physiological aspects of breastfeeding include hormone secretion rates, suckling stimuli and completeness of breast emptying. Maternal illnesses and infectious diseases influence milk production (Lawrence 1989, 1994). Studies suggest that maternal malnutrition may negatively affect the quantity and quality of milk (Frisancho 1993; Prentice et al. 1981a, 1981b). Mothers' and infants' anthropometry are employed as markers of nutritional status to correlate with breastmilk production. Parity and maternal age are also mentioned as biological variables in various studies (Butler et al. 2004; Ford and Labbok 1990).

Physiology of Lactation

Scholars described 3 stages of lactation, lactogenesis I, lactogenesis II and lactogenesis III (aka galactopoiesis-milk production) (Biancuzzo, 1999; Kellymom.com, 2005; Lawrence,1994). In Lactogenesis I, the mother's body starts making what will be called colostrum as early as halfway through pregnancy. Lactogenesis II, colostrum-transitional milk-mature milk- or copious milk production, goes from just hours after birth to 2-3 day after birth. Other authors like Grajeda and Perez-Escamilla (2002), describe the same process as onset of lactation (OL) or when women said that the milk has "come in," that could begin between a few hours to 7 days after delivery. Lactogenesis III, an "autocrine" or local process controlled by the milk removal from each breast, is self-regulating. It is importance to understand the process of lactogenesis I and II as hormonally driven, independent of breastfeeding, versus lactogenesis III, which is almost totally dependent on whether or not a mother is breastfeeding her baby, a supply-demand system (Kellymom.com 2005; Riordan and Auerbach,1999). Both inadequate milk supply and over supply of milk (West, 2006; La Leche League, 2006) could occur during lactogenesis III.

From Endocrine to Autocrine

For Giugliani (2004), lactogenesis phase III is controlled by an "autocrine" mechanism that depends on the emptying of the breast. Any maternal or infant factors that reduce breast emptying, including incorrect latch-on, introduction of complementary feeding, scheduled feedings, absence of night feedings, and use of pacifiers, may reduce breastmilk synthesis and may cause insufficient milk supply. The quality and quantity of suction regulate the synthesis of maternal milk by triggering the hypothalamus to inhibit dopamine secretion (dopamine is a prolactin antagonist); this decrease in dopamine levels stimulates prolactin secretion, which promote milk secretion (152).

While studies of milk insufficiency have shown that behavioral factors can influence early lactation problems, other research suggests that behavioral influences may become even more important later in lactation. Theories support a shift from endocrine to "autocrine" control of milk production as lactation progresses (Bonyata, 2001; Daly and Hartman 1995a, 1995b; De Coopman 1993; Giugliani 2004; Kent et al. 2006). Endocrine control is a hormonal control, which acts on both breasts, and seems to be more important at the beginning of lactation and separate (not influenced) by breastfeeding behavior. On the other hand, "autocrine" control is a local control operating separately within each breast in relation to milk removal, and regulated, according to De Coopman (1993), to match the "demand-appetite" of the infant, and possibly to prevent overproduction of milk, since milk production is costly to the mother. This autocrine control appears to become more important after the third to fourth month. This may be a crucial time for the development of milk insufficiency. However, more research needs to be done on this stage of lactation because most studies of milk insufficiency have focused on very early lactation.

Fat Content of Milk

Kent et al. (2006) measured milk volume, frequency of breastfeeding, and fat content of milk among 71 women breastfeeding infants from 1 to 6 months of age in Australia. Test-weighing was used to measure milk volume and creamatocrit to measure fat content. Researchers found milk production averaging 788 $\pm$ 169 g during 24/h milk production for both breasts. Infants consumed 64% of their daily intake in feedings between 6 a.m. and 6 p.m. = 497 $\pm$ 17g (6), with a frequency of 6 feedings in 12/h. Interestingly, in this study there was no significant difference in the total 24-hour milk production for infants who did not breastfeed at night. The fat average was of 41 $\pm$ 8 g/l, independent of breastfeeding frequency, but with significant variation in relationship to the time of the day. The fat content average was higher during the day (10:01 am to 4:00 pm) and lower at night (10:01 pm to 4:00 am). The best predictor of fat content was degree of emptying. These researchers distinguished one breast from the other. For instance, they found that the right breast always produced more milk than the left breast, suggesting that the difference in milk production between the breasts may be due to differences in mother's preference (or possibly intrinsic milk production) rather than the infant's preference. That is what is called this an "autocrine" effect by many authors already mentioned.

Infant's crying is one of the indicators for the mothers of perceived milk insuffient. According to Woolridge and Fisher (1988), this crying could be due to excessive breast switching, causing infants to become engorged on "foremilk" with insufficient fat so that they never feel full --foremilk is the milk that is produced and stored between feeding, similar to skimmed milk, lower in fat. Hindmilk is the milk that is produced during and released at the last part of a feeding and it is richer in fat (Biancuzzo 1999:43). These babies cry a lot, gain weight poorly, and are very fussy, despite mother's milk being adequate. In this way, "overfeeding" can lead to “insufficient” nutrition of the child, if the infant does not sufficiently “empty” one breast at a time.

Parity

Forman et al. (1992) studied a large sample of 1005 urban Bedouin Arabs of Negev, Israel. They found that reported milk insufficiency was the reason 72% of women introduced bottles before two months. In their study, reported milk insufficiency was positively associated with parity. Only this first study explicitly examines the relationship between parity and milk insufficiency, but other studies have examined the relationshipo between parity and breastfeeding duration. In a New Zealand study, Butler et al. (2004) reported that high parity ($\geq$ 5 children) was associated with cessation of exclusive breastfeeding before 6 weeks postpartum. On the contrary, in another study in the United States, Ford and Labbok (1990) found that high parity is associated with longer breastfeeding duration. In summary, there is no conclusive relationship between parity and milk insufficiency as an effect suggested to be either biological or behavioral.

The Nutritional Status Dilemma

There are established data showing that composition of human milk changes from mother to mother, day to day, and with the mother’s diet, especially the lipid composition (Haug and Harzer 1987, Harzer and Bindels 1987, Woolridge 1995). Although there is some evidence that maternal nutritional status may have little to do with the production of breast milk, data on this matter remain inconclusive and disputed. The Institute of Medicine (1991), in its extensive review of the literature on breastfeeding and nutrition, concludes that data from different populations are mixed in terms of how maternal nutritional status affects lactation. Maternal nutritional status is not related to milk production (quantity and quality) among healthy women in industrialized countries. But the data are not conclusive from non-industrialized countries.

In a study in Ivory Coast, Lauber and Reinhardt (1979) took all the milk from one breast (once a month) after asking the mother to nurse the child the night before on only the other breast. They found a decrease in protein in the baby’s diet after 5 months of age correlating with decreased growth, even though the decrease in protein is “normal.” The babies’ lower growth may be due to infectious disease/diarrhea. These women eat mainly tubers, but their milk production was considered adequate (although the researchers do not mention how this was measured). Moreover, there is no maternal weight loss associated with long-term breastfeeding.

Steenbergen et al. (1984), employing a 24-hour test-weighing technique in a study in Kenya, compared Kamba mothers’ milk production in the lean season to their milk production during the harvest season, and compared maternal nutritional status of 52 better-nourished women to 46 less-nourished women. Interestingly, these researchers found that mothers produced more milk during the harvest season in the first months of lactation (170-300 ml/24h). The better-nourished women produced on average 720-860 g/24h in the first six months, compared with the less-nourished women, who produced on average 640-825 g/24h. Steenbergen concluded that although the difference average variation in milk production between the two groups was not significant, and the less-nourished women’s milk production was within the normal range, the variation in milk production by season and maternal weight does suggest a relationship between nutrition and milk production.

Dugdale and Eaton-Evans (1989) found that among middle-class Australian women, postpartum changes in weight were similar whether or not the mothers breastfed their infants. But there are reports that among malnourished women, pregnancy and lactation place considerable nutritional demands on the mother, creating energy deficits manifested by maternal loss of weight (Johnston 1987). Some studies suggest that maternal malnutrition may negatively (lowering the quality and quantity of breastmilk) affect the production and composition of breastmilk (Prentice et al. 1981a, 1981b). These studies suggest that mothers' nutrition may play a role in lactation problems, and that these factors need to be brought into any analysis of lactation problems.

There is also the question of whether the babies of mothers who report milk insufficiency suffer nutritionally. Hillervik-Lindquist et al.'s (1991) study of 51 well-educated Swedish mothers is the only previous longitudinal study to employ test-weighing as a method. Mothers were given scales and asked to measure their infants' weight and 24-hour milk intake at age 1 week to the first 6 months (±1 week), and during and one week after perceiving milk insufficiency. Over half of the mothers experienced milk insufficiency at some point (n=28), and were categorized as the "crisis" group. The authors concluded that while there was no significant difference in measured milk intake during and one week after the perceived "crises," infants' weight-for-age and intake were significantly lower in the crisis group at several points during the study.

BMI and Prolactin

As for body mass index (BMI) and lactation, studies have tried to explain how overweight/obesity negatively affects lactational performance. Rasmussen and Kjolhede (2004) postulate that BMI is negatively associated with the timing of lactogenesis II. Maternal obesity may compromise prolactin response to infant suckling. This study found overweight/obese women had a lower prolactin response to suckling, which in turn compromises their ability to produce milk and over time could lead to premature cessation of lactation. The investigator proposed that obesity alters the 24 hour spontaneous release of prolactin and prolactin secretion is blunted in response to various stimuli among obese subjects. These reasearchers also found that at 48 hours post-partum primiparous mothers experienced a decrease in the prolactin response to suckling similar to those of the obese. However, Scott et al. (2007), found no statistically significant relationship between maternal BMI and delayed lactation in a study done among 453 women in Perth Australia.

BMI and Behavior

BMI has been associated with breastfeeding performance. For instance, overweight or obese women introduced complementary foods sooner and breastfed for shorter periods in Denmark, in the United States and Australia (Baker et al. 2004, 2007; Donath and Amir 2000; Kugyelka et al. 2004; Hilson et al. 2004; Li 2003; Oddy 2006). Early introduction of complementary food is one of the major factors that restrict the emptying of the breast therefore reducing breastmilk synthesis at lactogenesis III (Giugliani 2004; Riordan 2005).

In another study done in Timor-Leste by Senarath et al. (2007), the authors found that mothers with a BMI less than 18.5 (kgm^2) introduced artificial milk, solids and other liquids to the infant at a higher rate than those with higher BMI more or equal to 18.5 (kgm^2). According to the same authors, this difference can be explained by the belief of these "thin" mothers that they have milk insufficiency (1002).

FROM CULTURAL OR BIOLOGICAL TO BIOCULTURAL

Studies of breastfeeding that focus on both biological and sociobehavioral factors have historically been quite few, but recently more studies are being developed with a biocultural approach, mainly resulting from researchers' field affiliations, training and points of view. Many authors cited here began writing a few decades ago with a biological or cultural approach, eventually "evolving" to a more biocultural approach.

Allen and Pelto (1985), Dettwyler and Fishman (1992), Forman (1984), Forman et al. (1992) and Stuart-Macadam and Dettwyler (1996) have all suggested that what is needed is careful study of cultural beliefs and practices along with careful study of biological factors associated with breastfeeding problems. Quandt (1995) proposed that breastfeeding researchers should examine cultural factors and the biology of lactation linked in a dual model to an understanding of breastfeeding performance, including lactation failure.

Allen and Pelto (1985) suggest studying biocultural determinants of breastfeeding duration, variables that are interactions between biological and socio-behavioral processes such as hospital feeding practices, anxiety, perception of milk adequacy, perception of infant growth, perception of infant satisfaction, feeding frequency, supplementary foods, feeding schedule, previous experience and breast preparation.

Allen and Pelto point out that studies that focus on both biological and socio-behavioral factors have been quite rare, and in any case, have not been very clear about separating which factors predict breastfeeding success. These researchers suggest that a major effort must be made to separate the variables currently regarded as biocultural into their biological and cultural components. And according to the authors, although the weight of evidence is on the side of the importance of social variables as predictors of breastfeeding outcome, the biological component of biocultural variables has not been adequately investigated.

Quandt (1998) proposed applying a human biology perspective to the promotion of breastfeeding in the United States. For Quandt, social science models seek to link breastfeeding with sociodemographic variables of income, educational attainment and ethnic group affiliation. Biological anthropologists can add to this social science model by combining it with a behavioral base. This base includes breastfeeding behavioral structure, measurements of temporal patterns of suckling frequency and duration, and interval duration – all key to maintaining lactation, and all behaviors of the early postpartum period which have been linked to lactogenesis. By specifying the proximate determinants of breastfeeding rates, the routes by which characteristics such as ethnicity and educational level are related to breastfeeding can be better understood. According to Quandt there are three main contributions that biological anthropologists can make to improve breastfeeding performance: a) study of a wide range of anthropological factors, b) contributions to the terminology used to describe infant feeding, and, c) extension and expansion of research.

Studies on Onset of Lactation

There are several recent studies on delayed onset of lactation that point to causes of future problems with breastfeeding including milk insufficiency (Grajeda and Perez-Escamilla 2002; Hruschka et al. 2003; Perez-Escamilla and Chapman 2001). These studies employ a biological approach with some behavioral components, such as measuring stress or early introduction of supplements, and they focus on the onset of lactation or lactogenesis. Other authors (Grajeda and Perez-Escamilla 2002) have mentioned that this process can take longer, as some women said that the milk “came in” as many as 7 days after delivery. Perez-Escamilla and Chapman (2001) noted that women can report their onset of lactation with great accuracy cross-culturally.

In a study of delayed onset of lactation and risk of ending breastfeeding in rural Guatemala among 328 mothers-infants born between 1996 and 1999 until 6 months postpartum, Hruschka et al. (2003) reported that delayed onset of lactation (>3 days postpartum) was associated with perceived milk insufficiency, the pre-onset introduction of supplements and, more interesting, the mothers’ loss of confidence in their ability to produce adequate amounts of breast milk, increasing the risk of ending breastfeeding before 6 months. According to this study, one-third of mothers who supplemented within one week reported milk insufficiency as a reason for supplementation. They concluded that delayed onset of lactation could affect the pattern of feeding in the first few days of the infant’s life, thus affecting the subsequent feeding practices. Importantly, early use of even small quantities of water, teas, and ritual fluids may have an adverse effect on mother-infant pairs who experience delayed onset of lactation.

Another study measured stress during labor and delivery in association with delayed onset of lactation among urban Guatemalan women (Grajeda and Perez-Escamilla 2002). By measuring salivary cortisol concentrations before delivery and after delivery, this study found that an increase in stress delayed the onset of lactation. Implications of this delay could be negative because it could make women anxious, and result in early introduction of supplements and subsequent further delay in onset of lactation.

Psychosocial Wellbeing

The effects of maternal stress events such as economic problems, social support, chronic emotional anxiety, postpartum depression and lactation are starting to be analyzed in the recent literature. There are few clinical or social studies on the relation between stress and milk production in humans. However, some studies have shown that mothers with less stress do produce more milk than mothers that are experiencing intermittent or chronic stresses. More studies that demonstrate a (direct or indirect) relationship between stress-related issues such as war or poverty and milk volume are needed.

In an appealing article, Dewey (2001) explores the relationship of stress and lactogenesis II in humans, openly examining the connection between biology and culture. The author first shows a division between biological factors and behavioral factors and later makes a connection between the two. For her, mothers' biological factors include parity, mode of delivery, labor experience, body max index (BMI), smoking, breast or nipple abnormalities or surgery, illness, exhaustion, anxiety, and stress. Behavioral factors include motivation to breastfeed, social support, nursing frequency, the use of supplements, pacifier and breastfeeding experience. Dewey considers infants' associated biological and behavioral factors as well. Among the first are infants' birth weight, gestational age and suckling ability (sex of infants was not considered in her study). Infants' behavioral factors include temperament irritability versus passivity and suckling style. Exhaustion, anxiety or stresses are partially biological factors but they are clearly influenced by behavioral factors. For Dewey (2001:3014), the impairment of lactogenesis II may lead to delayed onset of milk production and/or insufficient milk volume; for her, maternal stress affects levels of other hormones involved in lactation, such as prolactin. However, it may also show the combined effects of all of these factors.

Simic et al. (2004) studied war-torn Bosnia and Herzegovina from 1991 to 1995, finding lower breast feeding rates there compared to other European countries during that time of war. The most common reason given by mothers for early weaning was milk insufficient. This explanation is supported by another study in Croatia, showing that the breastfeeding rate was higher in regions that were not at war (Zakanj et al. 2000).

Hill et al. (2005:681), in a study on psychological distress and milk volume in lactating mothers, compared two groups of mothers with a preterm (n=95) and term (n=98) infants, at postpartum week 6, using a sample from the state of Illinois. For milk volume, they used a combination of test-weighing and expressed milk via breast pump. Self-reported stress was measured by behavioral responses such as difficulty sleeping or level of exhaustion, using the Perceived Stress Scale (VAS), the Richards-Campbell Questionnaire and Fatigue Scale. They found that perceived stress was higher in the preterm mothers when compared to term mothers; nevertheless they concluded that there was no association between psychological distress and milk production during the first six weeks postpartum.

CONTINUED DEVELOPMENT OF BIOCULTURAL MODELS FOR RESEARCH

In the 1980s, critical medical anthropology drew attention to the analysis of power relations among social groups and classes and their connections to global political and economic forces (Singer 1989). These representations reflect debates within anthropology as a whole. At the same time, human biologists called for a biocultural approach to health and nutrition matters that combines ethnographic, anthropometric and socioeconomic data (Popkin et al. 1986, Goodman et al. 1988, Thomas 1989, Little and Gray 1990, McElroy 1990, Szathmary and Ferrell 1990, Dettwyler 1987, 1992, Carey 1993, Pelletier 1994, Swedlund and Urla 1994, Leatherman and Goodman 1994). The biocultural approach addresses many of the same issues as critical medical anthropology. For instance, Leatherman and Goodman (1994) advocate biological anthropology research in a context of biological and social connections, in which global political and economic processes, regional histories, power and ideology are considered.

New articles describe the challenges and contributions of such an approach, many of which apply to this research (see methodology chapter 4 of the thesis). Dufour (2006) presents three main challenges of implementing the biocultural approach. The first challenge is the difficulty in understanding meanings of constructs like socioeconomic status (SES), poverty and rural vs. urban. The second challenge is operationalizing variables so they can be measured in ways that are ethnographically valid and replicable. Dufour states that to adequately operationalize social and cultural variables (such as “work”), a reasonable ethnographic understanding of the local setting is required, namely, understanding the meaning of the word within the cultural context. The third challenge is defining and measuring multiple causal pathways. Dufour believes there is value in going beyond the usual and measuring multiple causal pathways to fully understand the complexity of interactions in a culture.

For Schell et al. (2007), cultural anthropology and ethnography have critiqued how knowledge is produced within the humanities and the social sciences – mainly, the essentialized and disempowered research subject. There are significant and beneficial implications for research design and results that a shift from research "subject" to research "participant" has for the field of human biology and biocultural studies in general. Furthermore, for the authors, there are challenges in working with communities, including the identification of community groups that represent the community and "ownership of data" in compliance with the local rules governing research. Community research may be more expensive, requiring consideration of the various research outcomes sought by researchers and community groups.

Meeting the aforementioned challenges in order to create a research partnership can require a significant time investment for the community and the academic partners. Academic institutions should become more sensitive to serving surrounding communities. Schell et al. conclude that this approach should benefit both researchers and participants. For the researcher, benefits include enhanced cooperation with the study, which usually translates into a larger sample of participants and improved measurement of relevant cultural variables. For the community, research project purchasing and employment bring economic benefits to the community and hiring of community employees to direct the research's day to day operations produces experiences in leadership and administration.

MY THEORETICAL FRAMEWORK BASED ON THE LITERATURE

As I noted in the introduction, I define milk insufficiency complaint (MIC) as the mother's perception that she does not have enough milk for her infant at any moment during lactation. I have tried to determine, from both cultural and biological perspectives, whether there is a "measurable" phenomenon that we can label as milk insufficiency (MMI) corresponding to mothers' perceptions and if so what it means.

From all the literature, I have taken on some milk insufficiency concepts and I have transformed others to fit my purposes. I use the terms "perception" or "syndrome" when that's what the authors within the literature indicate. Both terms do not mean that milk has been measured and establish milk insufficiency as the problem. Sometimes such an interpretation or assumption could be made by the researchers on milk insufficiency. Researchers may use terminology such as "milk insufficiency" without having measured milk production. Which gives rise to a second problem: Even if researchers have measured milk volume, what are the values that can be classified as insufficient milk production? We need to have some kind of "range" that can give us some idea of what could be classified as low production of breastmilk. In this dissertation, I develop those parameters based on the literature and my own research. Therefore, the reader will see throughout this dissertation Milk Insufficiency (whether perceived or "real"), MIC (milk insufficiency complaint), and MMI (for measured milk insufficiency) and the reader should note this as an important theoretical distinction in terminology. Other more self-explanatory terms are sometime used from the literature like insufficient milk syndrome, insufficient milk supply syndrome, inadequate milk syndrome, reported milk insufficiency and perceived milk insufficiency, among others. I also present the criteria for a measurable milk insufficiency later on in this dissertation.

At this point, I would also like to examine whether the syndrome concept is useful or not in the case of milk insufficiency. For Segura-Millan et al. (1994), for example, syndrome is not the right term for the problem. They posit that milk insufficiency is not real, but rather a false perception by the mother. And for Greiner et al. (1981), as I mention above, milk insufficiency is a culture-bound[5] syndrome rather than a biomedical syndrome, contrary to Gussler and Breisemeister's assertions.

Let us review then briefly meanings of the term syndrome. According to the Tabers Medical Dictionary (1985:1677), syndrome is defined as "a group of signs and symptoms that collectively characterize or indicate a particular disease or abnormal condition; the sum or signs associated with any pathological process." Although the term syndrome refers to "clear signs and symptoms" within biomedicine, it is also expanded and used outside of medicine, without the presence of "clear signs and symptoms," primarily to refer to interactions among many cofactors (WBGU 2008:1); in other words, any perceived event or phenomena (in philosophy) seen in association with multiple factors will be also called a syndrome.

I think the term a syndrome (as milk insufficiency syndrome) should not be considered the theoretical problem, it is just a theoretical assertion that the phenomenon is describable and culturally malleable – and therefore that it can be different in different

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5 For Low (1985:195) culture bound-syndromes should be called "culturally interpreted" syndromes because the same culture bound syndrome "occurs in many cultural settings with diverse cultural interpretation."

places as well as change over time. In my opinion, every culture will have its own syndrome explaining why some women do not have enough milk. “Every phenomenon is unique in the ultimate sense; it is only through use of conceptual constructs that we create degrees of similarity or sameness among diverse phenomena at varying levels of abstraction” (Sargent and Johnson 1996:143).

SUMMARY

Research on milk insufficiency comes from multiple fields including endocrinology, obstetrics, nutrition, nursery, physiology, psychology, demographics, epidemiology, sociology and cultural and/or biological anthropology. In 1980 Gussler and Breisemeister’s published in the journal Medical Anthropology the article called “The insufficient milk syndrome: A bicultural explanation” which has become a departing point in the discussion of milk insufficiency. Following this article, many more articles were published, most refuting the statement that insufficient milk syndrome was due to changes in patterns of breastfeeding and modernization in the urban settlings or a form of medicalization. Others suggested that mothers’ culture, education and socioeconomic status, breastfeeding on schedule versus on demand, exclusive versus complementary breastfeeding may all contribute to milk insufficiency. Overall, I believe that research that focuses on milk insufficiency has not expanded much since the late eighties – at least within anthropology. The main researchers in this area have shifted their approach over time. I have divided the literature into three approaches, cultural, biological and biocultural. However, the division between cultural or biological approaches is not a clear one.

Cultural factors influencing milk insufficiency are: hospital environment, mother's lack of confidence, maternal stress, sore nipples, employment, advice from professionals or relatives such as husband or mother-in-law, excuses for early weaning, use of infant formula, early supplementation, education level, socioeconomic status, and lack of practical and precise information about breastfeeding. These were the critical factors associated with insufficient milk. Biological factors include hormonal secretion (prolactin-oxytocin-dopamine), suckling stimuli, completeness of milk removal from the breasts, infectious diseases, mothers' nutritional status and parity. The literature shows no conclusive relationship between milk insufficiency and biological variables.

The discussion focuses on what is called the "autocrine" effect, or each breast's "breast-self-regulation" based on the level of emptiness as a consequence of the suckling infant's level or amount. Bioculture is the combination of all the above approaches. As part of this biocultural approach, the scope of the discussion on milk insufficiency has been expanded. More and more interdisciplinary studies are crossing boundaries between what is defined as pure biological or cultural by their respective disciplines. Then I present some suggestions by scholars on how to develop new biocultural models for research which include the inclusion of poverty, agency and power relationships. This chapter ended with a discussion of the theoretical distinctions between concepts of breast milk insufficiency and insufficient milk syndrome.

CHAPTER 3

HISTORICAL, GEOGRAPHIC AND SOCIAL CONTEXT OF THE RESEARCH SITE

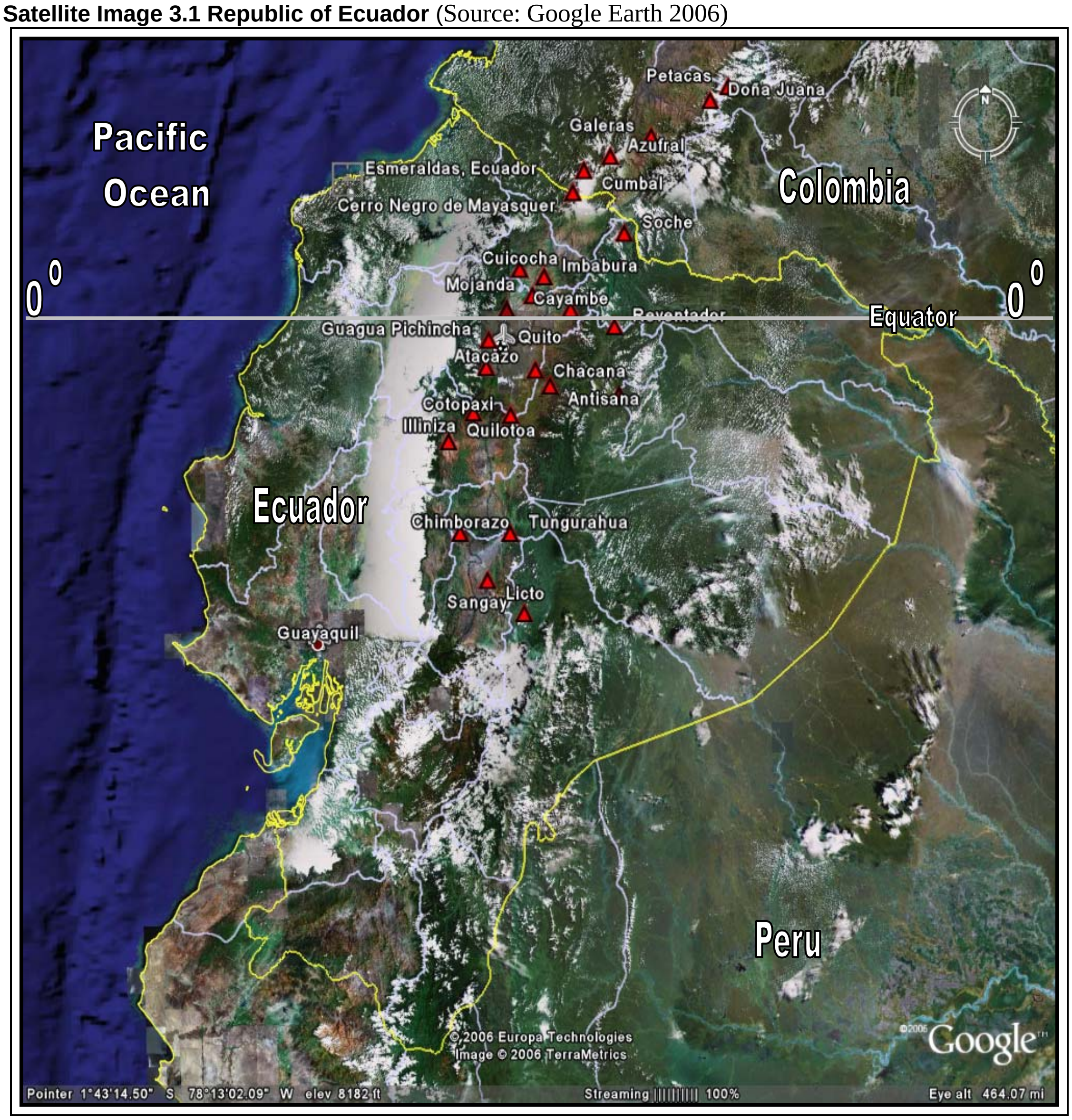
In this chapter, I present some basic geographic, demographic, political and economic information about Ecuador and Esmeraldas. I also describe the daily life, housing, and social activities of Esmeraldans (*Esmeraldeños*), including some information on diet. I offer an analysis of political economy, then of ethnicity, gender, and religion as they pertain to Esmeraldas and the people who live there, sufficient to provide the reader with a feel for the larger context of my research site.

GEOGRAPHY AND DEMOGRAPHICS

The site of the research presented in this dissertation was Esmeraldas City, Ecuador. The Republic of Ecuador is a small country of 255,970 km^2, located on the equator on the Pacific coast of South America (see satellite-image-map 3.1). Administratively, Ecuador is divided into 22 provinces, one of them being Esmeraldas, the capital of which is Esmeraldas City. Esmeraldas City is set alongside the mouth of the Esmeraldas River, where it meets the ocean (see satellite-image-map 3.2). The city is divided into four parishes: Esmeraldas, Luis Tello, Cinco de Agosto and Bartolomé Ruiz (Estupiñán 1984). The poorest neighborhoods are mainly located either on the floodplain of the river, or high up on the unstable sandy clay hills above. Esmeraldas City is also the location of the only petroleum refinery in Ecuador.

Esmeraldas is Ecuador's northernmost coastal province. It is located between the equator and 1 north latitude, in a tropically forested basin drained by two major river systems: the Esmeraldas and the Santiago-Cayapas. The province borders on Colombia's Department of Nariño to the north and is part of a Pacific lowland corridor that extends from Panama through Colombia and into northern Ecuador (Rueda 2001, Whitten 1986). This region is biogeographically distinct, due both to the local effects of the El Niño current and the proximity of the Andean uplands to the east (Madden 1989, Vos et al. 1999) (see satellite-image-map 3.3).

Satellite Image 3.1 Republic of Ecuador (Source: Google Earth 2006)



This satellite photo shows nicely the climactic features of the region. Notice the white elongated stripe to the west of the mountain chain caused by the Andes wall effect, creating a temperate humid zone in this part of Ecuador that includes Esmeraldas province.

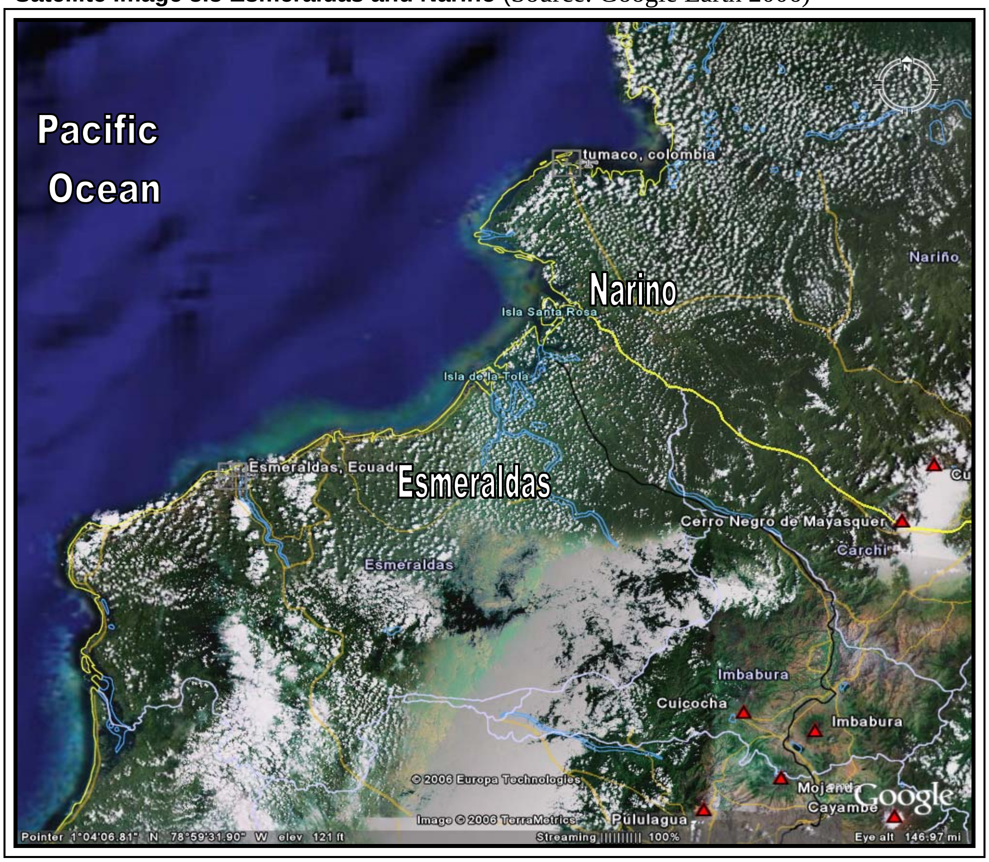
Satellite Image 3.2 City and River of Esmeraldas (Source: Google Earth 2008)

The city of Esmeraldas stretches along the left branch of the Esmeraldas River. Note the uppermost point of the city is Esmeraldas' sea-port. Across the river is the airport, with access from the city only far upriver. The white circles on the left side of the image are part of the petroleum refinery of *Codesa*. The Trans-Ecuadorian Oil Pipeline System (SOTE), currently transports some 349,000 barrels/day of crude oil from the Amazon Basin to the refining facilities at Esmeraldas" (Source: www.hydrocarbons-technology.com/projects/**sote**).The city is bounded on the west side by hills and on the east side by the Esmeraldas River. During the rainy season the hill neighborhoods (largely poor and overbuilt) are subject to dangerous mudslides, while the poor neighborhood bordering the river lowlands become inundated by flood waters.

Esmeraldas is unique in Ecuador geographically, historically, and ethnically. It is unique geographically for the reasons mentioned above, as well as because of its local biodiversity (Estupiñán 1984) and a very high rate of annual precipitation: 5,000-12,000 mm/year (Banco Mundial website 2002). It is atypical in the ethnic makeup of the area, with the largest Afro-Ecuadorian population in Ecuador. The ancestors of modern Afro-Ecuadorians were brought to the region very early in colonial times as slaves, mainly to perform agricultural labor. This forced migration has made Esmeraldas ethnically unique;

the majority of today's Esmeraldans are Afro-Ecuadorians, who may constitute as little as 5% of the population in Ecuador as a whole (Corkill and Cubitt 1988), although more recent data suggests that the figure is 9% to10% (Banco Central 2000,Wibbelsman 2003). In addition to Afro-Ecuadorians, mestizos, and whites, the province of Esmeraldas is also home to three indigenous[6] ethno-linguistic groups: the Chachi, the Awá, and the Espera or Épera (Gerlach 2003, World Bank web side 2005). Esmeraldas is culturally distinctive in part due to the continuing influence of these indigenous groups.

Satellite Image 3.3 Esmeraldas and Nariño (Source: Google Earth 2006)



This satellite photo shows Esmeraldas' proximity to Colombia. Nariño is the southernmost Colombian department that shares a border with Esmeraldas province along an important corridor between the coast line and the mountains and the sea shared by the two countries from historical times until today.

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[6] At least some indigenous groups had developed important regional centers and in the north of the province during prehistory, the well known site of La Tolita from 200 BC to A.D 350 (DeBoer 1996).

According to the most recent official census, dated November 2001, Ecuador's population was 12,156,608 inhabitants, of whom 385,223 were resident in Esmeraldas. Esmeraldas City itself had a population of 95,124 inhabitants (INEC 2001).

AFRO-ECUADORIANS IN ESMERALDAS

There are several different theories about the arrival of the first Afro-Ecuadorians in Emeraldas. Most have certain similarities and focus on two major sources of migration at two different times. One of the most popular claims[7] is that modern Afro-Ecuadorians are the descendents of survivors of a sunken slave ship; another is that they are descendants of free Afro-Colombians (Estupiñán Tello 1996, García-Barrio 1981, Newson 1995, Speiser 1991, West 1957, Whitten 1965). Both explanations involve Africans or their descendants who escaped enslavement. According to Esmeraldas historian Julio Estupiñán Tello (1996), in 1553, a ship with merchandise and slaves coming from Panama ran aground close to El Cabo de San Francisco in the southern part of the Esmeraldas Province. Seventeen men and six women escaped with some provisions and weapons into the jungle, where they battled and defeated the local Amerindians. They are reported to have later married Indian women, and thus to have established the first black and/or *mulato* and *zambo* (a person mixed African and indigenous ancestry) free colony in Esmeraldas.

Estupiñán Tello (1996) further specifies that these slaves belonged to the Spanish slave-owner Don Alonso de Illescas, and originally came from Cape Verde in West Africa. One slave, Alonso de Illescas (named after his owner), or *el Negro Alonso,* was brought to Seville Spain as a child and was later sent to Esmeraldas on the

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[7] Based on a 16th century account by the Spanish *Cronista* Miguel Cabello Balboa.

aforementioned ship. He is credited with organizing the other slaves to defeat the *Niguas*, or local indigenous peoples; he eventually married one of the indigenous women and procreated with her.

Estupiñán Tello (1996) suggests additional sources for Africans in Esmeraldas, among them, another ship that ran aground in the 17th century. During the 18th and 19th centuries, free blacks came to Esmeraldas from the Chota area in the highlands, first after escaping from Jesuit-owned sugar plantations and then after the Jesuit expulsion from Ecuador in 1767 (Estupiñán Tello 1996, Miranda 2005).

Another explanation of Afro-Ecuadorian presence in Esmeraldas is waves of migration from Colombia, beginning as early as the 16th century (Garcia-Barrio 1981, Speiser 1991, Whitten 1986). Afro-Colombians are supposed to have come to Esmeraldas as loggers, gold miners, workers on rubber plantations, for the collection of *tagua* (palm nuts), or to escape from slavery. All of these accounts point to blacks in Esmeraldas as free. During the last 150 years the region has been shaped by boom cycles of rubber, *tagua*, bananas and lumber, exploited by English, German, French, and American companies (Corkill and Cubitt 1988, Speiser 1991, Whitten 1965,).

More recent migration of Colombian blacks into Esmeraldas has been attributed to escape from the early twentieth century political battles between conservatives and liberals in Colombia (personal communication from an anonymous source, 1999) and lately, to displacement by the civil war between leftist guerrillas and the Colombian government (Wibbelsman 2003).

Interestingly, during my interviews I found that many of the participants in my research or their close relatives originally came from Colombia; some of them still hold national ID cards (*cédulas*) from both countries. National identity is somewhat fluid in this situation for Afro-Hispanics (using Norman Whitten's [1986] terminology). However, it is very difficult for these people to discuss their nationality openly because of a fear of potential discrimination experienced by such parties in both countries, and also due to the ongoing effects of civil war, violence, and narcotics trafficking on the border.

Not only blacks from Colombia have migrated to Esmeraldas province. There has been a constant wave of migration from the rest of Ecuador, especially from the bordering province of Manabí which has suffered periodic droughts (CEPAR 1988). Today many common last names in Esmeraldas come from Manabí province or from the *Manabitas* (Estupiñán Tello 2003). But it is also true that there is steady migration of Esmeraldans to other provinces of Ecuador such as to Guayas, Pichincha and El Oro (CEPAR 1988).

Racial Ambiguity and Ecuadorian Identity

As specified above, the great majority of residents in both the Province and City of Esmeraldas are Afro-Ecuadorian. As per the typical racial and ethnic hierarchies exhibited in Latin America, the elite class is either mestizo or white. Whitten (1974) suggests this hierarchy is due to the rather recent introduction of national patterns of stratification and describes a process of "ruralization" of Afro-Ecuadorian neighborhoods, where people are blocked from participating fully in urban life. The city of Esmeraldas is the center for migration from smaller towns and villages in the region (Middleton 1981). Esmeraldas is peripheral to centralized and polarized governments in

Quito and Guayaquil respectively, which are the major cities of Ecuador both in political and economic power (Adoum 1998; Cueva 1982; Torres 2002).

In the latest census, for the first time there was a structured question asking Ecuadorians to identify their "racial status." The results were as follows: 2.23% identified themselves as black; 2.74% as mulata/o; 6.83% as indigenous, 10.46% as white and 77.42% as mestizo (INEC 2001). I think these labels are ambiguous, because there is no way in which to classify any such groups, from either a biological[8] or a cultural perspective. Moreover this census's question simply measured and revealed how people felt about their ethnicity in a country where white skin is idealized and dark skin is ostracized. And these numbers still differ from other statistics; see for example CODENPE statistics cited by Wibbelsman (2003: 376) were: 30% - 40% are indigenous, 55% mestizos, 9% Afro-Ecuadorians and 1% whites. It shows, agreeing with Gerlach (2003: 13), that in Ecuador it is difficult and controversial to categorize people by race.

On the basis of the lates census data, we can say that Ecuador is a mestizo nation, or rather, as Whitten (1986:199) specifies, a "mestizo ethnic construct" country. In my opinion, people in Ecuador prefer to be labeled as mestizo rather than risk being categorized by others in ways that they consider pejorative, such as: *indio* (indigenous person), *cholo* (of mixed race with indigenous person), *longo* (of mixed race with indigenous person), *montuvio* (peasant from the coast), *mulato* (of mixed race with black and white), *zambo* (person mixed with black and indigenous) or *negro* (black). In the

[8] As the AAA statement on Race (1998) describes, "Evidence from the analysis of genetics (e.g., DNA) indicates that most physical variation, about 94%, lies *within* so-called racial groups. Conventional geographic "racial" groupings differ from one another only in about 6% of their genes. This means that there is greater variation within "racial" groups than between them." And they continue saying that: "Given what we know about the capacity of normal humans to achieve and function within any culture, we conclude that present-day inequalities between so-called "racial" groups are not consequences of their biological inheritance but products of historical and contemporary social, economic, educational, and political circumstances" (http://www.aaanet.org/stmts/racepp.htm).

final analysis, how individuals label themselves does not really count for much as compared to how white-standardized Ecuadorian society labels and classifies them.

In any case, the concept of being "*mestizo*" is an important one. Even though *mestizo* (meaning mixed blood) is an ambiguous term, the use of it implies that a person who is called *mestizo* has "at least some white blood" and is therefore somewhat "in the process of whitening" or "closer" to the superordinate group as opposed to the subordinate group. For this reason, the concept of being *mestizo* could be compared to the "one drop blood rule"[9] or the "rule of hypo-descent"[10] in the US, but in reverse.

As Wade (2003) states, in Latin America the glorification of *mestizaje* has two sides: on the one hand it glorifies the *mestizo* or *mestizaje* as a democratic process of the new Latin America and on the other hand *mestizaje* "…hides [the] racist and even ethnocidal practices of whitening." He continues, arguing that in Colombia, "black people are included and excluded: included as ordinary citizens, participating in the overcharging process of *mestizaje*, and simultaneously excluded as inferior citizens, or even as people who only marginally participated in 'national society,' and as individuals with whom whiter people might not want to actually practice *mestizaje*, especially in the most intimate sense of forming links not just of sex but of kinship" (Wade 2003:270).

In Ecuador, because of their skin color, Afro-Ecuadorians are farther than most from the Ecuadorian ideal, which substantially affects their participation and representation in state society, except with regard to *futbol* (soccer). Recently, returning

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[9] "Blacks become any one who had the slightest amount of black "blood" as attested to by their having even one ancestor who was known to have been identified as black" (Marvin Harris 1994:175).

[10] "Hypo-descent means affiliation with the subordinate rather than the superordinate group in order to avoid the ambiguity of intermediate identity" (Marvin Harris, cited by Whitten 1986:198).

from the World Cup[11] competition in Germany, the Ecuadorian team celebrated at a luxurious hotel in Guayaquil, displaying a large banner saying: "*Somos la piel de la Selección 100% afroecuatorianos*" (we are the skin of the World Cup team, 100% Afro-Ecuadorian) (El Comercio July 7, 2006). The World Cup participation of the team forced Ecuadorians to talk about skin color and equality overtly for the first time on TV shows and in news papers during June 2006.

The national and regional governments have long failed to provide basic infrastructure and services to the population of Esmeraldas because of a proven history of racial discrimination (Adoum 1998; Torres 2002; Whitten 2003). On the demographic and health statistical report of ENDEMAIN, 2004 (sponsored by the CDC, USAID, UNICEF, PAHO, and the Japanese national government, among others), the category black does not exist. The categories are only indigenous, *mestizo*, white and "other." I assume blacks were excluded as the "other" category. As Whitten (1986: 198) points out, "Ambiguity about calculating who is, or who is not, to be classed 'negro' in no way negates the fact that a 'negro' category exists in Ecuador and in Colombia, as in every other Latin American nation and territory, and that people who share a gene pool of West African characteristics, together with aggregating cultural traits, are the only ones other than 'indios' to be routinely excluded when speedup in economic opportunities takes place."

Today, the concept of *mestizaje* is still far from being well understood or widely discussed in Ecuador, at least in terms of socioeconomic and political power. In addition,

[11] During the recent World Cup tournament, almost all of the members of the Ecuadorian team were Afro-Ecuadorians. National and international reactions to this team were interesting, because it forced Ecuador to talk about equality, integration and membership for blacks and because internationally the team was accused of having players from African countries (Argentine TV sports commentator, June 2006).

there is a lack of open discussion of the racial categories *negro, mulato,* or *moreno* (meaning black, the last used as a less xenophobic term) at all levels of Ecuadorian society. Those terms are discussed and used in statistical reports issued by governmental agencies and NGOs, or by scholars writing about Ecuador and mainly in English (see the literature).

RECENT POLITICS AND ECONOMICS IN ECUADOR

As an Ecuadorian living abroad, I could not agree more with what is said about Ecuador in the introduction to the book *Ecuador: Fragile Democracy*, by Corkill and Cubitt (1988:1). They state that Ecuador "…seldom makes the headlines of the world's press..." because it is a country within Latin America that has neither gone through a major revolution like Mexico or Cuba, [nor a dictatorship with a bad human rights record like the Dominican Republic, Chile or Argentina], nor a violent guerrilla war like in [Central America], Colombia, or Peru…". I would add that neither is Ecuador a producer of coca leaves or cocaine and other drugs like its Andean neighbors,[12] which are subject to direct United States economic, political and military interventions.[13] Nevertheless, recent political events have finally put Ecuador on the front pages of the world's newspapers; including reports of mass movements that toppled the government on three occasions, which changed the outcome of the last three democratically elected presidents' terms. In one instance, the duly elected president was replaced by an interim president,

[12] Although according to some new sources, Ecuador has long been hosting both coca cultivation and cocaine production in several provinces and its use as a transshipment point is growing rapidly (El Comercio October 11, 2006).

[13] However, in July 1999 President Jamil Mahuad agreed to allow the United States to create a military base, a counter drug operation center or Forward Operation Location (FOL) –in Manta (Wibbelsman 2003). From this high-tech installation in Manta, the US military monitors the entire region including movements of the Colombian left guerrillas (Whitten 2003).

and in the other two cases, sitting presidents were replaced by their respective vice-presidents.[14]

During my field research, Ecuador suffered a major economic crisis. It was brought on by reverberations from an economic crisis in Asia, a global drop in oil prices,[15] local political turmoil, banking corruption, and the catastrophic events resulting from the El Niño phenomenon, which shook the coast throughout 1998, culminating in the total collapse of the Ecuadorian economy, with negative economic growth of -8.8% between 1998-1999 (North 2004).

The following Table (3.1) shows the average exchange rate for Ecuadorian sucres per US dollar over the course of five years, reflecting a dramatic depreciation of the local currency, which reflects and also helped produce the economic crisis of 1999 (Source: Internet site for the Republic of Ecuador and author's field notes).

Table 3. 1 Conversion of One US Dollar to the Local Currency

Conversion of One US Dollar to Sucres from 1997 to 2001				
1997	1998	1999	2000	2001
$1= ~ 3,988S.	$1= ~ 5,446S.	$1= ~11,786S.	$1= ~24,988S.	$1 =~25,804S.
Note: for calculations I use the average from 1998-2000; $1= 14,073.33 Sucres.				

[14] From 1997 through 2005, Ecuador has had a total of six different presidents.

[15] In 1998 the price per barrel of Ecuadorian oil fell to less than $10 (Correa 2005). By February 2006, the average price per Ecuadorian oil barrel was $41 (Diario El Comercio, 10 de febrero, 2006). The price listed on the New York Mercantile Exchange during February 2006 was more than $60 per barrel.

The Economic Crisis of 1999

During March 1999, the value of the Ecuadorian Sucre dropped by half against the dollar in just one day. The government froze all dollar bank accounts (including the money allocated for this research) and half of the Sucre accounts as well. That was the beginning of an economic crisis causing major change in the lives of all Ecuadorians. Less than one year later Ecuador adopted the dollar as its official currency.

Prices for most basic goods and services doubled almost immediately, and in some cases nearly tripled, as some merchants tried to take advantage of the desperate situation. Needless to say, the average salaried worker did not receive an increase in wages as a response to this crisis. On the contrary, many people lost their jobs or had their salaries deferred or reduced.

There were five eventual results of the collapse of the economy and the political turmoil that ensued during March of 1999. First, President Jamil Mahuad created *El Bono Solidario*[16] (an economic assistance program for the poor), which gave those who qualified the equivalent at that time of $11 per month in aid. This program was carried out in conjunction with the major Ecuadorian banks (in Esmeraldas, with *Banco Del Pichincha*). The second was the *dolarización* (dollarization) of the economy, announced on January 9, 2000. This was implemented slowly over the following years, with the eventual conversion of the national currency from the traditional Sucre to the US dollar. Third was the military-indigenous coup-d'etat of January 22, 2000. This lasted 24 hours and ended in the resignation of the president, Jamil Mahuad, along with the ascension of vice president Gustavo Noboa as interim president.

[16] In 2003 the name *Bono Solidario* was changed to *Bono de Desarrollo Humano* (BDH). There was also an increase from $11 to $15 dollars per month for poor and very poor families in Ecuador.

Fourth, was massive emigration (legal and illegal) of the country's economically active population to seek work in Spain, Italy, the United States, and Australia which, according to Acosta 2002 (cited in North 2004), involved 10% of the total population. And according with Correa (2005) the total migration since the crisis started has been from 300,000 to 1 million of Ecuadorians.

And five, after the sale of oil, monetary remittances sent by emigrants take second place in terms of their value (Diario El Comercio, February 6, 2006). To give the reader an idea of the magnitude and importance of these remittances, in 2004 alone, these funds totaled $1.6 billion (US). This represents more revenue than from bananas and flowers[17] combined (Fundación José Peralta 2005).

The economic crisis was particularly severe in Esmeraldas. In the city as well as in the province as a whole, the crisis caused many hardships and changes in the lifestyle of the people, leading to despair, anxiety, uncertainty, violence, and crime. Migration within the province and to other countries became common (personal observation within the mothers). Three times, general strikes accompanied by riots closed down the city for a period of several days in the months following the start of the crisis. All of these factors, along with the flooding and mudslides affecting the city due to the El Niño phenomenon in the winter of 1998, meant that throughout much of the course of my research Esmeraldas was constantly on the verge of social, economical and political collapse.

Behavioral changes came with the crisis as well. Sharing food, which was part of the Esmeraldas culture, now had become more difficult. People were reluctant to have guests, since they could not offer as much as in the past. This made some mothers

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[17] Ecuador's economy has traditionally been based on agricultural products like bananas, coffee and cacao. In the 1960's oil became a major export product; by the 1980's flowers and shrimp were added to the list.

reluctant to continue in the project, since they could not afford to offer as much food as before to the assistants conducting the observations (see next chapter on methods). We attempted to reassure them, and assistants were supposed to supply their own lunch. Some mothers stated that they felt forced to breastfeed, because there was no money to buy formula. The direct effects of the crisis on participants in my study can be summarized as follows:

1. Families ate less, both in frequency and in quality. For instance, instead of the usual three or two meals a day, they ate just two or even one.

2. Mothers were under a great deal of stress; both mothers and children were ill more often than before the crisis.

3. Many mothers were looking for work, or already working, leaving their infants at home with others for much of the day.

4. Every month mothers waited anxiously outside the bank with their children to receive their subsidy, the *bono*.

5. Broken families were left behind by those who immigrated to other countries.

Dollarization

For the economist Alberto Acosta (2001) the dollarization in Ecuador was the result of stressed politicians as an exit to bad economic policies. For him the dollarization is an artificial and an authoritarian decision that reduces the capacity of [economic] movement of a country (Acosta 2001:18). The conditions for dollarization of the Ecuadorian economy was in part the US desire to lower transaction costs of establishing a Free Trade of the Americas or (*Area de Libre Comercio or ALCA*) and the economic monetary expansion throughout the western hemisphere. Economists argue that in return for making this concession to Washington, and for being at the macroeconomic mercy of the Federal Reserve (FED), that Ecuador ought to have obtained some concrete benefits or aid, but Ecuador obtained virtually nothing in return for dollarizing its economy (Acosta 2001; Macedo et al. 2001).

During my 2001 return visit to Esmeraldas, when I asked people what they thought about dollarization, the answers were, “it has been confusing, complicated, catastrophic, or a disaster.” Nothing was priced lower than one dollar. Portions of basic food items such as vegetables or cereals that in the past would have cost the equivalent of 25-50 cents at the most were priced at a dollar instead. Indeed, certain food items then cost more to buy in Esmeraldas than in New York City.

Originally, I thought this overpricing was simply due to the confusion surrounding the introduction of the new currency, but in my recent trip to Esmeraldas (2006),[18] these exorbitant prices remain the same. At the same time I could notice changes in almost all aspects of people lives’ in Esmeraldas. One could notice more new cars in the streets. Telephone kiosks are everywhere (some for regular telephones and others just for cell phones), to call anywhere in the world, cheaper than calling from the

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[18] Today (2006) there are many points of view regarding the dollarization of the Ecuadorian economy. There are those who support it and those who reject it. Supporters suggest that dollarization helped to stabilize the macro-economy of the country, reducing inflation, and as a consequence, stabilizing salaries (Diario El Comercio, January 9-11, 2006). Perhaps buttressing this argument, big businesses, banks, export-import companies, tourism, construction, large retailers, and industries related to the international economy are growing and making profits (Fundación José Peralta 2005, North 2004). Those who reject dollarization believe that the stabilization of the macro-economy is not equal to the de-stabilization of the micro economy, or people’s economy (Fundación José Peralta 2005). Thus, they point to the fact that products from Ecuador can no longer compete in the market with those of its neighbors, as they are too expensive. In addition, Ecuador is now one of the more expensive countries in Latin America (North 2004). And for the current president of Ecuador, the economist Rafael Correa (2005), the dollarization was an economic and geopolitical mistake.

US. And for the first time in Ecuadorian history, the *ministro* (secretary) of culture in the current government is an Afro-Ecuadorian Esmeraldan (*Esmeraldeñan)*. During my recent trip to Esmeraldas, I noticed that Esmeraldas is undergoing very "rapid" change.

MOTHERS' LIVES AND SOCIAL ORGANIZATION

Education and Socioeconomic Groups

The mothers participating in my study came from households representing three different socioeconomic groups. A small number were professionals who had a certain amount of expendable income. For example, one mother was a dentist; she owned and lived in a brick house. She also had enough money to hire a babysitter. However, hiring a maid or babysitter does not have the same economic import in Esmeraldas as it might in the US. Such help may be obtained for very little in Esmeraldas: maids, housekeepers, or babysitters sometimes work for food instead of cash. In fact, one of the mothers in our study worked as a maid. In the same group were mothers who worked as teachers, substitute teachers, or in one case, as a secretary. The rest of the women were poor or very poor, mostly single mothers, without a "real" job. The following figures (3.1, 3.2) show the frequency of the distribution of household income and education in years.

Figure 3.1 shows household income descriptive statistics results. Because of missing income information for 12 of the mothers, the total number is 60 instead of 72. The mean monthly household income of the mothers was $68.63. The lowest monthly household income was $10.66 while the highest is $284.23. All but three of the 72 mothers had monthly household income less than or equal to $150.

Figure 3.1 Household Monthly Income

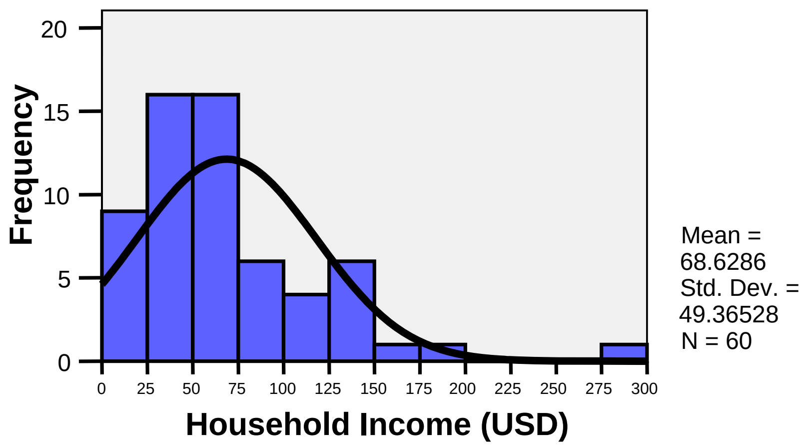


Figure 3.2 Years of Education

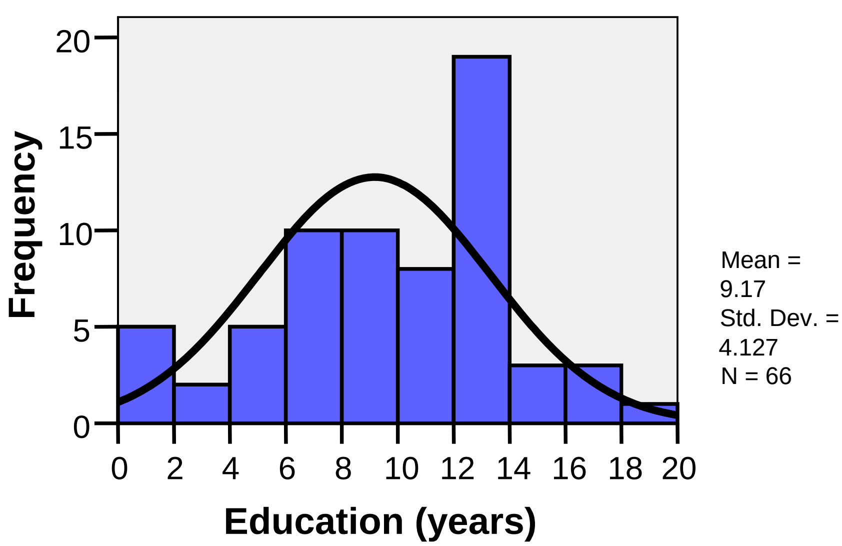


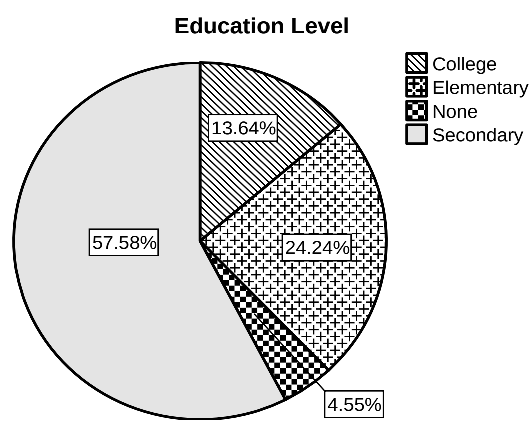
Figure 3.2 provides statistics for the variable Education (years). The mean number of years of formal education for mothers was 9.17. The minimum was 1 and the maximum was 18. The histogram shows that the variable peaks at the interval between 12 years and 14 years. Table 3.2 and Figure 3.3 below, show that from the 66 mothers 38

(57.6%) have a secondary school education,[19] 16 mothers (24.2%) have an elementary school education, 9 mothers (13.6%) have a college education and 3 mothers none education (information on education was not provided for 6 mothers).

Table 3.2 Education Level

		Frequency	Percent
Valid	College	9	13.6
	Elementary	16	24.2
	None	3	4.5
	Secondary	38	57.6
	Total	66	100.0

Figure 3.3 education level



For most, their income was correlated with their level of education. Tables 3.3 and 3.4 break down household income according to educational level and show the relationship between household income and education. Table 3.4 provides descriptive statistics regarding household income. The median monthly household income for mothers with college education was $135 while the median monthly household income

[19] In Ecuador school is divided in 6 years periods, elementary the first six, secondary the next six years and then college.

for mothers with elementary education is $ 28.42. And the median monthly household income for mothers with secondary education is $ 56.84.

Table 3.3 Household income (USD) by education level – Sample Size

		Cases
	Education Level	N
Household Income (USD)	None	3
	Elementary	13
	Secondary	33
	College	8

Table 3.4 Monthly Household Income (USD) by Education Level

	Education Level		Statistic	Std. Error
Household Income (USD)	None	Mean	33.1596	10.32425
		Median	35.5282	
		Std. Deviation	17.8821	
		Minimum	14.21	
		Maximum	49.74	
		Range	35.53	
	Elementary	Mean	40.5021	6.78026
		Median	28.4226	
		Std. Deviation	24.4466	
		Minimum	14.21	
		Maximum	85.27	
		Range	71.06	
	Secondary	Mean	65.5441	6.03362
		Median	56.8451	
		Std. Deviation	34.6605	
		Minimum	10.66	
		Maximum	142.11	
		Range	131.45	
	College	Mean	146.554	24.39158
		Median	135.007	
		Std. Deviation	68.9898	
		Minimum	42.63	
		Maximum	284.23	
		Range	241.59	

Although from the above table, we can see that mothers with higher educational levels have higher incomes, it does not statistically prove this assertion. A non-parametric[20] test, Kruskal Wallis (K-W) test, was used to examine whether there is a

[20] The Kruskal-Wallis test is a non-parametric alternative to one-way analysis of variance. The one-way analysis of variance could not be used with this variable because the assumption of normality (the

statistical difference in the income between mothers with different education levels. The p-value for the K-S test is <0.001, thus we can conclude that there are significant differences in household income among education groups.

Table 3.5 Mean Rank: Household Income (USD) by Education Level

	Education Level	N	Mean Rank
Household Income (USD)	None	3	14.17
	Elementary	13	18.58
	Secondary	33	29.79
	Collge	8	48.25
	Total	57	

Table 3.6 K-W Test Statistics [a,b]

	Household Income
Chi-Square	18.470
df	3
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: Education Level

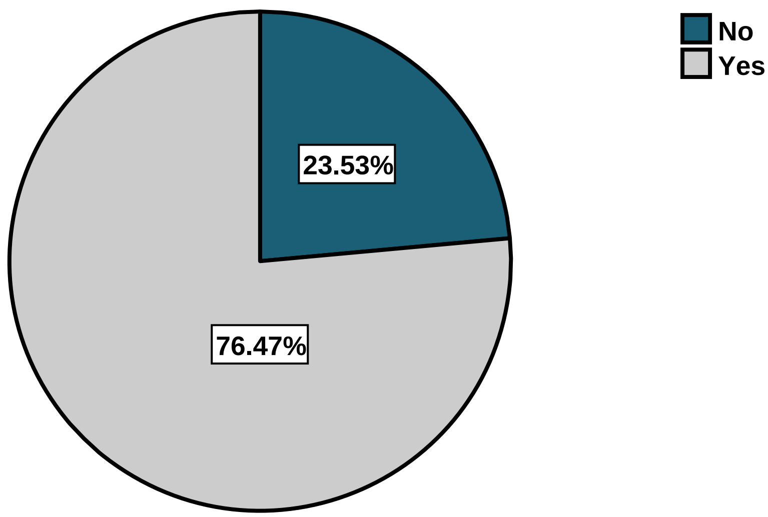
All these figures and ethnographic information show the importance of the Government Economic Assistance (*El Bono Solidario*), colloquially called *el bono*, which represented 15-21% of the average household income. The majority (72.22%) of the mothers in my study received this assistance (see Table 3.7 and Fig. 3.4). For the mothers, *el bono* was anxiously awaited every month, even though they expected and said that “it’s not enough to live on.”

distribution of income for each educational level is not normal) and homoscedasticity (the variance of income between the educational level is not constant) were violated.

Table 3.7 Government Economic Assistance

		Frequency	Percent
Valid	No	16	23.5
	Yes	52	76.5
	Total	68	100.0

Fig. 3.4 Government Economic Assistance



Most of these women lived with extended family members, contributing their salaries to help with the expenses of the entire household. Interestingly, some men in this extended group worked as tailors. As Whitten (1986:79) observed, “sewing clothes is a man’s occupation in the wet littoral.” Other jobs that some fathers had involved work on the plantations, in construction, in the food market as security guards, or as cooks. Even if one was lucky enough to get one of those jobs, the reward was often below subsistence wages. For example, one father found a construction job for which he was earning a salary of $7.50 per week, little more than a dollar per day, even though the minimum wage was supposed to be $3-$4[21] per day. Women worked washing clothes, cooking for another family, selling fruit on the street, or cooking food such as *maduros* (sweet plantain), *cocadas* (sweet coconut bars), or *corviches* (fried fish dumplings) to be sold on the street or beach, whether by themselves or by their children. Some members of the families that included our mothers worked in the informal sector of the market, making money selling alcohol (*aguardiente*) by the quarter or half a bottle, or drugs like *base* (a derivative of cocaine) and marijuana. Almost everyone was looking to leave Esmeraldas to find work, either within Ecuador, or outside of the country.

Social Support & Participation

Support from one's neighbors is very important for women in Esmeraldas. Many mothers lived in what could be called a communal house of women and children. Interestingly, some infants received breast milk from mothers other than their own. The women with children took care of each other's children, caring for all the children, washing clothing and cooking. Mothers worked a lot, did not eat much, and breastfed their children. Nevertheless, most of the mothers involved in this research had a BMI within the normal range (see chapter 6).

Fortunately for these mothers, the entire family helped pitch in to care for the baby. Cousins, aunts, uncles, grandmothers, *comadres-compadres* (god-parents), fathers, and neighbors alike; it's as if the baby belonged to everybody, with everyone having a say in how the baby should be cared for (see Whitten 1965, 1986:158 for network analysis). For instance, a grandmother decided that a baby needed to have his mouth cleaned with some local remedy, *violeta de gensiana* (antiseptic tincture), because

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21 Calculated from *salario minimo vital* (minimum wage) of $100-$120 per month in 2000.

someone had given the infant a *colada* (porridge) that was too sweet. Even though that might not have been the correct treatment for the baby, the grandmother's action was not questioned by anyone. It is also very common for mothers to chat constantly with other women who are neighbors, perhaps as a way to ease their common tensions and share pertinent information.

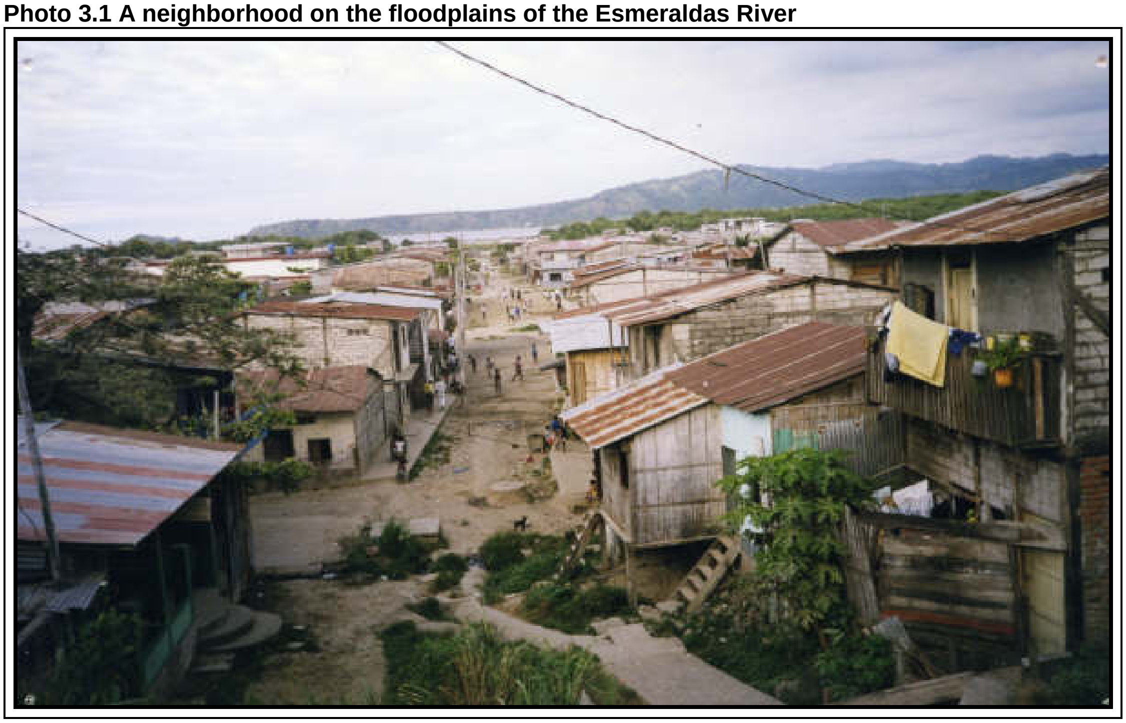
During this study, in many Afro-Ecuadorian households, a male figure was absent. This was not the case in the majority of non Afro-Ecuadorian households. In those households, it was common for the father and mother to work within the house. Thus the husbands or fathers in non-Afro-Ecuadorian households were more commonly present than those in the Afro-Ecuadorian families. Non-Afro-Ecuadorian men were usually very involved with the care of their children; they also took almost all decision making ability away from the mothers. I must add, as I mentioned before, that in the Afro-Ecuadorian households there almost always were a number of people, both family members and non-family-members, helping the mother. When the father was present, he helped with the household work as well.

In Esmeraldas, men are favored over women. Baby boys are given better care than girls. For instance, mothers favor the baby boys by feeding them formula, as they consider this a preferential food. However, if the baby is a girl, the mother might not give the infant formula and mostly likely the baby would be fed a cheaper form of supplement. It is very common that daughters perform a lot of housework, including the care of new babies. In fact, it appeared that the young girls were treated more like maids. A mother told us that the father of her baby was very *orgulloso* (proud) because it was a boy and how he was happy that the baby could say *papá*.

Even though some families were very poor, I do not recall having seen any house without at least a small black and white television set. Television is a very important communication medium[22] for all Esmeraldans. Mothers were constantly watching TV during our visits. They watched the famous *telenovelas* (Latin soap operas), one after the other, throughout the day. They also watched a shopping channel called *TV-Ventas* (Info-mercial). There is a store of the same name owned by the channel in Esmeraldas and viewers pay close attention to the items being sold, even if they do not have the money to go and buy anything. Adults encouraged babies to watch television; mothers placed them in front of the TV set (perhaps today this happens everywhere).

Housing

Photo 3.1 A neighborhood on the floodplains of the Esmeraldas River



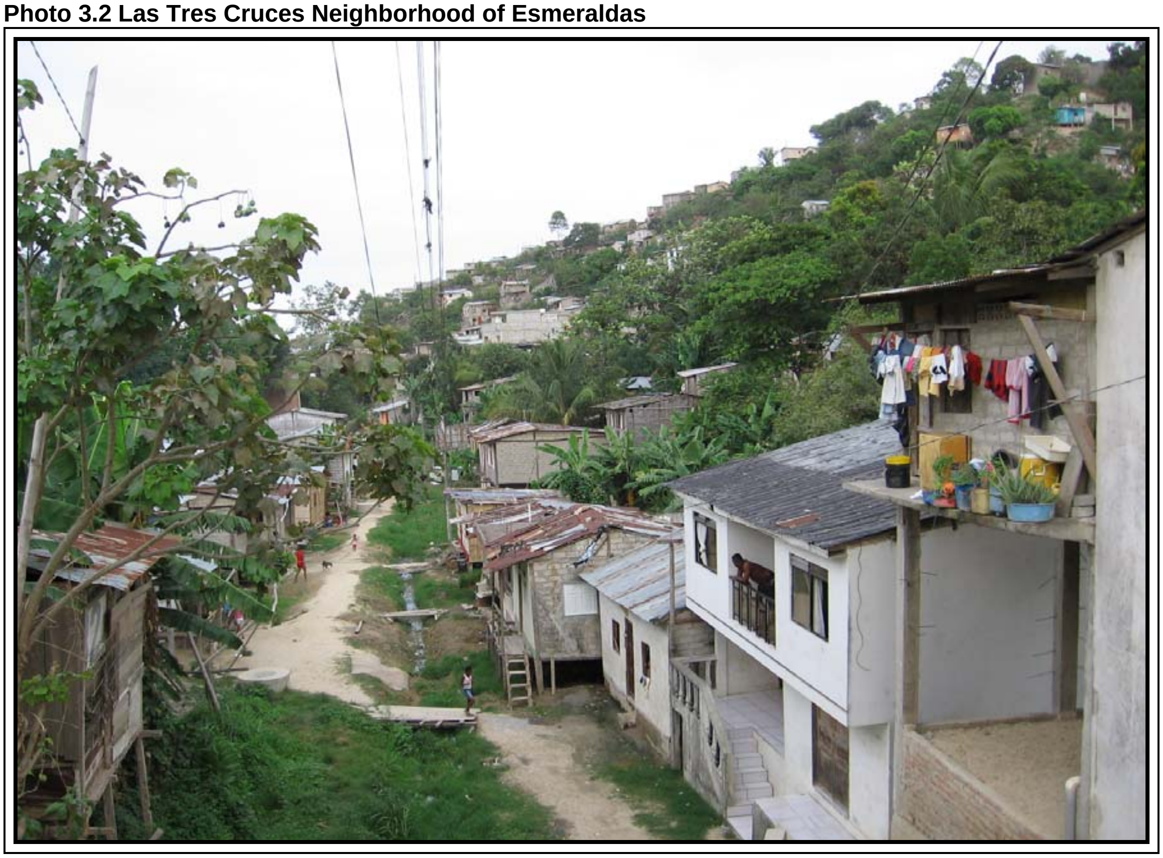
Milton Herrera, 1998

Houses in Esmeraldas City are built of brick, wood, bamboo or most commonly, a

[22] If used constructively, maybe TV could be a good medium for educational programs, including health education.

mixture of those materials. Floors are made of wood, bamboo, concrete, or dirt. Sheet metal, known locally as *zinc*, is the most commonly used material for roofing (see Photos 3.1, 3.2 and 3.3). Houses were owned, rented, or donated to the poor. Materials to build the donated houses were provided by the Catholic Church. The idea of donating houses as a way to help the poor came from a priest. Therefore, people refer to these donated houses as *Las Casas Del Cura* (the priest's houses). The idea behind this program seemed ideal, in actuality it was very difficult to implement because the donation included just the materials for a house but not the land to build it on. A precondition was that people who applied for this program were supposed to already own land; the Church together with other humanitarian agencies would then be responsible for donating the required building materials, mostly bamboo.

Photo 3.2 Las Tres Cruces Neighborhood of Esmeraldas



Milton Herrera, 2006.

One problem lay in the fact that suitable land was very difficult to find. When people found available legal lots, they were often awkwardly situated in potentially dangerous places, such as near the river, or far from the city in out of the way neighborhoods. Other lots were part of *invasiones* (squatter invasions). Squatters would take a piece of land without any permit or authorization and build houses on it. Such lots had no basic services, like access to water or sewage lines, sometimes not even a road. Electric power in Esmeraldas is unreliable. People tapped into the public electricity lines directly from the street, causing many problems and even some fatal accidents with fires, due in part to the houses' mixed construction materials (Hoy 2006). The electric company *Emelsa,* at any moment during the day, would cut off power. It happened so often (during the research period) that we became used to it.

Photo 3.3 Downtown Esmeraldas

Milton Herrera, 2006.

Although most of the city housing could fit the above description there are also urban areas that differ from the above. For example, downtown Esmeraldas where the government and bank offices are is different in terms of house structure and architecture and perhaps services, just one of the disparities or rather contradictions of Esmeraldas city (see photo 3.3).

Hygiene

Poor hygienic conditions are a big health problem in Esmeraldas city (Cooper et al. 2006). In some neighborhoods these conditions are worse than in others and certain households within every neighborhood are worse off than others as well. These conditions are due in part to the lack of an adequate sanitation infrastructure and in part to people keeping animals such as chickens, pigs, and dogs inside or around the house.

Many people in Esmeraldas City did not have potable water or they have water rationing. Mothers, and especially children, are forced to carry water in buckets into the house, a physically very exhausting activity. Houses in many areas are close to contaminated water or reservoirs, where mosquitoes breed.

Esmeraldas is notorious for the amount of garbage in the streets. It was not unusual to see dead dogs left in the middle of the road for weeks. Garbage was usually simply thrown into the streets. You can always smell garbage burning in Esmeraldas. People burn garbage, anytime and anywhere, including plastic items which are known to produce noxious and potentially dangerous gases (Wisconsin Department of Health 2007). From time to time, you could also smell a foul odor coming from the petroleum refinery (*Refineria Codesa*), which almost certainly is releasing contaminants into the local environment, causing environmental degradation (Hoy 2006, PSIE 2005). Cooper et al. (2006) in a study of risk factors for asthma and allergy in Esmeraldas, reports an increase in asthma and allergies linked to changes in life style -from rural to a more urban area and to environmental exposures to gases produced by the oil refinery.

Religion

The majority of Esmeraldans nominally belong to the Catholic Church, although I would say with a certain amount of skepticism and with their own interpretations of the sacred and profane. Their cosmovision has a dual division between this world and the other world after death, this world with things that you can control within your life, economy, health and actions and the other world with a substructure of heaven, limbo and hell, that you cannot control (Naranjo 1996, Quiroga 2003).

Some of the mothers we interviewed mentioned Catholic religious beliefs, such as of putting some holy water or "blessing/helping water" *(agua bendita, el agua del Socorro)* on the baby's head to bless her child. Or more commonly the *Bautizo con madrina de uñas*, baptize with a godmother of "fingernails."[23] That according to Quiroga (2003) is one of the rituals of baptism to introduce the child to the Christian world.

Traditionally the Catholic Church in Esmeraldas is represented by the politically powerful *Vicariato Apostólico* (with its bishop), which has a lot of influence on decisions and actions involving political and health issues of the city and the province (see chapter five on health care sectors). According to Carmen Martínez (presentation at NYU 2006) in Ecuador where there is not a state presence, the church functions as the state – occupying that vacuum, which is the case of the Catholic Church in Esmeraldas. There

[23] A "fingernails godmother" baptism is done between the mothers by a female friend. First they cut the baby's nails, then they put the nails inside of a glass with *agua bendita* (blessing water); next they pray (*rezan el credo)* and then the friend drinks the water and thus she becomes godmother of the child and *comadre* of the mother.

are also Christian churches of other denominations in Esmeraldas, such as the Jehovah's Witnesses, Seventh Day Adventists, and the Church of Latter Day Saints (Mormons). All of these appear to be rapidly gaining adherents.

Street Demonstrations

Demonstrations in the streets, such as secular or religious parades, funerals, rallies, and strikes are popular in Esmeraldas. Some, including parades, funerals and certain political demonstrations are non-violent, while protests or strikes are not. During these demonstrations, the streets are immediately closed and it is expected that cars and buses will stay off of them. There were many strikes during the course of our research period, particularly those of the *transportistas* (drivers). They did not allow anyone to travel with their cars, so when the strikes occurred, everybody had to walk.

ABOUT FOOD

In Ecuador there are supposed to be three meals a day: *desayuno* (breackfast), *almuerzo* (lunch), and *merienda* (supper). However, in Esmeraldas City, many families sometimes have only two or even one meal a day. As I mentioned before, men hold the top position as the head of the family in this hierarchical society. Men eat first and take a larger potion of food than other members of the family. Typically, if a father brought a guest for lunch, they might eat crab with coconut, while the rest of the family waited for the guest to finish eating. The rest of the family then ate some less desirable type of food, such as chicken soup. Mothers ate less than fathers and in general, mothers always ate their meals later than the rest of the family, many times half an hour after everyone else had already eaten. Most of the mothers in this study used gas for cooking, as the price of gas was subsidized by the government. The poorest people cooked with wood and/or charcoal.

***Desayuno* (breakfast)**

In the course of this study, it was observed that breakfast was typically a cup of coffee, with fried plantains and butter. A simple breakfast was just a cup of coffee (*café*) and some bread. Some people have a more elaborate breakfast which could be fried fish, green plantains and a cup of coffee or rice, eggs and cheese, with a piece of fried fish, and a cup of coffee. The coffee is usually instant, with lots of sugar.

***Almuerzo* (lunch)**

Of all of these meals, the most important is the *almuerzo*, traditionally the biggest meal of the day, which usually takes place between 12 PM and 2 PM. Temperatures in Esmeraldas can reach 40 degrees C (104 F) or more between noon and early afternoon. After the *almuerzo* most people, mothers included, take a nap, and almost everything closes down.[24]

A typical *almuerzo* (for a family of 6 to 8), consists of soup made with a pound of beef bones, water, plantains and spices. A second dish is also served. This dish is usually rice (two pounds) and a *menestra* (vegetable stew), made with 1/4 lb of lentils and a plantain (*verde*). This diet may be low in protein. Family members get protein from eggs, meat, fish or cheese they might also eat, typically in small amounts (approximately ~20g per family member). Nevertheless, the advantage of living close to the ocean is that fish

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[24] This was a difficult time for the families participating in our study to have one of my assistants there, as all were resting, and difficult for the assistant, who also rested, but in a chair.

are widely available: at the port, at the market, or from street vendors selling fish that has either been rejected, or sitting around too long in the food market to be sold there.

During the *almuerzo* and at virtually all other times, people drank the same thing, a lemonade or orangeade prepared by adding water and sugar to an artificial fruit flavored powder (*fresco solo*). Sodas like Coca-Cola, Pepsi, Sprite, or Seven-Up were for special occasions. Soda is considered a “nice” drink, a treat.

***Merienda* (supper)**

Supper or *merienda* is served in the late afternoon or early evening. It may consist of rice with fried fish, tea or coffee with a boiled plantain and some cheese, or even a cup of cold oatmeal with some bread.

Special Dishes

Special regional dishes in Esmeraldas include *encocado de pescado* and *masato*. *Encocado de pescado*, rice and fish cooked in a mixture of coconut milk and coconut meat ground with spices, is quite popular and highly recommended. *Masato* is a thick juice mainly utilized by Afro- Ecuadorians. It is prepared with special small coconuts, *maduro* (ripe plantain), and milk. In addition to these dishes, there is almost always a fruit or a plant that is in “fashion” because of its healthy attributes. During the time we spent there, it was a fruit drink called *borojo*, which was prepared by mixing the juice with milk and sugar. It was supposed to be very “good for men.” It is a fruit brought from Colombia, rapidly oxidizing, with a strong smell; about 10cm in diameter. According to

Gentry (1993:738) the scientific name is *Rubiaceae borojoa*, and "this is the source of the famed 'borojo' refresco of Chocó."

Infant's Diet Besides Breast Milk

All kinds of food are shared with everybody, including infants, regardless of age. There was the famous *colada de verde* (green plantain porridge), an important food for children, which mothers used as a substitute for breast milk. The recipe is very simple: blend a green plantain in a liter of boiling water, or cow's milk, if available. B*anasoya*, a mixture of banana with soy milk, was also popular for making *coladas* during our time in Esmeraldas. See Appendix A for a list of other foods, aside from breast milk, or supplements[25] that mothers in Esmeraldas gave to their babies during our observations.

SUMMARY

The setting for the study reported in this dissertation was Esmeraldas city, a medium-size city with a majority population of Afro-Ecuadorians. Esmeraldas province borders on Colombia's Department of Nariño to the north and is part of a Pacific lowland corridor that extends from Panama through Colombia and into northern Ecuador. The presence of Afro-Ecuadorians in the province has two explanations. The first is based on 16th-century accounts by the Spanish *Cronista* Miguel Cabello Balboa, which state that a sunken slave ship with merchandise and slaves coming from Panama ran aground off the coast of Esmeraldas. Survivors from that ship established the first black and/or *mestizo*

[25] Also see discussion, results on early supplementation or supplementation throughout of this dissertation.

free colony in Esmeraldas. The second explanation is a constant migration of Colombian blacks into Esmeraldas, an ongoing process that today is due to the Colombian civil war.

Afro-Ecuadorians are farther than most from the Ecuadorian ethic ideal, which substantially affects their participation and representation in state society. Furthermore, the national and regional governments have long failed to provide basic infrastructure and services to the whole province and city of Esmeraldas. Many people in Esmeraldas City do not have potable water and electric power is unreliable.

Mestizaje, in the first place it's glorified as a democratic process for the new Latin America and yet it is a process really based mainly on skin color, with direct economic and political consequences. It implies that a person who is called *mestizo* has at least some white blood and is therefore in the process of whitening or closer to the superordinate group as opposed to the subordinate group, in a region where white skin is idealized and dark skin is ostracized. *Mestizaje* is a historical, political, ethnic and identity process still not well discussed within Ecuadorian society.

During this field research, Ecuador suffered a major economic crisis that reached its peak in March 1999 when the government froze all dollar bank accounts. That was the beginning of a major change in the lives of all Ecuadorians; less than one year later Ecuador adopted the dollar as its official currency. The economic crisis was particularly severe in Esmeraldas. In the city, as well as in the province as a whole, the crisis caused many hardships and changes in the lifestyle of the people, leading to despair, anxiety, uncertainty, violence, crime, and migration within the province and to other countries, leaving behind broken families.

The mothers participating in our study came from households representing three different socioeconomic groups. A small number had a certain amount of expendable income. The rest of the women were poor or very poor, mostly single mothers. The combined average income of all the households participating in our study was just $70 per month. Most of these women lived with extended family members, contributing their salaries to help with the expenses of the entire household. Many mothers lived in what could be called a communal house of women and children. In Esmeraldas, men are favored over women; baby boys are given better care than girls.

Many of the mothers in our study lived in substandard housing. There were some programs where the Catholic Church would help to build a house, but recipients needed to have the land first. When people found available legal lots, they were often awkwardly situated in potentially dangerous places, such as near the river, or far from the city in out of the way neighborhoods. During this study, in many Afro-Ecuadorian households, a male figure was absent. This was not the case in the majority of the non-Afro-Ecuadorian households studied.

In Ecuador there are supposed to be three meals a day: *desayuno*, *almuerzo*, and *merienda*. However, in Esmeraldas City, many families sometimes have only two or even one meal a day; this was in part due to the economic crisis. All kinds of foods are shared with everyone in a household, including infants, regardless of age. Men eat first and eat more. Diet is based on carbohydrates, with not as much protein and fat. I end this chapter with a list of foods that we observed as part of the regular diet in Esmeraldas. Many of these foods were used as supplements for infants. For instance, *colada de verde* (green plantain porridge) was commonly fed to children as a substitute for breast milk.

CHAPTER 4

MATERIALS AND METHODS

The phenomenon of a perception of milk insufficiency versus actual milk insufficiency is widespread cross-culturally. Milk insufficiency may occur at any stage during lactation, but its causes are not well understood. In the previous chapter(s), I have reviewed the literature on milk insufficiency and found that the argument as to its causes is focused on cultural, biological, and bio-cultural explanations of the problem. In this chapter I present the specific methodology I used to elucidate such a phenomenon. The methods described in this section were designed to provide data to address those unresolved issues in the literature on milk insufficiency from a bio-cultural perspective. The goal of this study is to clarify the mutual influences of culture and biology on human lactation.

RESEARCH QUESTIONS

A fundamental question is whether those women who complain of producing insufficient milk for their infants are really producing less milk than their peers, or alternatively, whether their perception of milk insufficiency results from cultural beliefs, a misconstrued interpretation of the breastfeeding process, inadequate social support, and/or biological factors such as inadequate nutrition or the mother's age. The study combined a cultural and behavioral investigation of breastfeeding through interviews and structured observation, in concert with consideration of ethnographic data. The milk consumption of infants was directly evaluated by test-weighing, measurement of milk fat content according to the creamatocrit, and measurement of maternal and infant nutritional status through anthropometry, in order to answer, among others, the following questions:

1. What are the mothers' explanations of milk insufficiency? Is there any folk theory of illness related to breastfeeding and milk insufficiency?
2. How do socioeconomic status and work status of the mother influence breastfeeding behavior and reports of milk insufficiency?
3. How did the economic crisis of 1999 affect reports of milk insufficiency and how did mothers manifest the crisis in breastfeeding behavior?
4. What is the relationship among onset of lactation (OL) or "when did your milk arrive," milk insufficiency complaints (MIC) and early supplementation?
5. How is supplementation related to biological data and behavioral data, in other words, how is supplementation related to test weighing (T-W) and MIC?
6. How do biological factors like parity and age of the mother relate to MIC and milk production?
7. Is there any correlation between nutritional status (BMI) and MIC, and what is the relationship of nutritional status and milk production and fat?
8. Are mothers who complain of milk insufficiency actually producing less milk? How is the perception of milk insufficiency related longitudinally to an actual reduction in milk supply?
9. Is there a measurable phenomenon that we can label as milk insufficiency independent of a mother's perception?

Hypothesis

The original hypothesis was that cultural beliefs about infant feeding and variation in breastfeeding practices would prove to be the predominant causes of milk insufficiency in any setting. Furthermore, it was expected that nutritional status of the mother, the age of the mother, multiparity, individual psychological factors, and social factors would play a part to some degree. This original hypothesis ultimately evolved into one suggesting that "external factors" (non-physiological) might interfere with breastfeeding practice, resulting in reduced milk production by means of their effect on "internal factors" (that is, the biological process of lactation).

In other words, one's own cultural milieu can and will determine the success of breastfeeding's biology. Cultural and biological factors have a close relationship and are inextricably linked; biology can be changed by culture and produce a "new" biology. This hypothesis could be explained within the context of new theories on stress (some working theories on stress are provided by McEwen 2002, Morris 1998, and Sapolsky 1994).

RESEARCH DESIGN

The field study reported here was a longitudinal one, carried out from September 1998 to November 1999, and incorporating one additional follow-up season during April-May 2001. My study consists of two groups of mother-infant dyads. The first group (G1) was twenty-five women recruited mainly for method testing (see Table 4.1). Anthropometric and interview data were collected over a ten-month period. Structured prospective observations of breastfeeding within a 12-hour time frame were collected for a period of two months. Structured retrospective recalls of breastfeeding within a 24-

hour period (following the methods of Gray 1995), were collected for a period of one month. The relative brevity of this component of the research was largely determined by the need to become familiar with the structure of breastfeeding in Esmeraldas before more intensive test-weighing began with the second group. In addition, I wanted to refine the initial methodology and allow for the comparison of prospective data on breastfeeding behavior from direct observations with retrospective recall of breastfeeding behavior, in order to be able to better evaluate the reliability of the retrospective data.

The main focus of the study is on the second group G2 of women (n=47), on whom data were collected for a period of eight to eleven months, including test-weighing, measurement of the lipid content of milk samples or creamatocrit, anthropometry, structured prospective observations within a 12-hour frame, and ethnographic information about breastfeeding views and practices. Women and their babies from both groups (N = G1 25 + G2 47 = 72) were visited on a monthly basis.

In this study, 12 hours of structured observation and test-weighing were repeated up to the 9^{th} month, on the sample of 47 mothers and infants. Creamatocrit was also recorded until the 9^{th} month, but for fewer cases than structured observations and T-W because some of the mothers stopped breastfeeding earlier than the 9^{th} month. During field work in 1999, for group one, some anthropometric data were collected and interviews conducted until the 11^{th} month. And during the 2001 season we collected anthropometric data. This resulted in recording of anthropometric measurements at 26 months of age for those infants we were still able to locate at that time.

Description Of Activity	CALENDAR YEAR																
	1998				1999											2001	
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Apr	May
Settle in Esmeraldas	*																
Recruitment of the Assistants and Training																	
	*	*															
Recruitment of Sample and First Interview –I. Consent F.		+	+	+													
					x	x	x										
Structure Retrospective Recalls					+												
Second Interview -II				+	+												
						x	x	x									
Third Interview -III					+	+	+	+									
								x	x	x							
Fourth Interview -IV										+	+	+					
										x	x	x	x				
Fifth Interview -V													+				
													x	x	x		
Six Interview -VI																+	+
																x	x
Anthropometry				+	+	+	+	+	+	+	+	+	+			+	+
						x	x	x	x	x	x	x	x	x	x	x	x
Structure Prospective 12h Observations				+	+												
					x	x	x	x	x	x	x	x	x	x			
Test-Weighing																	
						x	x	x	x	x	x	x	x	x			
Creamatocrit																	
						x	x	x	x	x	x	x	x				

Table 4. 1Time Table of Activities - it marks the first and last time that a particular method was use. Group 1 = + & Group 2 = x.

Sampling Procedure

The site of this research was Esmeraldas City, Ecuador. A more limited field of study, Esmeraldas parish — albeit the most populous, central and "urban" sector of the city — was defined in the original proposals to NSF and PAHO. I broadened this approach for the following reasons:

First, the devastating effects of the El Niño phenomenon in 1998 caused many people to be relocated from Esmeraldas parish. Second, recruiting women for this study was extremely complicated. All contacts with the women were informal; there was little functioning health infrastructure to help either locate women in late pregnancy or ensure that the participants fit the target parameters of the research protocols as outlined below. Third, the local individuals assisting the research resided throughout the city and helped to recruit women in their respective neighborhoods.

Informed consent was obtained from all women recruited for this study, as per the requirements of the Committee on Human Subjects of the Graduate School and University Center of the City University of New York (see Appendix B for the text of the Informed Consent form used in the field). Three separate committees approved the form I used for ensuring informed consent — the Committee on Human Subjects, the ethics committee of PAHO, and an ad hoc ethics committee assembled specifically for reviewing this research at the Universidad San Francisco de Quito in Ecuador.

Because my objective was to find pregnant women at a late stage of gestation within the general population, I used purposive or judgment sampling (Bernard 1995). Any pregnant woman encountered whom we construed to be in a late stage of gestation was asked if she would like to be a participant in this research.

This kind of non-probability sampling (in contrast with probability or representative sampling) carries the disadvantage of low external validity because the selected subjects cannot be posed as a representative sample of the general population. Nevertheless, for Bernard (1995:44),“when backed up by ethnographic data, studies based on these sampling techniques are often highly credible.” In this study, the results of measurement, observation, and interviews are augmented with supporting ethnographic information. Much of the published research on breastfeeding behavior is based on recall data. This study, on the other hand, is based principally on direct longitudinal observation of the subjects.

My research team recruited women 20 to 40 years of age who had previously had a child because, as mentioned above, multiparity is a possible factor associated with milk insufficiency. In the final selection of our subjects, I included only women who had a vaginal delivery, without complications, of a full term infant (birth weight > 2500g, gestational age > 37 weeks, and an Apgar of ≥ 7). The number of women originally recruited was greater (36+78=114) than the ultimate sample size (25+47=72) because, as expected, after giving birth some of the individuals did not meet the selection criteria.

For the first component of the research, 36 women due to give birth in November-December 1998 were recruited as an initial sample. I began collecting data on the 32 individuals who had vaginal deliveries. However, another seven of the subjects ceased to participate in the study at some point: three were lost due to changes of address; one because her husband disapproved; one had to go to the hospital for unrelated surgery; two decided not to continue for unspecified reasons.

For the second component, 78 women due to give birth in February-March 1999 were recruited. I began collecting data from 62 subjects who fulfilled the criteria mentioned above, but ended up with complete data for only 47 due to further selection or dropping out. For this second group: seven were lost track of due to changes of address; two had such crowded living conditions that it was impossible to collect data in their respective houses; one husband disapproved; one moved out of the city; four decided not to continue for unspecified reasons. Furthermore, the second group included one (primiparous) mother of 18-year-old and one 41-year-old mother. While neither fit both the age and parity criteria, I retained them anyway because they were so enthusiastic about participating.

DATA COLLECTION

Recruitment of the Assistants and Transportation

In September 1998, I settled in Esmeraldas City, hiring and training six female assistants. Five of the assistants were senior students from the School of Nursing at the Catholic University of Esmeraldas, and one was a recent graduate of the program. Each assistant worked one or two days per week, in addition to meeting as a group each week to discuss assessment, summaries, concerns, and work planning for the following week. All of the assistants were paid on a biweekly basis.

Immediately after I launched my project the nurse quit. To replace her, I hired a student of geography from the public Technical University *Luis Vargas Tello* (who ultimately became a key informant). Later, I recruited and trained two additional assistants in order to ensure the continuity of data collection under the prevailing logistical conditions.

I also hired three different taxi drivers at various times, each with his own car, in order to facilitate the drop-off and pick-up of the assistants and the equipment. Every day (except Sundays) we went to the home of a mother scheduled for that day's twelve hour visit. Early in the morning, no later than 8:00 AM, the taxi driver picked up the assistant and dropped her at the selected mother's house. Later, the driver would pick up the assistant and return her home not earlier than 8:00 PM.

Interviews

In October and November 1998, we conducted the first component of the study with 36 subjects. During December 1998 and January, February and March 1999, we carried out the second component of the research program, in which we interviewed the second sample of 78 women. The questionnaires were based on examples provided in CEPAR (1994b), Dettwyler and Fishman (1992), Hill (1991), Riordan (1991), Vitzthum (1988, 1994a) and WHO (1981). I also conducted some interviews with midwives or *parteras* and collected samples of plants that most of the women used for reasons related to childbirth and breastfeeding (see the Appendix B for the text of questionnaires used in the field).

Definitions

I used both semi-structured and structured interviewing techniques. Three original questionnaires were used as building blocks. Information gathered during the interviews included:

1) Demographic data, including maternal age, parity, number of household members, and residence history.

2) Data about future plans, including intended plans for delivery and infant feeding, previous breastfeeding experience, maternal confidence, as well as advice from family members, household members, neighbors or health workers.

3) Views and practices associated with breastfeeding. This included information regarding the circumstances in which it is considered inappropriate to breastfeed, circumstances that influence milk production, ideas about colostrum, whether sorcery, envy, or the “evil eye” could influence milk production, and whether milk insufficiency is a culturally acceptable reason for weaning.

The final number of questionnaires administered to each of the mothers was six. The first questionnaire was pre-partum and was administered to each mother after she had signed the Informed Consent form. The second questionnaire was administered within the first few weeks postpartum.

Then the rest of questionnaires were administrated on a monthly bases, except when the circumstances did not permit that routine, such as if the mother had traveled out of the city. The third questionnaire, administered during a third visit, was essentially a repeat of the second questionnaire with some minor changes. The fourth questionnaire was a slightly abbreviated version of the third questionnaire. The fifth questionnaire was a revised version of the fourth questionnaire with an appendix section added. Finally, the sixth questionnaire was a post-research interview.

Procedures

I attempted to revisit all mothers in the study between eight to fifteen days postpartum. At this time we administered the second questionnaire, which included postpartum data such as the place and characteristics of the delivery. Apgar scores or estimates, early contact and feeding of the infant, infant feeding policies in the hospital or at home, the early experience of milk production, reported frequency and duration of feedings, infant feeding behavior, and perceived thriving were discussed. Reported frequency of nursing may not accurately reflect actual feeding frequency (Vitzthum 1994b), but was recorded as an indicator of each woman's perception of feeding frequency.

After the first postpartum interview, the subsequent interview utilized the third questionnaire to assess longitudinal changes in household composition, cultural views and practices, and socioeconomic information. The socioeconomic information collected included indicators such as household possessions, methods of cooking food, type of residence, whether rented or owned, and the amount of household income. Information about changes in household income was solicited only during the third and subsequent interviews, when a congenial and trusting rapport with the family was well established.

The fourth questionnaire, similar to the third but containing fewer questions, was administered to the mothers on the fourth visit, and then at each visit repeatedly, until the end of the project. The fifth questionnaire, similar to the fourth but with an added appendix section, asked the mothers to assess the local health care system, and was administered to the mothers at the end of the research period (September-November 1999).

The sixth questionnaire was utilized during follow-up interviews that took place during the season of April-May 2001. It included only eleven questions and was administered to all still-available mothers from the second group. The questions were focused on breastfeeding, weaning, and reporting any more recent pregnancies.

Structured Twelve-Hour Observations

Twelve-hour structured breastfeeding observations were conducted on the first postpartum visit and then on a monthly basis thereafter. The first group was followed for only two months while the second group was followed for eight months. The assistants kept diaries of the activities that were carried out in the household while they were present. Following the established procedures of Vitzthum (1988, 1994a), these structured observations included: recording of suckling magnitude, which is the frequency or number of breastfeeding times during the 12h, and the length of suckling of each breastfeeding session measured to the minute; who initiates and terminates each nursing session; any other perceived activities engaged in while feeding[26] (see below for definitions). In conjunction with these instructions, assistants were trained to make note of LATCH (Jensen et al. 1994), an acronym which stands for:

L: How well the infant latches. More important than how well the infant latches, was who, mother or infant, initiated the latching and unlatching. How does this initiation take place? Does the mother insert her nipple into the mouth of the baby, or does she allow the baby to do this him/herself by simply placing the baby next to the nipple? Does the mother use her finger to break the suction?

A: Audible swallowing. Start and stop times of swallowing. I attempted to record the number of swallows, but in practice this was very difficult. If the assistants could hear audible swallowing, it meant that the milk was being expressed with a great deal of force. Whenever possible the assistants would note this.

T: Mother's nipple type. This was not a very significant point for Jensen et al.

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[26] Assistants were trained to record which breast, left or right, a mother used during each session. These data become less relevant upon analysis.

(1994) and neither was it considered important for the purposes of this study.

C: Mother's comfort level. For example, does the mother grimace? At some point during the research, I asked each of the mothers to describe their most favorable and most comfortable breastfeeding position.

H: How much help was required in holding the infant to the breast? Even though this test was primarily intended for description of first time attempts at holding, either in the hospital or at home, it was useful to note the mothers' position while breastfeeding: sitting, lying down, using a pillow, walking around, etc.

Structured Retrospective Recalls, as described by Gray (1995), were also recorded during the first phase of this project, in order to see if we could use these as a reliable method of eliciting information over extended periods of time, especially during the recall of overnight activities, which were not directly observed.

Definitions

Concepts, methods, and formulas described by Vitzthum (1994) were utilized for analysis of the 12-hour observations, with certain modifications. It was important to adhere to the same terminology used in the above study, in order to have a true basis for comparison between studies.

As such, the following definitions were established:

Event – any time an infant takes a breast in the mouth.

Episode – any series of breastfeeding events separated by less than five (5) seconds.

Session – any series of episodes separated by less than one (1) minute. For the purposes of this study, a single session was construed as any series of episodes separated by up to one (1) minute.

According to Vitzthum (1994: 337-338), events and episodes vary little cross-culturally, but sessions will tend to vary significantly. In other words, the duration of time the infant is attached to the breast has a particular pattern depending on the culture involved. In Esmeraldas, I found the pattern likewise to be in the breastfeeding session, rather than in the episode.

Procedures

Once the assistant arrived at the subject's residence, typically before 8:00 AM, observations began immediately. First, it was very important for us to develop a trusting rapport with each subject in order to increase the tolerance level toward "stranger presence." Second, the assistants were trained to observe all household activities, not just breastfeeding. It has been noted (Vitzthum, 1994) that some women may increase breastfeeding on any given day if they perceive that outside influences desire it. For that reason, assistants were instructed not to make comments, such as "*está con hambre*" (the child is hungry), that might induce a mother to nurse more than usual.

As previously mentioned, Structured Retrospective Recalls were administered to the first group as a control method. The Retrospective Recalls were conducted with mothers whom we had visited the previous day. The recall was administered by a different assistant and was structured by activity times. The recall included recording activities such as when the baby napped or was awake, or what the mother was doing at different times during the day or night.

In response to responses such as, "why don't you check with the assistant to learn about yesterday's activities?" we explained that the point of the interview was to see how well "the mother" recalled what had happened. This was in order to be able to compare the differing recalls of individual mothers, as well as to be able to check on the accuracy and completeness of the assistants' data recording.

Structured Retrospective Recall did not really work in Esmeraldas. Frequently, mothers could not specifically recall the activities of the same day and simply gave an impressionistic view of the activities of either day or night. Recall of time was the most difficult problem to address. Perhaps the perception of small blocks of time, 10 minutes in this case, is not significant enough to register in the minds of Esmeraldan women. Perhaps larger blocks of time such as hours or days would prove to be more meaningful to them.

Gray (1995) reported that Turkana mothers could remember the number of times and approximately when an activity took place, especially in relation to some other activity. For example, they could describe an activity as having occurred "before I ate lunch," but they could not recall how long these activities took. Gray also reported that her subjects suggested that she was "crazy" to ask the question of "how long" a particular activity lasted.

Anthropometry

Anthropometric measurements recorded were the length, weight, arm and head circumference of the babies, as well as the height, weight, arm circumference, triceps and subscapular skinfold dimensions of the mothers, following the techniques described by Frisancho (1990) and Lohman et al. (1988).

The materials used for anthropometry were an infant measuring board (Seca), a portable anthropometer (GPM), a Lange Skinfold Caliper, an adult spring scale (Seca), and pediatric metric tapes. Intra-observer reliability was measured using the procedures described by Mueller and Martorell (1988). I also inquired about the current health of each mother and her infant, as well as their health in the preceding month.

Definitions

Anthropometry was used to assess the nutritional status of the infants and their mothers. For measurement analysis of the infant data, I used the Epi Info NutStat[27] program (2000); for the mothers, Body Mass Indexes (BMI)[28] was calculated. BMI was calculated using the formula: Weight (Kg)/ [Height (m)]. ^{2}

Procedures

On the same day as a 12-hour observation, I made anthropometric measurements on both the mother and her infant. I tried to take the measurements mid-morning to avoid *almuerzo* (lunch) time. In all cases, the resulting data were recorded on a standard form by the assistant (see the Appendices for anthropometry data forms). The subjects were instructed to wear loose clothing, without shoes, for all measurements. In Esmeraldas, this proved to be no problem, as most people wore light clothing due to the tropical climate.

The mother's height was measured, standing with the heels together and back as straight as possible (head, shoulders, buttocks and heels touching the vertical part of the portable antropometer). I measured her weight with a calibrated portable scale, with the subject standing upright on the scale. I measured arm circumference at the midpoint of

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[27] NutStat is part of Epi Info; it does not analyze adult data. It is "a program for recording and evaluating measurements of length, stature, weight, and head and arm circumference for children and adolescents." U.S. Department of Health & Human Services, (CDC 2003: 75).

[28] BMI was calculated using the mother's weight and height. According to the CDC (2006:1), BMI is a "reliable indicator of body fatness for people" and "…It is an inexpensive and easy method for population assessment of overweight and obesity."

the upper arm. The midpoint is midway between the acromion in the shoulder area and the elbow flexed to 90 degrees (Lohman et al. 1988); I used my pen to make a small mark on the arm. With the upper arm held parallel to the side of the body (Frisancho 1990), the mark of the mid-arm circumference was also used for measuring the triceps skinfold in the middle of the posterior aspect of the arm, over the triceps muscle. As described in Lohman et al. (1988:67), the triceps skinfold was "picked up with the left thumb and index finger approximately 1 cm from the mid-arm marked level, with the tips of the caliper applied to the skinfold at the marked level." I was careful to always take two or more skinfold readings, and recorded the average of those readings. Measurement of the subscapular skinfold, on the inferior angle of the scapula, followed the same procedure as with the triceps skinfold.

The first anthropometric measurement of the infants taken was weight, simply because we already had the scales in place for test-weight measurements. I followed the same procedures as those for the test-weighing measurements, described below.

In order to measure infant arm circumference, I followed the same techniques as those used to measure the mothers, except that I used pediatric metric tapes. To measure infant head circumference, I followed the technique described by Lohman et al. (1988:41): "the tape is placed just superior to the eyebrows and posteriorly it is placed so that the maximum circumference is measured, the tape is pulled tightly to compress hair and obtain a measure that approximates cranial circumference."

The last infant measurement taken was recumbent length, because it is the most disruptive measurement for the infant. Using an infant measuring board, I placed the infant on the board, with the head touching the vertical headboard. While the assistant held the infant's head, shoulders and buttocks flat against the board, I extended the infant's legs and placed one hand on one knee. I then put the movable vertical board against the heels of the baby. I repeated this procedure two or three times, taking a measurement each time, before recording the average measurement.

During the research period, I introduced all of the assistants to general anthropometry techniques. I then chose the two most promising assistants for intensive training in anthropometry techniques. Once the reliability and validity of their measurement practices had been verified during the training phase by comparing their measurements with my measurements, these two assistants were allowed to take some measurements on their own during the final months of research. Nevertheless, less than 10% of more than 550 encounters-incidences of taking anthropometric measurements were undertaken by the assistants.

Test-Weighing

To assess milk intake volume, I used the 12-hour test-weighing technique. Supplementary food was also weighed and recorded, including measurement of the volume of breast milk substitutes such as formula, cow's milk, coladas, medications, as well as the amount and type of any other supplements consumed.

During the course of this research, we used three portable integrating electronic balances: two Dina baby balances with printers, accurate to 5g, and one lightweight Ohaus, accurate to 2g. The balances functioned on electricity, either plugged into an outlet, or battery operated. It is widely recognized that the test-weighing method of estimating intake volume of milk is both simplest and most accurate as compared with other methods (such as Nipple Shield and Ultrasound Flow Transducer or Deuterium Oxide Dilution Technique), thus making it appropriate for this type of field research (Brown 1986, Drewett et al. 1989, Drewett et al. 1993, Garza et al. 1986, Woolridge et al. 1985).

Definitions

Infants were weighed before and after each nursing session using one of the portable integrating electronic balances. Prior to taking measurements, infants were dressed in watertight diapers to prevent the loss of urine or stool during feeding (Brown 1986) or during measurements. We were also aware that, unfortunately, "the weighing procedure disrupts the usual feeding process to some extent and the potential impact of the measurement technique on the amount of milk consumed remains uncertain" (Brown 1986: 5).

Two measurements were taken per feeding; before and after the infant had eaten. Additional measurements were only necessary 4 to 5 months later when the infants began moving around on the scale (Woolridge 1985). At this stage, we weighed the infant 3-5 times per measurement (3-5 times before the feeding and 3-5 times afterward). According to Woolridge et al. 1985, it is necessary to take the average of several weighings. In accord with this same protocol, I concluded that if the first two electronic (see next) measurements were equal it would not be necessary to do a third set of measurements because when using integrating electronic balances, their "computerized" system automatically averages a weight event and that is what was used in this process. If using these scales, then "the weighing can be completed as soon as 3 or 5 satisfactory weights have been obtained" (Woolridge et al. 1985:13).

Procedures

Each day I visited the mother scheduled for that days' 12 hour visit. The assistant arrived via taxi, bringing the scale, and promptly installed it in the most secure and stable place in the house. This was important because the electronic scales need to be leveled in order to operate properly.

All assistants were instructed to follow a strict protocol, beginning with how to explain to the mother what I was going to do, including the taking of measurements. The precise instructions given to each assistant were to:

1. Provide each mother with a burp-towel upon the first visit and to provide diapers during every visit. Ask each mother: When are you going to breastfeed your child to have a pre-feeding weighing.

2. Tell each mother (in Spanish): "I'll weigh the infant when you're finished with this feeding; please don't alter the frequency or duration of the baby's usual feeding pattern; or please don't change the way you usually do it." Each assistant was instructed to use the same basic phrases, without omissions or embellishments.

3. Put a diaper on the baby soon after arrival, and to change it about every 3 hours (I expected to use 3 to 4 diapers per 12 hour session). Otherwise, they were instructed to change the infant's diaper before each individual feeding.

4. Have a pre-weighed towel ready and stored in a plastic bag, in order to collect any spilled or regurgitated formula. The pre-feeding weight measurement included the diaper (on the baby), and the burp-towel.

5. Record in the observation notes any loss of milk, urine or feces. It was important to record the amount of regurgitated milk because I was more concerned with

the milk production of the mother than the quantity actually consumed by the baby.

6. Wait a minimum of one minute after the mother finished feeding before weighing the infant (i.e., when the baby stops feeding, check your watch an the time, and don't weigh the baby if it starts to nurse again within a minute of first stopping).

7. Weigh everything, anytime the baby nurses, even if the infant was nursing for only a few minutes. The assistants were instructed to take measurements for even very brief feeding sessions or events, even if the mother thought the baby hadn't ingested any milk. They were instructed to take measurements even if the mother thought that the baby was only nursing "for comfort."

8. Weigh very young babies only once before and once after feeding, but for babies more than four to five months old, weigh them 3-5 times before and after each feeding.

9. Re-use the diaper cover only if completely dry, with no feces adhering to it. Otherwise, they were instructed to use a clean diaper or a clean diaper cover.

Creamatocrit

During our monthly visits, we utilized the creamatocrit method described by Lucas et al. (1978) to look at the fat composition of each mother's breast milk. There are several advantages to this method that make it suitable for fieldwork: sample preparation is not required and it incurs very low costs. Some examples of successful use of the combination of creamatocrit and test-weighing techniques can be found in Woolridge et al. (1990). In that study, these techniques were used together in order to measure mean fat concentration and the net milk intake of infants who were given either one, or both breasts per feeding. Interestingly, results of the study suggest that infants regulate their intake of fat, rather than the volume of milk. A similar combination of techniques was also utilized by Drewett et al. (1993), who measured the energy intake from breast milk and supplementary food among 60 infants in a rural area of Thailand over a twelve month period.

The creamatocrit equipment used in our study included a Clay Adams hematocrit centrifuge and standard glass capillary tubes (75 * 1.5 mm, without heparin). A very small sample of milk (about 75 *ul*) was drawn into a capillary tube, sealed at one end with plasticine, and then centrifuged for 15 minutes. Using a standard MLW hematocrit measuring ruler, the cream layer was then measured and calculated as a percentage of the total length of the milk column (Jensen et al. 1985, Lucas et al. 1978).

Definitions

Creamatocrit is expressed as the percentage of cream (fat) separated from the milk by centrifuging. Recommended time frames for sampling include from midmorning to the time of the first feeding after 1:00pm (Garza et al. 1985), when the fat concentration in breast milk was found to be at a 24 hour peak (Garza et al. 1985, Jensen et al. 1985, Neville et al. 1984). According to Garza et al. (1985:116), "The time chosen for sampling is usually midmorning, when the fat content is highest." Neville et al. (1984), suggest that a single sample drawn two minutes after let-down yielded the same "population average" result as samples taken from the whole single breast two minutes after the milk collector heard the baby swallow. According to Jensen et al. (1985: 99), the samples should be: "…stored in polypropylene tubes or glass tubes (or vials) with Teflon liners. Caps with bonded paper liners, plastic liners, cork or rubber should not be used ...." The most accurate results are derived from analysis completed within hours after sampling, without either cooling or freezing the milk.

Procedures

During her 12-hour scheduled observation day, a small sample of breast milk were taken manually by the mother and inserted into a small glass bottle. This sample was taken during the first mid-morning feeding, two minutes after the let-down reflex had occurred (Neville et al. 1984, cited in Jensen et al. 1985). The sample was then picked up and centrifuged within six hours of collection. Although we were supposed to collect the milk sample in the morning, many times the sample was collected early/late in the afternoon, simply because a mother did not breastfeed until "late" that day. Many factors influenced the collection of milk, such as if the baby was sleeping and the mother did not want to detach the baby from her breast for milk collection. There were also instances when the mother did not breastfeed during our entire visit.

In Esmeraldas the samples did not cool. The lowest ambient temperature recorded was ~20 Celsius degrees and it could go as high as about 40 Celsius (at 2:30 pm, room temperature was typically about 31C, or 88F). For total lipid analysis, as in the case of creamatocrit, there is no need to sub-sample immediately. It is advisable to use multiple samples in order to minimize the chances of error, which is what I did; I ran at least two sub-samples simultaneously. In recording the data, I used the average finding from all sub-samples run. Instructions given to the assistants as to proper collection of breast milk samples were as follows:

1. Collect the sample immediately following the mid-morning feeding.

2. Collect milk from either breast.[29]

2001 Follow-Up Season's Data

In this season, I used a quick data gathering strategy composed of a short structured questionnaire (see appendix for questionnaire) and basic anthropometry measurements, with weight of the mother and weight and height of the child. This second season's data of April and May 2001 have became extremely important, because they allowed me to make an assessment of some variables: 1. Milk insufficiency (MI) complaint; 2. Health status of the children of the MI and non-MI mothers; 3. Length of time of breastfeeding; 4. Reasons why mothers stopped breast feeding; 5. Household socioeconomic changes and 6. If mother is pregnant or had a new baby at the moment of the interview. Unfortunately, because of the two-year hiatus in data collection, I could not locate all of the mothers and children. Many had moved to another neighborhood or to different cities in Ecuador and abroad. From the first group we were eventually able to connect with 16 mothers; from the second group I was able to connect with 32 mothers (16+32=48), representing the 66.6% from the total original sample.

METHODS OF ANALYSIS

In this sub-section I describe the considerations, parameters, definitions, equations and units of analysis that were ultimately used. As previously mentioned, some of the data collection methods described initially in my proposals had to be modified during fieldwork. As one result, some data were eliminated from consideration in the final

[29] This test was not intended to check the "normal" fat content of the mothers' milk, or the total fat intake of the infant, or total milk production by the mother. This creamatocrit measurement was designed to check that the fat content in at least one breast was reasonably high.

analysis.

The Sample and the Information Gathered

Most family members of subjects in this study were willing to participate, even though, at times, they may have been bothered by our presence. I am aware that our presence and our intention of monitoring the breastfeeding behavior of mothers and infants may have influenced their actions. Besides our mothers and their infants, I had many other people influencing decisions made with regard to child rearing. There were siblings, uncles, aunts, mothers, neighbors, friends and visitors assisting, advising, and helping the mother with infant care. Therefore, the information gathered here represents the breast feeding culture of the people of Esmeraldas City as a whole.

Infant's Age and Measurements

Infant's age was calculated from the date of birth, plus the number of days that had passed up until the time of the visit. The total number of days was then divided by 30, thus we have: 1-30 days is equal to the first month of age, 31-60 days equals the second month of age, 61-90 days equals the third month of age and so on.

Data was sorted according to the variable Age of Infant in days. Next, a new variable, Age in Months, was created by assigning Month 1st to data in which Age of Infant was between 1 and 30 days, Month 2nd to data in which Age of Infant was between 31 and 60 days, Month 3rd to data in which Age of Infant was between 61 and 90 days, Month 4th to data in which Age of Infant was between 91 and 120 days, Month 5th to data in which Age of Infant was between 121 and 150 days, Month 6th to data in which Age of Infant was between 151 and 180 days, Month 7th to data in which Age of Infant was between 181 and 210 days, Month 8th to data in which Age of Infant was between 211 and 240 days, and Month 9th to data in which Age of Infant was between 241 and 270 days. Data was available for a total of nine months, but only the first seven months were used in most of the analysis because the last two months had very small samples because of supplementation, weaning and end of the research period.

Suckling Variables

Again, for the purposes of this study, session units were calculated in one-minute intervals, thereby differing somewhat with the protocol of Vitzthum (1994), who calculated in seconds. The following are the variables and combinations that I used for analysis of the suckling data. To illustrate what each of these variables represents and how they are combined, I use the measurements from case number 39 at the 53rd (or second month) collection-data-day as an example.

1. Total Suckling Duration [**TSD = minutes**] is the amount of time in minutes that the infant spent attached to the breast during the 12 hour observation period.

Example: 67 minutes/12 hours.

2. Number of Suckling Sessions [**NSS = times**] is the total number of sessions recorded during the 12 hour observation period.

Example: 7 times/12 hours.

3. Average Minutes Suckling [**AMS = minutes**] is the average length of a suckling session during the 12 hour observation period. This was calculated by dividing the TSD by the NSS.

The formula is as follows: AMS = TSD/ NSS.

Example: 67 minutes/7 times = 9.5minutes.

4. Mean Intercession Duration [**MID = minutes**] is the average time that the infant was not breastfed between sessions. I calculated that by subtracting TSD from the 12 hour (720 minute) observation period and dividing the result by the NSS.

The formula is as follows: MID = 720 MINUTES - TSD = X/NSS = MINUTES.

Example: 720 minutes- 67 minutes = 653minutes/7 times = 93.2 minutes.

5. Milk Production Per Minute [**MPPM = grams/minute**] is the amount of milk the mother produced per minute or the amount of milk the baby consumed per minute.[30] This gives us a good idea of either how much milk is being expressed and/or how much milk the infant is ingesting. MPPM is calculated using the total test-weighing measurement (TTW) in grams for the 12 hour observation period, divided by the TSD, yielding a result in grams per minute.

The formula is as follows: MPPM = TTW/TSD = GRAMS/MINUTE.

Example: 415grams/67 minutes = 6.1grams/minute, of milk.

6. Average Milk Production Per Average Session [**AMPPAS = grams**] or the average amount of milk consumed per average session. This gave us an idea of how much milk a baby drank per session, and/or how much a mother produced per average session at particular juncture during lactation. This was calculated by multiplying the average of minutes suckling by the milk production per minute.

The formula is as follows: AMPPAS = AMS * MPPM = GRAMS.

Example: 9.5 minutes ∗ 6.1grams/minutes = 57.9 grams of milk, when measured

[30] That is, if we assume that the infant gets milk as soon as it's attached to the breast, something that is not necessarily the case.

during the second month.

7. Supplement Consumption per Minute [**SCPM = grams/minute**] is the amount of supplements that the baby consumed per minute using a bottle (it is the same as MPPM, but instead of breast milk we measured supplements). This was calculated using the total test-weighing measurement (TTW) of supplements for the 12 hour observation period divided by the total bottle suckling duration (TBSD). Supplements[31] were measured using the exact method as per the breastmilk intake. The result is in grams per minute.

The formula is as follows: SCPM = TTW/TBSD = GRAMS/MINUTE.

Example (C16): 520 grams/35 minutes = 14.8 grams/minute of supplements.

Breastmilk Consumption Structure (BCS)

Breastmilk-Consumption-Structure (BCS) was created by combining Test Weighing and the two factors of breastfeeding structures: TSD and AMS. BCS has 3 variables: MPPM, SCPM and AMPPAS.

Test-Weighing Parameters for the Data Analysis

The volume of milk collected for this study was measured in grams. I used the equivalent of 28g per oz, as this is the equivalent of 1 oz as used in Ecuador. See weight conversions for volume as a reference (Riordan and Auerbach, 1999:833).

I ignored insensible water losses, or rather I did not make any conversion for them in the data presented here, for three reasons. First, this was a longitudinal field study;

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[31] Most supplements were liquids or semi-liquids. Supplements that were not liquids were measured with the same technique as per breastmilk, weigh infant pre and post intake of the supplement.

therefore the number of measurements generated was far greater than in any cross-sectional study, where differences of a few grams might have significance. Secondly, I was more interested in inter-individual variation than in the precise intake of each infant. Third, for individual feedings, the total potential water loss was as low as or equal to the resolution of the measuring instruments used. At least to me, that meant that insensible water losses were not worth worrying about. Nevertheless, I have provided enough information here[32] and elsewhere (see results for TSD and NSS) for any interested party to make the conversion on their own.

In analyzing the results of this research, no extrapolation from the 12 hour actual intake measurements to a theoretical 24 hour period were made. As Woolridge (1985:10) suggests, a 12 hour observation "can provide a useful comparative measure," so "they should remain as such [without] transformation." I also found that a 6 hour framework gave me comparable results to those generated using the 12 hour protocol. This may need further research, since some scholars suggest that no extrapolations should be made from the original time-framework (Brown et al. 1982; Kent et al. 2006; Scanlon et al. 2006; Woolridge et al. 1985).

12 Hour Framework Changes for Data Analysis

Reductions in the 12 hour framework period for analysis were due to missing data or error/s in the data recorded. For instance, during one observation, the mother and baby

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[32] The formula for making adjustments for insensible water loss during test-weighing procedure is: 2g/kg/hr (Woolridge et al. 1985:13). However, there is no way to make an exact estimate of this water loss. If we consider that in Esmeraldas each feeding session was approximately 7, 10 or 15 minutes total during our first visit, this conversion would yield a very small increase relative to test-weighing measurement in water loss per feeding. So, for example, during a 10 minute feeding session for an infant weighing 3k, the insensible water loss would be approximately 1g. Multiplying this amount by the number of feedings per day (3 to 10), yields approximately 3g to 10g of water loss. Although this is not very significant, it will nevertheless have to be added to the total amount of water loss for the entire day.

fell asleep after have taking the first test-weighing measurement, so the assistant could not do the second test-weighing measurement. At other times the mother and infant were out together, chatting and visiting with neighbors. In these circumstances, the assistant did not have the ability to record precise information. There were also times that the mother, infant, and assistant all left the home base. Since the scale couldn't be moved, breastfeeding sessions during such times did not have test-weight measurement, again leading to a reduction in the length of the actual observation period. This caused a reduction of the intended 12 hour observational framework to a framework that included only the hours during which the assistant was able to record complete and verifiable information.

Also any error detected in the test weighing data resulted in elimination of that piece of information. Eliminating mistakes or errors in the data recorded implied some reduction of the 12 hour framework. That particular error measurement had to be eliminated, effectively reducing total observation time.

There were two ways of resolving the problem of the missing/eliminated test-weighing information. When the test-weighing was missing a measurement, but I had the suckling duration for that session, I calculated how the missing minutes were represented within the 12 hour observation period, doing a simple cross multiplication to solve for X.[33] Another option was to calculate the amount of milk produced per minute and multiply it by the time of the missing session. In this case, we would keep to the total

[33] Take a case with a session of 4 minutes, missing/eliminating one measurement. For that day the TSD was = 116.5 minutes/12h. How should those 4 minutes be represented in this 12h if 116.5 represents 12h? The total test-weighing measurement framework will be 11 hours 35 minutes and not 12 hours (4 * 720 = 2880/116.5 = 24.7minutes – 720minutes = 11hours and 35 minutes).

test-weighing framework of 12 hours.[34]

I used the first option, thus changing the length of the observational framework, rather than add to the total production of milk for that visit, because there are ways to cope with missing data during statistical analysis. Thus, the variable Test Weighing grams/hours was created using Test Weighing (g) and Test Weighing Framework (min). Since Test Weighing Framework (min) was not always the same for each data collection session, Test Weighing (g/h) standardizes Test Weighing (g) and allows for comparisons between cases.

The formula for T-W (grams/hour) is as follows:

(TEST WEIGHING GRAMS/TEST WEIGHING TIME FRAMEWORK MINUTES)*60

Creamatocrit

Creamatocrit measures the lipid concentration and therefore the energy content of human milk. Calculation from the creamatocrit to estimated fat percentage uses the following formula described by Lucas et al. (1978:1019): fat (g/l) = (creamatocrit (%) - 0.59)/0.146. To calculate energy value from creamatocrit, I use the formula: kcal/l = 290 + (66.8 * creamatocrit %).

Using this formula, I can see the linear relationship that exists between fat concentration and energy content and crematocrit. In part, this is because fat is the major determinant of the energy value of breast milk due to the relative constancy of the contribution of protein and lactose (Lucas et al. 1978). Thus, most of the energy variation in milk is due to variation in fat percentage.

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[34] For example: Total Test-Weighing = 90g. TSD =116.5 – 4minutes = 112.5minutes, then 90g/112.5minutes = 0.8grams/per minute. Then 0.8 * 4 minutes = 3.2grams in those 4 minutes. The total test-weighing would be 93.2 grams in 12 hours.

Single Measurements

We had some instances in which the mother breastfed the infant only once during the entire 12 hours. The problem here is that one session is not a good indicator of high or low breastfeeding performance or calculation like averages or means. However, that single session tells us something about the mother and her breastfeeding behavior.

Validity and Reliability

Validity and reliability, or the veracity and consistency of the measurements made using our instruments were an ongoing concern. Before starting to take measurements, instruments were checked to make sure that they worked properly. I also did random samples of the recorded measurements. I checked scales, measurements and other activities recorded by the assistants. In the case of the electronic scales, we used some pre-weighed items to check calibration (ex. the scale's scoop = 496g). At home, I always checked the instruments weekly for proper functioning.

STATISTICAL ANALYSIS

There are many variables that could be correlated with the problem of milk insufficiency, such as a dependent variable consisting of whether women complain, perceive, or have problems with their milk production, while the independent variables consist of the bio-cultural data that this research gathered. For the general analysis, first I analyzed these whole data set on a case by case basis. Once I corrected errors or mistakes I entered the data into Excel as the first data base for analysis. Then, the Excel data set was exported to SPSS 13 and 15 for statistical analysis. Here are the kinds of analysis conducted on these data:

Descriptive statistics were used. Non-parametric tests, including the Chi-Square Test, Mann-Whitney U Test, and Kruskal-Wallis Test were also used. Finally, Linear Mixed Models[35] (LMM) was used to conduct repeated measures analysis. Although repeated measure data can also be analyzed using General Linear Models (GLM), LMM was more suitable for our data set for the following reasons:

1. LMM handles missing data. While GLM deletes cases with any missing values, LMM permits cases with missing values.
2. LMM is more flexible with respect to measurement times. While GLM assumes all subjects are measured at the same point in time, LMM allows subjects to be measured at different time points (McCulloch and Shayle, 2001).

Since many of the cases had missing values and the measurements were not taken at exactly the same point in time for each subject, LMM was the choice for our analysis. In order to conduct the analysis first I had to categorize Milk Insufficiency Complaint (MIC) and the use of Supplements in low and high levels. New variables, MI Compliant Level and Supplement Level were created. During the six[36] visits, mothers who complained of milk insufficiency on three or fewer visits were assigned to the Low MIC Level category while mothers who complained on more than three visits were assigned to the High MIC Level category. Similarly, mothers who gave their infant supplements less than three times on each of the 6 visits were assigned to the Low Supplement Level category while mothers who gave their infant supplements three or more times were

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[35] Source: Linear mixed-effects modeling in SPSS, an Introduction to the Mixed Procedure. http://www.spss.ch/upload/1126184253_Linear%20Mixed%20Effects%20Modeling%20in%20SPSS.pdf

[36] I used the first 6 visits. While women were followed for more than six visits, the last visit had fewer participants.

assigned to the high category. There were 5 cases that had to be removed from the analysis because they had too few readings and could not be categorized.

Software for Analysis

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS), Versions 13 (2003) and 15. Descriptive statistics were used. Non-parametric tests, including the Chi-Square Test, Mann-Whitney U Test, and Kruskal-Wallis Test were also used. As described above, linear mixed models (LMM) was used to conduct repeated measures analysis (Epi-Info Version 3.5, 2007; McCulloch and Shayle, 2001; SPSS Technical Report, 2002).

PROBLEMS WITH THE METHODS

In actual practice, given the way that our methods were structured, it turned out that there were problems involved in conducting a longitudinal study with human subjects. Logistical problems, human error, and electronic dysfunction were some of the issues. There were also national and local political, as well as environmental problems in Ecuador during the time of this research. Sometimes our methods and techniques didn't mesh well with the normal lives of the people and their accustomed behavior. Research methods are designed with an expectation of predictability, while the lives of our subjects were inherently unpredictable.[37]

Prospective Longitudinal Studies

Prospective longitudinal studies have many advantages but also have some

[37] See Appendix B for research recommendation.

disadvantages. Among the advantages is that a longitudinal study allows us to establish "the temporal order of development" (King 2001:7), thus offering a chance to compare or "identify similarities and differences in intra-individual and inter-individual change and the relationship of independent and dependent variables over time" (Menard 1991, cited in King 2001:7). Such data can also be used to follow up on the same population and/or to compare with data collected in other cultural settings.

Nevertheless, longitudinal studies have many disadvantages. Among the most serious are cost of the research, attrition of the subjects and of the assistants involved in the research, and unexpected societal problems. As King (2001:2) suggests, "the personality, commitment and understanding of the study will vary with multiple research personnel and can affect data collection in unmeasurable ways, as can historical, socio-political, economic and political events," such as the economic crisis during our fieldwork that negatively impacted systematic collection of data.

Our methodology caused considerable disruption to the normal lives of the mothers involved, really a chain of interruptions. In order to do anthropometry and interviews, the assistant's 12-hour observations also had to be interrupted. The simplest part of the study were the observations. On the other hand, Creamatocrit samples that were taken were not as difficult to obtain as I had thought they would be based on the literature of milk collection. The most disruptive activity was the test-weighing.

Although we had planned to have all subjects visited systematically in the first two weeks postpartum, in some cases the first observations were conducted as much as three weeks after birth. It took to us quite a while to start making the visits, including observations and test-weighing, in a coordinated way. Setting up transportation for the scales was a problem, because I had to depend on the taxi drivers and their cars. They in turn, had to depend on the condition of the roads.

While in the field, I modified the questionnaires slightly; this created a problem during analysis. I used master questionnaires, but wrote the answers on a separate sheet. This was a problem during analysis because of the sheer amount of data that had to be compared. Another mistake that I made was changing the questionnaire while the research was already underway. This added a considerable cost in processing time.

LATCH and Apgar

All in all, the LATCH criteria were valuable because they allowed us to be more focused in our observations. LATCH gave us a relevant structure for the description of breastfeeding behavior. Even so, LATCH, by itself, was not very important in terms of the overall methodology employed in this study.

Mothers in this study were aware of how well attached babies were to the breast. If a mother noted any problems, she simply adjusted the baby until the baby was well latched. LATCH was a good observational protocol in theory, but at least in Esmeraldas, latching didn't seem to pose any actual problem. I did encounter ramifications of one of the LATCH features: (T). Some mothers had small nipples, nipples *empollados*- (sore nipples), inverted nipples, or cracked nipples, with reports of pain when breastfeeding. Nevertheless, there was only one case (C31) of small nipples and a brief concern by the mother about latching, which she resolved almost immediately.

The Apgar Score, used to determine an infant's physical condition after birth, was not useful in my research because we were not present at the moment of birth. To the extent that there was recalled, it was usually subjective and vague. By design, all of the infants studied were the products of natural birth and normal delivery.

Scales

As I mentioned earlier, we used three portable integrated electronic balances. They were numbered 1, 2 and 3; if any problem occurred with a scale we could backtrack the corresponding measurements. Scales 1 and 2 also had the capacity to print out their measurements. This was an advantage to us, in that we had two ways of recording and reading measurements; having the digital screen on the scale and a hard copy of the printout, which allowed me to retrieve any measurement that needed to be verified. The disadvantages with the printers were that the paper got jammed and the paper needed to be changed. The problem with the third, smaller scale was that the infants outgrew it. Eventually, I had to improvise a larger plastic plate to be placed over that scale.

Another significant problem with the scales was the lack of a level area to place them on. In general, due to the fact that the houses were constructed of wood, bamboo or cane, it took some time to stabilize the scales. A lesser problem was a lack of space in which to place the scale and or the lack of furniture to place it on. In general, the scales worked well. However, there were some problems to contend with during the course of the study. Each of the balances ultimately needed some kind of maintenance. Children played with the scales and broke one of them. Technicians in Quito repaired a damaged cable and I brought it back to the field. Another time, a technician had to come to Esmeraldas to recalibrate the Spanish scales.

The Human Factor

The nursing students I used as research assistants were good for the most part. However, I did have to replace some of them due to a variety of circumstances. In the end, I did not really have any extra assistants. This was my own fault because I could have used other female assistants who weren't necessarily nursing students. In retrospect, the training for the assistants may not have been long enough, but at the time, I considered it adequate.

The biggest problems were with the T-W measurements and the ways in which the data were collected. Some of the assistants did not strictly follow the instructions they were given. One assistant forgot to tell mothers not to change the infant's diaper between measurements. Another problem was individual variation in the assistants' point of view. One particular assistant collected data on every activity in the household within the 12 hour framework and included a detailed description of breastfeeding, which was useful. Another assistant collected only the data on breastfeeding and did not make any note of ancillary activities.

The relationships that developed between the mothers and the assistants were interesting, but sometimes problematic for data collection. Many times mothers used the assistants to babysit while they were working and therefore, no breastfeeding took place. Mothers often did not allow the assistants to weigh their babies when the babies were sick. In one case, when the assistant asked to weigh the baby the mother responded, "What for? She is just playing with the breast, there aren't going to be any changes." There was also one mother who was especially difficult. She would tell the assistant what to do and when to take measurements.

Television was an unexpected factor that affected data gathering. The assistants watched TV as much as the mother did. In Esmeraldas, the TV was turned on as a gesture of hospitality,[38] but it interfered with the conduct of our research.

The problem of lunch created an unspoken tension in many of the subject households. These families did not have enough food to feed themselves. Assistants were required to bring their own lunch, so the families would not be responsible for feeding them. I did not want the families to feel obliged to feed the assistants. Yet, the assistants who brought their own food created another problem. Sometimes the family did not have food themselves and therefore, assistants shared food with them or simply did not eat for the entire day.

Last, but not least, at times our work could not be carried out due to strikes in the city. At such times, the scales could not be transported, the assistants could not be transported, or it was simply too dangerous for the women to go out onto the streets. Security for our team was always my principal concern.

SUMMARY

This methodology was derived from the literature on breast milk research coming from different fields, some within anthropology and some from outside of anthropology. The methodology itself is innovative, drawing on methods and theory from different disciplines. The structure of these methods was based on the question of whether those women who complain of producing insufficient milk for their infants are really producing less milk than their peers. I have tried to determine from both a cultural and a biological perspective whether there is a measurable phenomenon that we can label as milk

[38] Because mothers like to invite visitors to watch TV.

insufficiency. The variables that could be correlated with the problem of milk insufficiency are qualitative and quantitative, based on the bio-cultural approach of this research.

The field study reported here was a longitudinal study. This study was carried out from September 1998 to November 1999 with one additional follow-up visit in 2001. The universe was seventy-two (N=72) breastfeeding women, twenty to forty years old and seventy-two (N=72) infants, up to 11^{th} months of age during the fieldwork period and up to 26^{th} months old during the follow-up visit in April 2001.

With the help of six female assistants the following data were collected: 1. Interviews, which produced demographic data, data about future plans, cultural views and practices associated with breastfeeding and socioeconomic information; 2. Structured twelve hour observations, which produced a recording of suckling magnitude, which is the times or number of breastfeeding sessions and the length to the minute of each nursing session; as well as any other perceived activities engaged in while feeding and not feeding; 3. Anthropometry, used to assess the nutritional status of the infants and their mothers. Anthropometric measurements taken were the length, weight, arm and head circumference of the babies, as well as the height, weight, arm circumference, triceps and subscapular skinfold dimensions of the mothers; 4. Test-Weighing tell us to determine either milk production by the mother or breast milk intake by the infant, a method that involves two measurements, before and after the infant had breast fed, using portable integrating electronic balances; 5. Creamatocrit, which measures the lipid concentration expressed as the percentage of cream (fat) separated from the milk by centrifuging. I have tried to clearly describe these methodologies, in the hope that they can be easily reproduced in the future. I close this chapter on materials and methods with a brief discussion of the problems that I encountered in the field, mainly as a cautionary tale.

CHAPTER 5

HEALTH & ILLNESS:

CHILDBIRTH IN ESMERALDAS CITY

In this chapter, I describe health related issues that I encountered during fieldwork among the mothers and children of Esmeraldas City. Health and illness are an important part of the everyday life of a population. They reflect access to care, nutrition, cultural beliefs, the structure of the society, and its cosmovision, as well as physiological and psychological concepts (Alchon1991). One critical aspect of the concept of illness, and the healing processes that aims to overcome it, involves what anthropologists call “ethnomedicines” (Rubel and Hass 1990, Nichter 1992). In order to understand the use of these ethnomedicines and their explanatory models, it should be kept in mind that the use of particular selections or combinations of those ethnomedicines represents strategies for health care and survival in a local context within a particular time frame.

NATIONAL AND LOCAL INDICATORS[39] ON MATERNAL AND INFANT HEALTH

According to the Human Development Report for 2005, infant mortality in Ecuador is mid-range for the Americas with 22 infant deaths/1000 live births, compared to higher infant mortality countries of Peru (23), Nicaragua (30), Brazil (31), Guatemala (32), Bolivia (52) and Haiti (84), and lower infant mortality countries of Cuba (6), Chile (8), Costa Rica (11), Colombia (17) and Venezuela (18) (http://www.nuso.org/revista.php?n=172). It is interesting that Columbia/Ecuador/Peru and Venezuela are similar.

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39 There are some disparities among the health statistics given in the literature and in some cases there is no specific information for either Esmeraldas Province or Esmeraldas City. It is necessary to look carefully at the methodology used to collect the data presented as well the specific site of such studies.

On average, Amerindians and blacks have the worst socio-economic and health conditions among all Latin Americans and that is also the situation in Ecuador (World Bank 1997, Torres 2002, Pan-American Health Organization 2005). Ecuador and Esmeraldas in particular, have experienced a statistical shift since 2000. In Esmeraldas province the rate of infant mortality has been reported to be as much as 84.2 per 1,000 live births, the highest in the country (Madero 1993). More recent data from PAHO (2001:6) indicate that the infant mortality rate in Esmeraldas is closer to 40 or 50 per 1,000 reported live births (higher in the areas close to the Colombian border), while in the country as a whole the rate is just 30 per 1,000 live births. Maternal mortality was reported as 109.7 per 100,000 live births in Esmeraldas, as compared to 74.3 per 100,000 live births for Ecuador overall. According to Torres (2002:10), these differences result from unequal access to health care for Afro-Ecuadorians in Esmeraldas province.

Table 5.1 Ecuador Health Indicators

ECUADOR - HEALTH INDICATORS		
Demographic	**Total fertility rate (female)**	**2.8**
Mortality	**Infant mortality rate, reported (< 1 year). Per 1,000 live births**	**30.0**
Breastfeeding[40]	**Average of breastfeeding in months**	**16.2**
	Exclusive[41] breastfeeding in months	**2.7**

Pan American Health Organization (PAHO), 2001:1 & ENDEMAIN, 2004.

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[40] Data from ENDELMAIN, 2004.

[41] According to ENDEMAIN (2004: 244), "exclusive breastfeeding measures the number of breastfed months without using any other kinds of milks or foods."

Table 5. 2 Esmeraldas Health Indicators

ESMERALDAS PROVINCE – HEALTH INDICATORS		
Demographic	**Total fertility rate (female)**	**3.9**
Mortality	**Infant mortality rate, reported (< 1 year). Per 1,000 live births**	**36.0**
Breastfeeding	**Average of breastfeeding in months**	**14.1**
	Exclusive breastfeeding in months	**2.9**

ENDEMAIN, 2004.

Comparing these statistics (Table 5.1 and 5.2) from Esmeraldas with those for the country as a whole, we can see that the total fertility rate is higher in Esmeraldas than the average for the country; likewise the infant mortality rate. Average breastfeeding duration is slightly over two months less than the national average, although the average exclusive breastfeeding duration is 0.2 months longer than the country's average.

Among the most commonly diagnosed infectious diseases in both the city and the province of Esmeraldas are acute respiratory infections (ARI), acute diarrheal diseases (ADD), malaria or *paludismo* (mostly caused by *Plasmodium falciparum*), dengue fever, and tuberculosis (Narvaez 1995, PAHO 2001, ENDEMAIN 2004).

HEALTH CARE SECTORS[42] IN ESMERALDAS

Cosmopolitan allopathic or professional medicine in Esmeraldas is provided and controlled by the provincial headquarters of the Ecuadorian Health Department (*Jefatura Provincial de Salud*), the Catholic Church, and by private or semi-private health care facilities. The only large public hospital in Esmeraldas city is the *Hospital Delfina*

[42] According to Arthur Kleinman (1980-1988), in complex societies there are three sectors of the health care system: popular, folk and professional.

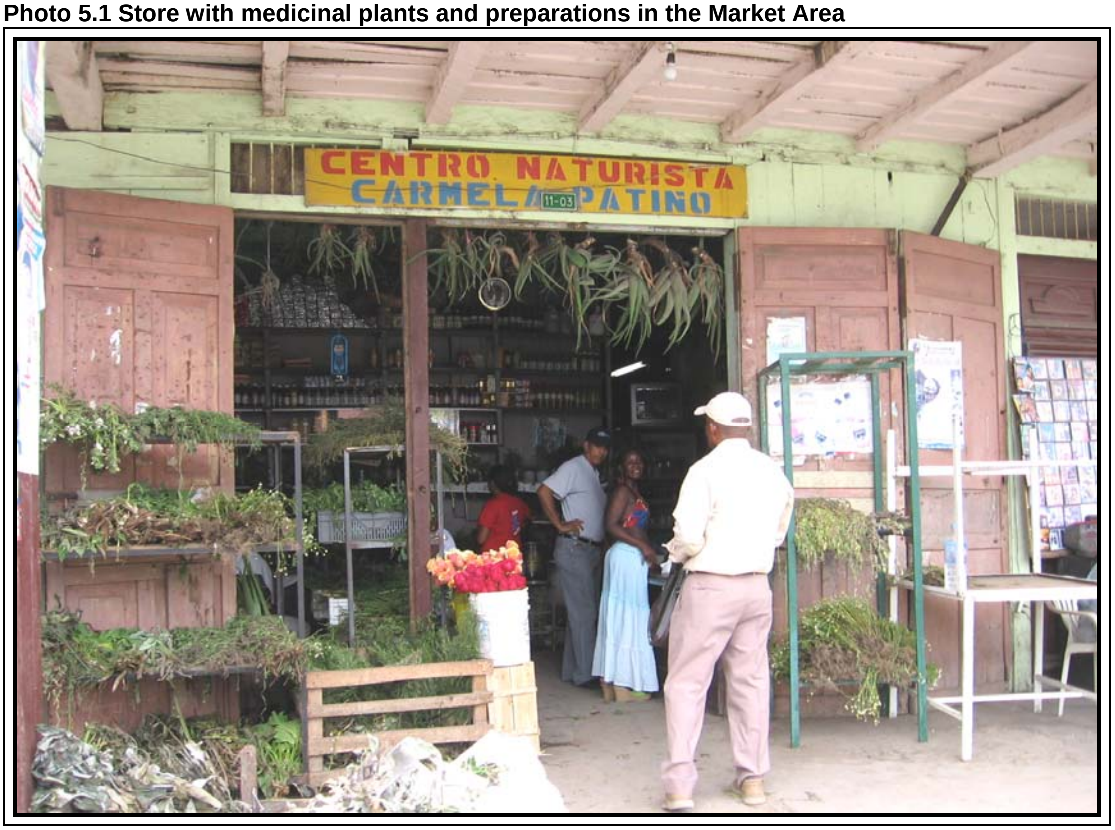
Torres. There is also a clinic (a smaller hospital) for workers insured by social security called the *Clínica Del IESS*. The provincial authorities provide almost every neighborhood in the city with a *Sub-Centro de Salud* (Health Center), some of which are administered or co-administered by the Catholic Church.

Each of the *Sub-Centros* is supposed to have a doctor, nurse, and dentist, all of whom are young professionals working for one or two years as part of their training in rural medicine. Unfortunately, many of these *Sub-Centros* have very poor performance records. Often the clinics are closed altogether or the doctors are not present (almost every year doctors are on general strike, mostly because of their discontent with salaries). They simply do not have the basic equipment necessary to service the community. When we asked the mothers involved in our study where they preferred to go when they needed to see a doctor, almost all specified the *Sub-Centro San Vicente de Paul*, which is under control of the Catholic Church. Mothers reported this center charges very little, and provides good care to their patients – "good care" meaning patients are treated with greater respect than they are at other health centers. This center also has various specialists that come from Quito once or twice per week and nuns serve as nurses. In addition to these institutions, we also found small clinics and private doctors' offices, especially around the center of the city.

There are also many pharmacies, all of which act as health care providers to the general public in one way or another, especially by recommending and selling medicines. Automedication is very widespread in Esmeraldas City, as in much of Ecuador (Price 1989). Most medications are available at pharmacies without a doctor's prescription. According to Kleinman (1980), self medication is part of the popular health care sector in biger or more complex societies.

As part of the folk sector of healthcare, we found all kinds of healers one of the mothers worked as a *curandera* (folk healer), including those using incantations. There were also shamans, and those who claimed to be sorcerers or sorceresses, who used hexing, magic charms, curses, or enchantments. There are many stores in Esmeraldas city selling medicinal plants and healing preparations, usually manufactured products made in Colombia, Peru or Brazil (see Photo 5.1). In these stores you can find a remedy for almost anything. In Esmeraldas the folk sector, popular sector, and the professional sector constantly intertwine or overlap.

Photo 5.1 Store with medicinal plants and preparations in the Market Area



Milton Herrera, 1999.

Moreover, in the case of Esmeraldas city, folk medicine and biomedicine are not different milieus, but exist on a continuum. Mothers regularly consult with both folk and medical practitioners. Their visions of health and illness include both explanatory models. The following cases exemplify this nexus of beliefs, cures, and interactions of allopathic medicine and folk therapies.

An infant's belly button had been bleeding since the previous day, so the mother took the baby to the doctor, who recommended using vitamin K (according to biomedicine[43] this vitamin helps with blood coagulation; Merck's Medical Dictionary 1984). However, the mother did not feel confident in the doctor's prescription, so she also consulted a *curandera*. This *curandera* was an old woman who advised her not to use the vitamin K that the doctor had prescribed. Instead the *curandera* recommended using antibiotic powder (*aspergomicil*) on the belly button as well as on the baby's entire body. It seems that the "antibiotic powder" caused some rash or allergic reaction. To treat this allergic reaction, the grandmother bathed the baby with chamomile, cleaned the belly button with iodine, and put some cream on the infant's body, with the mother assisting.

In another case, there was a baby who had a fever and cried without stopping. The father thought it might be because the mother's friend took the baby into her arms while she had a *mala espalda* (bad back) or was menstruating (*estaba con la regla*). The father told the mother to take the baby back to her friend in order to cure the baby of those possible illnesses or "enchantments." The mother took the baby to see her friend and came home quickly. She reported that her friend was not able to cure the baby because [technically] she did not actually take the baby into her arms (*porque no le habia cargado*). Not having held the baby in her arms, the friend could not have caused harm to

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[43] According to the Linus Pauling Institute of Oregon State University: Vitamin K could be insufficient in newborns because a baby's intestine is not ready to synthesize vitamin K. and also because breastmilk is lower in vitamin K compared to formula (source: http://lpi.oregonstate.edu/infocenter/vitamins/vitaminK).

the baby. The baby kept crying. The mother put some breast milk on the baby's belly and gave it a massage. Later, the mother gave the baby a glycerin suppository from the pharmacy, because the baby had not defecated since the previous day. She continuously massaged the baby's belly as she gave it the suppository. None of this helped and the baby kept crying. Finally, the mother took the baby to another friend, a *curandera*, who put some saliva on the baby's belly. Afterward, the baby defecated and stopped crying.

Sick Children and Sick Mothers

During the entire research period, all of the children and nearly all of the mothers' were sick one or more times. Mothers suffered from malaria, headaches, stomach aches, back pain, and exhaustion – and exhaustion was by far the most common of these complaints. Some of the mothers in our study complained of back pain when they breastfed their babies and would lie down while breastfeeding as a way to ameliorate the pain. Other mothers complained of being very tired (*cansarse mucho*) from the demands of daily life. They complained about everything from breastfeeding, household chores, and the stress of dealing with various family health problems, to their precarious economic situation exacerbated by the nationwide economic crisis. There always seemed to be one sick family member. One single mother had a nine year old girl whose leg was in a very advanced stage of infection, but she had not been seen by a doctor or any other healer because the mother had neither the money nor the time to take her, and the child's grandmother was dying of cancer in the next room. (We took the girl to a clinic for treatment.)

The infants suffered from many different illnesses, including: respiratory infections, with complications such as bronchitis; cold-flu (*gripe*); cough (*tos*); chickenpox (*varicela*); malaria; conjunctivitis; skin rash (*granos*); diarrhea, constipation and one child (Case-24 of G1) developed hydrocephaly and had surgery in Quito when he was five months old.

Constipation was a chronic problem among the infants in our study. Constipation lasted anywhere from a few hours to several days. Babies became fussy, cried, and could no longer eat. Precise causes for the constipation were unclear, however according to La Leche League FAQs (2006-7) "…it is also normal for a breastfed baby older than six weeks to have only one bowel movement every few days." Another potential cause of the constipation could be the indiscriminate use of many different kinds of hard-to-digest supplements, or perhaps, in some cases, the result of some underlying infection.

Mothers usually treated their babies' constipation with commercial suppositories or folk remedies purchased at either a pharmacy or a grocery store. One such treatment was a homemade suppository, consisting of a bit of soap (*jabón de lavar*) inside a piece of banana skin, which was inserted into the baby's anus and moved around inside. The mothers usually repeated this process 3 times, continuing even after the baby had already defecated. The soap used is usually abrasive, and together with the harshness of the banana skin, this practice could have negative health consequences for the babies. In addition, placing foreign objects in the rectum can cause obstruction and infection and could be painful for the baby.[44] Mothers think of both soap and banana peels as "slippery" and having a lubricating effect, which may explain their use as laxatives.

Interestingly, some mothers allowed their sick infants to breastfeed for more extended periods of time. Those sessions were not continuous, but were divided into

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44 From personal communication with a gastroenterologist.

episodes (any series of breastfeeding events separated by less than five seconds, Vitzthum, 1994) – mothers changed the feeding pattern during these infant's ailing times. In addition to the illnesses listed, we found some that could be categorized as local or folk illnesses or illnesses with local names, discussed in more detail below.

CHILDBIRTH: THE NUMBERS

To begin, presented below are some descriptive statistics that provide an overview of the 72 mothers observed during the course of the study. This includes results on the age of the mother, parity and sex of the child, as well as statistics on delivery and delivery practices, whether or not babies sleep with the mother on the first night after the birth and co-sleeping, colostrum, when milk arrived for the first time or onset of lactation, and breastfeeding duration.

Mothers Age

The mean age of the mothers in this study was 28.60 and the standard deviation is 5.668. The youngest mother was 18 years while the oldest was 41 (see Figure 5.1 and Table 5.3). The histogram shows that the variable is more or less symmetrically distributed about the mean. The 5% trimmed[45] mean is 28.46 mothers' age while the 95% CI has a lower bound 27.27 hours and an upper bound of 29.93 mothers' age.

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[45] 5% Trimmed Mean is another way of getting rid of the outliers.

Figure 5.1 Age Distribution of Mothers

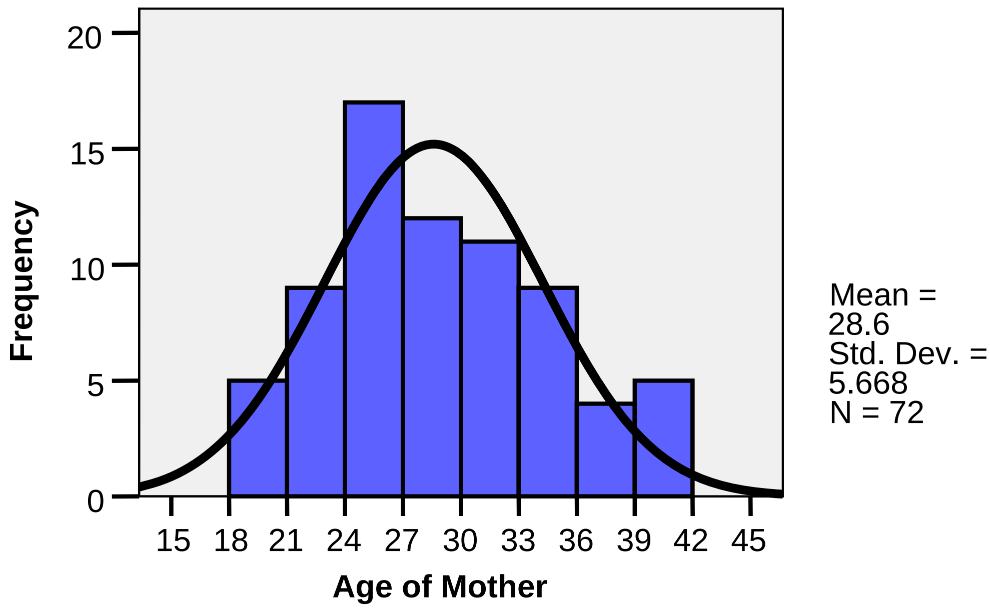


Table 5.3 Age of Mother Summary

			Statistic	Std. Error
Age of mother	Mean		28.60	.668
	95% Confidence Interval for Mean	Lower Bound	27.27	
		Upper Bound	29.93	
	5% Trimmed Mean		28.46	
	Median		28.00	
	Variance		32.131	
	Std. Deviation		5.668	
	Minimum		18	
	Maximum		41	
	Range		23	

Number of Births

For the purpose of the study, women who had already given birth to at least one child were recruited because, as mentioned before, multiparity is a possible factor associated with milk insufficiency (Forman et al.1992), see table 5.4 and Fig. 5.2.

Figure 5.2 Number of Births per mother

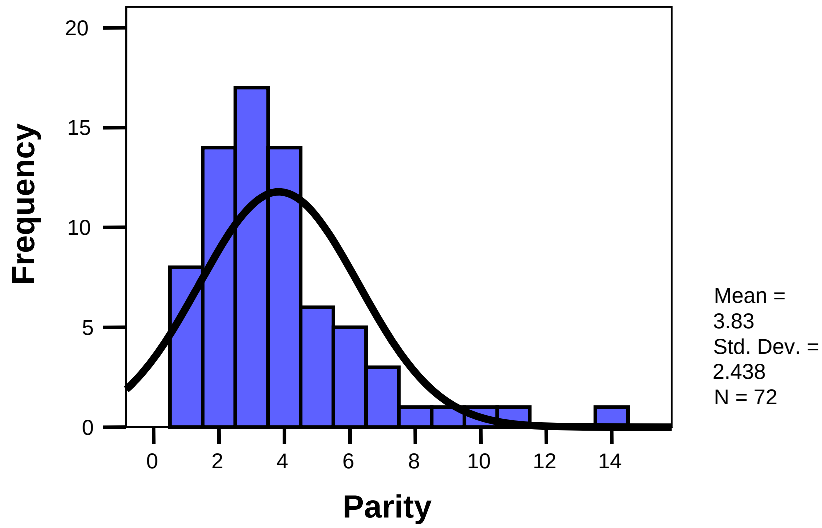


Table 5.4 Number of Births per mother

			Statistic	Std. Error
Parity	Mean		3.83	.287
	95% Confidence Interval for Mean	Lower Bound	3.26	
		Upper Bound	4.41	
	5% Trimmed Mean		3.58	
	Median		3.00	
	Variance		5.944	
	Std. Deviation		2.438	
	Minimum		1	
	Maximum		14	
	Range		13	

As shown in Table 5.4 and Figure 5.2 the mean number of children per mother in this study was 3.83 and the standard deviation is 2.438. The minimum count is 1 and the maximum was 14. Of the 72 mothers, 5 have eight or more children. Comparing parity with the total fertility rate from the rest of the country's data, the fertility rate of Esmeraldas City is over 1% higer compare to the rest of the country (2.8%), and 1 % less than compared with the province of Esmeraldas (3.83%).

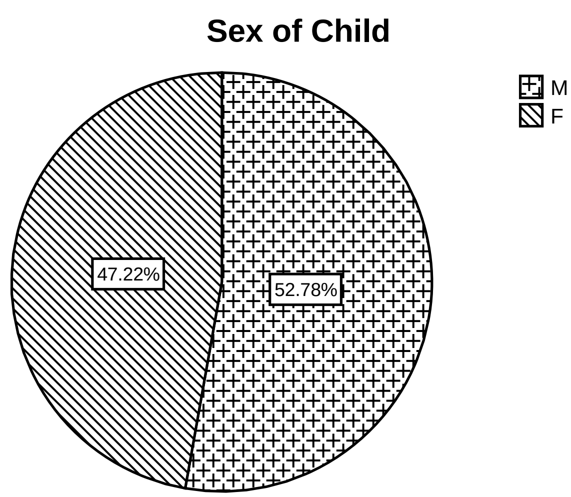
Sex of the Child

Pictured below is a frequency table for the variable Sex of Child. Thirty-eight of the 72 children (52.8%) were male and 34 (47.2%) were female. As I mentioned before, in Esmeraldas families wish for a boy more than a girl.

Table 5.5 Sex distribution of Children

		Frequency	Percent
Valid	M	38	52.8
	F	34	47.2
	Total	72	100.0

Figure 5.3 Sex distribution of the Children



Delivery

The work of traditional birth attendants, midwives or *parteras*, has traditionally been a significant aspect of popular health care in Esmeraldas, but is changing rapidly. The informal system of midwifery, still robust only a few years ago, has declined with the aging of these women and concerted efforts by the public health authorities to control their activities. Of the mothers participating in our study, 62.5% gave birth in a hospital and just 26.4% at home. A few years ago those percentages were reversed. Madero et al. (1993) estimated that between 60% and 70% of mothers in Esmeraldas gave birth at home in the late 1980's and early 1990's.

During the course of this study, mothers were asked about their delivery plans. The charts below show that the plan to deliver and the actual delivery site did not differ notably, and illustrate the change in attitude towards the use of *parteras*, and the overall shift toward using institutionalized health care delivery systems.

The variable Plan to Deliver shows that forty-six of the 72 mothers (63.9%) planned to deliver at a hospital, 20 mothers (27.8%) planned to deliver at home, 5 (6.9%) planned to deliver at a clinic, and 1 mother (1.4%) was unsure of where she was going to deliver her child.

Table 5.6 Planned Delivery site Frequency

		Frequency	Percent
Valid	Hospital	46	63.9
	Home	20	27.8
	Clinic	5	6.9
	Do not know	1	1.4
	Total	72	100.0

Table 5.7 Actual Delivery Site Frequency

		Frequency	Percent
Valid	Hospital	45	62.5
	Home	19	26.4
	Clinic	7	9.7
	Dr. Office	1	1.4
	Total	72	100.0

Figure 5.4 Planned Delivery Sites

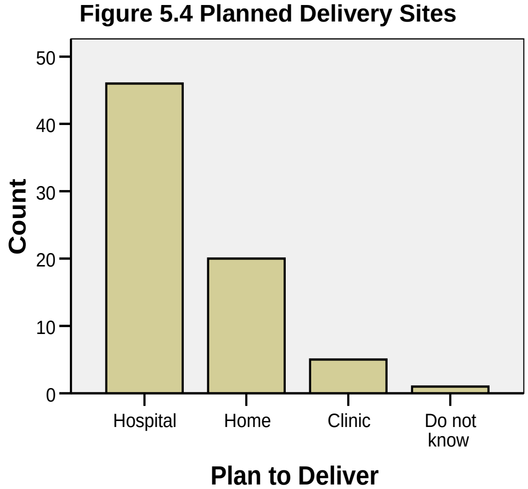
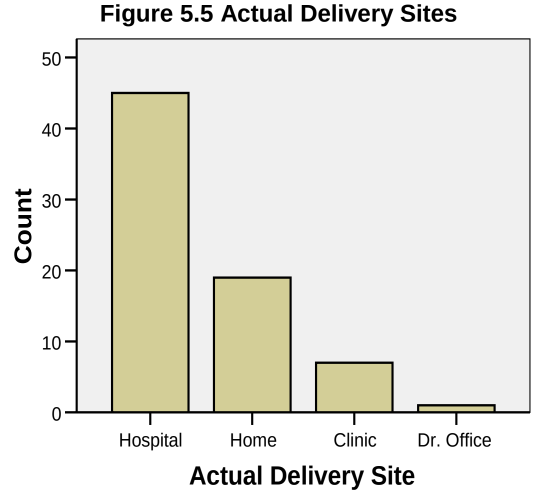


Figure 5.5 Actual Delivery Sites



For the variable Actual Delivery Site, we found that 45 of the 72 mothers (62.5%) delivered at a hospital, 1.4% less than planned, 19 mothers (26.4%) delivered at home, 1.4% more than planned, 7 (9.7%) delivered at a clinic, 2.8% more than planned, and 1 mother (1.4%) delivered her child at a doctor's office. These findings show an increase of the use of the biomedical sector over the use of midwifes or *parteras*. If we compare to Madero et al. (1993) data, there is a marked decline in children delivered by *parteras* in favor of delivering children within the professional sector.

A well known *partera*, 62, from Limones (north of the province), reported to us that she does not have many clients anymore, "…because mothers now prefer to give birth at the hospital, because they give to them *la canasta para el bebe* (a basket with baby things like soap, diapers, shampoo, etc.), so mothers prefer to go there." In some parts of Ecuador it is believed that if a large number of deliveries are attended by *parteras* in lieu of doctors, it reflects a lack of progress or backwardness of the region. (El Universo, May 9, 2007).

Compared with the statistics for the province as a whole, we find that in the city of Esmeraldas there was a higher number of deliveries at the hospital than with the *parteras*. Province-wide statistics show a higher number of home deliveries in general, a difference that could be attributed to urbanization and "modernization" forces more prevalent in the city.

In terms of delivery procedures, if we look at the statistical reports from the Hospital Delfina Torres for the years 1998-1999, we find that of the total births in 1998, 1,605 were by vaginal delivery and 310 by cesarean section (19% of the total births). In 1999, of a total of 2,310 deliveries, 1,804 were vaginal deliveries and 506 were cesareans

(22% of the total deliveries, an increase of 3% from the previous year). In the month of January 1999 alone, 31% of the total births were reported as cesareans. While I do not have a specific explanation for this increase in the rate of cesarean sections, it would seem to represent a "medicalization"[46] of childbirth in Esmeraldas, at least for the first months of the year. This increase may not be statistically significant and may or may not represent a long-term trend. It also differs from the pattern for the province as a whole, as can be seen from comparison with ENDEMAIN's 2004 statistics (see Table 5.8), which show a much lower rate for cesareans (9.5%).

Table 5.8 Place and Type of Delivery

ESMERALDAS PROVINCE – PLACE AND TYPE OF DELIVERY		
Place of birth	**Hospital, Sub-center, Clinic, Dr's office (health professionals)**	**52 %**
	Home (midwifes, *parteras*, family member, others)	**48 %**
Type of Delivery	**Vaginal**	**90.5 %**
	C-Section	**9.5 %**

ENDEMAIN, 2004.

During the fieldwork, ligature of the fallopian tubes or *ligadura de trompas* was routinely recommended to mothers and performed as minor surgery by doctors. Some of the mothers participating in this study went to the hospital and had their "tubes tied." In Esmeraldas it is commonplace for doctors to suggest that mothers who have "a lot" of children, or who are old and/or poor, undergo this procedure. Perhaps the procedure is

[46] According to Helman (2001: 114) medicalization is seen "as the way in which the jurisdiction of modern medicine has expanded in recent years and now encompasses many problems that formerly were not defined as medical entities. These include a wide variety of phenomena, such as many of the normal phases of the female life cycle [like] menstruation, pregnancy, childbirth and menopause. As well as old age, unhappiness, loneliness and social isolation, and the results of wider social problems such as poverty or unemployment."

suggested as a means of contraception[47] for the purposes of population control[48] at times.

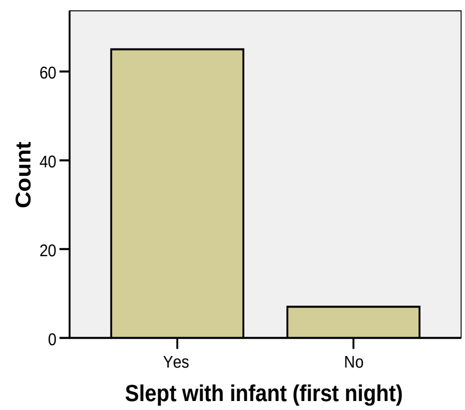
First Night and/or Co-Sleeping

Whether or not mothers sleep with their infants in the same bed during the first night was also explored in this research. Sixty five (65) of the seventy-two mothers (90.3%) slept with their infants on the first night and seven (7) mothers (9.7%) did not sleep with their infants on the first night. The majority of the mothers did not follow the old practice in the hospital, where the newborns were kept away from their mothers right after birth.

Table 5.9 % of mothers slept with infant (first night)

		Frequency	Percent
Valid	Yes	65	90.3
	No	7	9.7
	Total	72	100.0

Figure 5.6 Mothers slept with Infant (f.n.)



47 In Esmeraldas, women do use contraceptives, not on a large scale, but they do use them. The most common ones used are oral contraceptives (the pill), and intra uterine devices (IUD). Mothers do believe that breastfeeding is a way of not getting pregnant, although in this research some women got pregnant while they were breastfeeding. There was not a direct relationship between the use or not of contraceptives and breastfeeding during this research, and as far as I know no women were using any kind of contraceptives during the 1999 season study period. In any case, research has shown that "the estrogens can reduce milk supply in some women" (Nichols-Johnson 2001:2).

48 In the 1990s, some developing countries' governments, including Ecuador's, viewed their population growth as too high, and saw the need to have population policies and family planning (UNFA 1993:1). According to the same report, "high rates of population growth are detrimental to their development." Therefore, an increased use of birth control was promoted and established by either NGOs or government health institutions or both. To Ordoñez and Olmedo (1991:1), Ecuador has initiated a demographic transition (since the 1980s) in which the fertility rate declined from 5.6 in 1975 to 3.8 in 1988. Pro-natalist Catholics and Marxists in Latin America, including Ecuador, argue that overpopulation should not be considered the primary cause of economic strife, nor should birth control be promoted as the solution (Tobin 2002). I have not done research on this topic; certainly, it is something to explore further.

Prevalence of bed-sharing is common around the world and is more common among younger, less educated non-white mothers with low socioeconomic status (Ball, 2007). In Esmeraldas, co-sleeping or bed sharing with the infant is the rule. At home, all of the mothers except two co-sleep with their infants. In many households, sharing a bed was the norm due to limited space. The rationale for an infant co-sleeping with the mother is that the infant will be breastfed throughout the night. A study on night waking among different social classes in Thailand by Anuntaseree et al. (2006) reported that the majority of parents responded to the infants' night waking by breastfeeding them. Interestingly, in this study, breastfeeding was found to be highly associated with frequent night waking because since breast milk "leaves" the infants' stomach more quickly than formula does, breastfed infants experience shorter periods of satiety and therefore shorter periods of sleep.

New studies show that mothers who bed-share with their infants also tend to persist in breastfeeding longer than those who do not. Bed sharing mothers offer their babies more frequent suckling and breastfeed for a longer duration, thus stimulating and maintaining milk supply (Ball, 2007; McKenna and Volpe 2007). Contrary to previous studies, Hayes et al. (2007) reported that co-sleeping with parents was associated with sleep disturbances among infants from middle class-families in the Northeastern US. According to Parker-Pope (2007), contrary to the norm of co-sleeping in most parts of the world, co-sleeping is not recommended by family members or the medical community in the more prosperous western societies (New York Times, October 23, 2007).

Colostrum and Onset[49] of Lactation

It is described in the literature (Duong et al. 2004; Holman and Grimes 2003; Shirima et al. 2001; Zietlyn and Rowshan 1997) that in many cultures, colostrum is not given to children because people believe that it is bad, spoiled, dirty, old milk, expired milk, yellow or bad luck. Even though some mothers did believe that colostrum was bad for their infants, in this research, all the mothers fed colostrum to their infants. In a survey conducted on breastfeeding initiation from a sample of 463 rural women in the Thanh Hoa province in rural Vietnam, Duong et al. (2003) found even though colostrum was fed to 85.6% of infants as the first meal, some mothers believed that colostrum is of little value or harmful to babies' health. In hospitals, some mothers were directed to discard colostrum due to "bad luck." However, if an infant was fed colostrum in the first meal, the likelihood for exclusive breastfeeding was higher.

The timing of onset of lactation is critical in the mother's confidence and attitudes. It is particularly important to how mothers establish their lactation behavior towards their infant (Grajeda and Perez-Escamilla (2002).

In this research, time of onset of lactation was of particular interest because some mothers had milk before they gave birth and others produced milk as late as six days after birth. Here are the summary statistics for the variable When Did Your Milk Arrive for the First Time in hours. Mothers, whose milk arrived before they gave birth, were assigned the time 0 hour. The mean time is 40.24 hours and the standard deviation is 35.54 hours. The earliest arrival time of mother's milk is 0 hours and the longest is 144 hours (6 days).

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49 Onset of lactation, or lactogenesis II (according to biomedical classification), is when mothers, after their babies' birth, refer to their milk "coming in," and this is an easily defined event cross-culturally (Pérez-Escamilla and Chapman, 2001).

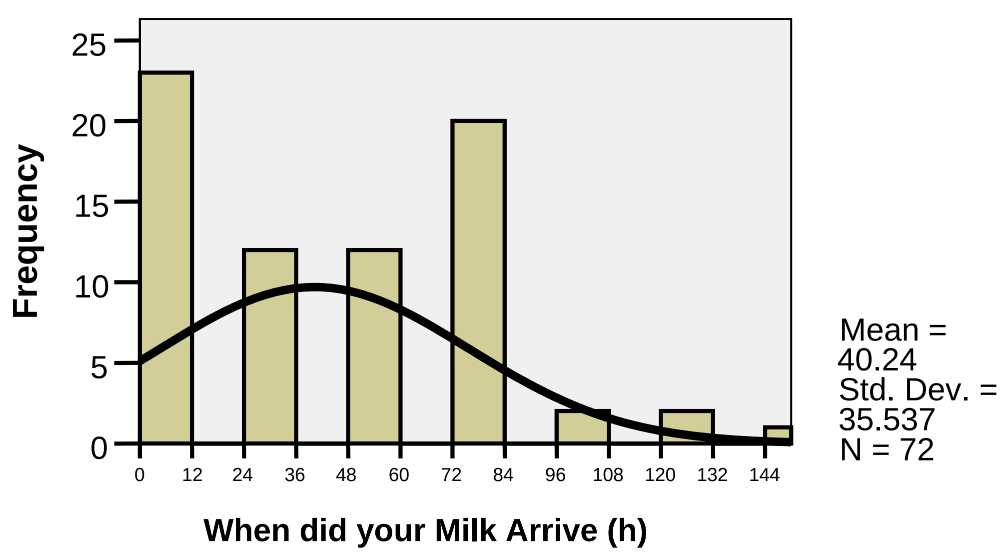
The 5% trimmed mean is 37.89 hours while the 95% CI has a lower bound 31.89 hours and an upper bound of 48.59 hours.

Table 5.10 When Did Your Milk Arrive Summary Statistics

			Statistic	Std. Error
When did your Milk Arrive (h)	Mean		40.24	4.188
	95% Confidence Interval for Mean	Lower Bound	31.89	
		Upper Bound	48.59	
	5% Trimmed Mean		37.89	
	Median		48.00	
	Variance		1262.859	
	Std. Deviation		35.537	
	Minimum		0	
	Maximum		144	
	Range		144	

The histogram below shows that the variable is not symmetrically distributed about the mean and that it is grossly discontinuous.

Figure 5.7 When did your Milk Arrive (h)



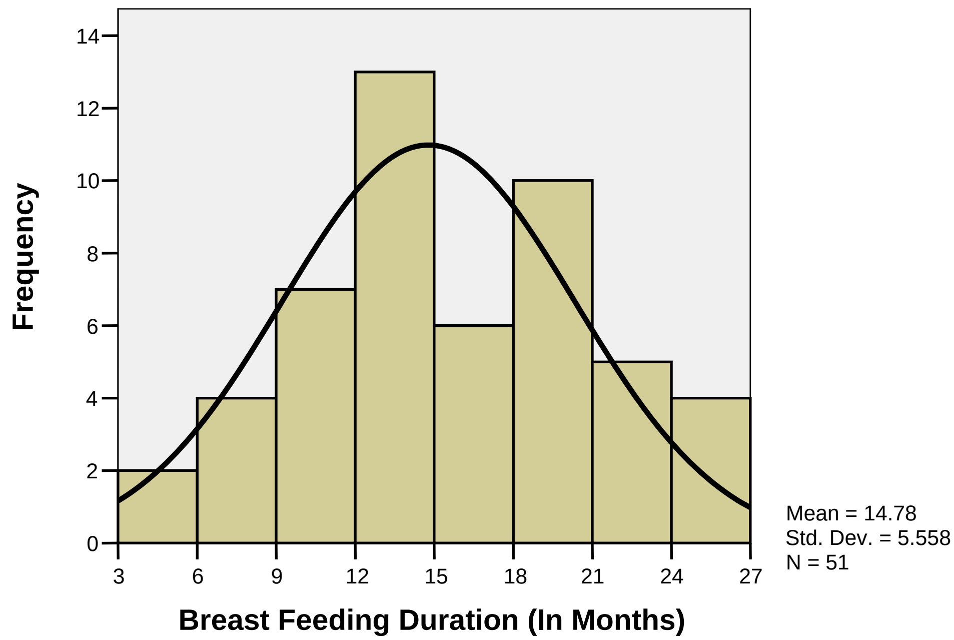
Breastfeeding Duration

In 2001 we were able to locate and follow up directly with 48 of the original 72 mothers, as well as locate sources of proxy information for an additional 3 mothers (48 + 3 = 51). In the follow up group, each was asked how long she breastfed her infant, whether she was currently pregnant and if she had any additional children since the time of the original 1998-1999 study. Three mothers were still breastfeeding their children at the time of our interview. For those three mothers, breastfeeding duration was calculated as of the date of the interview. Only seven participants had fully weaned their babies during the original 1999 season, study period. The mean breastfeeding duration was 14.78 months (standard deviation of 5.56 months). This number is almost exactly the same as the one presented by ENDEMAIN (2004).

Table 5.11 Breastfeeding Duration (In Months) Summary Statistics

			Statistic	Std. Error
BF Duration	Mean		14.78	.778
	95% Confidence Interval for Mean	Lower Bound	13.22	
		Upper Bound	16.35	
	5% Trimmed Mean		14.75	
	Median		14.00	
	Variance		30.893	
	Std. Deviation		5.558	
	Minimum		4	
	Maximum		26	
	Range		22	

Figure 5.8 Breastfeeding Duration

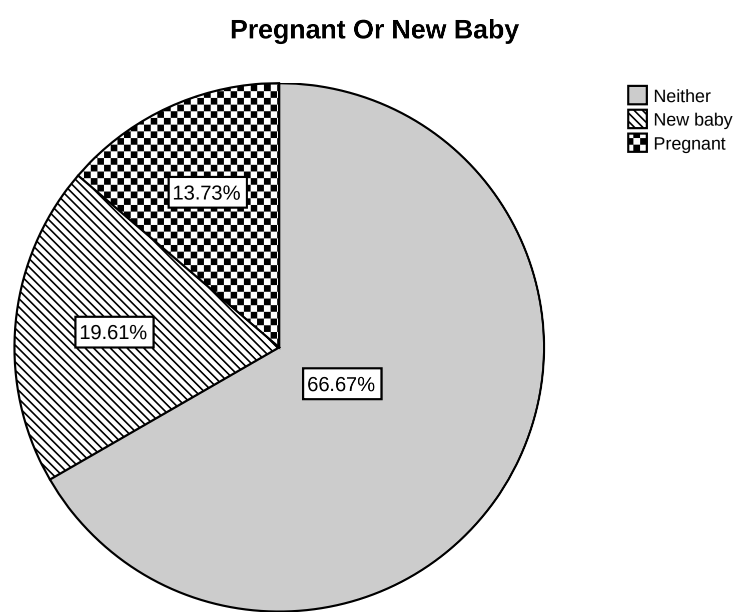


Although because some women in the sample were still breastfeeding at the time of re-interview, this number underestimates the true mean. For Esmeraldas's province the breastfeeding duration is 14.1 months, less than the breastfeeding duration for Ecuador as a whole, which is 16.2 months (PAHO, 2001). The minimum duration was 4 months while the maximum was 26. Figure 5.8 shows that most mothers breastfed their infants anywhere between 12 and 13 months. Table 5.12 and Figure 5.9 indicate how many mothers in the follow up portion of the study were either currently pregnant or had given birth to an additional child in the interim. Of the 51 mothers, 34 (66.7%) where neither pregnant nor had a new baby. Ten (19.6%) had a new baby, and seven (13.7%) were pregnant. Combining last two variables shows that one third did have a new baby or were pregnant. Both are states that stop breastfeeding without delay, because the mother is no longer producing good milk for the prior child, according to Esmeraldan beliefs.

Table 5.12 Pregnant or New Baby

		Frequency	Percent
Valid	Neither	34	66.7
	New baby	10	19.6
	Pregnant	7	13.7
	Total	51	100.0

Figure 5.9 Mothers that were Pregnant or had a New Infant 2001



CHILDBIRTH: THE BELIEFS

In Esmeraldas there were local[50] categories of health and illness related to childbirth, childcare, breastfeeding and mother's care with their own explanatory models, cures, treatments, and remedies. Often the mothers and family members felt

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50 Many of those "local" illnesses aren't limited to Esmeraldas.

uncomfortable sharing their folk illnesses and secret knowledge. As one midwife told us, "…I am not going to share with you my secrets." The local illnesses described here are the ones that seem to relate most specifically to our research and by no means constitute all such local beliefs about health problems.

The Diet

The diet (*la dieta*) is a postpartum period during which some foods, as well as sexual and other activities, are restricted for the women. This postpartum period or diet is a reflection of how many cultures recognize that immediate postpartum is a special time when the mother and infant bond and lactation are initiated. For instance Ribeirinha women, in the Brazilian Amazon, practice what they called the *resguardo*, a forty-day postpartum period when women observe food taboos and work restrictions, living a type of seclusion (Piperata and Dufour, 2007).

In Esmeraldas, such restrictions used to be in place for forty days following birth. According with Naranjo (1996), in Esmeraldas, women were not permitted to eat pork and were not given left over food. But during our study, there was not a clear diet that mothers had to follow. As one mother observed, "times have changed … we do not use these diets anymore." Nevertheless some of the beliefs described below are part of the diet or postpartum practice.

Plants[51] and Remedies

Treatment of a variety of health problems involved different combinations of herbal remedies or other cures, along with pharmaceutical products and prescribed medications. Nearly all of the mothers used herbal remedies after delivery, particularly a plant called *nacedera*, which in English could be translated as “the birthing.” According to the local botanist Alfredo Lojanes[52] the scientific name of this plant is *Tricanthera gigantean*; family name *Acanthaceae* (see Appendix C; photos 8, 9, and 10). According to Muñoz (1995) *Trichanthera gigantean* acts as an *antiespasmódica* (antispasmodic). Apparently, it can also be used to induce abortions.

Mothers used this plant as a means of “cleaning” themselves internally (*limpiar*), to stop bleeding, and to get rid of blood clots after a delivery. However, most important from the standpoint of this research, mothers also used it to increase the early production of milk. I do not know whether this plant actually has the desired effects or whether those effects are oxytocic. Mothers made various teas from this plant, such as *nacedera* with or without brown sugar, tea with alcohol (which is made as a hot brewage), and tea to put in baths. A typical regimen would be administration of *nacedera* in any of these forms three times a day for five to seven days.

Bathing in water with plants is a very important procedure to cure many illnesses. For instance, for complications during birth or *desgarro en el parto* (rupture of uterus), mothers were adviced to take baths in *guanábano* (soursop tree) (*Anona muricata*), plus to use an iodine alcohol solution, to cure the birthing wounds.

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51 Names of the plants are first presented in the local or common name, then identified and traced to their respective scientific names, using as botanical guides Gentry 1993 and Caballero Muñoz 1995. Some plants have animal names like goat or black vulture. Those names I translated to English as well.

52 Information obtained through personal communication with Alfredo Lojanes.

Chamomile tea to purge or "*agua de manzanilla para purgarlo*" is given to cleanse the digestive system of parasites. Complaints of stomach pain were met by a *curandera* with a remedy of herbal teas and treatment consisting of body massages using eggs ("*frota un huevo criollo sobre el cuerpo de la madre*"). One mother, paralyzed on the right side of her body, saw a *curandero* (folk healer), who told her she was paralyzed because she was a victim of witchcraft (*porque le han hecho daño*).

A folk remedy supposed to cure a baby with an umbilical hernia is to write the complete name of the baby on a piece of paper and put it inside the bark of an *obo* tree (Anacardiáceas family), over which one has previously made the sign of the cross. It is believed that the hernia will disappear within a short time after this ritual is performed. For hiccups, mothers put a piece of paper or a wet thread on the baby's forehead.

Belly Buttons and *Polvo Secante*

After delivery, the care of an infant's belly button (navel or umbilical center) was considered important and involved many different procedures. Constant manipulation might explain the common occurrence of a protruding belly button in Esmeraldas, especially among Afro-Ecuadorian children. Among the most common procedures mothers carried out after birth were fumigation of the baby with incense (*saumar*) and application of *polvo secante* (drying-dust), which is any kind of absorbent powder, to the belly button. Mothers also used other substances, such as breast milk, alcohol iodide oil (*canime-oil*), and applying small wax balls held to the navel by a bellyband (*ombliguero*) for the purpose of causing the infant's belly button to sink. Usually at the end of each cure or ritual there is another *sauma* of the baby and the baby's clothing.

Most drying-dust-powders consist of a combination of plants and antibiotics which are burned and put through a sieve. One formula contains *palo santo* (“holy wood tree” - *Bursera graveolenan*) together with rosemary, *ruda* (*Ruta graveolens*), and *paico* (*Chenopodium antihelminticum*) leaves. This mixture is burned and the ashes are put into a small piece of cloth. Next, the substance is put through a sieve. The resulting powder is put on the infants’ umbilical area, which is then covered with gauze and tape. Other *polvo secantes* can be ground antibiotics, such as sulfathiazole and tetracycline (*sulfatiasol, aspergomicil*), dry *guayaba* (guava) leaf, or cornflower (*maicena tostada*).

Pasmo

Pasmo is a postpartum syndrome, which can include fever, headaches, and sweating. It could be a cause of milk insufficiency. According to Whitten (1986:151), “*pasmo*…refers to any debilitating illness.” It is said that *pasmo* may occur in a variety of ways that cause the blood to get *resfrío* (cold). The concept of *resfrío* is very common in Ecuador. According to many scholars, this idea comes from the hot and cold dichotomy, as explained in the humoral theory of medicine (see Foster 1994). When people go from a warm environment to one where there is cold air, they cover their heads to avoid *el pasmo* (a fit or shock). *El pasmo* is thought to be caused by cold air.

Pasmo is also seen as being associated with a mother’s activities just after birth. She is not supposed be very active for the first forty days postpartum. Mothers are specifically told to cover their heads when going outside during the first forty days postpartum to prevent *pasmo*. If a postpartum woman goes outside and exposes herself to the night dew (*sereno*) without covering her head before the forty day diet (see diet) period is over, if a mother takes a shower during the first nine days postpartum, or if a woman gets wet in the rain or while washing clothes during menstruation, *pasmo* is a likely result.

In order to treat *pasmo*, women use a *botella curada* (a treated bottle), which is a beverage consisting of plants like *paico* (*Chenopodium antihelminticum*), *ruda* (*Ruta graveolens*), *basil* (*Occimum basilicum*), and cinnamon infused in ethyl alcohol. They are told to take a small cup every eight hours for three days. Other remedies include tea of *paico* with sugar, or taking a bath with herbs when they feel the symptoms of *el pasmo*. If a mother has a headache, she makes sure to take a steam bath with *paico*, chamomile and rosemary. Giving warm baths laced with plant infusions, like chamomile and rosemary, is also a commonly prescribed remedy for children's illnesses.

Evil Eye

The fear of evil eye (*ojo, mal de ojo, ojeado, ojo y espanto*), is very common in Esmeraldas.[53] Both etiology and treatment are very broad. It is believed that when a person looks at a child with "desire, appreciation, love or envy," the child may be harmed. To those who really believe, a child may be harmed by anybody looking at him or her. In addition, they believe the love that a mother or father has for the child, or a child's own love for his or her mother, can also cause the evil eye. Even a mother's contemplation of her own child "with love" may cause *mal de ojo*. To prevent the evil eye, believers perform a variety of acts, such as taking one's own saliva on the index

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[53] *Evil eye* is well known in many different culture areas, including parts of Latin America, Europe, and Africa (Rubel, cited in Helman 2001).

finger and placing it on the baby's belly button, as well as behind its ears, in order to protect the baby from the mother's power of *ojear* (evil eye).

Symptoms of the evil eye can be fussiness, weight loss, constipation, fever, diarrhea, and feces with a very bad odor. For example, a baby was crying, according to the mother, because it could not defecate. The mother took the baby to the health center, where the doctor prescribed glycerin suppositories and some medicinal drops. After seeing the doctor, the mother took the baby to her aunt, who was a traditional healer. She asked the aunt to cure the baby of "*ojo y espanto*" (evil eye and fright).

The aunt prescribed a cure consisting of *aguardiente* (distilled alcohol) mixed with plant extracts including *flor amarilla* (*Tagetes patula*) (yellow flower), *gallinazo* (*Porophylum ruderale*) (black vulture), and *chivo* (*Hyptis verticillata*) (goat). The aunt/healer gave the infant a spoonful of *aguardiente*, at which point the baby fell asleep, possibly because it was drunk. Then the aunt took an egg and massaged the baby's body, saying that the baby was "*ojeado*" (suffering from the evil eye). Later that same day, the grandmother also massaged the baby's body with an egg, because she also thought that the baby suffered from "*ojo y espanto*" (evil eye and spite). Notice that both of these healers were female members of the mother's family, but that before resorting to their advice and remedies, she first went to see a conventional doctor.

Children's Names

It is very common that for some time after babies are born they are not given names,[54] as if they do not yet need one. Sometimes it takes months before a child is given a name and even when they are given names, it could be changed after few months for another name[55] (certainly the spelling changes continuously, especially when names are in a foreign language such as English, currently a fashionable practice).

Children's names are connected to the life cycle ritual of baptism within Esmeraldan Catholicism. Mothers call their infant *moritos* – a *morito* or *morita* is a child who has not yet been baptized (Quiroga, 2003) within the Catholic Church. According to Quiroga (157) "*moros* are related to evil in different manners…the devil steals children who remains *moros* for a long time" and "if a *morito* dies the spirit will remain on the earth." In traditional Catholicism children who die before they are baptized go to limbo – neither hell nor heaven.

In Esmeraldas names are apparently not so important in the first months of life, but the gender of the child is very important, as described by Naranjo (1996), gender is thought to be detected as early as forty days of pregnancy for boys and five months of pregnancy for girls. It is believed if the fetus moves "a lot" it is going to be a male.

Children's Discipline

Among breastfeeding mothers, there is a belief that babies should be allowed to cry so they can learn that "things in life are not easy." Sometimes babies are left to cry so

[54] By comparison, quite the opposite is true in the US. Babies here often have a name before they are born (see names posted in the websites to be selected), as if the parents are filling a space with the baby's name.

[55] Babies born in the hospital are not required to have a name, and usually they are registered with the mother's name. Technically the mothers will need to register the infants in the Civil Registry (*Registro Civil*) with a name that has to be approved by that institution. Interestingly, many times mothers have to change their babies' names because the Registro Civil has rejected the name chosen by the mothers.

as not to spoil them (*para que no se engria*). Mothers also explain that they allow the baby to cry and withhold the breast in order to make the baby hungry, with the hope that the baby won't play with the breast once getting it, but rather just eat.

At the same time, older children are punished both physically and psychologically by parents, most often by their mothers. Physical punishment is so well accepted in Esmeraldas that it is possible to buy whips (*latigo*) made of leather in the markets. Children are physically punished for almost any small infraction, such as breaking a pencil point, not to mention destroying something of value.

DOÑA LINDA'S STORY:
"I DON'T NEED ANYTHING FOR MYSELF; EVERYTHING IS FOR MY CHILDREN"

I close this chapter with one mother's life history, as an introduction to breastfeeding in Esmeraldas. It is my hope that this case study will serve as an introduction to the research findings and to the problem of milk insufficiency in Esmeraldas city. The following is the story of Doña Linda (C40), a breastfeeding mother with many other children to take care of. The information is based on an interview conducted in May 2001 and data collected during 1998-1999. With this life history I attempt to accomplish three things: first, to portray the stressful life of an Esmeraldan mother, second, to show how breastfeeding becomes an everyday part of that life, and third to introduce breastfeeding structure in Esmeraldas city. The names in this history have been changed for ethical reasons.

In 2001, Johanna, my assistant, told me that Doña Linda was living with another man after abandoning her husband, Don Nelson, and their 8 children, including the infant who was our research subject, Jairo, then 2 years old. Johanna found out through Don

Nelson how to locate Doña Linda. We learned that her new partner, Don Anastasio, had a meat shop outside the market area. We decided to approach Don Anastasio first, to ask him for permission to interview Doña Linda. While he appeared unenthusiastic about it, he finally allowed us to conduct an interview with Doña Linda. Here is her story.

The Union

Doña Linda was born in Pedernales, in the province of Manabí, south of Esmeraldas. She was the third of four children, three girls and a boy. By 1999, her father had been dead for five years; her mother and all of her siblings still lived in Perdernales. She told us: *"yo vine por el destino, acá,"* (I came here by fate), because she met the father of her children in Pedernales, from where he eloped with her and brought her to Esmeraldas.

At the time of our original research, Doña Linda was 31 years old, although her "*cédula*" (Ecuadorian national ID card) made her out to be only 21, listing her date of birth as January 30, 1978. She claimed not to know her age, but according to Don Nelson, she was, in fact, 31 years old. I readily believed her to be 31, because her eldest son was 11, suggesting that she had him when she was 20 and not 10 years old.

When she was 9, after she expressed a desire to go to Guayaquil to work because they were very poor, her father beat her on the head with the flat part of a machete. She told us "my head was spinning." Since then she has suffered from repeated headaches. After this episode, she moved to the house of a woman who took care of her for the next 10 years, until she was 19 years old. At that point, she met Don Nelson, who brought her to Esmeraldas. She said: "*Allí me jaló él*" (there he pulled me).

Don Nelson used to travel to Pedernales to visit his father, who is now deceased. It was on one of these trips that he met Doña Linda. Apparently, he moved Doña Linda to Esmeraldas because his own mother lived there. The two now have 8 children together, 5 boys and 3 girls. The children are each about a year apart from one another in age; the oldest is approximately eleven years old. The youngest child, Jair, who was our research subject, would have been two years old in 2001. According to his mother, Jair was "terrible," running all around making "*travesuras*" (mischief).

The Separation

Doña Linda met Don Anastasio when she got a job cooking for him. She says: "I started as a cook and he paid me well: 200,000 sucres (~$8)[56] per day or two. He also fed my children and Nelson as well." She called him *"el señor."* She continued, saying that she contributes to the household in any way, with "*el bono*" (the payment to poor families) and she also claimed: *"yo no necesito nada; todo para mis hijos"* (I don't need anything for myself; everything is for my children). The working relationship with Don Anastasio has developed into a more serious relationship.

While working/living with Don Anastasio, she missed her children, especially the older ones. While the youngest were allowed to come to see her, the older ones were not. The children were alone at home, except when their father took the smallest ones to work. Sometimes the father would send the youngest (our subject) to "her new house," but the baby did not like it there, preferring instead to be with his brothers and sisters at Don Nelson's. She added: *"El señor* likes the child (Jair)."

The new house itself was small and clean, really just one room, with a TV on a

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56 Exchange rate during the year 2001 was about $1=25,000 sucres.

chair, a bed, and a kitchen in the corner. “The house of love,” she called it. Don Anastasio had bought the house a year earlier for 2 million Sucres (~$80). *El señor* has money. Johanna asked her about a story we had heard, that she had been a victim of witchcraft, or sorcery. She said that she was having somebody cure her from that. She cried when she told us these stories.

About her ex-husband, Don Nelson, Doña Linda said: “What has he given to me? I love *el señor* Anastasio.” Among the other reasons she didn’t want to go back to her former home was that the neighbors had expanded their property and there were problems with them because of it. Don Nelson said that he would wait for her to come back. While we were conducting the interview, a neighbor’s music was so loud that we had to scream in order to be heard.

The Breastfeeding Story

Doña Linda breastfed Jair for a total of 10 months. She told us that she stopped because the infant did not get full enough on her milk and also because he did not want to breastfeed anymore. As with most of the mothers in this study, she complained of having Milk Insufficiency. The following is Doña Linda’s breastfeeding information (test-weighing data is not included at this point) before her separation from Don Nelson, as recorded during our initial research:

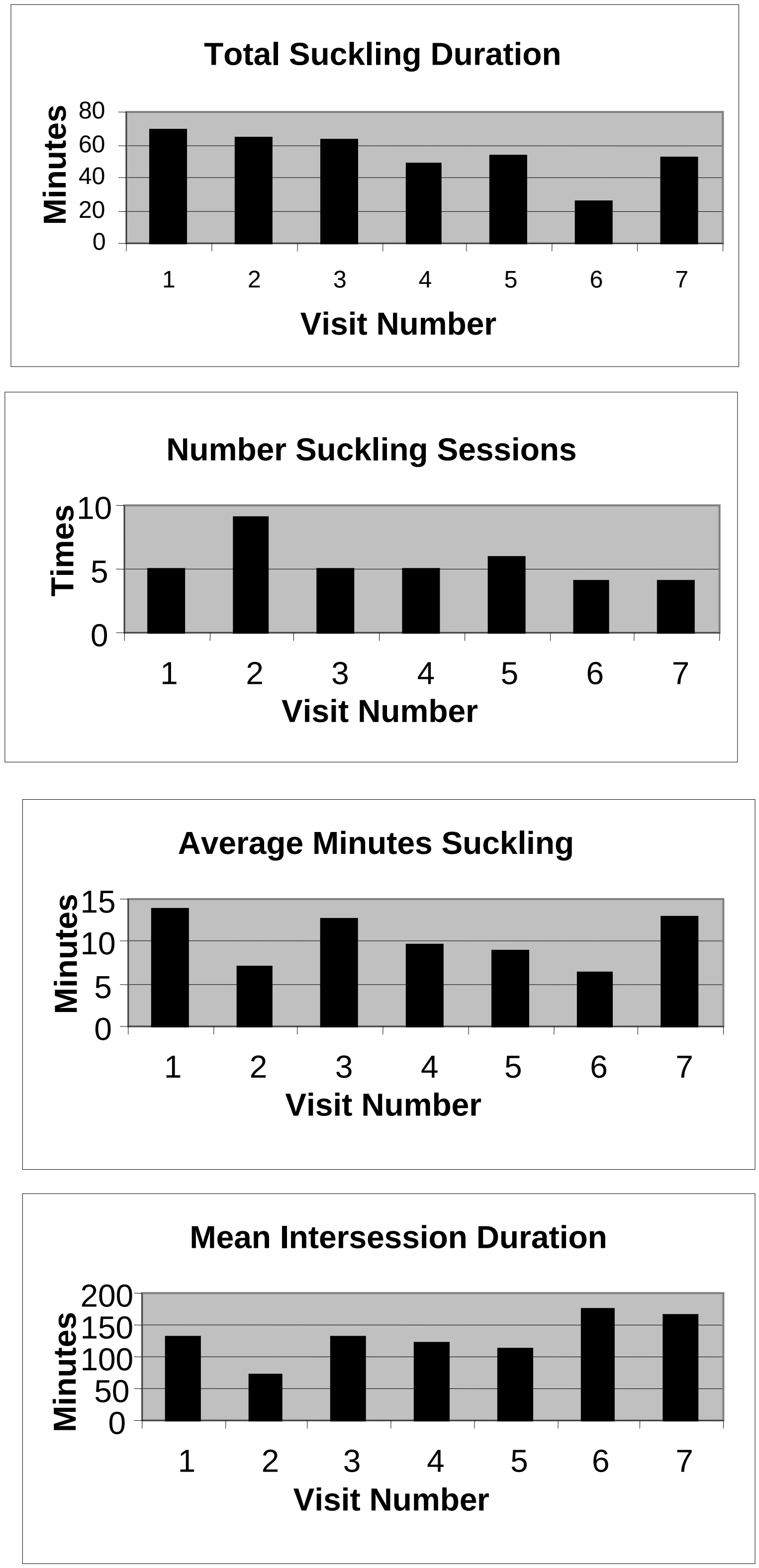
Doña Linda gave birth to Jair in the Delfina Torres Hospital with no complications. The baby’s birth weight was 3000g (recall information). Her milk came down in the first 24 hours. While still in the hospital, they insisted that Doña Linda feed the colostrum to her baby, although she was not inclined to do so because, according to her, that milk was "too yellow." She was allowed to sleep with baby in the hospital. Later, at home, she breastfed the baby and also gave him some tea. During the first few months, the mother complained of pain in the "*vientre*" (womb), yet she kept working, doing all of the household tasks, including the cleaning of the house floor.

We conducted a total of seven visits[57] with her during our 1998-1999 season of fieldwork (see Figures 5.10-5.13). On our first visit, she breastfed Jair for a total suckling duration of 69 minutes in 12 hours (Fig.5.10): 5 sessions (Fig.5.11), with the average lasting 13.8 minutes (Fig.5.12) and an intersession duration of about 2 hours (Fig. 5.13). She said that when Jair felt that there was no more milk in the breast, he stayed quiet and dropped the nipple so that the mother would change to the other breast. At the time of our first postpartum visit, her weight was 50.5 kg. Although she looked skinny, her BMI (22.14) was within the normal range according to the CDC (2006).

On our second visit, she breastfed more frequently, a total of 9 sessions, with an average time of 7 minutes for each session and a mean intersession duration of one hour. On the third visit, she breastfed for 5 sessions, with an average time of 12.6 minutes, much like during the first visit. The total suckling duration for each of these three visits was about one hour (69, 64 and 63 minutes) during the 720 minute observation period. While total suckling duration was similar, her breastfeeding behavior was different. Doña Linda told us that according to the doctors at SOLCA, Sociedad de Lucha Contra el Cáncer (Society Fighting Against Cancer), she is suffering from an ulcer in her uterus. Because of this, she drank milk infused with drops of "*sangre de drago*" (a local medicinal remedy from the bark of a tree – *Otobo* family), in order to clean her stomach. In addition, she was drinking an herbal tea of *llanten* (*Plantago major*).

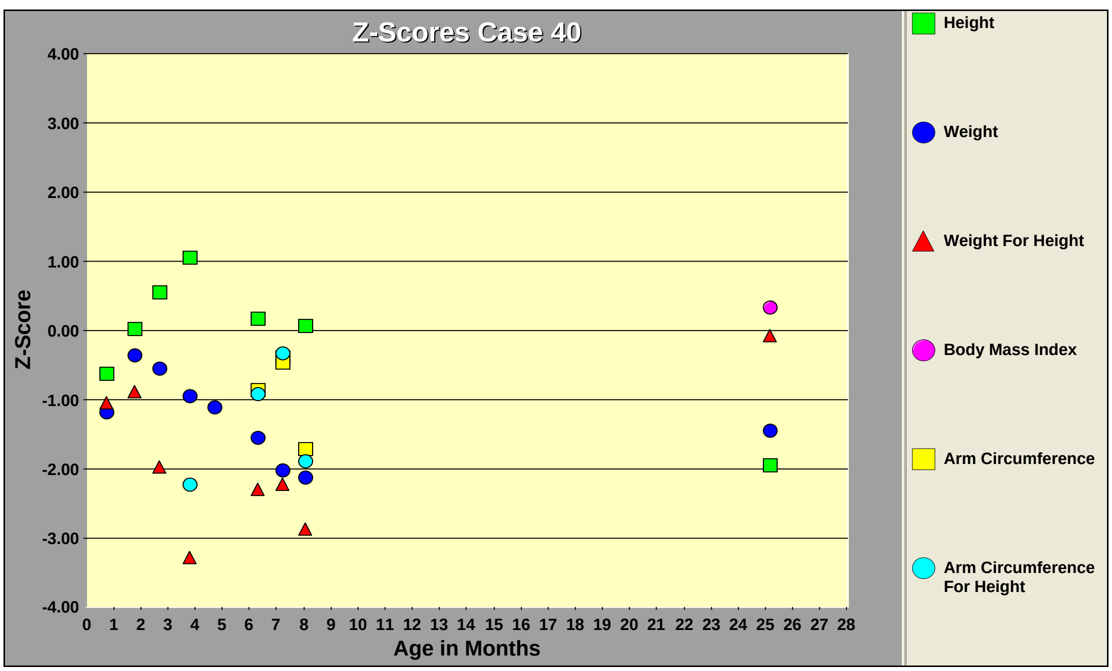
[57] I present here only data related to breastfeeding structure + anthropometry.

Figure 5. 10-14 Doña Linda's Breastfeeding Structure -- Case-40



As with the majority of the mothers in Esmeraldas she also took some *nacedera*, which is supposed to increase milk production. Her regular lunch (*almuerzo*) was comprised of a noodle soup with cheese and potatoes followed by a bowl of rice. During the fourth visit, total suckling duration dropped to below 60 minutes for the first time, perhaps because the mother had been sick. Jair always had a low ratio of weight to length (which is often a sign of malnourishment). Starting with this fourth visit, Jair was far below the 5th percentile and he reached more than 3SD away from the mean (see z-scores, Fig.5.14). Notice that during the first research period, Weight for Height standard deviation was below the mean. Two years later his height was below 2SD from the mean, short for his age.

Figure 5.14 Case-40 Z Scores



On the fifth visit we recorded a total of 6 breastfeeding sessions, with the average session lasting 8.8 minutes. The assistant wrote: "3:50 pm, Mother starts to breastfeed, baby is fussy, mother said because there is no milk; you can see that the breasts are dry." This was an 18 minute session, exceptionally long as compared with the others.

We should also consider that by this time the family had introduced the use of supplements given in a "*colada de maicena con leche*" (corn starch porridge with milk). They had been feeding this to Jair since the previous month. Later, they would introduce additional supplements, such as "*colada de verde licuado crudo con leche*" (green plantain porridge and milk) and "*puré de papas*" (mashed potatoes), along with some medicines like "*Mucosolvan*" when they felt Jair needed it to combat a cold. On the sixth visit, Jair did not breastfeed as much. He was receiving almost half as much volume from supplements as from breast milk (114g of supplements + 262g of BM). Doña Linda was still producing milk.

Later in the research period, Doña Linda went to the hospital to have a "*ligadura,*" a tying off of the fallopian tubes. She informed us that when she was in the hospital her breasts were full of milk and that her milk was collected to give to children who couldn't suckle or to the children of mothers who did not yet have milk. After the operation, the family seemed to be more "stressed out." Doña Linda was working all the time, unable to take a nap, even interrupting her *almuerzo* to wash clothing.

Interestingly, during the seventh visit there was an increase in breastfeeding time, with a total suckling duration of 52 minutes in four sessions. The average time for each of the fours sessions also increased to 13 minutes, almost the same total time as during the first and third visits, but with a longer mean intersession duration of almost three hours.

This might be explained by an increase in the production of milk per minute during the later months, in this case at the seven month of lactation, due in part to the increase of the baby needs and demands.

Once again, the assistant reported “mother’s breast doesn’t look full” and Doña Linda said she didn’t have much milk. This case exemplifies the kinds of breastfeeding variations that can occur longitudinally and how complex the issues are surrounding a mother’s complaint of milk insufficiency.

SUMMARY

Following Kleinman’s (1980-1988) classification of health care systems within a complex society, we can describe three sectors: popular, folk and professional. In Esmeraldas the popular sector is represented by family members, midwifes and pharmacies with pharmacists. The folk sector, within a particular set of beliefs and procedures, are represented by witchcraft and enchantments with shamans and *curanderas/os*. Representing the professional sector we have hospitals, clinics, heath sub-centers and doctor’s offices. Pharmacies are also very important places for health advice and medication, serving as a complement of the professional sector as well as part of the popular sector. Auto-medication is very widespread in Esmeraldas City.

There are not, by any means, clear boundaries between these sectors. In Esmeraldas City popular, folk and professional sectors were not different milieus, but rather represented a continuum. Moreover a number of non-physiological factors, both social and economic, influence whether ill people seek one or more of the health care systems offered them within the Esmeraldan setting.

In Esmeraldas, the work of midwives or *parteras* has been changing rapidly. The popular system of midwifery, still robust only a few years ago, has declined with the aging of these practitioners and a concerted effort by the public health authorities to control their activities. As part of the folk sector of health care, we found all kinds of healers using incantations and those who claimed to be sorcerers or sorceresses using hexing, magic charms, curses, or enchantments.

Among the illnesses reported during this research we found that mothers suffered most from malaria, headaches, stomachaches, back pain, and exhaustion (stress). Exhaustion was by far the most common complaint of all. The infants suffered from many different illnesses, including: respiratory infections, with complications such as bronchitis; cold-flu (*gripe*); cough (*tos*); chickenpox (*varicella*); malaria; conjunctivitis; skin rash (*granos*); diarrhea and constipation. Constipation was a chronic problem among the infants in our study.

As in every region, in Esmeraldas there were locally peculiar classifications, interpretations, or perceptions of health and illness, with their own explanatory models, cures, treatments, and remedies. I call these health issues “Esmeraldan Illnesses” although many of them are not exclusive to Esmeraldas. Their remedies can be called Ethnomedicines.

Treatments for almost any health problem that we encountered usually involved combinations of herbal remedies or other cures, along with pharmaceutical products and prescribed medications. Nearly all of the mothers used herbal remedies after delivering, in particular *nacedera,* which in English may be translated as “the birthing” (scientific name: *Tricanthera gigantean*; family name *Acanthaceae*). Most important from the standpoint of this research, they used it to increase the early production of milk.

The fear of evil eye (*ojo*, *mal de ojo*, *ojeado*, *ojo y espanto*), is very common in Esmeraldas. Even a mother's contemplation of her own child "with love" may cause *mal de ojo*. To prevent the evil eye, believers perform a variety of acts, such as taking one's own saliva on the index finger and placing it on the baby's belly button, as well as behind its ears in order to protect the baby from the mother's power of *ojear*. Symptoms of the evil eye can include fussiness, weight loss, constipation, fever, diarrhea, and feces with a very bad odor.

Drying-dust-powder (*polvo secante*) consists of a combination of plants and antibiotics which are burned and put through a sieve, then applied to the belly button. The idea of "drying" powder with curative properties for something "wet" combines conventional therapies with cultural concepts of "reality," thus constructing "reality." Breast milk is used by mothers in Esmeraldas as a remedy for problems in many different areas, including the belly button and the eyes (pink eye, conjunctivitis), as well as against the evil eye. The etiologies and cures of these syndromes vary among people of different ethnicities and class, as well as between regions.

In Esmeraldas being sick or having some illness is not just a biological state, but rather a cultural and biological combination of realities, biological by the professional health care providers and their explanatory models and cultural by the local, popular or folk explanatory models of illnesses. In the end, illness and disease are cultural events with explanations that could be biological or cultural.

I close this chapter with one mother's life history, as an introduction to the structure of breastfeeding Esmeraldas.   It is the story of the life of a breastfeeding mother with many other children to take care of. With this life history I attempt to accomplish three things: first, to portray the harsh life of an Esmeraldan mother, second to show how breastfeeding becomes an everyday part of that life and third, to introduce breastfeeding structure in Esmeraldas city. This case exemplifies the kinds of breastfeeding variations that can occur longitudinally and how complex the issues are surrounding a mother’s complaint of milk insufficiency.

CHAPTER 6

BREASTFEEDING PATTERNS IN ESMERALDAS: DESCRIPTIVE STATISTICS

The following descriptive statistics provide an overview of the mother-infant pairs observed during the course of the study. In this chapter I include analysis of Breastfeeding Structure (BS), Test Weighing (TW), Breastmilk Consumption Structure (BCS) and Creamatocrit of 47 mothers from group two (G2). Anthropometric data analysis for 72 mothers and infants from group one and two (G1&G2) are also presented here.

In order to compare the infants' chronological development and to be consistent with other studies, the variable Age in Months was created (see Chapter 4 for details). Infants who were aged between day 1 to day 30 were assigned as one month of age. Those who were aged between day 31 to day 60 were assigned as two months of age, and so on and so forth. All of the variables presented here were factored by the variable Age in Months.

BREASTFEEDING STRUCTURE

According to Vitzthum "breastfeeding structure refers to the temporal patterning of suckling duration and frequency and hence, interval duration." (1994:309) Thus results for breastfeeding structure are presented here as: Number of Suckling Sessions (NSS), Total Suckling Duration (TSD), Mean Intercession Duration (MID) and Average Minutes Suckling (AMS). Researchers (Brown et al. 1982; Dettwyler 1992; Ghosh et al. 2006; Gray 1994; Holman and Grimes 2003; Martens and Young 1997; Marriot 1998; Piperata and Dufour 2007; Stallings et al. 1998; Vitzthum 1994a, 1994b, 1998; Wilson et al. 2006) have shown that breastfeeding patterns varies in different cultures. Moreover, as an infant's age increases, breastfeeding structure pattern changes.

Data is presented here in tables showing the summary statistics, figures showing the means and the medians, and line plot[58] graphs showing the individual pattern of each mother. The sample size for the analysis varies according to the cases available for each month. I present the sample size summary in each table, indicating the number of mothers included in each month for the summary analysis (results presented here are from the first through the seventh months – for an explanation, see Chapter 4). The sample size summary is the same for all the variables presented except for anthropometry.

Number of Suckling Sessions (NSS)

NSS is the total number of sessions recorded during the twelve-hour observation period. Table 6.1 displays the mean, median, standard deviation, minimum and maximum of the variable NSS. The mean NSS of 7.5 was highest in the first month and the lowest mean NSS of 4.13 occurred in the seventh month. From the line graph (Fig. 6.1.a), mean and median NSS had a general downward trend, with a small peak in mean at month five months. The mean average NSS in Esmeraldas in the first seven months was 5.6 and the median average was 5.7 sessions per 12/hour. The mean and median are approximately the same.

NSS line graphs for individual women (Figures 6.1.b) show that most mothers stay in the same range, even though there are drop outs after the 9th month. By the 6th month, everybody is converging around the same range, except for one or two women.

[58] I divided each plot graph into three sections so that the patterns can be more easily seen.

Basically there are two kinds of variations; one is within the data for individual mothers and the other is among the mothers.

Total Suckling Duration (TSD)

TSD is the total amount of time in minutes that the infant spent attached to the mother's breast recorded during the twelve hour observation period. Table 6.2 displays the mean, median, standard deviations, minimum and maximum of the variable TSD. The highest mean (65.93 mins) and highest median (64.50 mins) occurred in the first month while the lowest mean (37.54 mins) and lowest median (35 mins) occurred in the seventh month. Figure 6.2.a shows the mean and median TSD had a general downward trend, with small peaks at months three (mean) and five months (mean and median). The mean average TSD in Esmereldas in the first seven months was 50 minutes. Figure 6.2.b represents TSD by month as line graphs for individual women. It shows that, as with NSS, that each mother stays within the same range. Therefore most of the variation comes from between the mothers.

Mean Intersession Duration (MID)

MID is the average time between breastfeeding sessions during the twelve-hour observation period. Table 6.3 displays the mean, median, standard deviation, minimum and maximum of the variable MID. The mean MID of 227 minutes was highest in the seventh month and the lowest mean MID of 102 minutes occurred in the first month. From the line graphs (Fig.6.3.a), mean and median had a general upward trend. The mean average MID in the first seven months was 170 minutes or 2 hours and 50 minutes and the median average MID was 115 minutes or almost two hours. The given difference in mean and median is due to the presence of outliers.

With the MID line graphs for individual women (Fig. 6.3.b), we can see that all mothers start off with low mean intercession duration. (The higher the number, the less breastfeeding of the mother to her child, or it represents the pattern that mothers did not breastfeed their infants during that that 12-h observation or breastfed very little.) Then at various points over the total months of the study some few of the mothers' MID goes up and then comes back down again in a random pattern; and if you look at just the 6th month, when several mothers weaned and hence "dropped out" of the study, still most of the mothers stayed within the same range between 100 and 200 minutes which reflects the normal breastfeeding pattern of Esmeraldas.

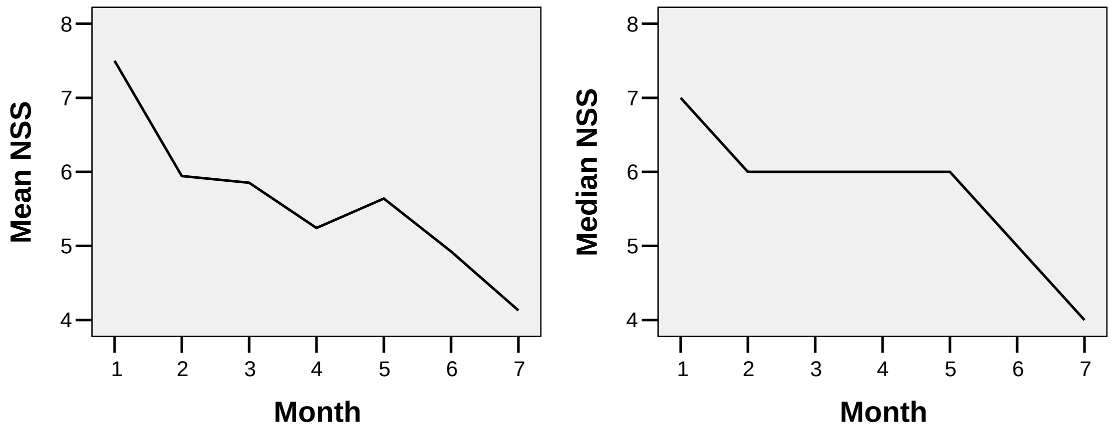
Average Minutes Suckling (AMS)

AMS is the average length of a suckling session recorded during the twelve hour observation period. Table 6.4 displays the mean, median, standard deviation, minimum and maximum of the variable AMS. The mean AMS of 10 minutes was highest in the fifth month and the lowest mean AMS of 8 minutes occurred in the sixth month. Figure 6.4.a shows that only the mean AMS had a general upward trend, up to the 5th month. The mean average length of time a baby was attached to the breast was 9 minutes and the median average was 8.5 minutes. Although the given difference in mean and median is due to the presence of outliers it is not as marked as it is with the MID variable. In Esmeraldas, AMS shown as line graphs for individual women (Fig. 6.4.b) also illustrates that most of the mothers stay in the same range. After the 6th month, all mothers are grouped within a narrow range, showing little change in the AMS pattern.

Table 6.1 Summary Statistics: Number of Suckling Sessions (NSS) by Month

	Month		Statistic	Std. Error
NSS	1	Mean	7.50	.424
		Median	7.00	
		Std. Deviation	2.68	
		Minimum	2	
		Maximum	13	
		N	40	
	2	Mean	5.94	.461
		Median	6.00	
		Std. Deviation	2.77	
		Minimum	1	
		Maximum	14	
		N	36	
	3	Mean	5.85	.416
		Median	6.00	
		Std. Deviation	2.43	
		Minimum	1	
		Maximum	12	
		N	34	
	4	Mean	5.24	.394
		Median	6.00	
		Std. Deviation	2.40	
		Minimum	1	
		Maximum	10	
		N	37	
	5	Mean	5.64	.380
		Median	6.00	
		Std. Deviation	2.28	
		Minimum	1	
		Maximum	9	
		N	36	
	6	Mean	4.93	.468
		Median	5.00	
		Std. Deviation	2.43	
		Minimum	1	
		Maximum	9	
		N	27	
	7	Mean	4.13	.463
		Median	4.00	
		Std. Deviation	2.22	
		Minimum	1	
		Maximum	10	
		N	23	

Figures 6.1.a Mean and Median: Number of Suckling Sessions (NSS) by Month



Figures 6.1.b NSS Line Graphs: Number of Suckling Sessions (Times) by Month

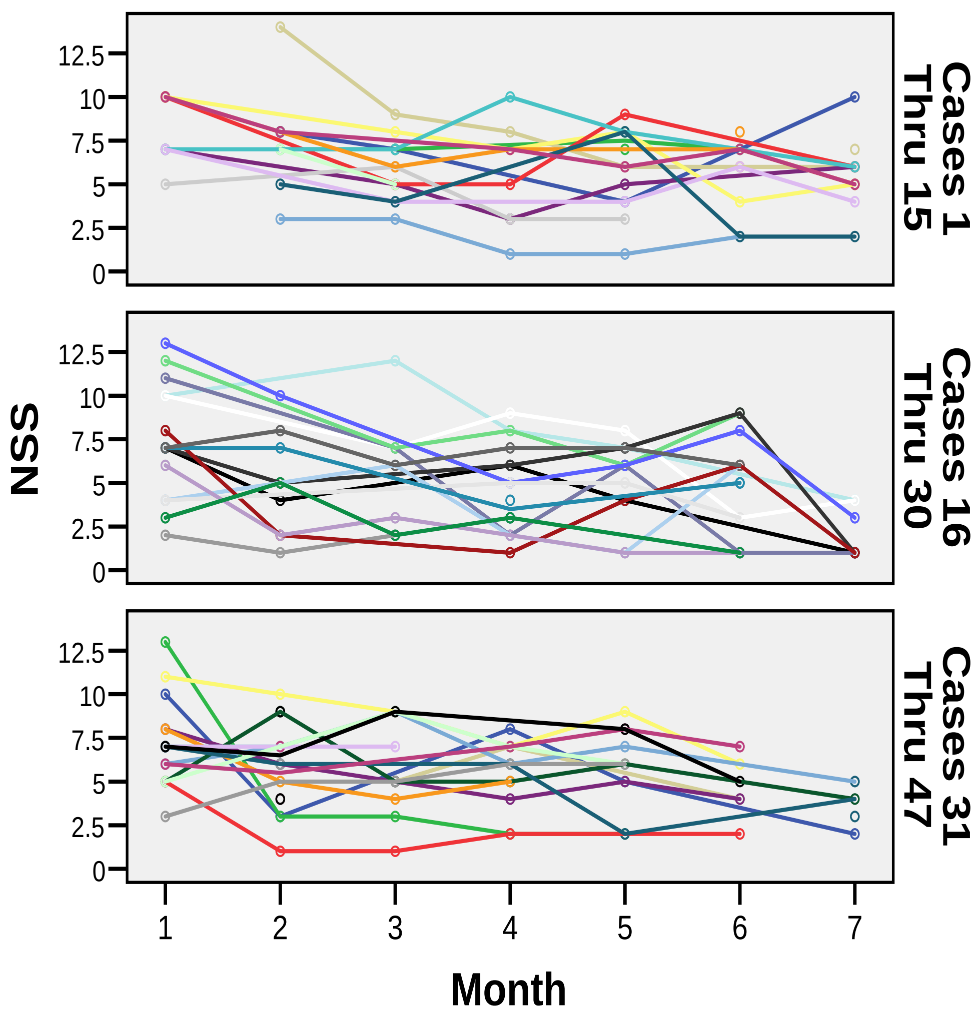
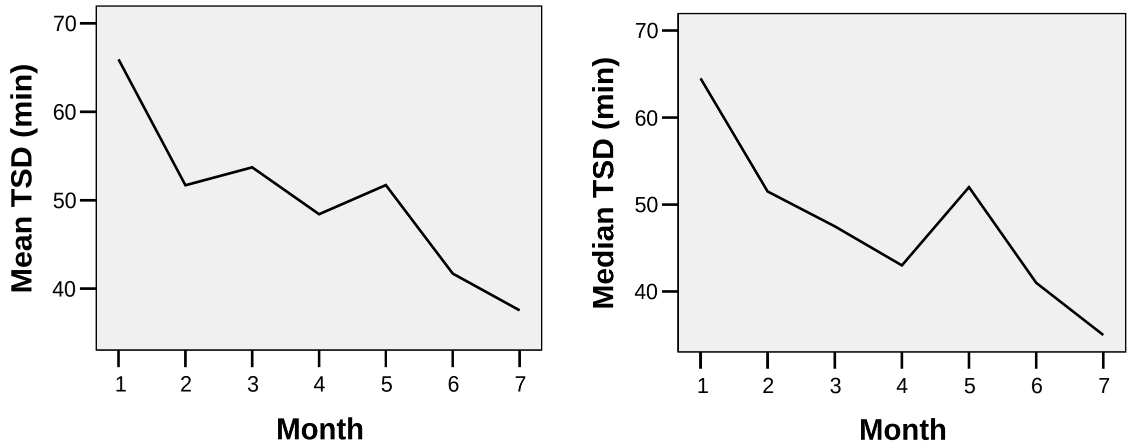


Table and Figures 6.2 Summary Statistics: Total Suckling Duration (TSD) by Month

	Month		Statistic	Std. Error
TSD (min)	1	Mean	65.93	4.39
		Median	64.50	
		Std. Deviation	27.77	
		Minimum	17	
		Maximum	139	
		N	40	
	2	Mean	51.69	4.49
		Median	51.50	
		Std. Deviation	26.93	
		Minimum	5	
		Maximum	117	
		N	36	
	3	Mean	53.72	5.46
		Median	47.50	
		Std. Deviation	31.83	
		Minimum	7	
		Maximum	124	
		N	34	
	4	Mean	48.43	4.61
		Median	43.00	
		Std. Deviation	28.05	
		Minimum	1	
		Maximum	126	
		N	37	
	5	Mean	51.72	3.66
		Median	52.00	
		Std. Deviation	21.94	
		Minimum	9	
		Maximum	112	
		N	36	
	6	Mean	41.70	5.38
		Median	41.00	
		Std. Deviation	27.95	
		Minimum	5	
		Maximum	102	
		N	27	
	7	Mean	37.54	4.65
		Median	35.00	
		Std. Deviation	22.29	
		Minimum	5	
		Maximum	81	
		N	23	

Figures 6.2.a Mean and Median: Total Suckling Duration (TSD) by Month



Figures 6.2.b TSD Line Graphs: Total Suckling Duration (Minutes) by Month

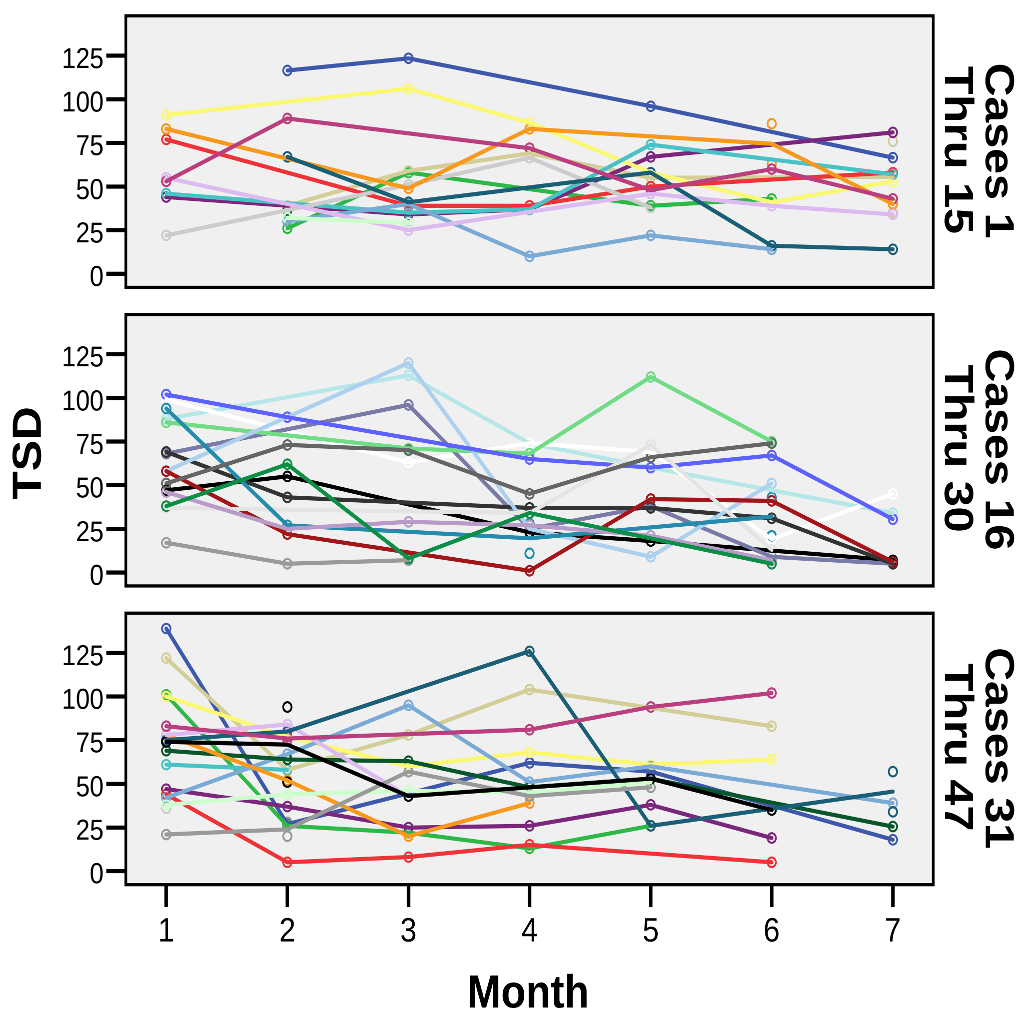
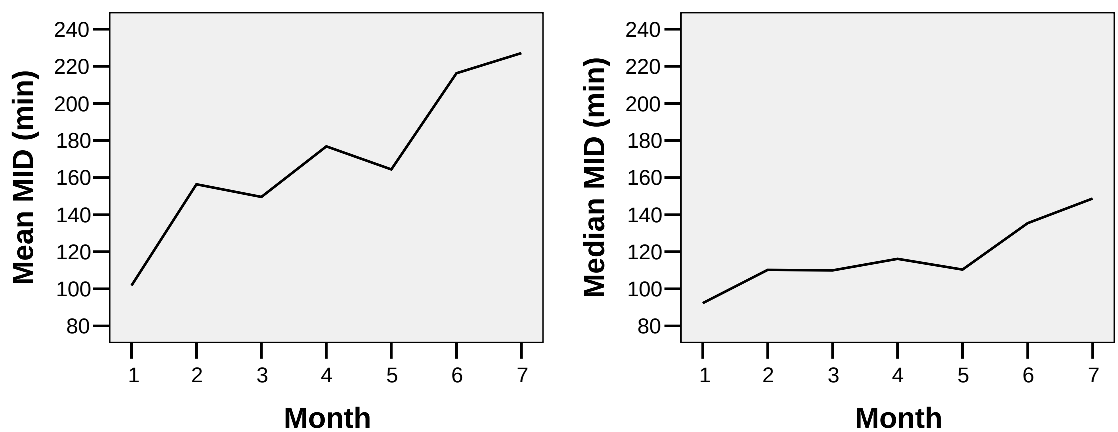


Table 6.3 Summary Statistics: Mean Intersession Duration (MID- min) by Month

	Month		Statistic	Std. Error
MID	1	Mean	101.72	8.87
		Median	92.21	
		Std. Deviation	56.10	
		Minimum	47.54	
		Maximum	351.50	
		N	40	
	2	Mean	156.43	24.88
		Median	110.25	
		Std. Deviation	149.27	
		Minimum	48.64	
		Maximum	715.00	
		N	36	
	3	Mean	149.56	21.20
		Median	109.92	
		Std. Deviation	123.60	
		Minimum	50.58	
		Maximum	712.00	
		N	34	
	4	Mean	176.88	22.14
		Median	116.17	
		Std. Deviation	134.68	
		Minimum	68.30	
		Maximum	710.00	
		N	37	
	5	Mean	164.42	28.72
		Median	110.42	
		Std. Deviation	172.33	
		Minimum	66.00	
		Maximum	711.00	
		N	36	
	6	Mean	216.31	38.00
		Median	135.40	
		Std. Deviation	197.43	
		Minimum	71.67	
		Maximum	715.00	
		N	27	
	7	Mean	227.22	41.11
		Median	148.67	
		Std. Deviation	197.16	
		Minimum	65.35	
		Maximum	715.00	
		N	23	

Figures 6.3.a Mean and Median: Mean Intersession Duration (MID) by Month



Figures 6.3.b MID Line Graphs: Mean Intersession Duration (Minutes) by Month

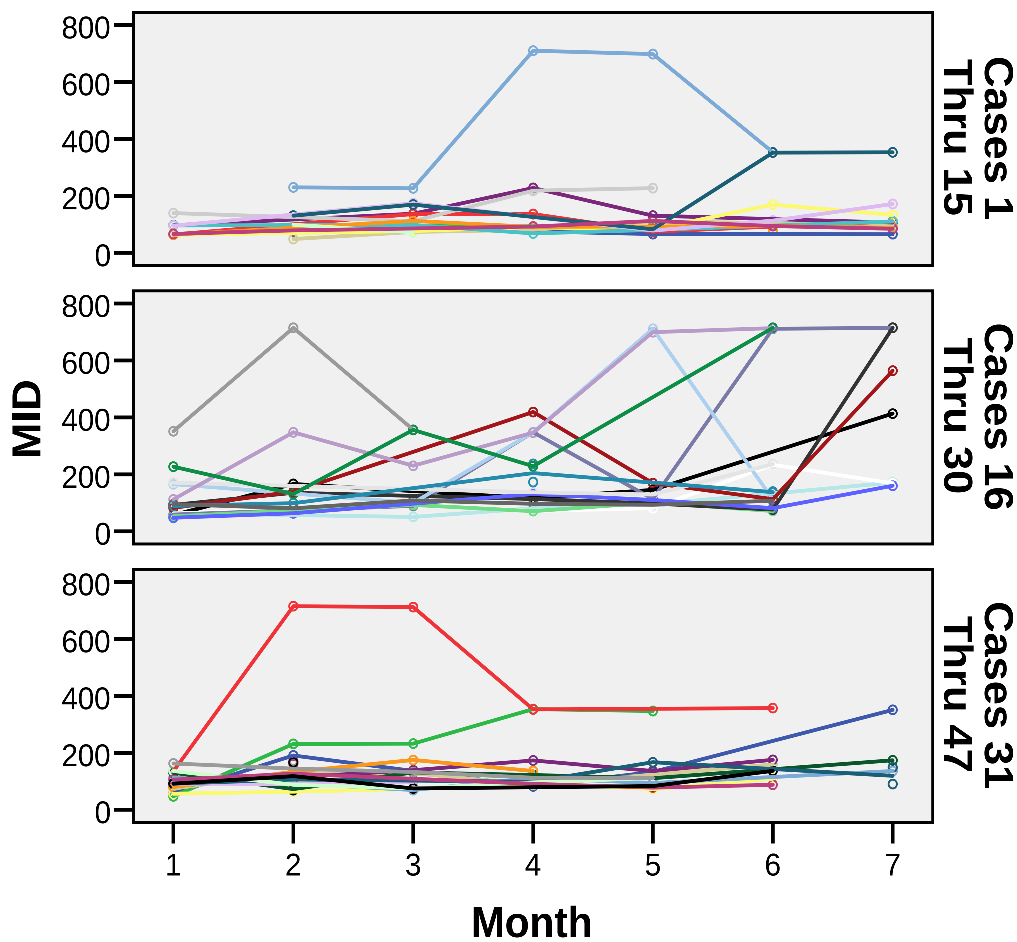
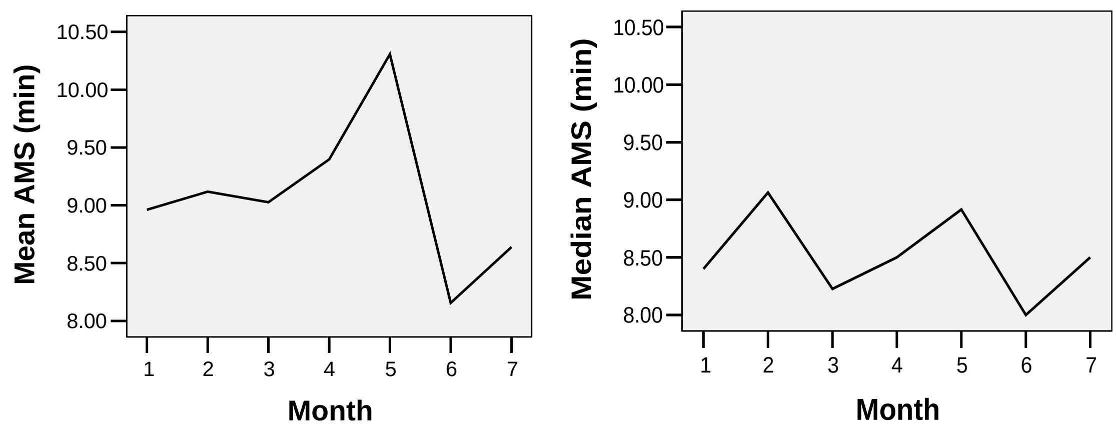


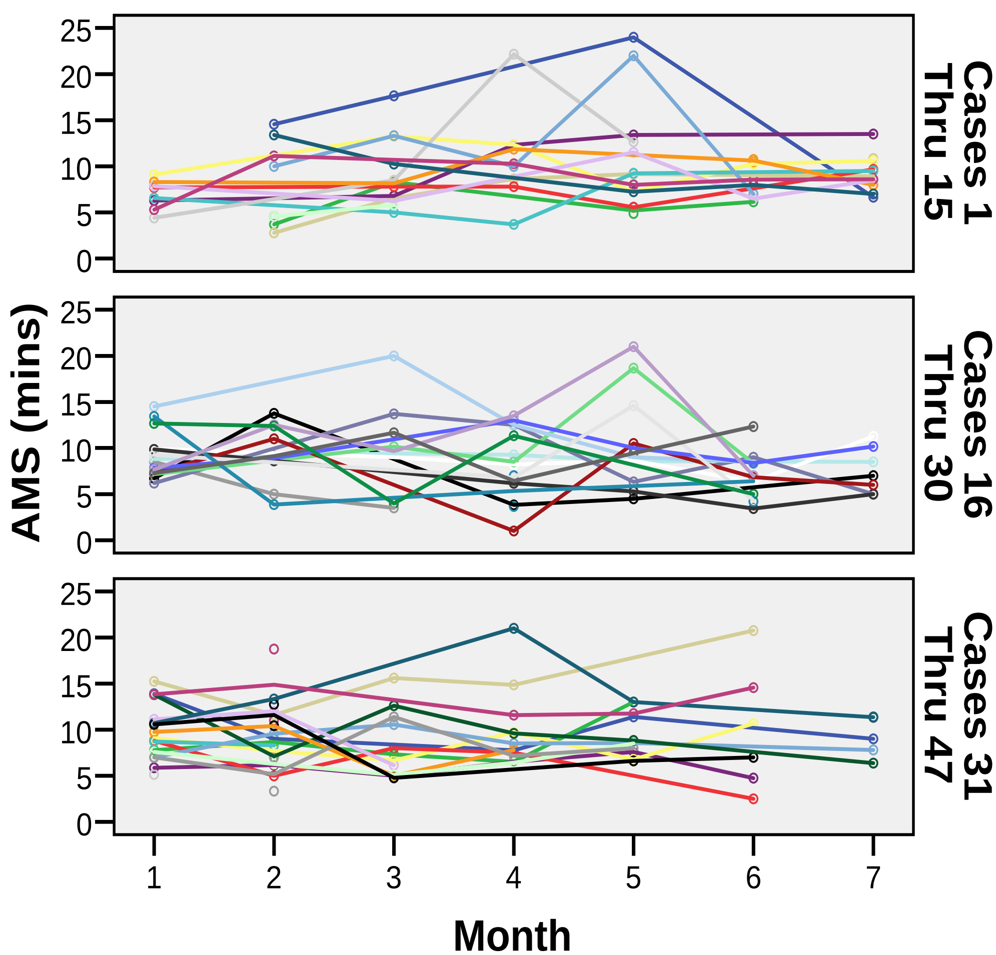
Table 6.4 Summary Statistics: Average Minutes Suckling (AMS) by Month

	Month		Statistic	Std. Error
AMS (min)	1	Mean	8.96	.438
		Median	8.40	
		Std. Deviation	2.77	
		Minimum	4.40	
		Maximum	15.25	
		N	40	
	2	Mean	9.12	.617
		Median	9.06	
		Std. Deviation	3.70	
		Minimum	2.79	
		Maximum	18.75	
		N	36	
	3	Mean	9.03	.678
		Median	8.23	
		Std. Deviation	3.95	
		Minimum	3.50	
		Maximum	20.00	
		N	34	
	4	Mean	9.40	.701
		Median	8.50	
		Std. Deviation	4.26	
		Minimum	1.00	
		Maximum	22.17	
		N	37	
	5	Mean	10.31	.793
		Median	8.92	
		Std. Deviation	4.76	
		Minimum	4.50	
		Maximum	24.00	
		N	36	
	6	Mean	8.16	.719
		Median	8.00	
		Std. Deviation	3.74	
		Minimum	2.50	
		Maximum	20.75	
		N	27	
	7	Mean	8.64	.466
		Median	8.50	
		Std. Deviation	2.24	
		Minimum	5.00	
		Maximum	13.50	
		N	23	

Figures 6.4.a Mean and Median: Average Minutes Suckling (AMS) by Month



Figures 6.4.b AMS Line Graphs: Average Minutes Suckling (Minutes) by Month



Cultural Variation

There is cultural variation (many different cultural patterns) as to the initiation of breastfeeding. For instance, Holman and Grimes (2003) report that Hindu dyads in India delayed the initiation of breastfeeding comparing to Islamic dyads in the Middle East. There is also cultural variation in breastfeeding structure over time. Marriot (1998) reports, in a study of breastfeeding structure in Mali that as infants got older, session frequency increases, but sessions last for shorter periods of time. Among Ribeirinha women, in the Brazilian Amazon, as lactation progressed, the women spent less time in infant care and breastfeeding and more time in agricultural work in manioc processing. By 6 months, postpartum infants were breastfeeding much less frequently and all were consuming other foods (Piperata and Dufour, 2007). But each culture does tend to have its own particular pattern. Stallings et al. (1998:192), showed how among the Tamang and Kami groups in Nepal had an averages of 6 to 7 minutes per session, 9 times per day, 60 minutes per day.

In my research, TSD and NSS went downwards as the age of the infant increased. TSD and NSS have an inverse relationship with MID. As the TSD and NSS went downwards, MID went upwards. However, AMS mean peaked at the 5th month[59] then dropped down in the 6th month, and then rose slightly in the 7th month.

These results showed that as infants got older, the breastfeeding frequency decreased and – at least throughout the first 5 months – the time infants spent per session increased (in mean not in median). This distinction between cultures suggests cultural difference may play a role in breastfeeding behavior. In summary, for the first 7 months, on average, the breastfeeding structure in Esmeraldas was as follows: an infant was

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[59] I call this statistical pattern "the 5th month factor" and analyze it later in this chapter.

breastfed about 5 times between the hours of 8 a.m. and 8 p.m. Infants were being fed about every 2 hours and 45 minutes, and each session lasted about 9 minutes.

TEST WEIGHING

Test-Weighing (T-W) outcomes, presented here, allowed us to measure how much milk was consumed by the infants and, as a result, how much milk was produced by the mothers through the course of the study. Almost all the studies referenced in this section are presented in ml/day or ml/24. Some studies (Brown et al. 1982; Kent et al. 2006; Scanlon et al. 2006) suggested that more milk is consumed during the day (6 am-6pm or 8am-8pm or even 10am-10pm) than during the night. Therefore doubling 12h intake measurements could result in inaccuracies in estimation of 24h milk consumption. Other studies though, have shown that co-sleeping is positively correlated with breastfeeding sessions throughout the night, suggesting that some extrapolations may be allowed (Ball 2007; McKenna and Volpe 2007).

Nevertheless, for the purpose of comparison and analysis of milk volume I converted measurements from 24h to 12h and vice versa. I want to be clear that this is not an extrapolation in the full sense; rather it is an approximated conversion. Such a conversion is in part due to three factors: first, mothers in Esmeraldas do breastfeeding during the night (see co-sleeping in chapter 5). Second, mothers do not normally sleep for 12 hours. Mothers may or may not have breastfed before we arrived in the morning and after we left at night, but would not report those feeding times as a “night breastfeed” session. Third, this study was a longitudinal study conducted in the home environment, which kept mothers’ breastfeeding patterns intact as much as possible (in much of the cross-sectional research, studies are conducted within different settings including laboratories). Any conversion will be clearly identifiable among the results presented here and reported in terms of grams.[60]

Breast Milk Production Cross-culturally

I present here a review of published studies of milk volume from different countries in order to have a reference with which to compare test weighing results. I also present my findings on milk volume among Esmeraldan women. Table 6.5 shows the mean production of breast milk per day (24h) in Swedish women, using test-weighing (by Lönnerdal et al. 1975 in Jelliffe & Jelliffe 1978:63).

Table 6.5 Mean Breastmilk production in Swedish Women

Months Postpartum	Milk ml/24h	Milk ml/12h[*]
0-½	558 ml/24h	279 ml/12h
½-1½	724 ml/24h	362 ml/12h
1 ½-3 ½	752 ml/24h	376 ml/12h
3 ½-6½	756 ml/24h	378 ml/12h

Modified from Jelliffe & Jelliffe 1978.

Next Table 6.6 shows the mean intake of breast milk per 24h in U.S. infants. The methods are not described, and data are not broken down by ethnic group. I have assumed the U.S. data was gathered via test-weighing among "white" women (by Ferris and Jensen 1984, in Lawrence 1994:96).

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60 In this study measurements are expressed in grams, because 1 gram can be considered as 1 ml of breast milk (Riordan & Auerbach 1999) and in part because breast milk density is of 1.03g ml, nearly equivalent to ml (Kent et al. 2006).

* I converted them from ml/24 to ml/12 and vice versa. This conversion-estimation may not necessarily represent an accurate milk production within this converted new framework.

Table 6. 6 Mean Breastmilk production in U.S. Women

Months Postpartum	Milk ml/24h	Milk ml/12h*
< 1	673 ml/24h	337 ml/12h
1-2	756 ml/24h	378 ml/12h
2-3	782 ml/24h	391 ml/12h
3-4	810 ml/24h	405 ml/12h
4-5	805 ml/24h	402 ml/12h
5-6	896 ml/24h	448 ml/12h

Modified from Lawrence, 1994.

Table 6.7 presents some results on breastmilk production in some poorly nourished communities, at different periods of lactation, compiled by Jelliffe & Jelliffe 1978 (p.66). Again, methods used to measure milk production are not described. The results are presented as 1-6 months postpartum in ml/day (24h).

Table 6.7 Breastmilk Produced[61] 1-6 Months Postpartum in Poorly Nourished Women

Country	Milk ml/24h	Milk ml/12h*
Egypt	733 ml/day	367 ml/12h
Mexico	650 ml/day	325 ml/12h
India	600 ml/day	300 ml/12h
New Guinea, Baiyer River	600 ml/day	300 ml/12h
Nigeria, Benin	555 ml/day	278 ml/12h
New Guinea, Chimbu	525 ml/day	263 ml/12h
Sri Lanka	475 ml/day	238 ml/12h
Biak Island	427 ml/day	214 ml/12h

Modified from Jelliffe & Jelliffe 1978.

Next, I present here the average milk production among women in Esmeraldas for the first seven months (Table 6.8). For the purpose of comparison between the studies presented here and my data, I assumed the total milk production was steady over the 24-hour period measured and divided data into 12 hour increments.

[61] Methods used to measure milk volume are not described in the cited studies.

Table 6.8 Average Milk Production in Esmeraldas Women

Month of Lactation	N	Milk g/24h*	Milk g/12h
First Month	40	556 g/24h	278 g/12h
Second Month	36	526 g/24h	263 g/12h
Third Month	34	618 g/24h	309 g/12h
Fourth Month	37	608 g/24h	304 g/12h
Fifth Month	36	634 g/24h	317 g/12h
Sixth Month	27	516 g/24h	258 g/12h
Seventh Month	23	498 g/24h	249 g/12h

Table 6.9 compares milk production of well nourished and poorly nourished women during the first six months according to Jelliffe and Jelliffe 1978 (p. 63-68). The table also shows the mean breast milk production of the Esmeraldas women in the first six months of lactation. The group of mothers I studied would be classified as poorly nourished women according to the Jelliffes' criteria.

Table 6.9 Mothers' Nutritional Status and Average Milk Production 1-6 Months

Nutritional Status	Milk ml/24h	Milk ml/12h
Well Nourished Women	600-700 ml/24h	300-350 ml/12h*
Poorly Nourished Women	500-700 ml/24h	250-350 ml/12h*
Esmeraldas Women	576 g/24h*	288 g/12h

For the reader, just to have an idea of comparable volume, a New York City cup of coffee is the equivalent of 224g (see appendix D with photographs of different volume/containers, to give the reader an idea of the volume of breastmilk consumed by the infants). One more note on volume: According to Hill and Aldag (2005) and Hill et al. (2005), an adequate milk supply, at 6 weeks postpartum, should be anything ≥ 500 ml/day. My results show that, on average, mothers in Esmeraldas have low milk production in comparison with other groups; this will be discussed in detail in the next chapter.

Test Weighing Summary Statistics

First, the variable TW grams/hour was created because the twelve hour framework was not always the same for all data collected (see chapter 4 for a more comprehensive explanation of methods). Thus TW (g/h) standardizes TW (g) and allows for comparisons between cases. Second, in order to have the average of milk production per 12 hours, I multiplied it by 12 and have as a result grams/12hours (see Table 6.8).

Table 6.10 Summary Statistics: Test Weighing (T-W) by Month

	Month		Statistic	Std. Error
Test Weighing (g/hr)	1	Mean	23.20	1.79
		Median	26.13	
		Std. Deviation	11.33	
		Minimum	2	
		Maximum	58	
		N	40	
	2	Mean	21.91	1.82
		Median	21.80	
		Std. Deviation	10.95	
		Minimum	1	
		Maximum	41	
		N	36	
	3	Mean	25.77	2.23
		Median	24.46	
		Std. Deviation	13.01	
		Minimum	5	
		Maximum	57	
		N	34	
	4	Mean	25.37	2.09
		Median	25.83	
		Std. Deviation	12.71	
		Minimum	2	
		Maximum	54	
		N	37	
	5	Mean	26.38	2.14
		Median	27.75	
		Std. Deviation	12.82	
		Minimum	2	
		Maximum	47	
		N	36	
	6	Mean	21.48	2.32
		Median	22.92	
		Std. Deviation	12.07	
		Minimum	2	
		Maximum	43	
		N	27	
	7	Mean	20.71	2.27
		Median	18.35	
		Std. Deviation	10.91	
		Minimum	2	
		Maximum	44	
		N	23	

Table 6.10 displays the mean, median, standard deviation, minimum and maximum of the variable TW in grams/hour. The mean and median TW were highest in the fifth month and the lowest mean and median TW occurred in the seventh month.

Figures 6.5.a Mean and Median: Test Weighing (T-W) by Month

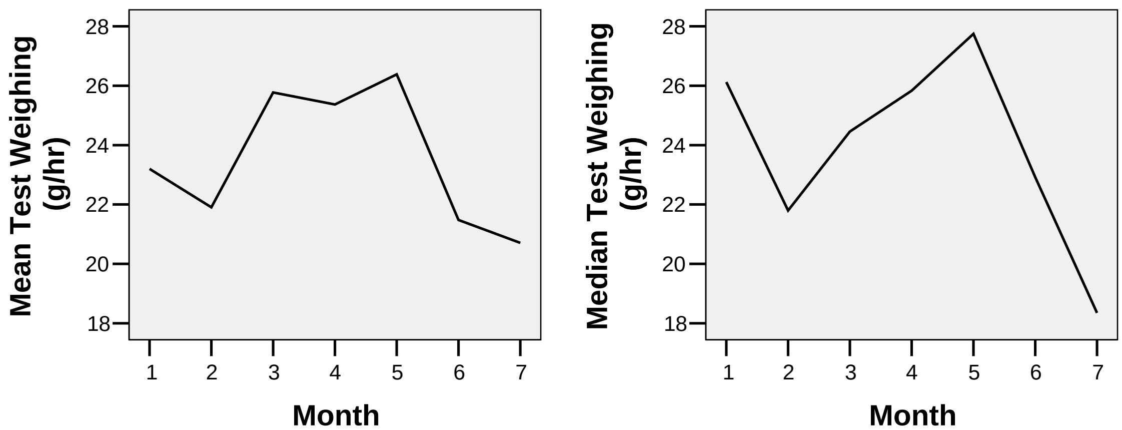
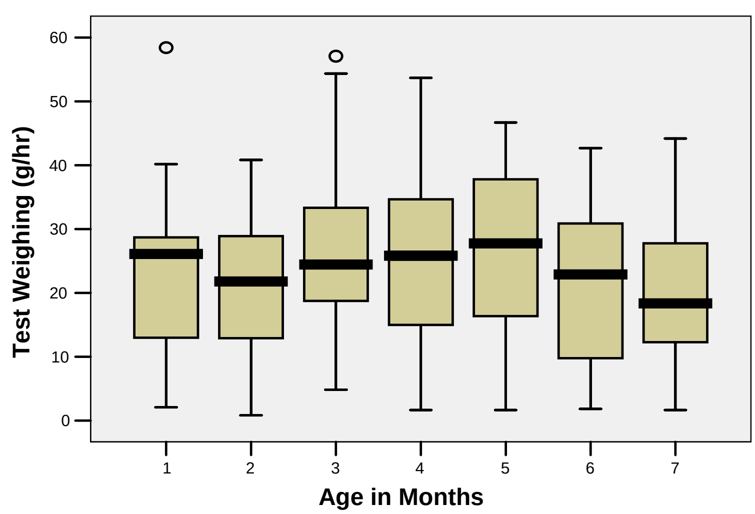


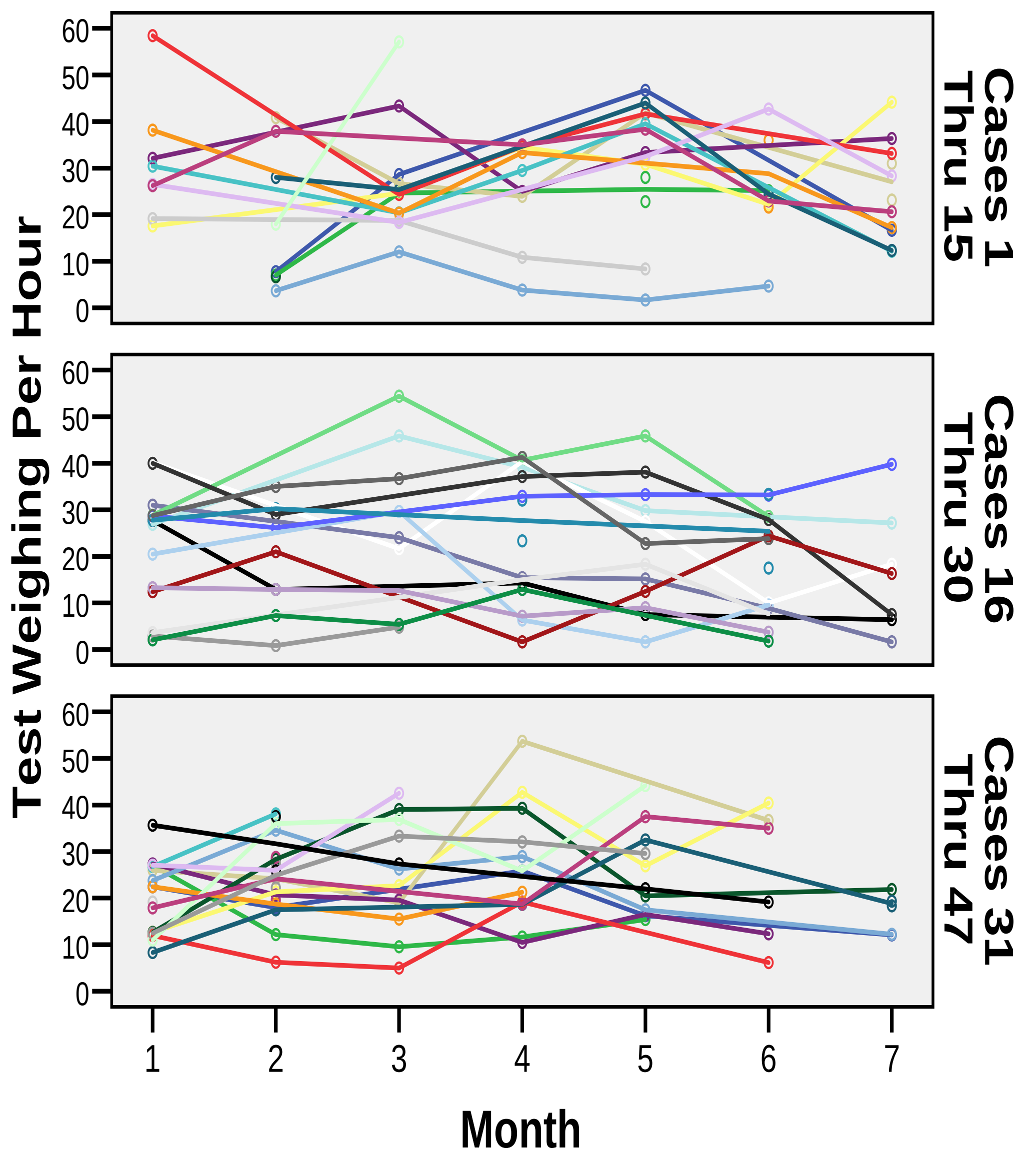
Figure 6.5.a shows the mean TW was lower in the first two months, higher during months three, four and five, and dropped back down during months six and seven. Figure 6.5.b displays the range of milk production by month, including minimum, maximum, median, and inter-quartile range boxes.

Figure 6.5.b Range of Milk Production by Month



The small circles represent outliers or cases that had a very high production in that particular month. Every month had a different median as well as being different in their inter-quartile range, except for the first and second month that were almost identical. Notice that the minimum and the maximum milk production could be quite far apart.

Figures 6.5.c T-W Line Graphs: Test Weighing (Grams) by Month



In the T-W line graphs for individual women (Fig. 6.5.c), we can see that test weighing is a little more scattered than the BS variables. There are a few mothers that increase, then come back down, but most of the mothers stay steady. Within the same range, most of the mothers are at the same range at the end as where they started. So we have two things illustrated here: the variation within each mother and the variation between mothers in terms on milk production.

High and Low Cutoff Cases

The summary statistics presented above do not reflect the individual variations in production per month within the samples studied. Some mothers produced very little and some produced significantly more. Tables 6.11 to 6.17 show the cases that had the highest and the lowest test weighing results per month. Hill and Aldag (2005) and Hill et al. (2005), defined adequate milk supply as maternal milk production of equal or more than 500ml/day (at 6 weeks postpartum). In this study, the mean value of maternal milk production was 263g/12h (at 8 weeks postpartum) or the equivalent to 526ml/day, similar to those of Hill and Aldag and Hill et al. I have chosen two cutoff points in order to define high and low maternal milk production. Mothers who produced 400g/12h could be considered as having high milk production. Those who produced less than 100g/12h certainly could be considered as having low milk production in this study (see chapter 8).

Table 6.11 Milk Production in the First Month (Average production 278g/12h)

More than 400 g/12h	**Less than 100g/12h**
Case 47 = 428g/12h	Case 16 = 35g/12h
	Case 30 = 24g/12h

Table 6.12 Milk Production in the Second Month (Average production 263g/12h)

More than 400g/12h	Less than 100g/12h
Case 3 = 490g/12h	Case 2 = 85g/12h
Case 37 = 457g/12h	Case 10 = 80g/12h
Case 15 = 455g/12h	Case 36 = 75g/12h
Case 47 = 450g/12h	Case 9 = 44g/12h
Case 29 = 420g/12h	Case 16 = 10g/12h
Case 39 = 415g/12h	

Table 6.13 Milk Production in the Third Month (Average production 309g/12h)

More than 400g/12h	Less than 100g/12h
Case 4 = 520g/12h	Case 30 = 65g/12h
Case 42 = 510g/12h	Case 36 = 60g/12h
Case 40 = 468g/12h	Case 16 = 58g/12h
Case 44 = 443g/12h	
Case 29 = 440g/12h	

Table 6.14 Milk Production in the Fourth Month (Average production 304g/12h)

More than 400g/12h	Less than 100g/12h
Case 33 = 644g/12h	Case 28 = 86g/12h
Case 29 = 495g/12h	Case 23 = 76g/12h
Case 19 = 484g/12h	Case 9 = 46g/12h
Case 18 = 470g/12h	
Case 15 = 420g/12h	
Case 6 = 416g/12h	

Table 6.15 Milk Production in the Fifth Month (Average production 317g/12h)

More than 400g/12h	Less than 100g/12h
Case 21 = 550g/12h	Case 8 = 100g/12h
Case 44 = 530g/12h	Case 23 = 20g/12h
Case 13 = 528g/12h	Case 9 = 20g/12h
Case 26 = 502g/12h	
Case 7 = 474g/12h	
Case 15 = 460g/12h	
Case 22 = 457g/12h	
Case 45 = 450g/12h	

Table 6.16 Milk Production in the Sixth Month (Average production 258g/12h)

More than 400g/12h	Less than 100g/12h
case 12 = 512g/12h	Case 26 = 92g/12h
case 33 = 440g/12h	Case 36 = 74g/12h
case 11 = 432g/12h	Case 9 = 56g/12h
case 45 = 420g/12h	Case 30 = 22g/12h

Table 6.17 Milk Production in the Seventh Month (Average production 249g/12h)

More than 400g/12h	Less than 100g/12h
Case 5 = 530g/12h	Case 22 = 90g/12h
Case 35 = 485g/12h	Case 47 = 70g/12h
Case 4 = 436g/12h	Case 28 = 45g/12h
	Case 20 = 20g/12h

The tables above allow me to illustrate potential MI or perceived milk insufficiency cases. Cases that have a constant low production for more than 2 months are potential cases with an "inadequate milk supply" or perhaps MI. Among the lowest production cases, case number 9 has a constant low production for 4 months, followed by cases 16, 23, 30 and 36 for 3 months, and case number 28 for 2 months. This will be discussed further in the next chapter.

BREASTMILK CONSUMPTION STRUCTURE

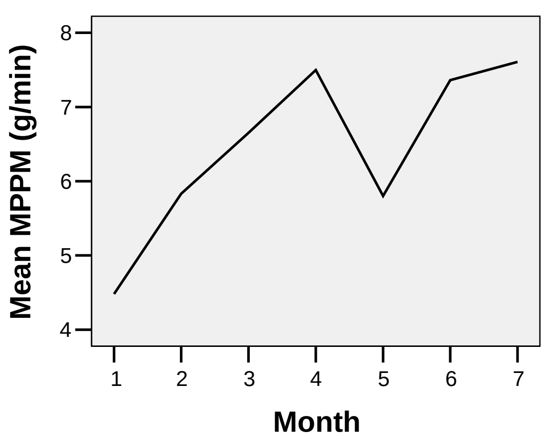
Breastmilk Consumption Structure (BCS) as variables were created by combining breastfeeding structure and Test Weighing (see chapter 4 for details). The first variable described here is Milk Production Per Minute (MPPM), calculated by dividing the total test weighing (T-TW) in grams by the total suckling duration (TSD) in minutes. The results tell us how much milk a mother produces in grams per minute, or its velocity.

The second variable, Average Milk Production Per Average Session (AMPPAS) is the average of milk produced (consumed) per average session, measured in grams. The AMPPAS multiplies the Average of Minutes Suckling (AMS) by the Milk Production Per Minute (MPPM). The results tell us how much breastmilk a mother produced per average session at a particular point in time. The importance of these variables is that they represent both behavior and biology.

Milk Production Per Minute (MPPM)

Table 6.18 displays the mean, median, standard deviation, minimum and maximum of the variable MPPM. The mean MPPM was highest in the seventh month and the lowest mean MPPM occurred in the first month. Figure 6.6.a shows an upward trend until month five, followed by a drop at fifth month, and the upward trend resumed at months six and seven. The median has a similar pattern but with truncated point at the third and fourth month and a downward trend at months six and seven. The overall mean was 6.4 g/minutes and the overall median 5.7 g/minutes, almost 1g/minutes lower than the mean.

Figures 6.6.a Mean and Median: Milk Production Per Minute (MPPM) by Month



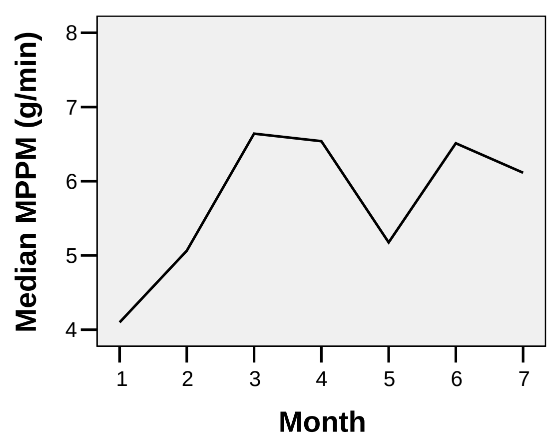
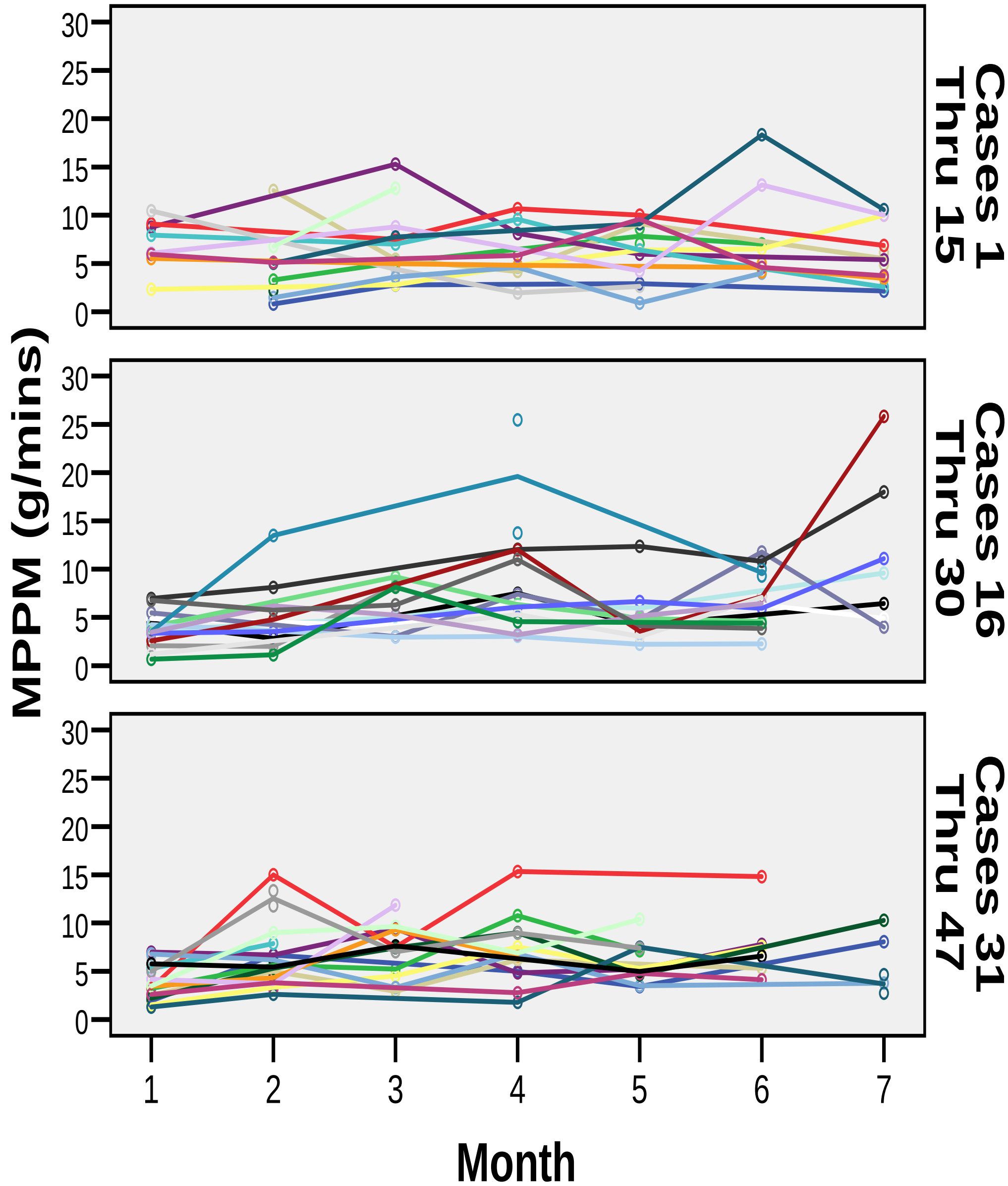


Table 6.18 Summary Statistics: Milk Production Per Minute (MPPM) by Month

	Month		Statistic	Std. Error
MPPM (g/min)	1	Mean	4.48	.367
		Median	4.10	
		Std. Deviation	2.32	
		Minimum	.66	
		Maximum	10.45	
		N	40	
	2	Mean	5.83	.600
		Median	5.06	
		Std. Deviation	3.60	
		Minimum	.80	
		Maximum	15.00	
		N	36	
	3	Mean	6.65	.521
		Median	6.64	
		Std. Deviation	3.04	
		Minimum	2.78	
		Maximum	15.29	
		N	34	
	4	Mean	7.50	.726
		Median	6.54	
		Std. Deviation	4.42	
		Minimum	1.78	
		Maximum	25.45	
		N	37	
	5	Mean	5.80	.427
		Median	5.18	
		Std. Deviation	2.56	
		Minimum	.91	
		Maximum	12.35	
		N	36	
	6	Mean	7.36	.718
		Median	6.51	
		Std. Deviation	3.73	
		Minimum	2.25	
		Maximum	18.33	
		N	27	
	7	Mean	7.61	1.14
		Median	6.11	
		Std. Deviation	5.46	
		Minimum	2.15	
		Maximum	25.83	
		N	23	

Figures 6.6.b MPPM Line Graphs: Milk Production Per Minute (g/minutes) by Month



MPPM (g/min) line graphs for individual women (Fig. 6.6.b) show a low individual mother variation and even a low variation between mothers. Mostly everybody stays within a certain range clustering around the same point, with few exceptions.

Average Milk Produced Per Average Session (AMPPAS)

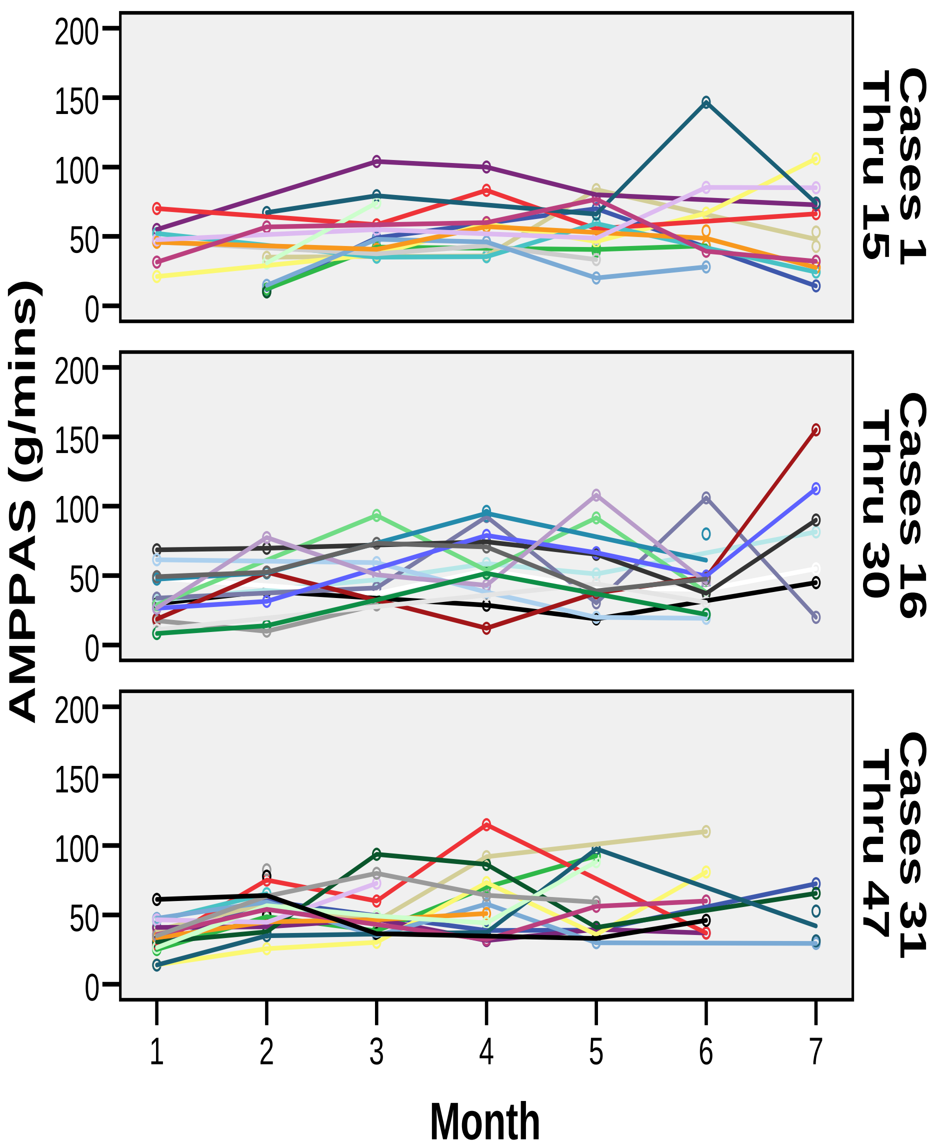
Table 6.19 displays the mean, median, standard deviation, minimum and maximum of the variable AMPPAS. The mean and median AMPPAS were highest in the seventh month and the lowest AMPPAS occurred in the first month.

Table 6.19 Summary Statistics: Average Milk Produced Per Average Session by Month

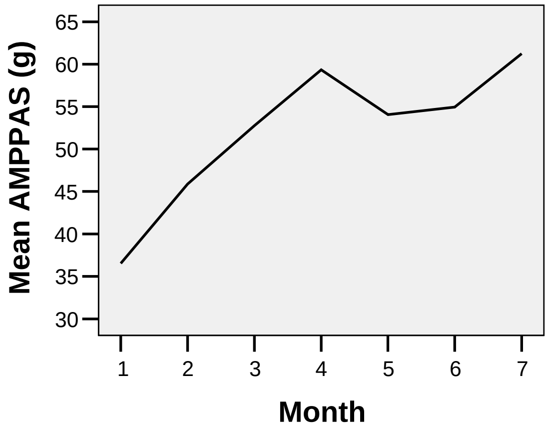
	Month		Statistic	Std. Error
AMPPAS (g)	1	Mean	36.53	2.43
		Median	33.72	
		Std. Deviation	15.37	
		Minimum	8.33	
		Maximum	70.06	
		N	40	
	2	Mean	45.88	3.43
		Median	48.98	
		Std. Deviation	20.56	
		Minimum	10.00	
		Maximum	82.50	
		N	36	
	3	Mean	52.77	3.41
		Median	47.04	
		Std. Deviation	19.87	
		Minimum	29.00	
		Maximum	104.00	
		N	34	
	4	Mean	59.34	3.94
		Median	57.14	
		Std. Deviation	23.95	
		Minimum	12.00	
		Maximum	115.00	
		N	37	
	5	Mean	54.06	3.92
		Median	47.50	
		Std. Deviation	23.55	
		Minimum	18.75	
		Maximum	108.00	
		N	36	
	6	Mean	54.95	5.67
		Median	45.00	
		Std. Deviation	29.46	
		Minimum	19.17	
		Maximum	146.67	
		N	27	
	7	Mean	61.25	7.12
		Median	55.00	
		Std. Deviation	34.15	
		Minimum	14.30	
		Maximum	155.00	
		N	23	

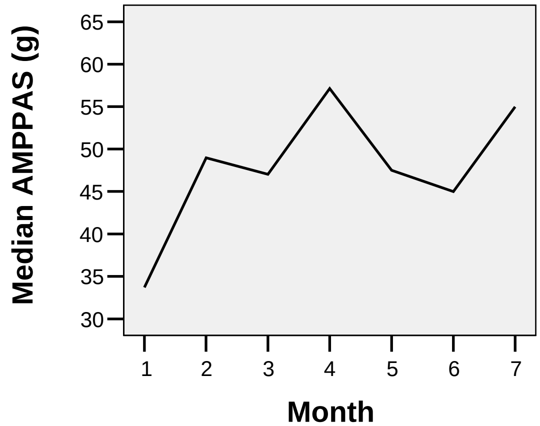
Table 6.19 could be used to see the average amount of milk consumed by the infant per average session for the first seven months. From the line graph (Figure 6.7.a), mean and median AMPPAS peaked at month four, followed by a concave shape between months four and seven, with the lowest point at month five for the mean and month six for the median.

Figures 6.7.b AMPPAS Line Graphs: Average Milk Produced Per Average Session (g) by Month



Figures 6.7.a Mean and Median: Average Milk Produced Per Average Session by Month





AMPPAS (g) line graphs for individual mothers (Fig. 6.7.b) show almost the same pattern as MPPM, which is low within mother variation and even low between mothers variation, everybody staying within the same range, except for in the last month, when there is more variation.

CREAMATOCRIT

What do the creamatocrit percentages mean, whether 1% or 17%? First of all, the higher the creamatocrit the higher the fat milk content and therefore the higher the kilocalorie intake of an infant. This is due to the linear relationship that exists between creamatocrit, fat and kilocalories (see methods for formulas). In part this could be explained by foremilk versus hindmilk. "Foremilk is the milk that is produced and stored between feeding and released at the beginning of the next feeding, which has an appearance similar to skimmed milk, with a characteristic blue tinge. Hindmilk is the milk that is produced during and released at the last part of a feeding" (Biancuzzo, 1999:43). There is also a relationship with the time that the milk is "stored" in the breast:

the longer the MID the more "diluted" the breast milk becomes, with higher lactose and lower fat content (West and Marasco in La Leche League, 2006). Interestingly, Kent et al. (2006) found that fat average is independent of breastfeeding frequency. Moreover, the best predictor of fat content is the degree of emptying. Table 6.20 (below) can be used to find the equivalents between creamatocrit and kilocalories per liter in human milk.

Table 6.20 Equivalents between Creamatocrit and Kilocalories per Liter in Human Milk

Creamatocrit % =	**Kcal/l**
1	357
2	424
3	490
4	557
5	624
6	691
7	758
8	824
9	891
10	958
11	1025
12	1092
13	1158
14	1225
15	1292
16	1359
17	1426
18	1492
19	1559
20	1626

An Ecuadorian study by Aguinaga et al. (1987) shows that creamatocrit went down exactly when mothers started weaning their babies in the 5th and 6th month. Creamatocrit was high among the mothers who continued breastfeeding beyond the 6th month. In the same study, it was found that there is a creamatocrit difference (~1%), between the left and right breast. Creamatocrit was higher in the right breast, according to the study, because most of the mothers are right handed and it is more comfortable for the mothers to use their right side and therefore they fed more from the right breast. Although Kent et al. (2006) discovered that the right breast always produces more milk than the left breast, which according with the authors may be due to the difference in intrinsic milk production between the breasts, rather than the infant's preference or whether the mother was right or left handed.

Next is the summary statistics of creamatocrit, milk fat content and kilocalories. Table 6.21 displays the mean, median, standard deviation, minimum and maximum of the variable creamatocrit. The mean creamatocrit of .082 (8.2%) was highest in the third month and the lowest mean of .062 (6.2%) occurred in the second month. and the median creamatocrit of .08 (8%) was highest in the third month and the lowest mean of .05 (5%) occurred in the seven month. Figures 6.8.a (creamatocrit) and 6.9.a (fat) show that the mean and median have an interweaving pattern.

Figures 6.8.a Mean and Median: Creamatocrit by Month

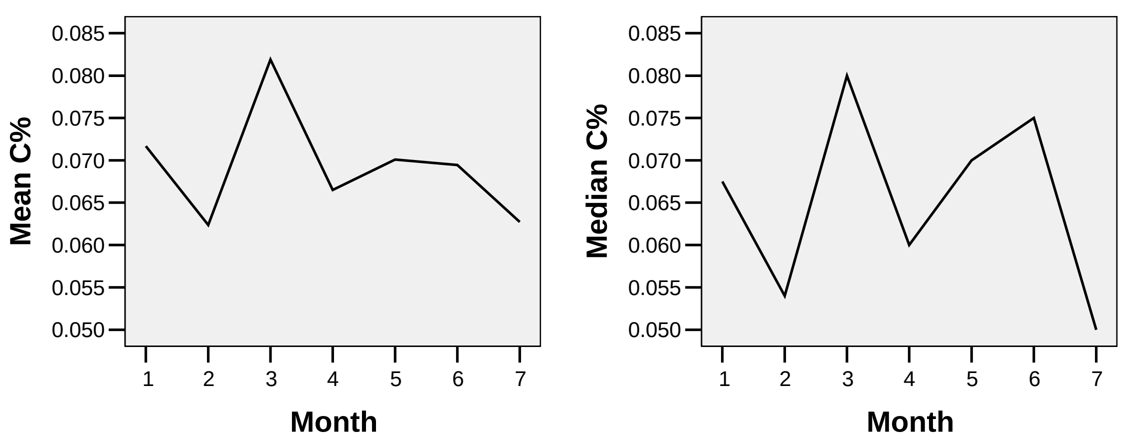
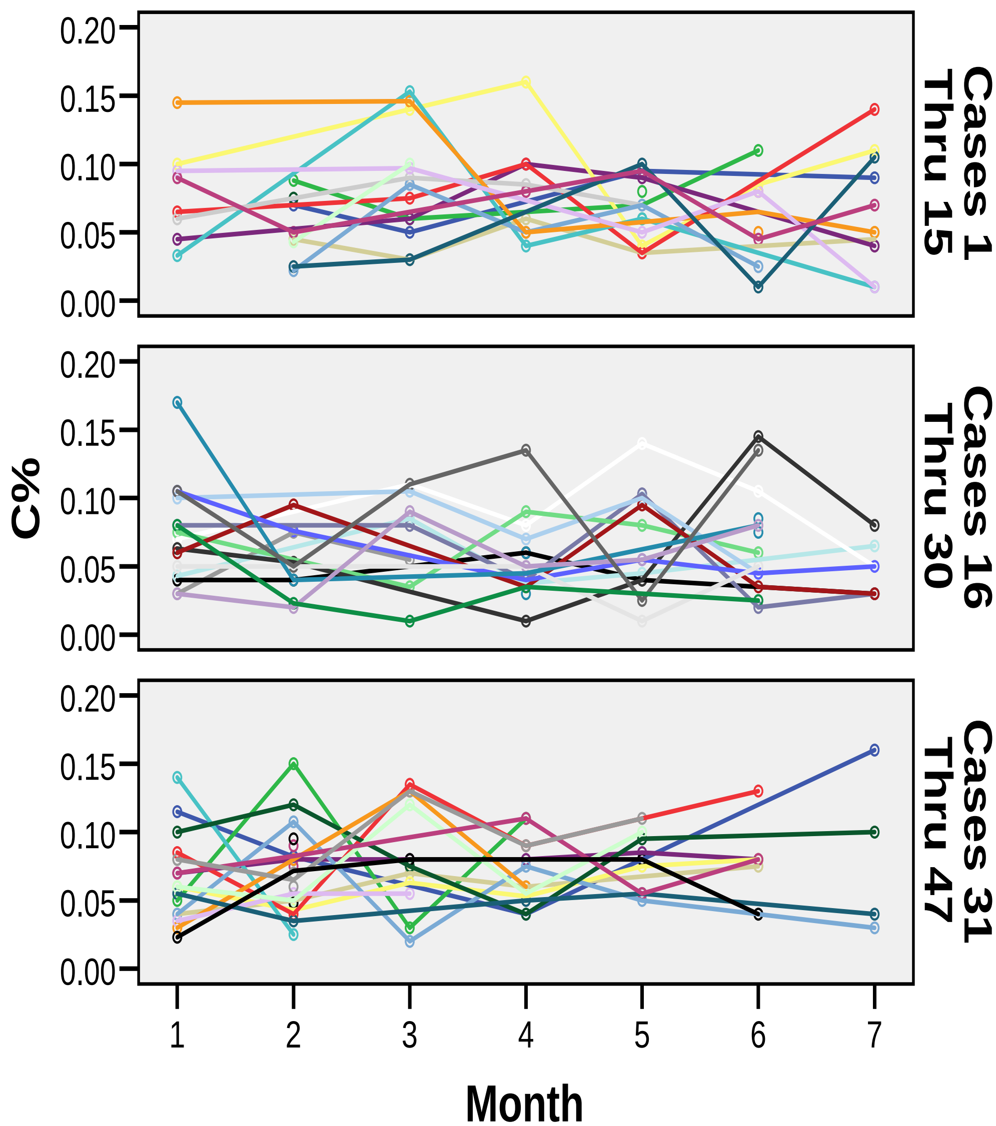


Table 6.21 Summary Statistics: Creamatocrit by Month

	Month		Statistic	Std. Error
C%	1	Mean	.072	.005
		Median	.068	
		Std. Deviation	.034	
		Minimum	.023	
		Maximum	.170	
		N	40	
	2	Mean	.062	.005
		Median	.054	
		Std. Deviation	.029	
		Minimum	.020	
		Maximum	.150	
		N	36	
	3	Mean	.082	.007
		Median	.080	
		Std. Deviation	.038	
		Minimum	.010	
		Maximum	.153	
		N	34	
	4	Mean	.067	.005
		Median	.060	
		Std. Deviation	.031	
		Minimum	.010	
		Maximum	.160	
		N	37	
	5	Mean	.070	.005
		Median	.070	
		Std. Deviation	.028	
		Minimum	.010	
		Maximum	.140	
		N	36	
	6	Mean	.069	.007
		Median	.075	
		Std. Deviation	.035	
		Minimum	.010	
		Maximum	.145	
		N	27	
	7	Mean	.063	.009
		Median	.050	
		Std. Deviation	.040	
		Minimum	.010	
		Maximum	.160	
		N	23	

In Esmeraldas, the highest creamatocrit value of 17% was found in the mother of a one month old infant (case 27). The second highest value of 16 % was found in the mother of a five month old (case 5) and a seven month old (case 31) respectively. The lowest value of 1 % were found in cases 7, 12, 13, and 26. In cases 7 and 12, the infants were seven months old. In cases 13 and 26, the infants were five months old.

Figures 6.8.b Line Graphs: Creamatocrit (%) by Month



Creamatocrit line graphs for individual women (Fig. 6.8.b) illustrate that the results are all scattered. Therefore there are clearly two kinds of variation there, within the individual mother as well as among the mothers, including after the six month. The average creamatocrit from all cases in the first 7 months was 6.9%. However, on a case by case basis, case 5 had the highest average percentage of 10.5%. The lowest average of creamatocrit was 3.2% (case 30), from a 40 year old mother. The second lowest creamatocrit of 4% was found in case 43. These cases will be discussed later as potential MI cases.

Milk Fat Content and Kilocalories

Creamatocrit, fat and kilocalories figures/graphs have exactly the same pattern because they are the result of an algebraic formula based on creamatocrit results. I present here tables and graphs of creamatocrit and fat only (for more see chapter 4).

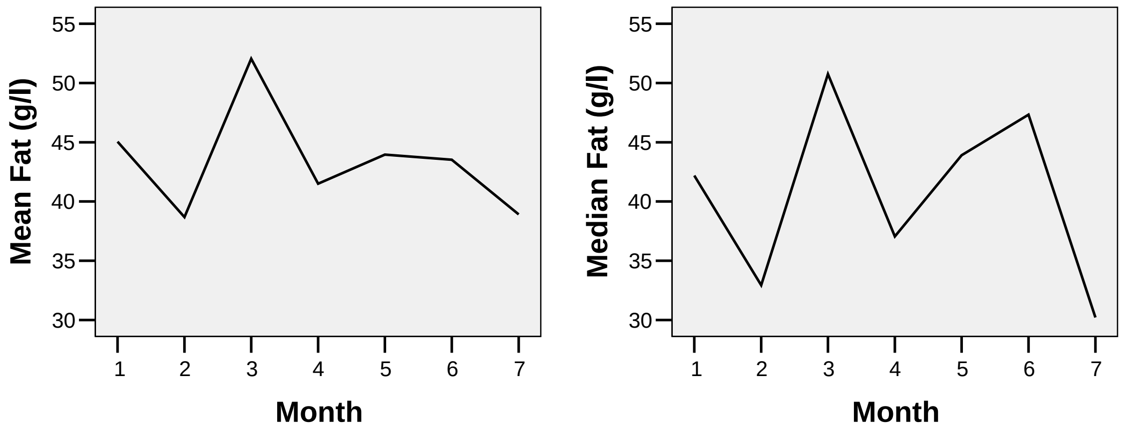
The mean Fat was highest in the third month and the lowest mean Fat occurred in the second month (Table 6.22). And the median Fat was highest in the third month as well and the lowest mean Fat occurred in the seven month (see Figure 6.9). In this study, the total fat average for the first seven months was 43.3 g/l (at six months it was 44.11 g/l). Kent et al. (2006) report in their study a fat average, for the first six months postpartum, of 41 $\pm$ 8 g/l, which according to the authors was higher during the day (10 am to 10 pm) and lower at night.

The mean average kilocalories/l was 752. The mean Kilocalories of 836.97 was highest in the third month and the lowest mean Kilocalories of 706.67 occurred in the second month. And the median Kilocalories of 824.4 was highest in the third month and the lowest mean Kilocalories of 624 occurred in the seven month.

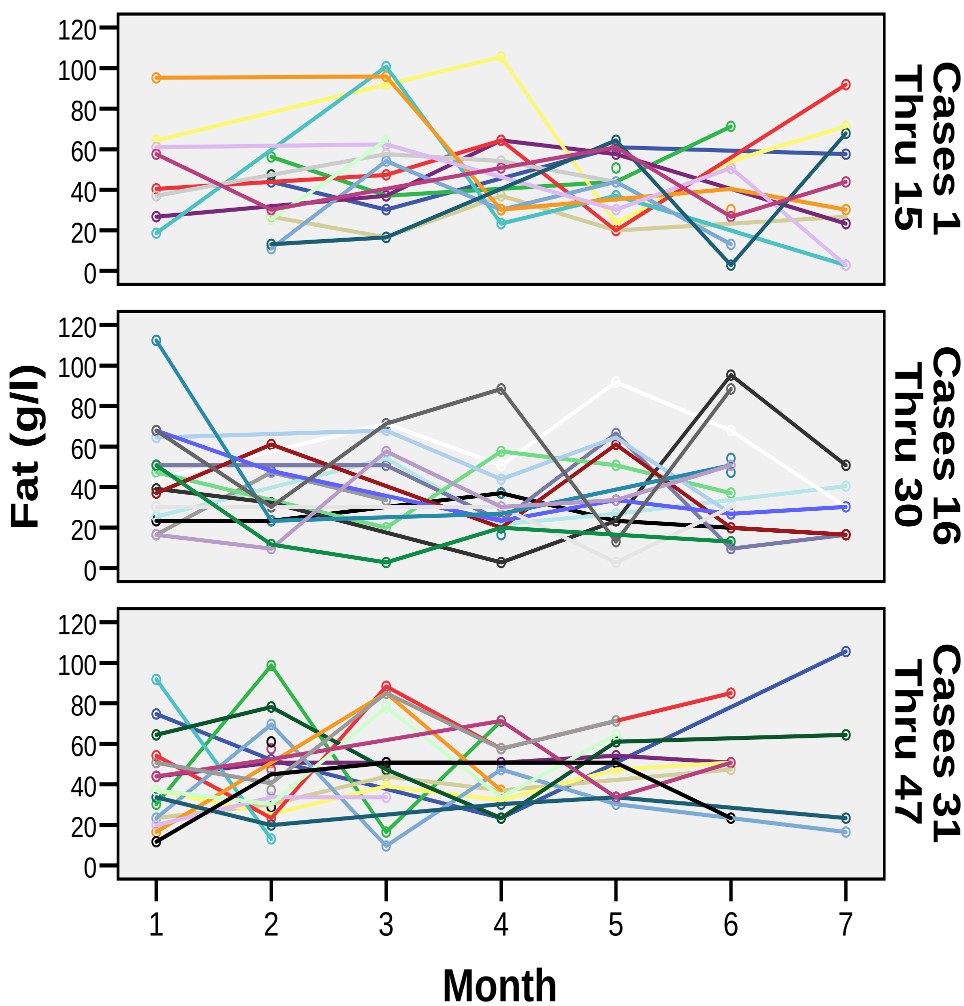
Table 6.22 Summary Statistics: Milk Fat Content by Month

	Month		Statistic	Std. Error
Fat (g/l)	1	Mean	45.05	3.65
		Median	42.19	
		Std. Deviation	23.12	
		Minimum	11.71	
		Maximum	112.40	
		N	40	
	2	Mean	38.68	3.36
		Median	32.95	
		Std. Deviation	20.19	
		Minimum	9.66	
		Maximum	98.70	
		N	36	
	3	Mean	52.04	4.46
		Median	50.75	
		Std. Deviation	26.00	
		Minimum	2.81	
		Maximum	100.75	
		N	34	
	4	Mean	41.51	3.50
		Median	37.05	
		Std. Deviation	21.31	
		Minimum	2.81	
		Maximum	105.55	
		N	37	
	5	Mean	43.96	3.27
		Median	43.90	
		Std. Deviation	19.35	
		Minimum	2.81	
		Maximum	91.85	
		N	36	
	6	Mean	43.52	4.65
		Median	47.33	
		Std. Deviation	24.18	
		Minimum	2.81	
		Maximum	95.27	
		N	27	
	7	Mean	38.92	5.87
		Median	30.21	
		Std. Deviation	27.55	
		Minimum	2.81	
		Maximum	105.55	
		N	23	

Figures 6.9.a Mean and Median: Milk Fat Content by Month



Figures 6.9.b Line Graphs: Milk Fat Content (g/l) by Month

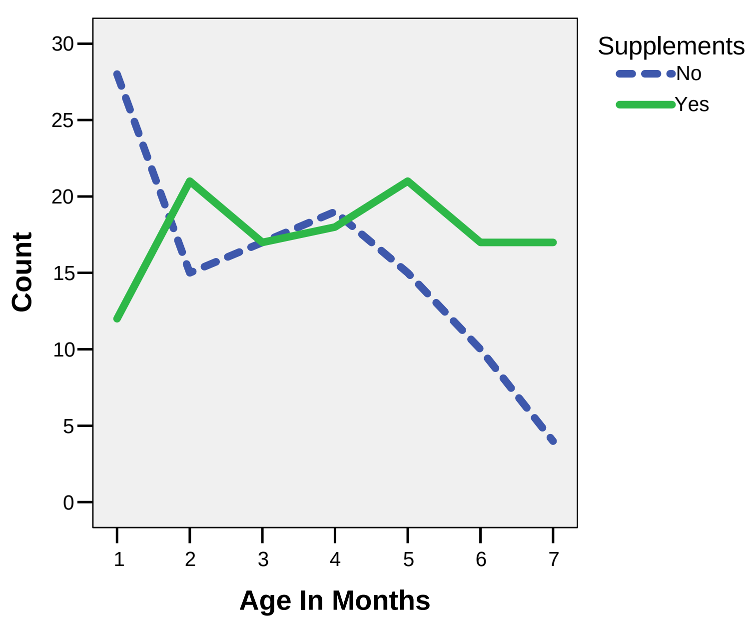


Line graphs for individual women in Figures 6.9.b showing milk fat content by month has the same shape as the creamatocrit which shows that the results are all scattered and showing variation within the individual mother as well among the mothers. There does not seem to be a clear pattern.

The 5th Month Factor

In the 5th month, there is an apparent shift in breastfeeding patterns where mean TSD, NSS and T-W increased sharply and MID, MPPM and AMPPAS all decreased. Even though the mothers did breastfeed more frequently and did produce slightly more milk, we found that MPPM decreased during month five. It may be due in part to an increase of supplement consumption in this month, although the second month also has a supplement increase (see figure 6.10). This can also be explained by the fact that the increase in infant nutritional needs prompted the infant to increase suckling (AMS).

Figure 6.10 Supplements Count by Age in Months for Group 2



The 5th month “factor” is certainly the month where the breastfeeding pattern changed. I speculated that this was due in part to an increase in supplementation in infants, an increase in the nutritional need of the infants and weight loss of the mothers.

ANTHROPOMETRY

Anthropometric data for the mothers and their infants is presented here. Data for mothers in both G1 and G2 consisted of tracking their BMI over a 7-month period. I also present infant data for G1 and G2 as z-scores reports[62] for both groups covering a wide range of characteristics, as well as percentile figures[63] presenting age, weight-for-length,[64] length-for-age, weight-for-age, and head circumference for age. The following data is presented in detail for the benefit of future research and analysis.

Mothers’ Anthropometry

For the mothers, anthropometric data included mother’s weight and height, used to calculate body mass index (BMI). Anthropometric results, for the mothers, are presented here as BMI. The chart below (Table 6.23) provides summary statistics for the variable Mother’s Height. The mean height of the mothers is 154.57 cm and the standard deviation is 5.703 cm. The minimum height is 143 cm and the maximum is 168 cm. The mean height in this study is identical to the one presented by ENDEMAIN 2004, 154.8 cm among mothers in Esmeraldas Province. The histogram (Fig.6.11) also shows that the

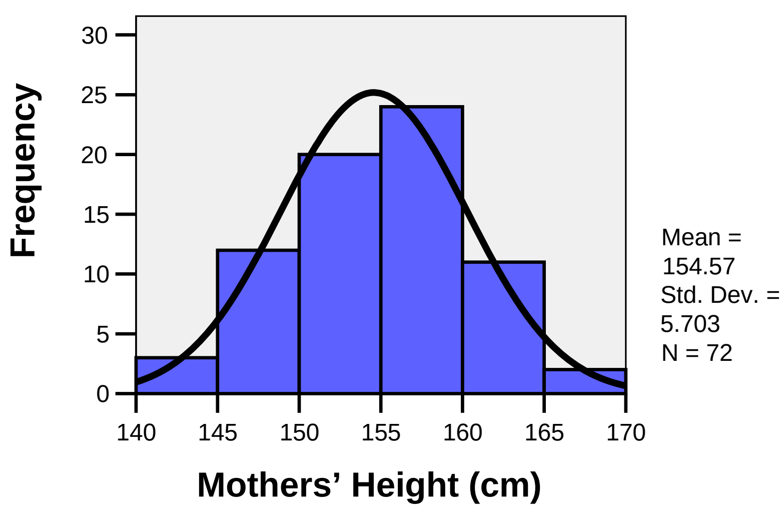
62 Z scores are the number of standard deviation units (SD) from the mean, with cutoff points.
63 Percentiles range from 0 to 100, with the 50th percentile representing the median.
64 EpiInfo presents height of infants in terms of child length since height is a measurement of standing upright and length is a recumbent measurement.

variable is more or less symmetrically distributed about the mean, which was = 154.57 cm.

Table 6.23 Summary Statistics: Mothers' Height

			Statistic	Std. Error
Mothers" Height (cm)	Mean		154.57	.672
	95% Confidence Interval for Mean	Lower Bound	153.23	
		Upper Bound	155.91	
	5% Trimmed Mean		154.53	
	Median		155.00	
	Variance		32.521	
	Std. Deviation		5.703	
	Minimum		143	
	Maximum		168	
	Range		25	

Fig. 6.11 Mothers' Height



Next is the analysis of the variable Mother's Weight and BMI with respect to the variable Months Postpartum (or age of the infants in months) over a 9-month period. For weight and BMI, I described medians and not means since weight is not normally distributed and the means are manipulated by the outliers. See box plots representing the medians for weight (Fig.6.12) and BMI (Fig 6.13). Table 6.24 displays the mean, median, standard deviation, minimum and maximum of the variable Mother's Weight factored by the variable Months Postpartum. The median Mother's Weight of 61 kg was highest in the fourth month and the lowest mean of 55 kg occurred in the eight month. On average, mothers lost weight in the second month, the median weight dropping from 60.25 kg to 57.75 kg. Subsequently mothers' weight fluctuated over the course of months 3 through 7, within 60 kg, ± 1kg. Overall, mothers were not losing or gaining any marked amount of weight in the first 7 months following the birth of their children.

BMI of the mothers was factored by the variable Months Postpartum (see Table 6.25 for BMI ranges). The median BMI of mothers was highest in the first month at 25.22, and the lowest median of 23.71, 23.59 and 23.55 occurred in the second, eight and ninth months respectively. The weight loss observed in the second month following infant birth, as well as during eight and ninth month, briefly dropped mothers into the "normal" BMI range, and the mean weight in all subsequent months placed mothers in the "overweight" category. The second month postpartum relative to weight loss of the mothers is not significant since BMI kept within the overweight range. A study by Valeggia and Ellison (2003:722) found that Toba women in Argentina retain some of their pregnancy weight gain for more than a year postpartum. This weight retention "contributes to the increase in BMI with age," similar to what I found in my research.

Table 6.24 BMI Ranges for Adults

BMI	Weight Status
Below 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0 and Above	Obese

WWW.cdc.gov/bmi/adult 2006:2

For each mother, mean and median BMI was calculated using the BMI recorded for each visit. The mean and median BMI was then categorized according to the CDC guidelines.

Table 6.25 Mothers' Postpartum Weight by Months

	Age In Months		Statistic	Std. Error
Mother's Weight (kg)	1	Mean	62.70	1.40
		Median	60.25	
		Std. Deviation	11.74	
		Minimum	42	
		Maximum	95	
		N	70	
	2	Mean	58.92	1.28
		Median	57.75	
		Std. Deviation	9.44	
		Minimum	44	
		Maximum	95	
		N	54	
	3	Mean	60.49	1.61
		Median	60.00	
		Std. Deviation	11.02	
		Minimum	40	
		Maximum	95	
		N	47	
	4	Mean	62.88	1.85
		Median	61.00	
		Std. Deviation	13.76	
		Minimum	37	
		Maximum	97	
		N	55	
	5	Mean	60.26	1.44
		Median	59.75	
		Std. Deviation	10.38	
		Minimum	43	
		Maximum	98	
		N	52	
	6	Mean	62.81	2.18
		Median	60.00	
		Std. Deviation	14.46	
		Minimum	37	
		Maximum	100	
		N	44	
	7	Mean	59.90	1.54
		Median	60.50	
		Std. Deviation	9.76	
		Minimum	46	
		Maximum	83	
		N	40	
	8	Mean	63.62	3.39
		Median	55.00	
		Std. Deviation	17.26	
		Minimum	37	
		Maximum	103	
		N	26	
	9	Mean	60.08	4.74
		Median	58.75	
		Std. Deviation	16.42	
		Minimum	38	
		Maximum	103	
		N	12	

Table 6.26 Mothers' Postpartum BMI by Months

	Age In Months		Statistic	Std. Error
BMI (kg/m)	1	Mean	26.02	.491
		Median	25.22	
		Std. Deviation	4.10	
		Minimum	18.42	
		Maximum	39.54	
		N	70	
	2	Mean	24.72	.438
		Median	23.71	
		Std. Deviation	3.22	
		Minimum	18.80	
		Maximum	34.11	
		N	54	
	3	Mean	25.23	.573
		Median	24.63	
		Std. Deviation	3.93	
		Minimum	17.54	
		Maximum	39.54	
		N	47	
	4	Mean	26.13	.665
		Median	25.08	
		Std. Deviation	4.93	
		Minimum	16.23	
		Maximum	40.37	
		N	55	
	5	Mean	25.14	.540
		Median	24.98	
		Std. Deviation	3.89	
		Minimum	18.86	
		Maximum	40.79	
		N	52	
	6	Mean	26.02	.774
		Median	24.67	
		Std. Deviation	5.14	
		Minimum	16.23	
		Maximum	37.80	
		N	44	
	7	Mean	24.98	.585
		Median	24.20	
		Std. Deviation	3.70	
		Minimum	19.68	
		Maximum	33.31	
		N	40	
	8	Mean	26.04	1.26
		Median	23.59	
		Std. Deviation	6.40	
		Minimum	16.23	
		Maximum	42.87	
		N	26	
	9	Mean	24.66	1.63
		Median	23.55	
		Std. Deviation	5.66	
		Minimum	16.45	
		Maximum	36.49	
		N	12	

Fig. 6.12 Postpartum Median Weight by Month

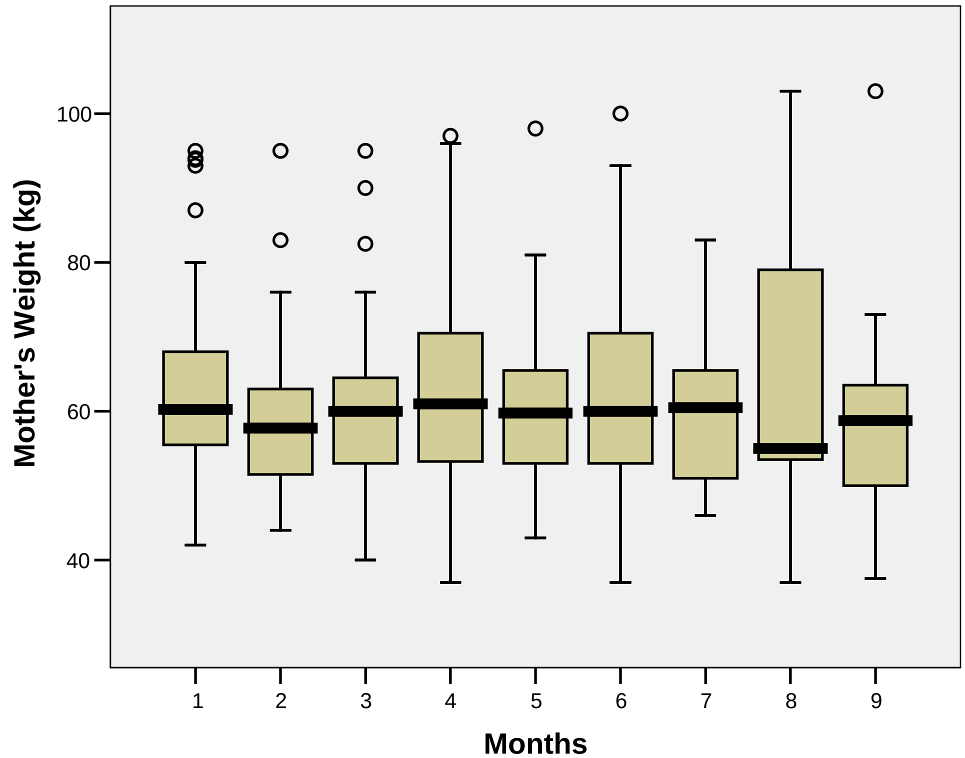
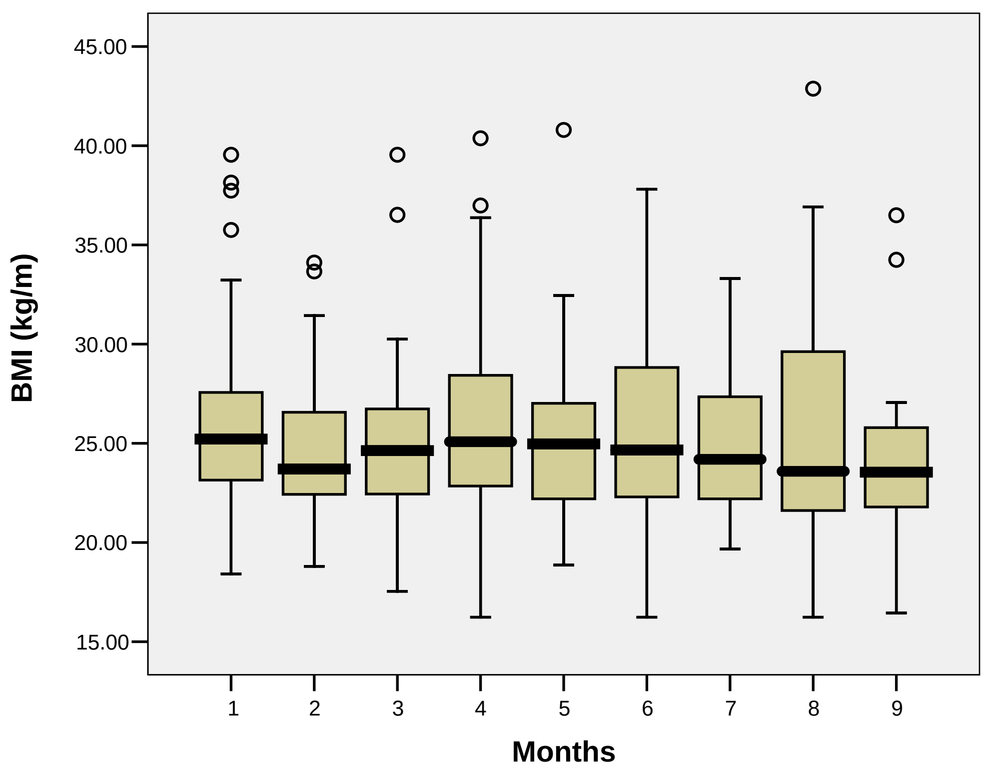


Fig. 6.13 Postpartum Median BMI by Month



Observationally, there were some cases of clearly overweight mothers and a few cases of apparently underweight mothers; while according to the BMI formula a large number of the mothers were within the overweight range, most of them do not appear to be. At this point, I do not know if BMI is a good indicator of body fat or nutritional status. For the second group, the BMI categorizes most of the mothers as normal, while 16 were overweight and 7 were obese – there were no underweight mothers. Only one mother, from the first group, was classifying as underweight (see Table 6.27).

Table 6.27 G1 and G2 Summary BMI Ranges

		Weight Status				Total
		Underweight	Normal	Overweight	Obese	
Group	G2	0	24	16	7	47
	G1	1	15	5	4	25
Total		1	39	21	11	72

Dufour et al. (1994) had almost the same results in an anthropometric and secular trends study done in Cali, Colombia, among women from three different socioeconomic status: low, mid-low and upper SES. They found a large group of women were of overweight status. And secular changes in stature indicate that stature was positively associated with SES. These changes, according to the authors, could reflect relative economic prosperity in Colombia. In another study by Piperata and Dufour (2007) on energy expenditure among Ribeirinha women in the Brazilian Amazon, anthropomorphic measurements were collected and maternal dietary intake was measured. The BMI results show that the women were not underweight. According to the authors, women can respond to the energy stress of lactation with flexibility because the cost of milk production per unit time is relatively low. However, certain socioeconomic conditions may constrain women. And Dufour (2002) suggested that lactating women in different populations use different strategies to cope with the cost of lactation.

Infants' Anthropometry

To evaluate the nutritional status of children, investigators use weight and height (Frisancho 1990). The two preferred anthropometric indices for determining nutritional status are Weight-for-Height (WH) and Height-for-Age (HA). A third index, Weight-for-Age (WA), is a combination of WH and HA (U.S. Department of Health & Human Services, CDC 2003: 81). When applicable, BMI data is also included. Malnourished children can be classified as wasted if they have low WH and stunted if they have low HA. This last indicator is associated with poor overall economic conditions. However, we have to be aware that WA fails to distinguish tall, thin children from short, well-proportioned children (Frisancho 1990, U.S. Department of Health & Human Services, CDC 2003).

Figures for the infants are presented here in Z Scores and percentiles. The data collected in this study were analyzed using the 2000 CDC Growth Reference Curves. In Z-Scores, very low anthropometric levels are usually interpreted as > 3SD units below the mean (U.S. Department of Health & Human Services, CDC 2003: 81). In percentiles, low anthropometric levels are construed as < 5th percentile of the study population. Following the graphic data representation, I have included tables containing Z-Score data for both groups of infants – G1 and G2. Absent or inaccurate data are left blank in the tables. Tables E.5 and E.6 contain infant age, weight, height, head circumference (HCircu) and middle upper arm circumference (MUAC) measurements and Z-Scores for WH, HA, WA, HC, MUAC for height and MUAC for age, and BMI when applicable. I present, next, figures representing the whole sample (G1+G2 cases). See appendix E for anthropometric data on each infants.

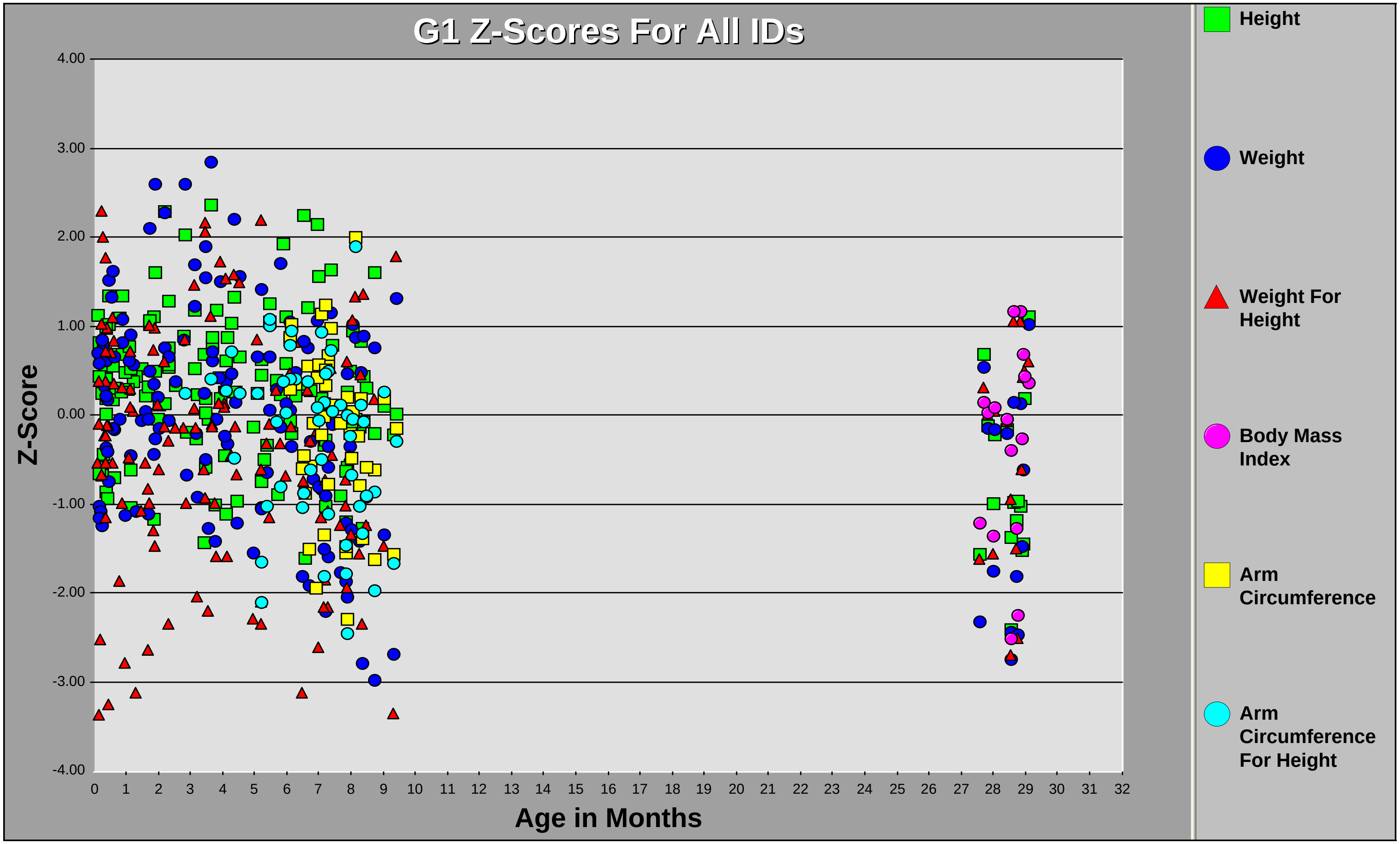


Figure 6. 14 Z-Scores for all IDs The majority of infants fall within the normal deviation for both groups. For infants who fall outside the standard deviation, the majority fall <2SD below the mean.

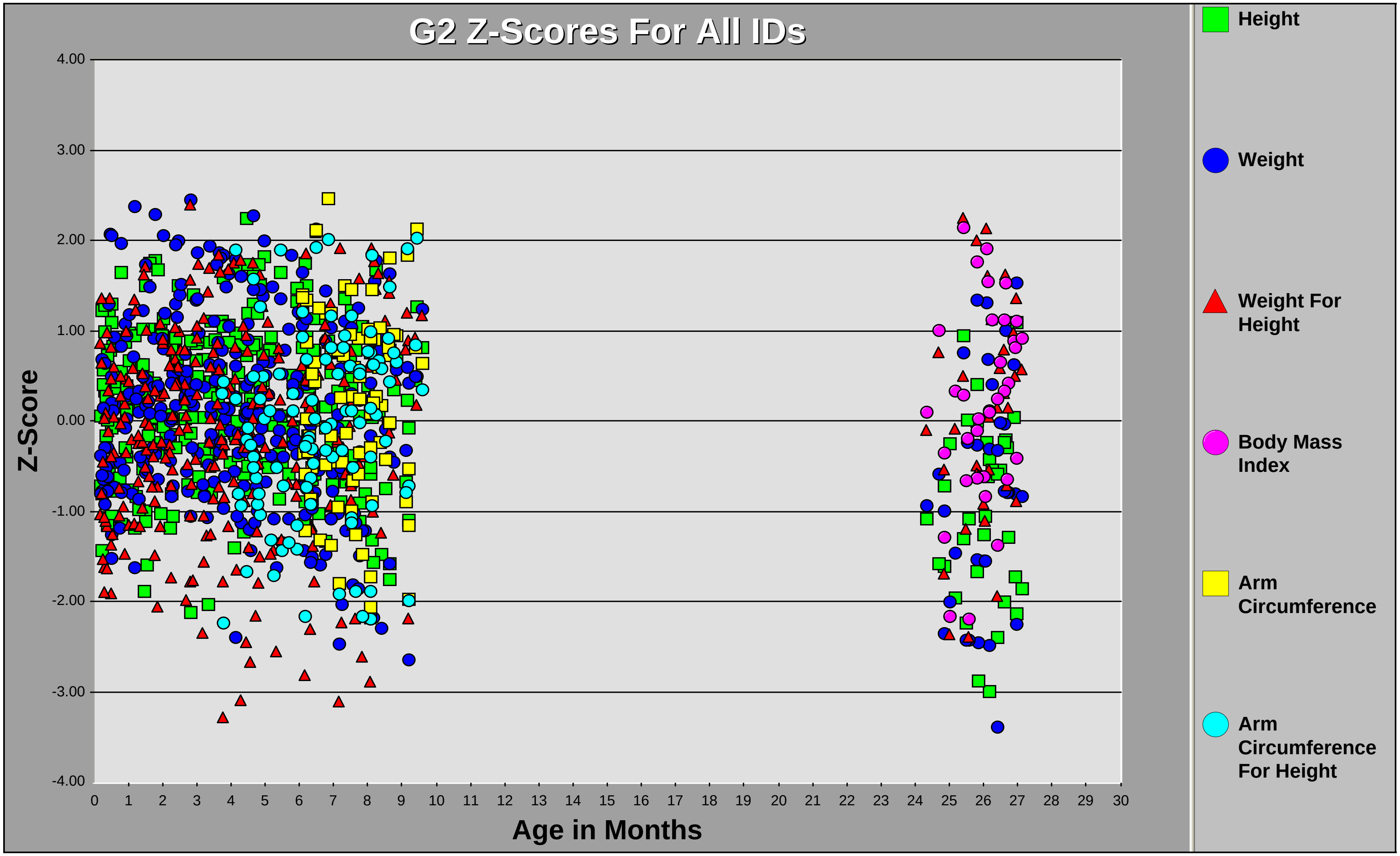


Figure 6. 15 Z-Scores for all IDs The majority of infants fall within the normal deviation for both groups. For infants who fall outside the standard deviation, the majority fall <2SD below the mean.

SUMMARY

In this chapter I presented the summary statistics of all of the data collected and illustrated the breastfeeding pattern in Esmeraldas. Each variable has a different pattern, basically there are two kinds of variations; one is within the mother over time and the other between the mothers. And although drop out may be a factor in the change (especially after the 6th month), is it not the strongest or the only factor in the change. In Esmeraldas, women breastfed 5 times during the day and each session lasted about 9 minutes. Creamatocrit has a direct relationship with breastfeeding structure.

T-W data is important to elucidate the MI question. This is the first study on milk volume among Ecuadorian women and in Latin America. The average milk production in Esmeraldas is lower in comparison with other populations. Based on the Jelliffes' data, the Esmeraldan women will be classified as poorly nourished. BCS or the combination of breastfeeding structure and TW will help to elucidate breastfeeding patterns from both a cultural as well as a biological perspective.

The fifth month "factor" is the month when the breastfeeding pattern changed among mothers in Esmeraldas. I speculate that this was partly due to an increase in supplementation in infants.

For each mother, mean BMI was calculated using the average of each BMI recorded for each visit. According to the BMI formula, most of the mothers in Esmeraldas (G1&G2) are within the normal BMI range. Although most mothers (39) in Esmeraldas are within the BMI range categorized as normal, there are a large number that are in the overweight and obese categorization (32). Perhaps this is a new trend in poor countries where we are now finding overweight mothers in impoverished areas, which contradicts general assumptions about impoverished areas and nutritional status. Lastly, it is my hope that this data could be used for further research. The implications of these results for MI or milk insufficiency will be presented in the next chapter.

CHAPTER 7

ANSWERING THE RESEARCH QUESTIONS

PART I

I am presenting here a combination of ethnographic data and inferential statistics to answer the research questions of this thesis. For most of the inferential analysis I use data from group G2, for some variables I used both groups G1 and G2, nevertheless I will specify only when the analysis described used both groups; all other analyses use date just from group G2. The data were analyzed with repeated measures analysis using Linear Mixed Models (LMM). Although repeated measure data can also be analyzed using General Linear Models (GLM), LMM was more suitable for this study (see methods for more detail); since many of the cases had missing values and the measurements were not taken at exactly the same point in time for each subject, LMM was a natural choice for our analysis.

In using LMM one must select the variance-covariance structure for the model. The variance-covariance structure designates the within-subject variation and the between-subject variation. Since subjects are assumed to be independent of each other, the between subject variation is zero. Compound symmetry was chosen for the within-subject variation. Compound symmetry assumes that the correlation of measurements is constant over time. In other words, the correlations of measurements between times that are closer together are the same as the correlation of measurements between times that are farther apart. Although repeated measures data tend to be correlated, with correlation decreasing with increasing time between measurements, compound symmetry was used because it permits unequal time intervals for measurements within subject. The other structures assume that the measurements taken for each subject are equally spaced in time. In addition, the individual profiles of the variables we are most interested in studying (T-W (g/hr), MPPM (g/min), and AMPPAS (g)) did not exhibit a coherent and discernable correlational pattern. Thus the compound symmetry assumption was reasonable.

Next, in order to answer some of the research questions, mothers were categorized according to the variables Milk Insufficiency Complaint (MIC) and Supplements. New variables, MIC Level and Supplement Level were created. During the first six visits, mothers who complained of milk insufficiency less than three times were assigned to the LOW MIC Level category while mothers who complained three or more times were assigned to the HIGH category. Similarly, mothers who gave their infant supplements on three or fewer visits were assigned to the LOW Supplement Level category while mothers who gave their infant supplements on three or more visits were assigned to the HIGH category.

In the introduction to this dissertation, I define milk insufficiency as the mother's perception of not producing enough milk for her infant at any moment during lactation. For this statistical analysis, I define perceived milk insufficiency as Milk Insufficiency Complaint (MIC). The term MIC only reflects a mother's reported perception of her own milk production – meaning that for this defined variable the actual amount of milk produced by the mothers was not measured. As noted above, the variables that represent actual measured amounts of milk produced by the mothers are T-W (g/hr), MPPM (g/min), and AMPPAS (g) (again, see methods for more detail).

1. WHAT ARE MOTHERS' EXPLANATIONS OF MILK INSUFFICIENCY? IS THERE ANY FOLK THEORY OF ILLNESS RELATED TO BREASTFEEDING AND MILK INSUFFICIENCY?

In Esmeraldas, the beliefs associated with breastfeeding and milk insufficiency included ideas about milk quality and quantity. Mothers who believe they have problems with their milk production report having *aguada* (watery), *azulada* (bluish) or *no bien bueno* "not very good" milk. The opposite is true too; mothers who have no problems perceive that they have "fattening," "white" or "good" milk. Besides color or appearance of the milk, they use the baby as an indicator of their milk quality; for example their milk is fattening (*engordadora*) if the baby is getting fat. And also they said if their baby was thin it was because it did not like the taste of their milk.

There are other problems related to perceived quantity of milk, with some mothers saying they have *leche de apoyo* (leaking milk) which they perceive as excessive milk, while another group of mothers say they have "not enough milk" or milk insufficiency. Among other folk beliefs concerning lactation, I was told that if a mother put the baby's urine-soaked diapers out to sun dry, or if the breasts are exposed to the sun, especially if the sun's rays catch the milk leaving the breast her milk could also become dry, causing milk insufficiency.

I found that many mothers believe that the production of milk is related to the nutritional status of the mother. Consuming flavored or "nutritious" liquids is considered important to produce enough milk, and drinking sugared water (*agua con panela*), cola, oatmeal drinks (*avena*), or beer among others will increase their milk production.

Some problems are not easily categorized as related to milk quality or quantity. A small number consider that colostrum is bad for newborns because it is “expired milk” (*leche guardada*) left in the breasts for nine months; as in many cultures, colostrum is thought of as bad milk rather than good milk for the infant (Duong et al. 2004; Shirima et al. 2001). Most of women in Esmeraldas had never heard the term colostrum but instead used the term “last” (*postrera*) milk. Nevertheless, in this study all mothers breastfeed the colostrum to their children.

Another belief related to lactation is e*ngalilla* (“overwhelmed by choking”). This occurs when the baby burps, or cannot swallow, or chokes when drinking the mother’s milk. To cure this problem, mothers will punch their breasts and blow on the anterior fontanel of the infant – “*Madre se da golpecitos en el pecho, porque bebe se atora.*” Some mothers suggested that the babies choked because they had a lot of milk. And the feeling of milk being “released” and coming down to the infant (the let-down reflex), is called *la polla*.

Breast milk is used by mothers in Esmeraldas as a remedy for health problems in many different areas for the baby, including the belly button and the eyes (pink eye, conjunctivitis), as well as against the evil eye. Mothers will not drink lemonade because they believe their milk will spoil (*se va a cortar*), although no mothers actually reported this happening to them. Another local belief, in *el sereno* (“night dew”), is related to diapers only. If an infant’s stools becomes greenish, the mother says that the baby *le cayo sereno (“caught the night dew”)* because she left the diapers outside on the patio late at night. A few mentioned the common practice of giving water or tea to newborns within the first 24 to 48 hours to “cool” them. Castle et al. (1988) report these same ideas related to milk insufficiency and early weaning in Bogota, Colombia. Many of these beliefs are associated with the childbirth beliefs (see chapter 5).

A different folk belief is called *colerin* ("heat or anger" illness). It is believed that when a mother gets upset, for example, after a fight with her husband, mother-in-law, or a neighbor, her milk may also become upset and "hot," and may hurt the baby. The saying is, "The milk behaves like the mother." As in Bangladesh, women considered their own health and that of their breastfed children as interconnected and indivisible (Zietlyn and Rowshan 1997). *Colerín* was said to cause fever, diarrhea, and vomiting in children, and possibly even death (*coraje* a synonym of *Colerín* is also reported in Mexico by Guerrero et al. 1999). The folk treatment is simply for the mother to calm down and not to breastfeed for a period of time. The mother is also told to drink teas made of oregano and *valeriana* (valerian). There were no reports of babies with *Colerín* during our research period. Most of these beliefs were collected at various times, and they comprise lay knowledge.

Beliefs about breastfeeding are rich in every culture, representing as in Esmeraldas the cultural construction of reality within a particular historical, political and economic setting. During the 17th century, European physicians maintained that sexual relations during lactation would spoil or ruin breast milk (Riordan 1991). Haitian mothers attribute their "spoiled milk" to domestic problems, and Farmer (1988) suggests that "spoiled milk" serves as a moral barometer submitting private problems to public scrutiny. And women in Mali believe that the process of breastfeeding creates maternal kinship, transferring the mother's "blood" to the child via breast milk (Dettwyler 1986b). Research in Bangladesh by Zietlyn and Rowshan (1997), find many interesting beliefs related to breastfeeding, including about colostrum which many urban women claimed that they had discarded because impurity and pollution associated with childbirth are associated with colostrum. Crying and other conditions, like diarrhea, were attributed to evil spirits or *batash*. Mothers of young babies often express a few drops of milk or spit on their breasts, or place certain objects under their mat before they start to breastfeed. Both of these actions are intended to exorcise the breast and protect the baby from the effects of *batash*. Rural healers tended to exorcise the mother to render her breast milk harmless so she could continue breastfeeding, while urban healers usually just prescribed bottlefeeding instead. So, many mothers assumed that a heavy feeling in their breasts was a sign that their milk had been spoilt by the *batash*. Interestingly, breast milk is also believed to be made from blood, further leading to the belief that the increase in the production of blood will also lead to the production of milk.

Notions of female modesty are being redefined – changing ideas of modesty are synonymous with new ideas of female beauty and fear that the appearance of breasts may be spoiled by breastfeeding. When a breastfed child becomes ill, the sickness is related to the mother who failed to maintain her body temperature, ate the wrong foods such as rice when eaten cold or after dark, or behaved in a way that made her vulnerable to attack from *batash* or evil spirits drawn to blood and spoiled breast milk.

In many parts of Latin America, including Ecuador, breastfeeding is considered "an act of sacrifice endured by the mother to ensure a secure bond with the child later in life." This is part of a complex of cultural ideas about mothers called "marianismo" by Browner and Lewin (1982). Marianismo is a term derived from the Spanish name for the Virgin Mary (María) that many scholars of Latin America employ as a counterpart term for “machismo.” For Comas-Díaz (1988), marianismo represents the ideal woman who is a subordinate to her husband but, more importantly, the caretaker of their children. As in the Roman Catholic Church, the Virgin Mary took care of the baby Jesus, including breastfeeding him. Marianismo is a concept that encourages breastfeeding. However, for those who do not observe Roman Catholic practice, like many of mothers in Esmeraldas, Marianismo has minimal impact on their breastfeeding behavior. In conclusion, it is very important to pay attention to what the mothers think and say about their milk insufficiency problems. Mothers conjure up their own explanation for illnesses and health problems. They also create their own explanations of “reality” in response to the external factors such as the economic crisis (discussed in question 3 below).

Lastly, my committee raised three interesting questions: First, about some historical data on the prevalence of milk insufficiency; second, what men think about milk insufficiency and/or women’s breastmilk; and third, whether there are beliefs relating male secretions (like semen) to breastmilk. Although I did not specifically collect information on these topics at the time of the research, I contacted one of my ex-assistants for some information. According to her, milk insufficiency seems to be a new problem in Esmeraldas. Even though the remedies for problems related to breastfeeding are old, the complaint of having weak milk, or milk insufficiency, according to older women she asked, is a “recent” development. Today mothers believe in increasing breastmilk production by eating more liquids, sugar cane, seafood, and even Coca-Cola or beer, which is something that they did not believe in the past. As to the second question, men do not want to participate (except for a few) in discussions of women’s physiology and decisions regarding breastfeeding. They seem to be totally uninvolved in breastfeeding decisions, or any decision related to women’s problems (personal communication with Johanna Rodriguez 2008). Finally, there is no expressed relationship between semen and breastmilk in Esmeraldas.

2. HOW DO SOCIOECONOMIC STATUS AND WORK STATUS OF THE MOTHER INFLUENCE BREASTFEEDING BEHAVIOR AND REPORTS OF MILK INSUFFICIENCY?

The following results compare household income with milk insufficiency complain or MIC and supplements levels, using data from G1 and G2. Using the variable Household Income, a new variable, Income Level, was created. Income Level divides household income into three categories. The first category is less than or equal to $45 per month, the second is greater than $45 per month but less than or equal to $90 per month, and the third is greater than $90 per month. I used $45 per month as a cutoff point for comparisons with $1 per day income (=$30 per month), that is an indicator of the extreme poverty level in the international forums, plus ~$11 from *el bono* (see chapter 3 for details) that the mothers receive from the government, so that $40-$45 per month are useful cutoff points indicating extreme poverty in Esmeraldas.

Table 7.1 Income Level * MI Complaint Level Crosstabulation

			MI Complaint Level		Total
			HIGH	LOW	
Income Level	Less Than or Equal To $45	Count	9	13	22
		% within Income Level	40.9%	59.1%	100.0%
	Greater Than $45 but Less Than or Equal To $90	Count	3	21	24
		% within Income Level	12.5%	87.5%	100.0%
	Greater Than $90	Count	6	7	13
		% within Income Level	46.2%	53.8%	100.0%
Total		Count	18	41	59
		% within Income Level	30.5%	69.5%	100.0%

Table 7.1 is a cross-tabulation between Income Level and MIC level. For example, for mothers in the Lowest Income Level, 9 (40.9%) of them have High MIC

level while 13 (59.1%) have low MIC level. But for mothers in the Middle Income Level, only 3 (12.5%) have high MIC level, while 21 (87.5%) have low MIC level.

The results of the Chi-Square test for independence between the variables Income Level and MIC level, shows a statistically significant relationship (p = .043) between income level and MIC level (Table 7.2). Interestingly, the results indicate that mothers in the Middle Income Level do not complain of milk insufficiency as much as mothers in the lowest and the highest income levels. In other words, mothers with a very low income and those with the highest incomes have similar amount of complaints about milk insufficiency.

Table 7.2 Chi-Square Tests For Income Level * MI Complaint Level Crosstabulatior

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.295 [a]	2	.043
Likelihood Ratio	6.786	2	.034
N of Valid Cases	59		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.97.

Now, Table 7.3, a cross-tabulation between income level and supplement level indicates that for mothers in the lowest income level, 15 (68.2%) of them have high supplement level while 7 (31.8%) have Low Supplement Level. For mothers in the Middle Income Level 16 (66.7%) have High Supplement Level, while 8 (33.3%) have Low Supplement Level. In contrast, all the mothers in the highest income level (100%) have high supplement level. Table 7.3 shows that the supplement level in the lowest and the middle income levels are similar to each other. However, the supplement level in the highest income level is markedly different numerically from both the lowest and middle income. The results of the Chi-Square test of independence between the variables

Income Level and Supplement Level, show a not statistically significant relationship (p = .058) between income level and supplement level (Table 7.4). Nevertheless, the p value is close to .05, showing that there is some relationship between income level and supplementation.

Table 7.3 Income Level * Supplement Level Crosstabulation

			Supplement Level		
			HIGH	LOW	Total
Income Level	Less Than or Equal To $45	Count	15	7	22
		% within Income Level	68.2%	31.8%	100.0%
	Greater Than $45 but Less Than or Equal To $90	Count	16	8	24
		% within Income Level	66.7%	33.3%	100.0%
	Greater Than $90	Count	13	0	13
		% within Income Level	100.0%	.0%	100.0%
Total		Count	44	15	59
		% within Income Level	74.6%	25.4%	100.0%

Table 7.4 Chi-Square Tests For Income Level * Supplement Level Crosstabulation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.698 [a]	2	.058
Likelihood Ratio	8.825	2	.012
N of Valid Cases	59		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.31.

The following tables (Tables 7.5-7.11) compare education level and household income as independent variables with test weighing (T-W). To test whether Educational level influences T-W, MPPM, and AMPPAS we ran repeated measures analysis using linear mixed models. The educational levels are categorized as follows: 1-6 elementary, 7-12 secondary, greater than 12 College as per the Ecuadorian education system. I also present the category of “not disclosed” (as the 4 education level) from mothers that did not want to disclose their education level for whatever reason. Without such a category the results become inflated.

The Table 7.5 below is a fixed effects model, which models T-W, MPPM and AMPPAS as the dependent variables and Education Level and Household Income the independent variables (The fixed effects). Since Household Income is interval data, it is modeled as a covariate. The model also indicates that the repeated effect is the variable Visit since the measurements were taken at different visits.

Table 7.5 A Fixed Effects Model Dimension for T-W, MPPM and AMPPAS

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables	Number of Subjects
Fixed Effects	Intercept	1		1		
	EducationLevel	4		3		
	HouseholdIncome	1		1		
Repeated Effects	Visit	6	Compound Symmetry	2	ID	39
Total		12		7		

The Table 7.6 below is a Type III Test for fixed effects. As we can see education level and household income are not significant with respect to the dependent variable T-W (g/h). The p-value for education level is .499; the p-value for household income is =.857.

Table 7.6 T-W and Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	32.766	31.458	.000
EducationLevel	3	33.336	.807	.499
HouseholdIncome	1	32.648	.033	.857

a. Dependent Variable: Test Weighing (g/h).

Table 7.7 provides the mean Test Weighing (g/h) in respect to education levels. Notice that more educated mothers with some college education have a mean T-W of 18.039 g/h while mothers with the lowest education level have a mean T-W of 27.373 g/h, a 9.334 g/h difference. Although the means are different, it is not statistically significant. The grand mean for this model was 22.704 g/h for all the mothers considered in this analysis.

Table 7.7 Mean TW (g/h) in Respect to Education Level b

Education Level	Mean T-W	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
College	18.039	5.812	33.066	6.216	29.862
Elementary	27.373	3.389	32.142	20.471	34.275
Not Disclosed	23.204	3.880	35.459	15.330	31.077
Secondary	22.198	1.890	32.187	18.349	26.047

b. Dependent Variable: Test Weighing (g/h).

Regarding MPPM (g/min), results show that none of the fixed effects are significant with respect to the dependent variable MPPM (g/min). The p-value for education level is .352, and the p-value for household income is .528. Both p-values are above .05 (see Table 7.8).

Table 7.8 MPPM and Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	34.081	23.764	.000
EducationLevel	3	34.846	1.125	.352
HouseholdIncome	1	33.927	.407	.528

a. Dependent Variable: MPPM (g/min).

Table 7.9 provides the mean MPPM (g/min) in respect to education levels. Again, there was a difference of 2.933 g/min. between college and elementary education level.

The grand mean for this model, MPPM was of 5.958 g/min. for all the mothers considered in this analysis.

Table 7.9 Mean MPPM (g/min) in Respect to Education Level b

Education Level	Mean MPPM	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
College	4.529	1.548	34.504	1.385	7.674
Elementary	7.462	.901	33.266	5.630	9.295
Not Disclosed	5.723	1.039	37.607	3.619	7.827
Secondary	6.119	.503	33.457	5.096	7.142

b. Dependent Variable: MPPM (g/min).

Lastly, AMPPAS (g) results show that none of the fixed effects are significant with respect to the dependent variable AMPPAS (g). The p-value for education level is .652, and the p-value for household income is .599 (Table 7.10). The AMPPAS (g) grand mean was of 49.189 g, for all the mothers considered in this analysis.

Table 7.10 AMPPAS and Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	31.851	58.934	.000
EducationLevel	3	33.152	.549	.652
HouseholdIncome	1	31.585	.282	.599

a. Dependent Variable: AMPPAS (g).

Table 7.11 provides the mean AMPPAS (g) in respect to education levels. Notice that more educated mothers with some college education have the lowest mean of 43.371 g, while mothers with the lowest education level have the highest AMPPAS (g) mean of 54.849 g, a 11.5 g difference. Although the means are different, it is not statistically significant. The grand mean for this model was 49.189g for all the mothers considered in this analysis.

Table 7.11 Mean AMPPAS (g) in Respect to. Education Level b

Education Level	Mean	Std. Error	df	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
College	43.371	8.526	32.810	26.020	60.722
Elementary	54.849	4.914	30.464	44.820	64.878
Not Disclosed	48.337	5.837	37.906	36.520	60.154
Secondary	50.198	2.748	30.737	44.592	55.803

b. Dependent Variable: AMPPAS (g).

Breastfeeding and Work

In my study, I found very mixed results in this regard. Sometimes women working outside the home had a large effect on breastfeeding success, and sometimes they were very creative about dealing with it so the effects were very small. Dufour (2002), in a study of the energetics of human pregnancy and lactation, suggested that lactating women in different populations use different strategies to cope with the cost of lactation. For instance, in another study of physical activity among poor urban women in Cali, Colombia, comparing mothers who worked and who didn’t work, Dufour et al. (2003) report that working women spend less time resting and watching TV, but more time traveling and doing miscellaneous work activities. The time allocation and energy expenditure is similar in both groups because many activities both groups of women engage in are the same or similar, and some working women work only for limited time periods.

There were a few participating mothers who had to work outside of their home and take care of their household and the new infant at the same time. Mothers are always concerned whether or not they will “develop” milk insufficiency. Here is a sample case that illustrates a very creative breastfeeding behavior and work pattern. There was a mother (Case 32) who had to go back to work as a secretary, leaving her baby with her sister that also had a baby. Her sister breastfed her baby while she was out working. The mother breastfed both her baby and her sister’s baby when she returned from work, The mother said that she was doing her best not to let her breast milk “dry up,” as she worked every day. She would breastfeed her child when she came home for lunch. She drank *masato*, so that she would produce a lot of milk. She told us that she also breastfed at night in a good amount. The mother said that she did not have “congestion” of her breasts because she tried not to have it, by taking care of it. She also said that she had enough milk. The mother said that during the night she always felt her breasts were very full, so that she would breastfeed as soon and as often as she could.

In May 2001, we interviewed the mother again and learned that she breastfed for 1 year and 3 months. She said her doctor recommended that she stop at that point. We also learned that the baby almost died from an intestinal infection at age 11 months. The baby was hospitalized for one week. The mother decided to quit her job the next week.

Another mother’s case is an example of a working woman who was less successful. She worked as a healer using clairvoyant skills. Her office is on the floor below her home, in the same house, in the basement. In general, she did not breastfeed her baby much because she had many clients. Even when she did not have a client, she often remained in her office. She combined breastfeeding and formula at first. Breastmilk Consumption Structure (BCS) showed that this mother did produce a good amount of milk (MPPM 104gr/min), even though she only breastfed 5 times a day for about 4 minutes per session. She reported that the baby cried a lot, sleeping and waking up and then sleeping again and waking up and crying, and so on and so forth, as if the baby were often hungry or uncomfortable. Grandmother, aunt, uncle and neighbors helped with the care of the baby. As the mother breastfed less and less, she then began to complain of milk insufficiency and that the baby was not doing well (see anthropometry for Case 8).

Last, I would like to mention the case of a mother who worked for her mother-in-law making and selling *cocadas* (a sweet coconut candy) in the market. We conducted three observations with this mother and there was just one breastfeeding session in each observation. She stated she may have enough milk, but certainly she did not have enough time to breastfeed because she is always doing things that her husband or mother-in-law are asking her to do. The mother has to take her daughter to school. She has to shop for lunch, work on the *cocadas* business both making and selling them in the market, and take care of the baby. During our interviews, her husband pressured her to finish with the interviews.

Among the working mothers, we found that they fed their children formula even when they were not currently working. This was because they were concerned that they might go back to work at any time and they were preparing their children for that time. As previously noted, that was one of the most common explanations given by the mothers for why they fed their children formula. Some of the poor mothers said they breastfed their children because they did not have enough money to buy formula. A few mothers had stable jobs. Most of them were teachers. The others worked in the informal economy and almost everybody was looking for some kind job, especially after the economic crisis, which I will analyze further in the next section.

Mothers with the highest income level have the higher MIC (46.2%). Nevertheless, income and education are not statistically significant in relation to BCS. Mothers with higher education tend to have lower BSC than mother with secondary and elementary education. However, mother with higher education level have the highest supplement level (but not statistically significant). In summary, education has a negative impact on breastfeeding behavior in Esmeraldas.

Studies showed that mothers' education has a correlation with breastfeeding performance. Ironically, infants in poorer societies are breastfeeding less than richer societies. For instance, today in the US, UK and Canada more educated mothers are breastfeeding longer than before (Griffiths et al. 2007), that does not happen in other countries where educated women are the ones that breastfeed the least period of time, like in Latin America, Africa and Asia (Perez-Escamilla et al. 1999).

A study in Babol in northern Iran found after controlling for the effect of mother's occupation that mothers with higher level of education tend to breastfeed longer than those with a lower education level (Hajian-Tilaki 2005). On the other hand, educated women in Bangladesh tend to breastfeed for a shorter duration of time (Giashuddin and Kabir 2004; Zeitlyn and Rowshan 1997).

In a study on urban and rural populations in Peru, Perez-Escamilla et al. (1999) examined the antecedents of breastfeeding duration, socioeconomic status, measured by the living situation, education, and employment of the mother and what the authors called biocultural variables, such as prenatal care, whether or not the pregnancy was planned, whether or not the birth was a C-section, and breast feeding initiation within 24 hours of the birth. They conducted a survey of 8,731 mothers and children, with subpopulations of mothers whose last child was born within 5 years of the survey and those whose child was born 2-5 years preceding the survey. The study found women who did not plan their pregnancy were at risk of breastfeeding for shorter periods of time. Prenatal care was associated with delayed initiation of breastfeeding in both samples and positively associated with breastfeeding in one of the samples with mothers with older children. Also, in this sub-sample, time initiation of breastfeeding and breastfeeding duration were inversely associated. Overall, a higher socioeconomic status tends to decrease breastfeeding duration.

3. HOW DID THE ECONOMIC CRISIS OF 1999 AFFECT REPORTS OF MILK INSUFFICIENCY AND HOW DID MOTHERS MANIFEST THE CRISIS IN BREASTFEEDING BEHAVIOR?

The economic crisis was a “natural experiment” that I am going to use to help me answer this research question. As I have mentioned before (chapter 3) and described elsewhere else in this dissertation; in March 1999 the Ecuadorian government froze all dollar bank accounts, initiating a major economic and social crisis. The economic crisis had created hardships and changes in the lifestyle of the people in Esmeradas city, leading to despair, anxiety, uncertainty, violence, crime, and migration within the province to other countries, leaving behind broken families. Breastfeeding complaints increased with two peaks in April and June and their breastfeeding behavior also changed noticeably at those times (see Table 7.12 and Figures 7.1a and 7.1b).

Mothers complained of having all sorts of problems like not knowing if food would be available for the next day. I remembered a mother in the days of the economic collapse, asking me: “do you know if we will have something to eat tomorrow?” Let’s look more closely on how the economic crisis affected two mothers. One of the youngest mothers in our sample (5) had a lot of milk initially. However, due to the economic situation of the country, she lost her confidence in breastfeeding and began to complain of milk insufficiency. After the month of March, her MPPM increased steadily every month on to the last month of our research. The second case was a happy and confident mother (7) until the onset of the economic crisis. She began breastfeeding less frequently and her MPPM fell. Her breastfeeding frequency and MPPM returned to the baseline the following month until her husband lost his job and her neighborhood got flooded. She became stressed all the time after that. Life got worse and worse for this family. Anxiety had replaced her confidence; all the variables results were down, including the creamatocrit, which on our last visit was just 1% (see anthropometry Tables for this case).

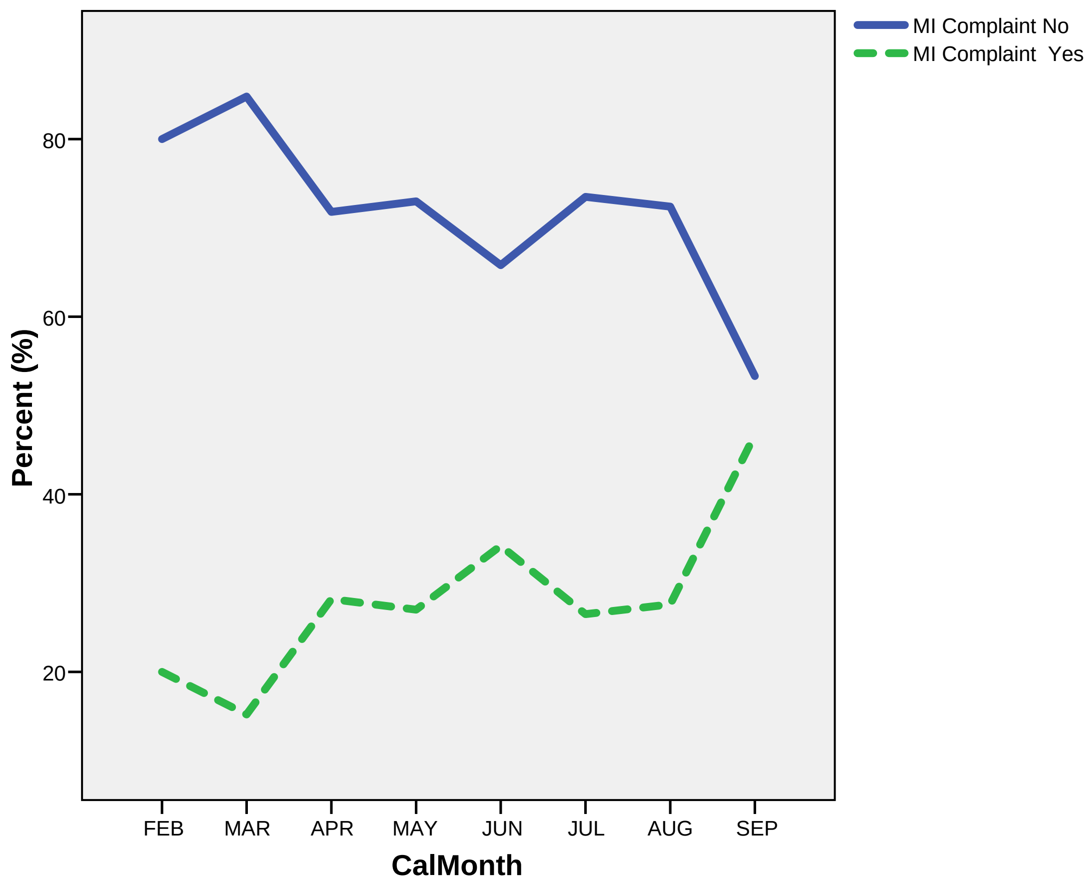
The changes were triggered by stressful situations that occurred during lactation. Mothers introduce supplements whenever they "think" that they do not have enough milk. Later when the mothers "felt" that they have enough milk, then they resumed breastfeeding. At the peak of the economic crisis, people in Esmeraldas felt that they were abandoned by the central government economically, politically and socially (see more on chapter 3). Next, I present here descriptive statistics to elucidate this question.

Table 7.12 Calendar Month * MIC Crosstabulation

			MI Complaint		Total
			No	Yes	
CalMonth	FEB	Count	8	2	10
		% within CalMonth	80.0%	20.0%	100.0%
	MAR	Count	28	5	33
		% within CalMonth	84.8%	15.2%	100.0%
	APR	Count	28	11	39
		% within CalMonth	71.8%	28.2%	100.0%
	MAY	Count	27	10	37
		% within CalMonth	73.0%	27.0%	100.0%
	JUN	Count	25	13	38
		% within CalMonth	65.8%	34.2%	100.0%
	JUL	Count	25	9	34
		% within CalMonth	73.5%	26.5%	100.0%
	AUG	Count	21	8	29
		% within CalMonth	72.4%	27.6%	100.0%
	SEP	Count	8	7	15
		% within CalMonth	53.3%	46.7%	100.0%
Total		Count	170	65	235
		% within CalMonth	72.3%	27.7%	100.0%

The Table (7.12) above uses data from G2 group. It provides the number and corresponding percentage of mothers who complain of milk insufficiency (MIC) versus mothers who did not complain. For example, in April 1999, 28 mothers (71.8%) did not complain of milk insufficiency while 11 mothers (28.2%), almost a third, complained of milk insufficiency. The figure 7.1.a provides a line graph, of the above table.

Figure 7.1a Percentages of MI Complaints by Calendar Month (1999)



The timing of MIC reports in three different periods: 1. Low complaints in February around the first two months at the start of the economic crisis. 2. Relatively constant from April to June with a small rise in June, which I called the 5th month factor because it was in June -the 5th month of our research for group two (see chapter 6). 3.

After June, the complaints decline until August to September that MIC increased again (see above Figure 7.1.a). In summary, MIC increased steadily from March to June.

Figure 7.1b Percentages of Suplements by Calendar Month (1999)

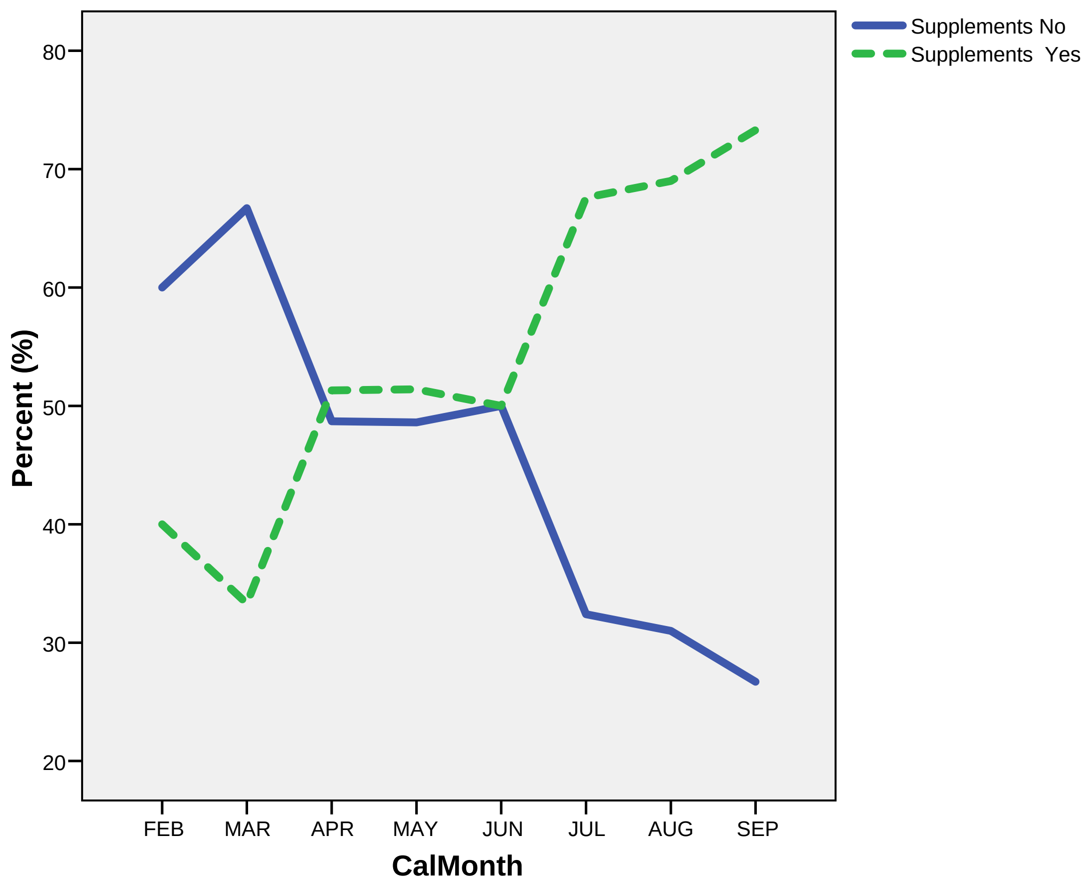


Figure 7.1b shows the supplementation by the calendar month. Beginning in the month of March in 1999, the supplementation level increased from ~30% to more than 50% within a month. There was also an increase in MI complaints during the same period. It can possibly be explained by the fact that the mothers were stressed out due to the economic crisis which started in March 1999. The increased level of stress leads to the increase in MI complaints and subsequently the increase in supplementation.

Next, I presented here the analysis of breastfeeding structure variables NSS (times), TSD (min), AMS (min), and MID (min) with respect to calendar month. Data for the second group of mothers were collected between February and October 1999. First the data were sorted according to the collection date. A new variable, Calendar Month, was created by assigning the calendar month of the collection date to each entry. Data collected in October 1999 was dropped because it only had a few number of entries. Tables 7.13 to 7.16 display the mean, standard deviation, minimum and maximum of the variable NSS, TSD, AMS, and MID factored by the variable Calendar Month (sample size is presented in Table 7.13). The mean NSS of 8.80 (times) was highest in February and the lowest mean NSS of 3.73 occurred in September. From the line graph, mean NSS had a precipitous descending trend from February to April, the crisis period, while leveling off between April and July, and then descending again from July to September.

The mean TSD of 66.08 (minutes) was highest in March, the crisis month. Does it indicate that mothers try to breastfeed more at the peak of the crisis to cope with it? Possible, at this point I will leave it only as a speculation. The lowest mean TSD of 37.80 occurred in September. From the line graph, mean TSD had a general downward trend, with a peak in March and a small peak in June. The mean AMS (minutes), had a steep ascending trend from February to March and April and bounced back and forth for the rest of the months. This variable is always in direct relationship with TSD. The highest AMS was 9.71 (minutes) in June and the lowest mean AMS of 6.87 (minutes) occurred in February. The mean MID of 248.78 (minutes) was highest September and the lowest mean MID of 81.33 (minutes) occurred in February. From the line graph, mean MID had a general upward trend with a small trough in June.

Table 7.13 NSS (Times) By Calendar Month Summary Statistics (1999)

Descriptives

	CalMonth		Statistic	Std. Error
NSS	FEB	Mean	8.80	.800
		Std. Deviation	2.530	
		Minimum	5	
		Maximum	14	
		N	10	
	MAR	Mean	7.36	.482
		Std. Deviation	2.771	
		Minimum	2	
		Maximum	13	
		N	33	
	APR	Mean	5.62	.354
		Std. Deviation	2.208	
		Minimum	1	
		Maximum	10	
		N	39	
	MAY	Mean	5.62	.451
		Std. Deviation	2.742	
		Minimum	1	
		Maximum	12	
		N	37	
	JUN	Mean	5.55	.365
		Std. Deviation	2.250	
		Minimum	1	
		Maximum	9	
		N	38	
	JUL	Mean	5.47	.401
		Std. Deviation	2.339	
		Minimum	1	
		Maximum	10	
		N	34	
	AUG	Mean	4.55	.427
		Std. Deviation	2.378	
		Minimum	1	
		Maximum	9	
		N	31	
	SEP	Mean	3.73	.492
		Std. Deviation	1.907	
		Minimum	1	
		Maximum	7	
		N	15	

Figure 7.2 NSS Represented by Calendar Month (1999)

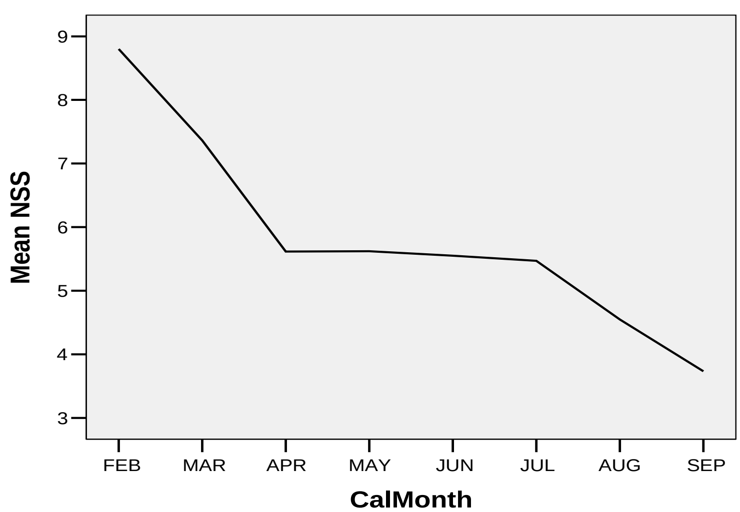


Table 7.14 TSD By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
TSD (mins)	FEB	Mean	59.75	9.725
		Std. Deviation	30.755	
		Minimum	22	
		Maximum	117	
	MAR	Mean	66.08	5.029
		Std. Deviation	28.890	
		Minimum	17	
		Maximum	139	
	APR	Mean	54.24	4.611
		Std. Deviation	28.795	
		Minimum	5	
		Maximum	124	
	MAY	Mean	48.51	4.573
		Std. Deviation	27.815	
		Minimum	7	
		Maximum	113	
	JUN	Mean	51.11	3.786
		Std. Deviation	23.341	
		Minimum	1	
		Maximum	104	
	JUL	Mean	49.72	4.762
		Std. Deviation	27.768	
		Minimum	9	
		Maximum	126	
	AUG	Mean	39.03	4.468
		Std. Deviation	24.875	
		Minimum	5	
		Maximum	94	
	SEP	Mean	37.80	6.814
		Std. Deviation	26.391	
		Minimum	5	
		Maximum	102	

Figure 7.3 TSD Represented by Calendar Month (1999)

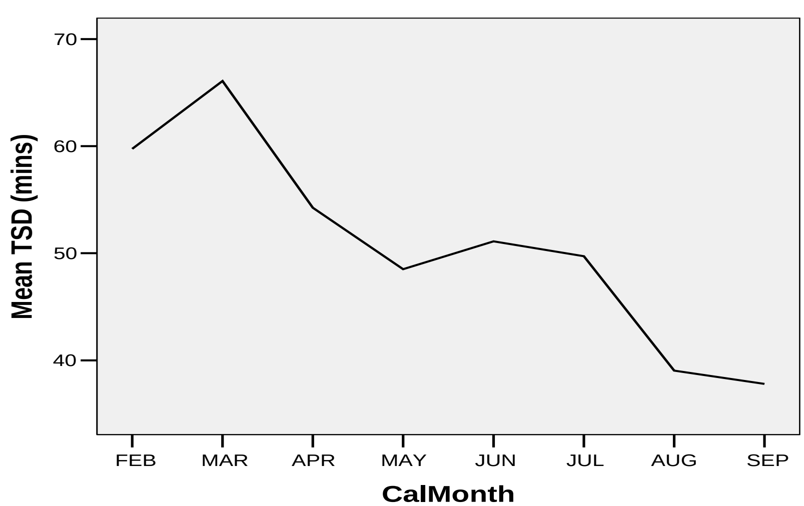


Table 7.15 AMS By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
AMS (mins)	FEB	Mean	6.87	1.067
		Std. Deviation	3.375	
		Minimum	3	
		Maximum	15	
	MAR	Mean	9.24	.508
		Std. Deviation	2.919	
		Minimum	5	
		Maximum	15	
	APR	Mean	9.61	.571
		Std. Deviation	3.563	
		Minimum	4	
		Maximum	20	
	MAY	Mean	8.98	.671
		Std. Deviation	4.082	
		Minimum	3	
		Maximum	22	
	JUN	Mean	9.71	.740
		Std. Deviation	4.561	
		Minimum	1	
		Maximum	24	
	JUL	Mean	9.44	.714
		Std. Deviation	4.161	
		Minimum	3	
		Maximum	21	
	AUG	Mean	8.27	.588
		Std. Deviation	3.271	
		Minimum	3	
		Maximum	21	
	SEP	Mean	9.42	.967
		Std. Deviation	3.744	
		Minimum	4	
		Maximum	18	

Figure 7.4 AMS Represented by Calendar Month (1999)

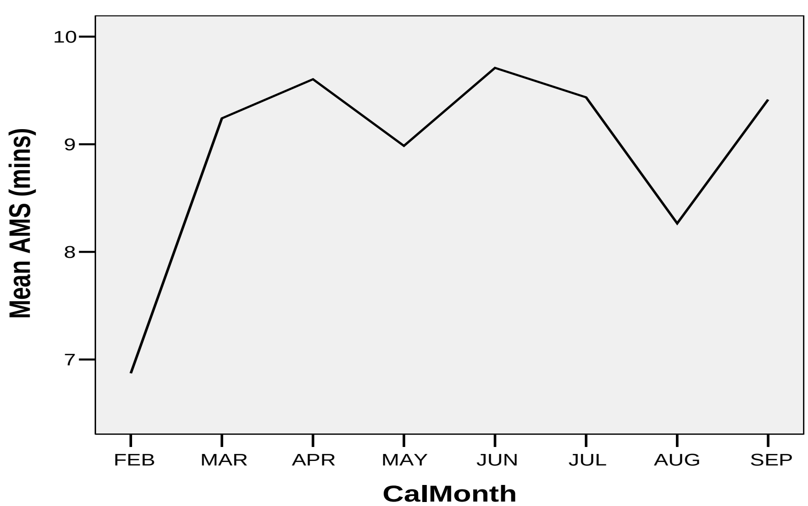
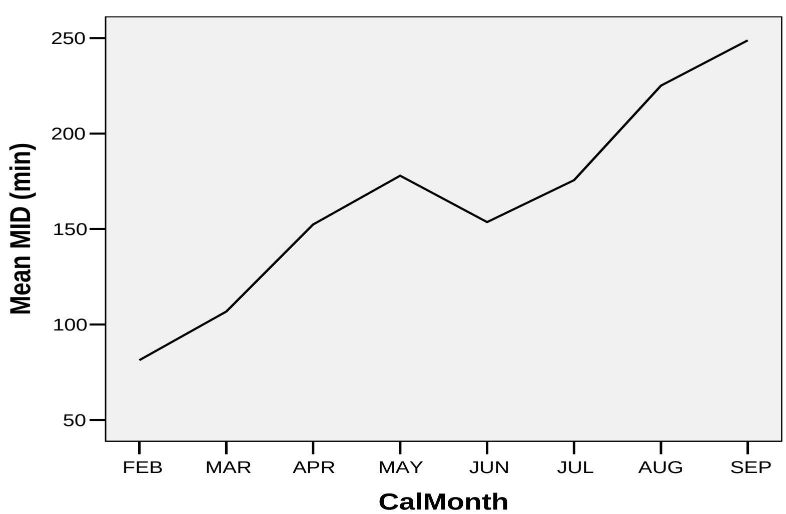


Table 7.16 MID By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
MID (min)	FEB	Mean	81.33	8.450
		Std. Deviation	26.722	
		Minimum	49	
		Maximum	140	
	MAR	Mean	106.81	10.993
		Std. Deviation	63.152	
		Minimum	48	
		Maximum	352	
	APR	Mean	152.37	22.795
		Std. Deviation	142.357	
		Minimum	63	
		Maximum	715	
	MAY	Mean	177.88	25.600
		Std. Deviation	155.720	
		Minimum	51	
		Maximum	712	
	JUN	Mean	153.61	20.073
		Std. Deviation	123.741	
		Minimum	66	
		Maximum	698	
	JUL	Mean	175.57	27.194
		Std. Deviation	158.566	
		Minimum	65	
		Maximum	711	
	AUG	Mean	225.12	37.432
		Std. Deviation	208.415	
		Minimum	72	
		Maximum	715	
	SEP	Mean	248.78	48.009
		Std. Deviation	185.937	
		Minimum	88	
		Maximum	715	

Figure 7.5 MID Represented by Calendar Month (1999)



The next group of tables and figures display the mean, standard deviation, minimum and maximum of the variables Test-Weighing (g/hr), MPPM (g/min), and AMPPAS (g) factored by the variable Calendar Month (figure 7.7 and figure 7.8). These tables and figures by displaying the range of milk production by Calendar Month are representing a more cultural response (February to September 1999).

First, T-W dipped to a low level in March, the month of the economic crisis, then steadily increased from March to June, and steadily decreased thereafter (none of them though met the MI criteria that will be discussed in the next chapter). There is a drastic drop from June to July or the sixth month of age (which applies to the 5th month factor discussed in chapter 6). The mean T-W of 28.20 g/h was highest in June and the lowest mean T-W of 18.96 g/h occurred in September.

The mean MPPM was 7.29 g/min. In March the mean MPPM was 3.78 g/min, which was a very low MPPM (see question 9 for MI criteria). From the line graph, mean MPPM decreased between February and March, and had an upward trend thereafter with a trough in July.

AMPPAS shows almost the same pattern as MPPM. But interestingly, the months of March as well as the first month of age had the lowest average. From the line graph, mean AMPPAS had a general upward trend with a trough in March and leveling off between July and August. The mean AMPPAS of 60.21 g. was highest in September and the lowest mean AMPPAS of 32.98 g. occurred in March. This shows that the month of March (the month of the economic crisis) had a clear change on breastfeeding behavior and milk production. In other words, the crisis negatively affected mothers' breastfeeding behavior (see question 3).

Table 7.17 Test Weighing By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
Test Weighing (g/hr)	FEB	Mean	27.78	5.002
		Std. Deviation	15.817	
		Minimum	7	
		Maximum	58	
	MAR	Mean	20.54	1.805
		Std. Deviation	10.369	
		Minimum	2	
		Maximum	40	
	APR	Mean	23.97	1.859
		Std. Deviation	11.610	
		Minimum	1	
		Maximum	57	
	MAY	Mean	24.75	1.914
		Std. Deviation	11.641	
		Minimum	4	
		Maximum	46	
	JUN	Mean	28.20	2.210
		Std. Deviation	13.621	
		Minimum	2	
		Maximum	54	
	JUL	Mean	23.35	1.946
		Std. Deviation	11.348	
		Minimum	2	
		Maximum	46	
	AUG	Mean	20.29	1.994
		Std. Deviation	11.103	
		Minimum	2	
		Maximum	44	
	SEP	Mean	18.96	3.034
		Std. Deviation	11.749	
		Minimum	2	
		Maximum	40	

Figure 7.6 T-W Represented by Calendar Month (1999)

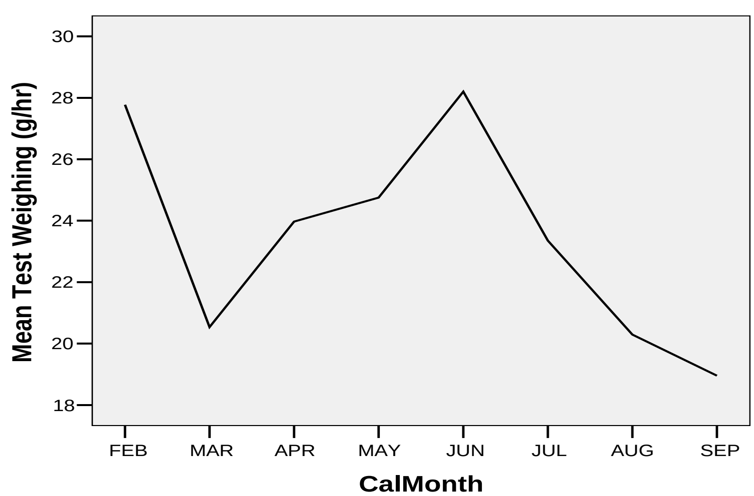


Table 7.18 MPPM By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
MPPM (g/min)	FEB	Mean	6.66	1.191
		Std. Deviation	3.767	
		Minimum	1	
		Maximum	13	
	MAR	Mean	3.78	.317
		Std. Deviation	1.821	
		Minimum	1	
		Maximum	7	
	APR	Mean	5.97	.556
		Std. Deviation	3.471	
		Minimum	1	
		Maximum	15	
	MAY	Mean	7.00	.478
		Std. Deviation	2.905	
		Minimum	2	
		Maximum	14	
	JUN	Mean	7.13	.705
		Std. Deviation	4.348	
		Minimum	1	
		Maximum	25	
	JUL	Mean	6.34	.585
		Std. Deviation	3.408	
		Minimum	2	
		Maximum	18	
	AUG	Mean	7.13	.642
		Std. Deviation	3.574	
		Minimum	2	
		Maximum	18	
	SEP	Mean	7.29	1.488
		Std. Deviation	5.761	
		Minimum	3	
		Maximum	26	

Figure 7.7 MPPM Represented by Calendar Month (1999)

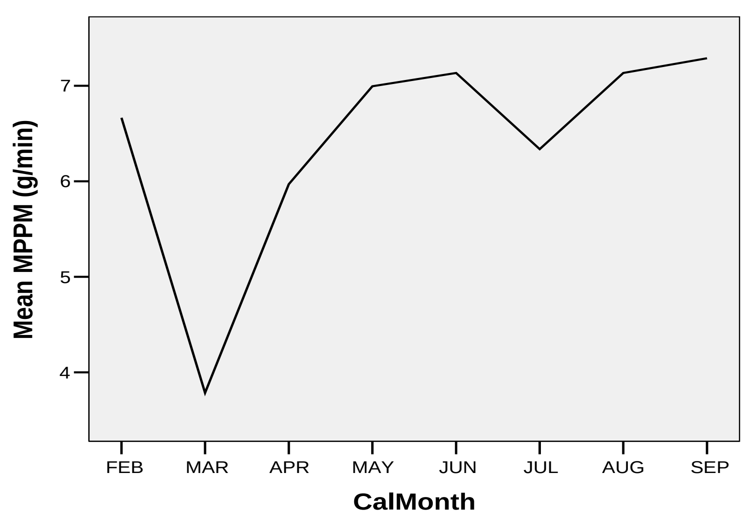
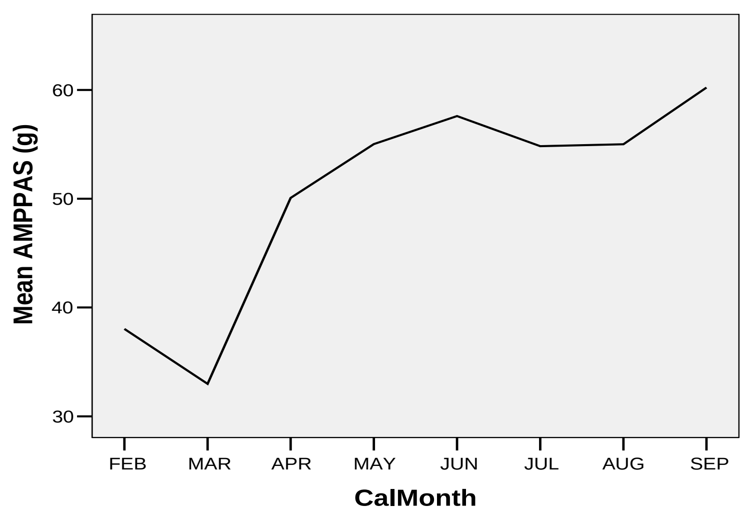


Table 7.19 AMPPAS By Calendar Month Summary Statistics (1999)

	CalMonth		Statistic	Std. Error
AMPPAS (g)	FEB	Mean	38.04	6.093
		Std. Deviation	19.266	
		Minimum	12	
		Maximum	70	
	MAR	Mean	32.98	2.760
		Std. Deviation	15.856	
		Minimum	8	
		Maximum	69	
	APR	Mean	50.07	3.144
		Std. Deviation	19.636	
		Minimum	10	
		Maximum	104	
	MAY	Mean	55.02	3.120
		Std. Deviation	18.978	
		Minimum	29	
		Maximum	100	
	JUN	Mean	57.58	3.687
		Std. Deviation	22.729	
		Minimum	12	
		Maximum	115	
	JUL	Mean	54.82	4.870
		Std. Deviation	28.397	
		Minimum	14	
		Maximum	147	
	AUG	Mean	55.00	4.862
		Std. Deviation	27.072	
		Minimum	19	
		Maximum	110	
	SEP	Mean	60.21	9.109
		Std. Deviation	35.278	
		Minimum	20	
		Maximum	155	

Figure 7.8 AMPPAS Represented by Calendar Month (1999)



These results corroborated recent scholarship which finds that stress may cause changes in milk production (Dewey 2001; Grajeda and Perez-Escamilla 2002; Hill et al. 2005; Hruschka et al. 2003). In the case study among Swedish women by Lindblad et al. (1975), "emotional factors on milk yield" was cited as a cause for a drop in breast milk production by 210ml/24h. In some parts of the world, such as central Africa, where a "season of hunger" exists, the production of milk can also drop by 100-200ml (Jelliffe and Jelliffe 1978). These results can be compared to my study. In this area, the economic crisis also produced a "season of hunger," in which daily life under poverty and difficult family situations, imposed undue amounts of stress on the mothers observed.

In a study in Rio de Janeiro by Almeida (1999), women's employment-related stress caused anxiety and depression, which were related to low milk production according to the participants in the study, although the researchers did not actually measure milk production. According to Almeida, stress resulted in production of suppressive peptides in the mammary glands, impeding the process of milk production. Ramos and Almeida's (2003) study concluded that the emotional state of the women negatively impacted the physiology of lactation, though they present only qualitative interview data to support this.

Stress and anxiety may hinder the milk ejection reflex and hamper lactation (Newton and Newton 1948, Ueda 1994, Riordan 2005). Tu et al. (2006) found that parity may be a major determinant in revealing the blunting effect of breast feeding on hypothalamic-pituitary-adrenal axis (HPA) responsiveness to a psychological stressor. As a result of multiple pregnancies and lactation, changes in neural mechanism occur and desensitize the stress circuits and reduce the overall stress-induced cortisol secretion after multiple births.

In conclusion, mothers were under tremendous stress at the beginning of the economic crisis. This stress affected mothers' confidence about breastfeeding. The lack of confidence triggered complaints of milk insufficiency and thus changed the breastfeeding behavior of the mothers. Stress[65] is described in the literature as a cause of difficult delivery, onset of lactation, and delayed production of breast milk (Dewey 2001; Grajeda and Perez-Escamilla 2002; Hill et al. 2005; Hruschka et al. 2003). Furthermore, I must point that out that those mothers in developing countries live under stressful situation almost all the times.

65 The ways in which our organism copes with a stressful situation are: first, through the immune system; second, through the nervous system, including reflexes and autonomic responses; and third, through the hormonal system (McEwen 2002:22). Any disturbing event triggers a signal to the hypothalamus which triggers a signal to the adrenal glands which in turn secretes the first stress hormones epinephrine or adrenalin. Thus the fight or flight response initiates a series of physiological changes inside of the body. The body, to help cope with the challenge, increases and decreases various functions. It increases heart rate, respiration, energy reserves and hormones like glucocorticoids and decreases gastrointestinal functions and the ability to perform sexually. This all happens instantaneously. The second response is triggered by the hypothalamic-pituitary-adrenal axis (HPA axis). In this phase, the Hypothalamus activates the corticotrophin-release-factor (CRF) that activates the Pituitary gland which in turn secretes adenocorticotropic hormone (ACTH), as well as prolactin and oxytocin. Adenocorticotropic hormone enters the circulatory system until it reaches the adrenal glands. The Adrenal glands produce the second most important stress hormone, cortisol; and send it into the bloodstream (McEwen 2002:24).

4. WHAT IS THE RELATIONSHIP AMONG ONSET OF LACTATION, OR "WHEN DID YOUR MILK ARRIVE," MILK INSUFFICIENCY COMPLAINTS AND EARLY SUPPLEMENTATION?

In order to answer this question let's first review the physiology of lactogenesis, already described in chapter two. Biomedicine described 3 phases of lactation, lactogenesis I, lactogenesis II and lactogenesis III (Biancuzzo, 1999; Kellymom.com 2005; Lawrence 1994). In Lactogenesis I, the mother's body starts making colostrum as early as halfway through pregnancy. Lactogenesis II, colostrum-transitional milk-mature milk- or copious milk production, goes from just hours after birth to 2-3 day after birth. Other authors like Grajeda and Perez-Escamilla (2002), describe the same process as onset of lactation (OL) or when women said that the milk has "come in," that could begin between a few hours to 7 days after delivery. It is importance to remember the process of lactogenesis I and II as hormonally driven, independent of breastfeeding, versus lactogenesis III, which is almost totally depending on whether or not a mother is breastfeeding her baby, a supply-demand system (Biancuzzo, 1999; Kellymom.com 2005; Lawrence, 1994; Riordan and Auerbach,1999).

The first few days after birth are very important for the future of lactation. In the first few weeks postpartum, the literature shows that breastfeeding confidence predicts the intention to breastfeed, and the anticipated length of breastfeeding. It also shows that there was an association between maternal perceptions of insufficient milk supply and breastfeeding confidence (Dennis, 2006).

This analysis uses Group G1 and G2. In Esmeraldas, the time of onset of lactation went from 0 to 6 days, with the mean at day 2 (see chapter 5 for details). I also analyzed MIC and introduction of supplement at the first visit (within a month). Then I looked at the relationship between the onset of lactation and the total breastfeeding trajectory.

Table 7.20 shows the onset of lactation (in hours) of mothers with and without MIC during the first visit. The results show that for mothers who complained of milk insufficiency on their first visit, the mean lactation onset was 52.36 hours. For mothers who did not complain of milk insufficiency, the mean lactation onset was 36.53 hours, a 15.83 hours difference between both groups.

Table 7.20 When did your Milk Arrive (Hours) By MI Complaint: First Visit

MI Complaint: First Visit			Statistic	Std. Error
When did your Milk Arrive (h)	No	Mean	36.53	5.053
		Std. Deviation	37.471	
		Minimum	0	
		Maximum	144	
		Range	144	
	Yes	Mean	52.36	7.806
		Std. Deviation	25.889	
		Minimum	0	
		Maximum	72	

To test if there is a statistically significant difference between the two means we use the Mann-Whitney U Test.[66] The mean rank for those who complained of milk insufficiency on their first visit versus those who did not complain are indicated on table 7.21 below. Nevertheless, there was no statistically significant (p = .118) difference between mean lactation onset for mothers from the two groups (see Table 7.22).

[66] The Mann-Whitney U test is a non-parametric alternative to one-way analysis of variance. Instead of using the actual means, the Mann-Whitney U test uses mean rank (in this case ranking the hours). It then tests whether or not there is a statistically significant difference between the mean ranks (the one-way analysis of variance could not be used with this variable because the assumption of normality is violated).

Table 7.21 When did your Milk Arrive By MI Complaint: First Visit

	MI Complaint: First Visit	N	Mean Rank
When did your Milk Arrive (h)	No	55	31.88
	Yes	11	41.59
	Total	66	

Table 7.22 Mann-Whitney U Test Statistics a

	When did your Milk Arrive (h)
Mann-Whitney U	213.500
Z	-1.562
Asymp. Sig. (2-tailed)	.118

a. Grouping Variable: MI Complaint: First Visit

Now let me present the relationship between onset of lactation and the introduction of supplements. Table 7.23 demonstrates the onset of lactation in mothers who supplemented and those who did not during our first visit. For mothers who gave their infants supplements on the first visit, the mean lactation onset was 44.46 hours. For mothers who did not give their infants supplements, the mean lactation onset was 35.73 hours, an 8.73 hour difference.

Table 7.23 When did your Milk Arrive (hours) By Supplement: First Visit

	Supplement: First Visit		Statistic	Std. Error
When did your Milk Arrive (h)	No	Mean	35.73	6.149
		Std. Deviation	38.888	
		Minimum	0	
		Maximum	144	
	Yes	Mean	44.46	6.157
		Std. Deviation	31.393	
		Minimum	0	
		Maximum	96	

Table 7.24 below shows the mean rank for those who complained of milk insufficiency versus those who did not complain, on their first visit. The mean rank for

those who complained of milk insufficiency on their first visit were 37.29 versus those who did not complain 31.04. The Mann-Whitney U test showed there was not statistically significant difference ($p = .187$) between mean lactation onset for mothers who fed their infants supplements on the first visit versus mothers who did not (see Table 7.25).

Table 7.24 When did your Milk Arrive (h) By Supplement: First Visit

	Supplement: First Visit	N	Mean Rank
When did your Milk Arrive (h)	No	40	31.04
	Yes	26	37.29
	Total	66	

Table 7.25 Mann-Whitney U Test Statistics a

	When did your Milk Arrive (h)
Mann-Whitney U	421.500
Z	-1.319
Asymp. Sig. (2-tailed)	.187

a. Grouping Variable: Supplement: First Visit

Next, I looked at the relationship between the onset of lactation and the total breastfeeding trajectory (not just the first visit). I analyze here the onset of lactation in relation to MI Complaint Level (see Table 7.26). For mothers with High MI Complaint Level, the mean lactation onset was 42.38 hours. For mothers with Low MI Complaint Level, the mean lactation onset was 37.67 hours, a 4.71 hour difference between women who had a high MIC versus women who had a low MIC. To test if there is a statistically significant difference between the two means we use the Mann-Whitney U Test. The mean ranks (hours) for High and Low MI Complaint Levels are indicated in the table 7.27 below. There was no statistically significant difference between mean lactation onset for mothers with high MI complaint levels versus mothers with low MI complaint levels ($p = .532$), see Table 7.28.

Table 7.26 When did your Milk Arrive (Hours) By MI Complaint Level

MI Complaint Level			Statistic	Std. Error
When did your Milk Arrive (h)	HIGH	Mean	42.38	6.575
		Std. Deviation	30.129	
		Minimum	0	
		Maximum	72	
	LOW	Mean	37.67	5.789
		Std. Deviation	38.832	
		Minimum	0	
		Maximum	144	

Table 7.27 When did your Milk Arrive By MI Complaint Level

	MI Complaint Level	N	Mean Rank
When did your Milk Arrive (h)	LOW	45	32.51
	HIGH	21	35.62
	Total	66	

Table 7.28 Mann-Whitney U Test Statistics a

	When did your Milk Arrive (h)
Mann-Whitney U	428.000
Z	-.625
Asymp. Sig. (2-tailed)	.532

a. Grouping Variable: MI Complaint Level

Next, Table 7.29 shows the onset of lactation and supplement Level. For mothers with High Supplement Level, the mean lactation onset was 39.94 hours. For mothers with Low Supplement Level, the mean lactation onset was 36.94 hours. There is really not much difference between both groups. The mean ranks for High and Low Supplement Levels are indicated in the table below (Table 7.30). Again, the Whitney U Test showed no statistically significant (p-value = .720) difference between mean lactation onset for mothers with high supplement levels and mothers with low supplementation levels (see Table 7.31).

Table 7.29 When did your Milk Arrive (hours) By Supplement Level

Supplement Level			Statistic	Std. Error
When did your Milk Arrive (h)	HIGH	Mean	39.94	5.127
		Std. Deviation	35.888	
		Minimum	0	
		Maximum	120	
	LOW	Mean	36.94	9.173
		Std. Deviation	37.819	
		Minimum	0	
		Maximum	144	

Table 7.30 When did your Milk Arrive (h) By Supplement Level

	Supplement Level	N	Mean Rank
When did your Milk Arrive (h)	LOW	17	32.09
	HIGH	49	33.99
	Total	66	

Table 7.31 Mann-Whitney U Test Statistics a

	When did your Milk Arrive (h)
Mann-Whitney U	392.500
Z	-.359
Asymp. Sig. (2-tailed)	.720

a. Grouping Variable: Supplement Level

In summary, there is a 10h difference in onset of lactation between mothers who complain of milk insufficiency at the first visit and those who did not complain. Mothers who had late onset of lactation introduced supplement early. But neither of these differences reach statistical significance. This is a very interesting piece of information about the onset of lactation. Women in Esmeraldas have an average of onset lactation (OL) from 0-6 days. Onset of lactation is often overlooked within scientific circles. Many assumed that milk arrived with delivery (see the literature -cited here- on breastfeeding, especially the ones that recommended immediate latch of infant to mother).

Exclusive breastfeeding for the first six months of life is recommended by WHO (1999; 2001) for its many nutritional, immunological, and psychosocial benefits. However, such practice is extremely rare since supplemental fluids are typically given to the infant during the first two months of life (Ergenekon-Ozelci et al. 2006; Garcia de Lima Parade et al. 2007; Kakute et al. 2005; Ly et al. 2006). Early supplementation or supplementation is a big problem in developing countries (WHO, 2001). According to McCann and Bender (2005), for instance, it is reported that in several Latin American countries, maternal perception of insufficient milk was a common reason for supplementing their infants with other liquids than breastmilk. Wayland (2004) in a study in Rio Branco, Acre, Brazil, found that 93% of infants receive water, 86% other liquids, and 62% receive solid food before age 6 months.

5. HOW IS SUPPLEMENTATION RELATED TO BIOLOGICAL DATA AND BEHAVIORAL DATA? IN OTHER WORDS, HOW IS SUPPLEMENTATION RELATED TO TEST WEIGHING AND MILK INSUFFICIENCY COMPLAINTS?

The concept of exclusive breastfeeding is a difficult one because there is more than one criterion for what is or what is not considered as exclusive breastfeeding. According to ENDEMAIN (2004:243,244) “exclusive breastfeeding is just mother’s breastmilk and nothing else.” And according to Dettwyler (1992), for the WHO (1991) exclusive breastfeeding is mother’s breastmilk plus some drops, medicines and syrups, and “predominant breastfeeding” includes milk from wet nurses, liquids, ritual fluids, drops, medicines and syrups. According to recent recommendations by the WHO (2003, 2004), exclusive breastfeeding is only breastmilk for at least the first six months (Wilson et al. 2006). According to these definitions, the mothers in this research do not practice exclusive breastfeeding but rather predominant breastfeeding. Almost all gave something other than breastmilk to their infants at different points in time.

The supplements offered to the babies consisted of herbal teas, sugar water, mashed banana, cooked mashed plantain, cooked fruit porridges (*coladas*), soups, thinned mashed potatoes, cow’s milk and formula (See Appendix A for a complete list of supplements used in Esmeraldas). Formula is expensive and therefore is typically used for only a short period of time. Nevertheless, if economically feasible, mothers will always choose to supplement their breastmilk. There were many other reasons why mothers introduce supplements. Attitudes towards breastfeeding in Esmeraldas are similar to the rest of the country. Breastfeeding is considered as lower status and less “modern” than bottle feeding. Not just the women, but also the health care authorities, are confused about the best advice on feeding babies and on how to breastfeed successfully.

Let us illustrate the reasons given by a mother on why she introduced supplements. According to one of the mothers interviewed, the father bought formula because she did not produce milk until the second day after giving birth. Since then, they have been given supplements, including *colada de verde* (green plantain porridge), to the baby. In addition, during this same interview, the mother reported that she was not feeling well, that she was depressed, and that she was taking antibiotics and suffering from back pain, perhaps due to breastfeeding and exhaustion (see more on this in chapter 5). To add one more problem to her list, her own mother instructed her not to "give the breast" when the baby wants (on-demand), but only every 3 hours.

In this study, among those who reported milk insufficiency, ninety-one percent (91%) of them introduced supplements by the third month of feeding. This tells us the importance of understanding supplementation within the first few months of the infants' life. I present first a cross-tabulation table on supplements and infants age in months, then some ethnographic data from 4 cases (case 19, 26, 16 and 41) to illustrate supplementation behavior and physiology (infant's growth, breastmilk production). It will be followed by statistical analysis and results. Table 7.32 below is a cross-tabulation of the variables age in months and supplements[67] for G1 and G2. For each month, the table shows the number and the corresponding percentage of mothers who fed their infants supplements versus those who did not. The percentage of mothers who fed their infants supplements steadily increased as the months passed by. By the first month 36 %

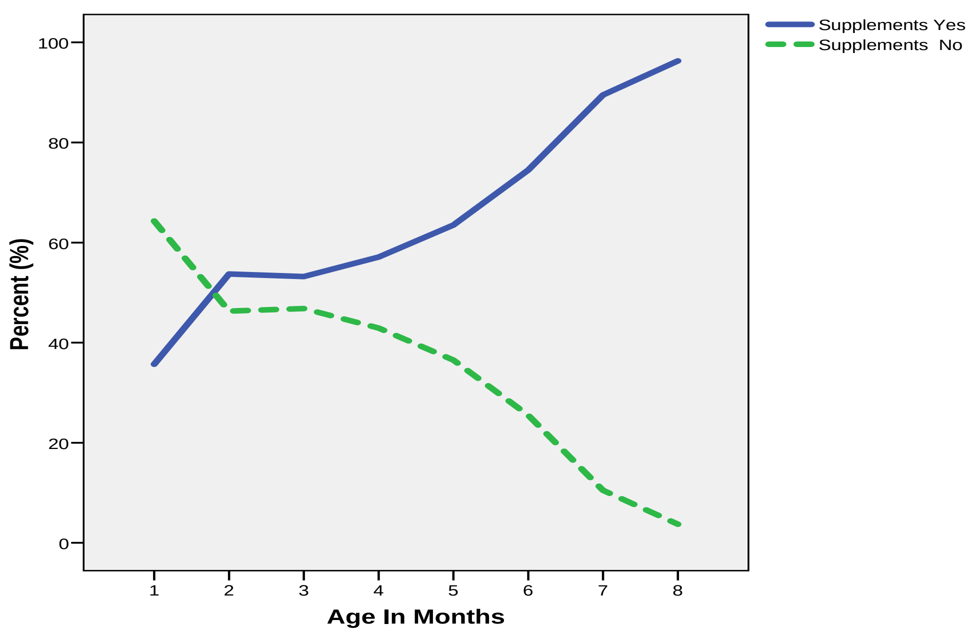
[67] For two entries, the Supplements variable indicated "Other breastfeeding milk" (meaning from another mother) and not "Yes". For purposes of the Chi-Square analysis, "Other breastffeding milk" was changed to "Yes." Leaving the entries as they were would have invalidated the Chi-Squared test as a third category for Supplement with too few counts would have been presented.

of the mothers had introduced some kind of supplements to their infants and by the second month more than half of the mothers had introduced supplements to their infants. By the eight month, almost all of the mothers had introduced some kind of supplements to their infants (see Fig.7.9).

Table 7.32 Age In Months * Supplements Crosstabulation for G1 & G2

			Supplements		
			No	Yes	Total
Age In Months	1	Count	45	25	70
		% within Age In Months	64.3%	35.7%	100.0%
	2	Count	25	29	54
		% within Age In Months	46.3%	53.7%	100.0%
	3	Count	22	25	47
		% within Age In Months	46.8%	53.2%	100.0%
	4	Count	24	32	56
		% within Age In Months	42.9%	57.1%	100.0%
	5	Count	19	33	52
		% within Age In Months	36.5%	63.5%	100.0%
	6	Count	12	35	47
		% within Age In Months	25.5%	74.5%	100.0%
	7	Count	4	34	38
		% within Age In Months	10.5%	89.5%	100.0%
	8	Count	1	26	27
		% within Age In Months	3.7%	96.3%	100.0%
Total		Count	152	239	391
		% within Age In Months	38.9%	61.1%	100.0%

Figure 7.9 Supplements Percentage by Age in Months for G1 & G2



A. Ethnographic Data

Next some ethnographic data, Case 19, illustrates the combination of using supplements with breastfeeding. In this case (in the fifth visit), there was a TSD of 41 minutes spent consuming 460g of supplements of porridge (*colada*), versus 19 minutes of breastfeeding (in 3 sessions) spent consuming only 120g of breast milk. This represents almost four times the amount of supplements versus breast milk. Yet the average length of a suckling session, AMS, was the same for both intakes, six minutes. The consumption per minute was far greater with bottle feeding of supplements, 11.2g/min, as opposed to that of breast milk consumption which was almost half the amount, registering only 6.3 g/mins. In total, the baby consumed 580g of food consisting of a combination of breastmilk and supplements. These results tell us clearly that bottle supplementation (=11.2 g/min) is much less regulated than breast milk intake (=6.3 g/min) so the infant could get fuller faster.

Further, the speed and amount which an infant may consume can depend on a variety of factors including the bottle delivery top, the supplement's texture, the infant's hunger, and the infant's adaptation or response to the supplement itself. In contrast, breast milk depends on various biological factors (explored later). Among these factors are the breast's production of breastmilk, storage capacity, the mother's delivery capacity (MPPM), and of course, the infant's hunger and desire to be on the mother's breast. The consequences of supplementation are many including malnutrition, increase risk of infections and obesity (Wadsworth et al.1999)

Case 26 illustrated the combination of supplements and breastfeeding. The total food intake for this baby during the third visit (3 months and 10 days) was 712g/12h, which included 532g of cow's milk, and 180g of breast milk. The MPPM of breast milk was 5.2g/min, and Supplement Consumption per Minute or SCPM[68] was 13.3gr/min of cow's milk. The results showed the baby consumed almost three times (2.9 times more) the amount of cow's milk than that of the breast milk per minute. In addition, the baby suckled for a longer duration (40 minutes) when consuming cow's milk verses mother's milk, 34 minutes. However, it was interesting to note that the AMS was more or less the same in both cases; 6.8 minutes with the breast milk vs. 6.6 minutes with cow's milk, or 5 sessions with breastmilk versus 6 sessions with milk from a bottle, with an MID of approximately every 2h (1h53 minutes) for bottle feeding, and every 2h 17 minutes for breastfeeding. There was a pattern or schedule for feeding. This pattern was consistent in mother's milk as well as supplement intake. And at least in the early stage of lactation, I think, the infant has some control over this pattern.

Next, case (16): an 18 day old infant who had consumed a total amount of 495 g/12h of food. The food consisted of 35g of mother's milk and 460g of formula mixed with water. The baby vomited frequently after consuming the formula mixture. The mother breastfed only twice during this 12/h observation. In our second visit, the mother breastfed the infant on just one occasion for 5 minutes. During this session, a total of 10g (MPPM of 2g/min) of breast milk was produced. In addition, she gave the baby 520g of formula in 35 minutes during the course of 8 sessions, with a SCPM of 15g/min. This was certainly above average for any kind of consumption in Esmeraldas. Again, the baby continued to vomit after consuming the formula mixture.

On our third visit, we recorded that the infant grew bigger than other infants in the

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[68] SCPM (g/min) -supplement consumption per minute is equivalent to MPPM (g/min), but instead of breastmilk it measures liquid supplements.

study (see anthropometry for case 16). In addition, we had difficulties weighing the baby because he moved frequently, and was more irritable, than other babies. We found that the mother had replaced the formula mixture with green plantain flour porridge *(colada de harina de verde)* supplement because the formula had become prohibitively expensive. In our fourth visit, there was no breastfeeding during the 12h observation. There was no more creamatocrit, and the only supplement used was the green plantain porridge (*colada de harina de verde*). As reported by the mother, the baby suffered from an excess of saliva production, and we confirmed this.

In order for the mother to go out frequently, she required the help of many people. Therefore, the baby was with others for extended periods of time. This raised the question, is this mother producing enough milk? Why did she introduce such a large amount of supplements? Later I learned that she did not want to breastfeed because she was looking for a job. She was planning to put the baby in the day care center.

During our fifth observation, the baby consumed 612g/12h of green plantain flour porridge (*colada de harina de verde*). During our sixth observation, the mother had started to give cow's milk to the baby under the recommendation of her doctor. Her doctor deemed the baby had gained too much weight (see anthropometry for this case). The doctor instructed the mother that since cow's milk was less "*engordador*" (fattener) than "*colada de verde*" (green plantain flour porridge), it would help to reduce the baby's weight. Due to the economic crisis in Ecuador in 1999 (see chapter 3 and question 2 for more details), the only job this woman could secure was to be a domestic servant in Europe. Later that year, this mother found a job as a domestic servant in Italy. The baby was left in the care of its grandmother and eldest sister.

Last case (41): A complainer of milk insufficiency, this mother used formula after the first month of breastfeeding because she thought the baby was not getting full. The baby always demanded more milk than she could produce, according to the mother. Although she gave more formula than breast milk, she produced an average amount of breast milk, and at some points even produced an ample MPPM of 9.3g/min. During our third visit, the infant consumed a total of 186g of breastmilk and 293g of formula.

During our fourth visit, this baby received 788g/12h of supplements. Among the supplements he consumed were formula, cow's milk with cereal and blended banana, soup, *colada de verde* (green plantain porridge) with cow's milk, and some syrup medication. This baby consumed many more supplements than breastmilk in a 12h period. He had a supplement session average length of 15 minutes and a SCPM of 10.6g/min (see anthropometry for this case). There was no breastmilk and no creamatocrit during this visit.

During our fifth visit, we noticed that the baby did not want breast milk anymore. He had rejected breast milk, and had completely adjusted to other kinds of foods. This behavior is not unusual after the systematic replacement of breastmilk with other substitutes. Nevertheless, the mother reported that the baby would drink breast milk only at the night. I did not see this mother again because she stopped breastfeeding the baby at age six months, in part because she was pregnant again. They could now afford to buy formula because both parents worked. The father worked as a tailor from home and the mother became a rural school teacher, commuting every day to her job. Since the father worked from home, he made all household decisions including those concerning breastfeeding. We could deduce from this case that this mother did produce enough milk, and that she had certain reasons for not breast feeding her child. Perhaps they were the combination of having to travel far away for her job, her husband's advice, the feasibility of buying formula and replacing breastmilk with all kinds of supplements. In any case, as a consequence of less breastfeeding, the early weaning of the infant, her menstrual ovulation cycle was restored earlier than normal, which resulted in pregnancy.

B. Statistical Data

Relationship between Milk Insufficiency Complaint Level and Supplement Level

Table 7.33 is a cross-tabulation of the variables MI Complaint Level and Supplement Level which shows the number and the corresponding percentage of mothers who had high supplement level versus those who had low supplement level. Chi-Square test (Table 7.34) showed there was no statistically significant relationship between MIC level and supplement level (p = .180).

Table 7.33 MI Complaint Level * Supplement Level Crosstabulation

			Supplement Level		Total
			HIGH	LOW	
MI Complaint Level	HIGH	Count	10	3	13
		% within MI Complaint Level	76.9%	23.1%	100.0%
	LOW	Count	16	13	29
		% within MI Complaint Level	55.2%	44.8%	100.0%
Total		Count	26	16	42
		% within MI Complaint Level	61.9%	38.1%	100.0%

Table 7.34 Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.801[b]	1	.180
N of Valid Cases	42		

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.95.

Test Weighing (T-W)

The data was analyzed with repeated measures analysis using Linear Mixed Models (LMM). Presented in figure 7.10 are individual linear profiles of the mothers' test weighing measurements paneled by supplement level. Each color-line represents a different mother and the figures show the mothers' measurement for the above variables at each visit (important: missing values were estimated by means of "interpolation" or best estimated between the points by connecting the points to the line).

Notice Figure 7.10 below, that test weighing of most of the mothers that have a low supplement level are above the ~15g/h of milk production, and that test weighings in women with a high level of supplements are below the ~35g/h of milk production. Table 7.35 below shows estimates of the fixed effect (sample size 42). For mothers who have High Supplement Level, mean Test Weighing was 11.58 g/h (approximately 144g/12h), lower than mothers with Low Supplement Level.

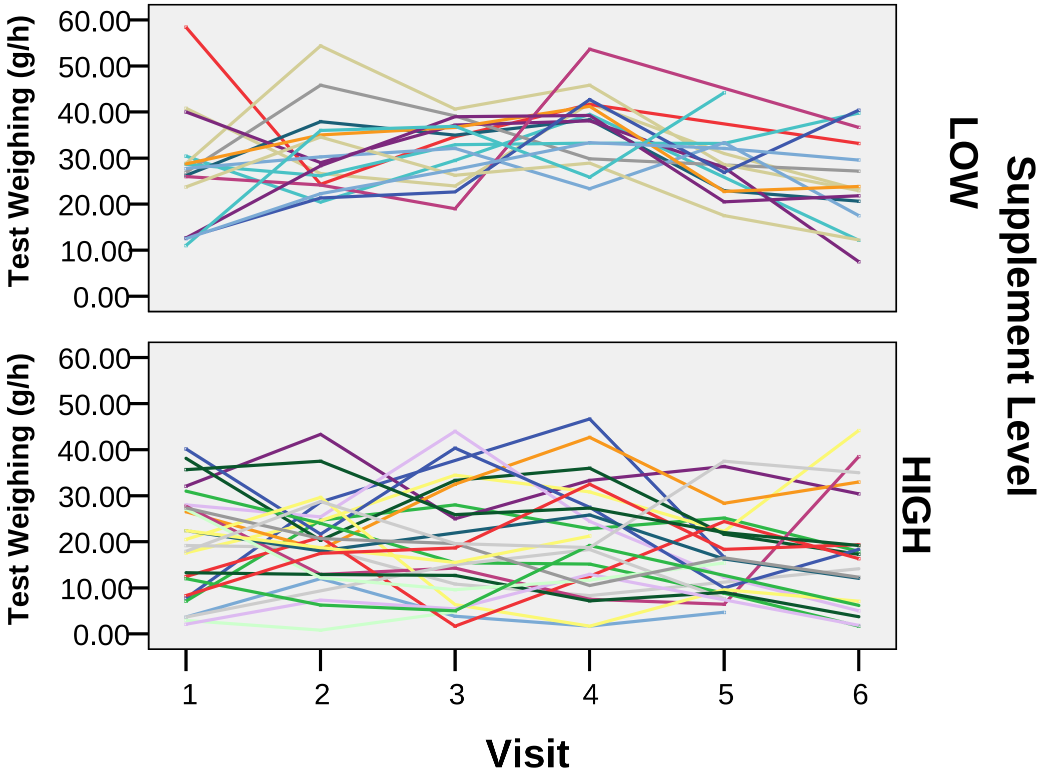
Table 7.35 T-W and Supplement Level: Estimates of Fixed Effects [b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	30.303124	1.695698	37.876	17.871	.000	26.870	33.736
[SupplementLevel=HIGH]	-11.5802	2.163581	38.383	-5.352	.000	-15.959	-7.2017
[SupplementLevel=LOW]	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: Test Weighing (g/h).

Figure 7.10 Line Graphs: Individual T-W by Supplement Level



The table below (7.36) shows the results of the Type III Test for fixed effects between the variables Supplement Level (fixed effect) and Test Weighing, g/h (dependent variable). The p-value of .000 is less than the significance level of .05. Thus, there is a strong statistically significant difference in mean Test Weighing between mothers who have Low Supplement Level versus those with High Supplement Level.

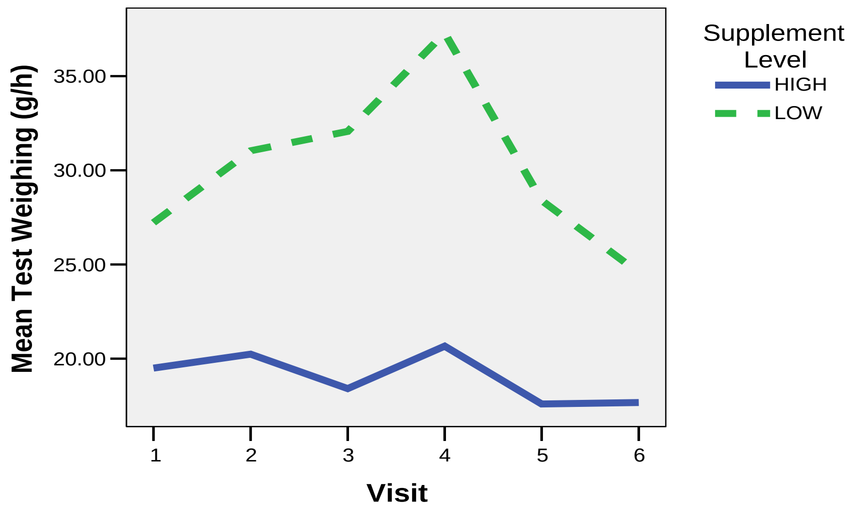
Figure 7.11 shows a profile of the mothers' mean Test Weighing measurements by supplement level. We could see that mothers with high supplement levels clearly had lower mean measurements than mothers with low supplement levels.

Table 7.36 T-W and Supplement Level: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	38.383	513.461	.000
SupplementLevel	1	38.383	28.647	.000

a. Dependent Variable: Test Weighing (g/h).

Figure 7.11 mean T-W by Supplement Level



Breastmilk Consumption Structure variables and Supplement Level

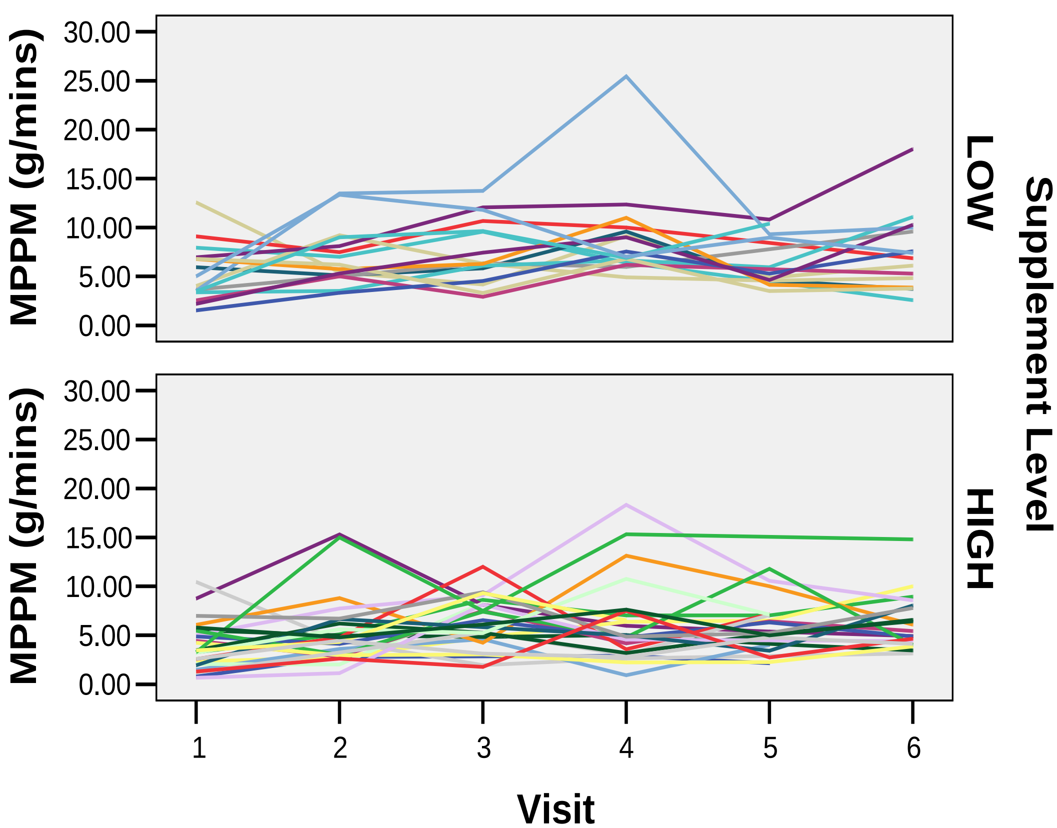
Here I present the individual profiles of the mothers' breastmilk consumption (BCS) variables. Test Weighing, MPPM (g/min), and AMPPAS (g) measurements paneled by supplement level. Each line represents a different mother and the figures show the mother's measurement for the above variables at each visit.

Next I present BCS variable profiles, by supplement level, of the mothers' mean of: MPPM, and AMPPAS measurements. For each of the two variables, mothers with high supplement levels had lower mean measurements than mothers with low supplement levels, with the one exception of the fifth visit for AMPPAS, where mothers categorized as low had a lower measurement. Then I present inferential statistics to see the relationship between BCS and supplement level for each variable (data were analyzed with repeated measures analysis using Linear Mixed Models -LMM).

Milk Production Per Minute (MPPM)

Figure 7.12 is an individual profiles of the mothers' MPPM (g/min) measurements paneled by supplement level (High and Low). This time there is some difference between low and high supplement level, with the high supplement level producing in average fewer grams per minute. Nonetheless the difference is not as marked as with T-W (g/h).

Figure 7.12 Line Graphs: Individual Profiles of mothers' MPPM Measurement by Supplement Level



The table (7.37) below shows estimates of the fixed effect. For mothers who have High Supplement Level, mean MPPM is 1.46[69] (g/min) lower than that of mothers with Low Supplement Level.

Table 7.37 MPPM (g/min) and Supplement Level: Estimates of Fixed Effects b

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	7.144251	.560010	39.255	12.757	.000	6.0118	8.2767
[SupplementLevel=HIGH]	-1.462728	.714746	39.810	-2.046	.047	-2.9075	-.01796
[SupplementLevel=LOW]	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: MPPM (g/min).

LMM provides a linear estimation for the model in table 7.37. It is estimated that mothers with High Supplements Levels produce 1.46 (g/min) less milk than mothers's with Low Supplements levels. The table below (7.38) shows the results of the Type III Test for fixed effects for the relationship between the variables Supplement Level (fixed effect) and MPPM g/min (dependent variable). The p-value of .047 is less than the significance level of .05. Therefore, there is a statistically significant difference in mean MPPM between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 7.38 MPPM and Supplement Level: Type III Tests of Fixed Effects a

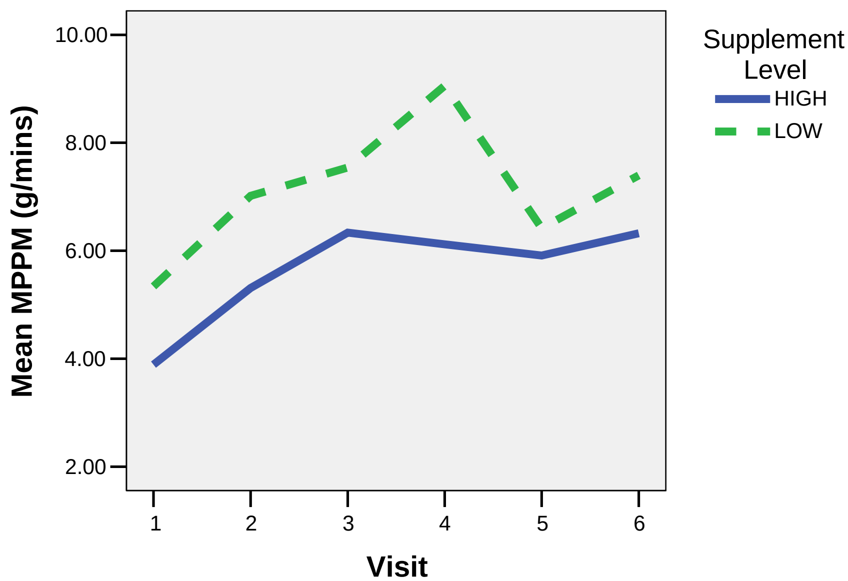
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.810	322.005	.000
SupplementLevel	1	39.810	4.188	.047

a. Dependent Variable: MPPM (g/min).

69 Again, as in the T-W case, MPPM 1.46 g/min is about half of the average MPPM (3.1 g/min) in Esmeraldas in the first 6 months.

Figure 7.13 below is a profile by supplement level, of the mothers' mean MPPM (g/min) measurements. Notice that mothers with high supplement levels had lower mean measurements than mothers with low supplement levels.

Figure 7.13 Mean MPPM by Supplement Level



Average Milk Produced Per Average Session (AMPPAS)

The table below (7.39) shows the results of the Type III Test for fixed effects for relationship between the variables Supplement Level (fixed effect) and AMPPAS (dependent variable). The p-value of .055 is greater than the significance level of .05. Although the p-value is close to .05, there is no statistically significant difference in mean AMPPAS between mothers who have Low Supplement Level versus those with High Supplement Level. The estimates of the fixed effect for mothers who have High Supplement Level was 6.79 (g) lower than that of mothers with Low Supplement Level.

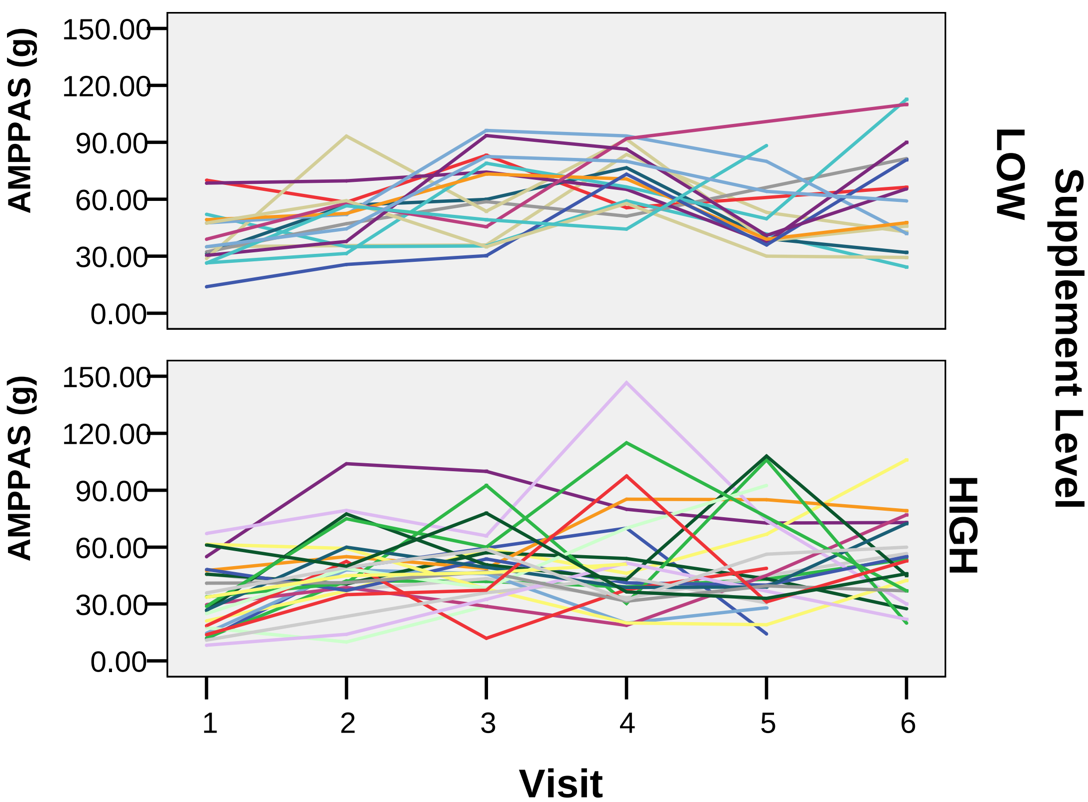
Table 7.39 AMPPAS and Supplement Level: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	37.883	710.571	.000
SupplementLevel	1	37.883	3.922	.055

a. Dependent Variable: AMPPAS (g/min).

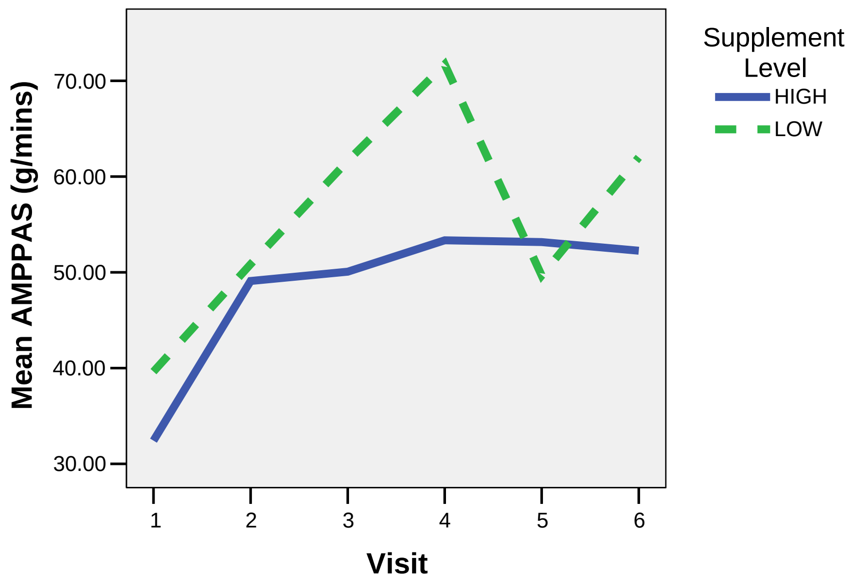
Figure 7.14 shows individual linear profiles of the mothers' AMPPAS (g) measurements paneled by supplement level; suggesting a pattern more similar to T-W than to MPPM (compare to Figure 7.10 and Figure 7.14). Nevertheless, like the other variables, high supplement level has lower profiles than the low supplement level.

Figure 7.14 Line Graphs: Individual AMPPAS by Supplement Level



The figure below (7.15) shows group profiles, by Supplement Level, of the mothers' mean AMPPAS measurements. Mothers with high supplement levels had lower mean measurements than mothers with low supplement levels, with the one exception of the fifth visit, where mothers categorized as low had a lower measurement.

Figure 7.15 Mean AMPPAS by Supplement Level



<u>Breastfeeding Structure Variables and Supplement Level</u>

Here I present the breastfeeding structure variables; NSS (times), TSD (minutes), AMS (minutes) and MID (minutes). For each of the four variables I use inferential statistics to show the relationship between breastfeeding structure variables and the supplement level for each variable (data was analyzed with repeated measures analysis using Linear Mixed Models -LMM).

Number of Suckling Sessions (NSS)

The table below (7.40) shows estimates of the fixed effect. For mothers who have High Supplement Level, mean NSS was 2.07 (times) lower than that of mothers with Low Supplement Level. As expected, mothers who used supplements breastfeed less frequently.

Table 7.40 NSS and Supplement Level: Estimates of Fixed Effects [b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	6.873226	.374398	38.457	18.358	.000	6.1156	7.6309
[SupplementLevel=HIGH]	-2.068674	.477191	38.795	-4.335	.000	-3.0340	-1.1033
[SupplementLevel=LOW]	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: NSS.

The table below (7.41) shows the results of the Type III Test for fixed effects for relationship between the variables Supplement Level (fixed effect) and NSS (dependent variable). The p-value of .000 is less than the significance level of .05. Thus, there is a statistically significant difference in mean NSS between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 7.41 NSS (Times) and supplement Level:Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	38.795	598.875	.000
SupplementLevel	1	38.795	18.793	.000

a. Dependent Variable: NSS.

Total Suckling Duration (TSD)

The table below (7.42) shows the results of the Type III Test for fixed effects for relationship between the variables Supplement Level (fixed effect) and TSD (dependent variable). The p-value of .088 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean TSD (min) between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 7.42 TSD (min) and Supplement Level: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.486	250.287	.000
SupplementLevel	1	39.486	3.064	.088

a. Dependent Variable: TSD (min).

Average Minutes Suckling (AMS)

The table below (7.43) is the Type III Test for fixed effects between the variables Supplement Level (fixed effect) and AMS (dependent variable). The p-value of .208 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean AMS between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 7.43 AMS (min) and Supplement Level: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.605	486.822	.000
SupplementLevel	1	39.605	1.639	.208

a. Dependent Variable: AMS (min).

Mean Intersession Duration (MID)

The table below (7.44) shows estimates of the fixed effect. For mothers who have High Supplement Level, mean MID is 105.57 (min) higher than that of mothers with Low Supplement Level, almost two hour difference higher than that of mothers with low supplement level.

Table 7.44 MID (min) and Supplement Level: Estimates of Fixed Effects [b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	109.0883	25.782267	38.037	4.231	.000	56.897	161.28
[SupplementLevel=HIGH]	105.5748	32.833138	38.292	3.215	.003	39.124	172.03
[SupplementLevel=LOW]	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: MID (min).

The table below (7.45) is the Type III Test for fixed effects between the variables Supplement Level (fixed effect) and MID (dependent variable). The p-value of .003 is less than the significance level of .05. Thus, there is a statistically significant difference in mean MID between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 7.45 MID (min) and Supplement level: Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	38.292	97.230	.000
SupplementLevel	1	38.292	10.339	.003

a. Dependent Variable: MID (min).

In summary, mothers with high MID level tend to have a high supplement level. It tells us that MID goes along with mothers giving supplements. However, statistically speaking, there is not a significant relationship (clear direction of causality) between these two variables.

Mothers who used high level of supplement have low T-W, low MPPM, longer MID and breastfed less frequently. The link between milk insufficiency beliefs and complaints by the various mothers, and the introduction of formula or other types of supplements, is an important one, because mothers who believed or perceive they did not produce enough milk would give supplements to their babies in an effort to help cope with what she perceived as milk insufficiency. However, the impact of the introduction of supplements created a new relationship and a new succession of events. Supplements began replacing breast milk once they were introduced. As a result, breast milk production diminished. At the same time, the baby increased its capacity to consume food. Von Kries et al. (1999) believe the indiscriminate use of supplements could get out of control, leading to early childhood obesity. In Esmeraldas, my research did show that supplementation produced bigger infants (this is commonly known) but the relationship to later childhood obesity is unclear. My informal observations were that women who supplemented more were themselves overweight, certainly this needs more research to be done.

Supplement consumption is a significant factor in the cessation of breastfeeding, and in the very least has a causal relationship to a diminishing or changed breastfeeding behavior. I think, one of the impacts that this debate on supplements vs. breastmilk and milk insufficiency is on the factor of “velocity” of consumption by the infant, versus the velocity of milk production by the mother. Supplementation and milk insufficiency complaint go hand in hand (Martens and Young 1997; Wilson et al. 2006). Many mothers started bottle-feeding because they perceived a milk insufficiency. There is a need to understand supplementation behavior and the physiology aspects of the mother (milk production, lactogenesis, endocrine-autocrine responses) and her child (infant growth and child obesity).

SUMMARY

In this chapter, I presented data and analysis on the more cultural or behaviorally related of my research questions, such as beliefs by the mothers about milk insufficiency. Then, at the end of this chapter, I covered a question on supplementation and its relationship to breastfeeding, behavior with a direct relationship to biology. This chapter presents a combination of ethnographic data and inferential statistics using Linear Mixed Model to answer some of the research questions of this thesis. The concept of milk insufficiency complaint (MIC) is used as a variable and replaces the concept of perceived milk insufficiency.

Mothers with the lowest income and those with the highest income shared similar high level of complaints about milk insufficiency and mothers in the high income level have a high supplement level. There is some relationship between income level and supplement level and education has a negative impact on breastfeeding in Esmeraldas. However, there was no statistical significance found between income level, education level and BCS. I think it is interesting that “middle” income women are doing better in terms of MIC and supplements than very poor or very well off; for one, it points to being able to fix the problem more easily, perhaps it’s not just “culture,” it’s that poor women are too busy trying to make ends meet, and richer women have disposable income to spend on “fancy” supplements like formula.

In March 1999, Ecuador underwent a severe economic crisis, which negatively impacted mothers' breastfeeding behavior. I conclude that a stressor like an economic crisis affects milk production and mothers' breastfeeding behavior. Breastfeeding patterns changed during the crisis. Mothers breastfed less frequently but in longer duration in each breastfeeding session. Interestingly, milk insufficiency complaints increased and milk production decreased.

Another important finding is that onset of lactation does not occur immediately after delivery. I found that onset of lactation began from 0-6 days in Esmeraldas. Mothers who had delayed onset of lactation tended to introduce supplements early, however, statistically speaking; there is not a significant relationship (clear direction of causality) between these two variables. Finally, mothers who used supplements substantially tended to produce less milk than mothers who used supplements sparingly.

CHAPTER 8

ANSWERING THE RESEARCH QUESTIONS

PART II

In this section, I answer the remaining research questions (6 through 9) posed in Chapter 4. These questions are predominantly biologically ones. For most of the inferential analysis, unless it is specified otherwise, the data were derived from group G2. The data was analyzed with repeated measures analysis using Linear Mixed Models (LMM).

Among the total sample of 72 mothers and their infants, 41 mothers at some point during the study presented with milk insufficiency complaints, which represents 57% of the total participants in this study. Among them, 12 mothers were from the first group (n=25), and 29 of the mothers were from the second group (n=47). This section will explore whether these mothers who complained about insufficient milk are in fact suffering from milk insufficiency.

In this chapter, I define MMI as measured low milk production. The criteria for measurable milk insufficiency (MMI) are also presented here. The question is what are the values that can be classified as insufficient milk production? We need to come up with a "reference range" that will give us some idea of what would be classified as low breastmilk production or milk insufficiency. In this chapter, I develop those parameters based on the literature and my own research; therefore, I show that there is something that we can measure as "actual" milk insufficiency (MMI).

6. HOW ARE BIOLOGICAL FACTORS LIKE PARITY AND AGE OF THE MOTHER RELATE TO MILK INSUFFICIENCY COMPLAINT AND MILK PRODUCTION?

First I am going to answer the question regarding milk insufficiency complaint (MIC) versus mothers' age and parity. Then I present a model for biological variables that includes: age of mother, parity, sex of infant, and when did your milk arrive or onset of lactation (OL), see also question 4. This model tested the breastmilk consumption structure as dependent variables. Nine mothers, three from the first group and six from the second, mentioned having some problems breastfeeding very early at the first month postpartum. From these nine, four have high age and high parity: One mother of 38 years with 9 children, one mother of 38 years with 3 children, one mother of 40 years with 4 children and one mother of 40 years with 13 children.

Mothers Age versus Milk Insufficiency Complaint (MIC)

This analysis used G1 and G2. Using the variable Age of Mother, a new variable, Mother's Age Category was created. Mother's Age Category divides Age of Mother into three categories. The first category is less than or equal to 25 years old, the second is greater than 25 but less than or equal to 33 years old, and the third is greater than 33 years old.

The table (8.1) is a cross-tabulation between Mother's Age Category and MI Complaint Level. For example, for mothers in the youngest age category, 4 (21.1%) of them have High MI Complaint Level while 15 (78.9%) have Low MI Complaint Level. But for mothers in the middle age category 13 (38.2%) have High MI Complaint Level, while 21 (61.8%) have Low MI Complaint Level.

Table 8.1 Mother's Age Category * MI Complaint Level Crosstabulation

			MI Complaint Level		
			HIGH	LOW	Total
Mother's Age Category	Less Than or Equal To 25 Years Old	Count	4	15	19
		% within Mother's Age Category	21.1%	78.9%	100.0%
	Greater Than 25 but Less Than or Equal To 33 Years Old	Count	13	21	34
		% within Mother's Age Category	38.2%	61.8%	100.0%
	Greater Than 33 Years Old	Count	4	9	13
		% within Mother's Age Category	30.8%	69.2%	100.0%
Total		Count	21	45	66
		% within Mother's Age Category	31.8%	68.2%	100.0%

The table (8.2) below displays the results of the Chi-Square test for independence between the variables Mother's Age Category and MI Complaint Level. The hypothesis is setup as follows: When testing at the 95% confidence level, the null hypothesis is not rejected because the p-value of .435 is greater than the significance level of .05. Thus, there is no statistically significant relationship between Mother's Age Category and MI Complaint Level.

Table 8.2 Chi-Square Tests for Mother's Age Category * MIC

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.667 [a]	2	.435
Likelihood Ratio	1.726	2	.422
N of Valid Cases	66		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.14.

Parity versus Milk Insufficiency Complaint (MIC)

This analysis also uses G1 and G2. Using the variable Parity, a new variable, Parity Level was created. Parity Level divides parity into two categories. The first category is less than or equal to 5 children and the second is greater than 5 children. The table below (8.3) is a cross-tabulation between Parity Level and MI Complaint Level. For mothers with 5 or fewer children, 17 (31.5%) of them have High MI Complaint Level while 37 (68.5%) have Low MI Complaint Level. For mothers with more than 5 children, 4 (33.3%) have High MI Complaint Level, while 8 (66.7%) have Low MI Complaint Level.

Table 8.3 Parity Level * MI Complaint Level Crosstabulation

			MI Complaint Leve		Total
			HIGH	LOW	
Parity Level	Less Than or Equal To 5 Children	Count	17	37	54
		% within Multiparity Level	31.5%	68.5%	100.0%
	Greater Than 5 Children	Count	4	8	12
		% within Multiparity Level	33.3%	66.7%	100.0%
Total		Count	21	45	66
		% within Multiparity Level	31.8%	68.2%	100.0%

The table below (8.4) displays the results of the Chi-Square test of independence between the variables Parity Level and MI Complaint Level. As with mothers age variable, there is no statistically significant relationship between Parity Level and MIC Level (p value = .901). Thus, there is no statistically significant relationship between Parity Level and MI Complaint Level.

Table 8.4 Chi-Square Tests for Parity Level * MI Complaint

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.016[b]	1	.901
Likelihood Ratio	.015	1	.901
N of Valid Cases	66		

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.82.

Breastmilk Consumption Structure (BCS)

The table below (8.5) is a fixed effects model, which models Test Weighing (g/h) and MPPM (g/min) and AMPPAS (g) as the dependent variables and Sex of Child, Age of Mother, Parity (as multiparity), and When did your milk arrive as the independent variables (the fixed effects). Since Age of Mother, parity, and When did your milk arrive are interval data, they are modeled as covariates. The model also indicates that the repeated effect is the variable Visit since the measurements were taken at different visits.

Table 8.5 Biological Model Dimension

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables	Number of Subjects
Fixed Effects	Intercept	1		1		
	SexofChild	2		1		
	Ageofmother	1		1		
	Multiparity	1		1		
	WhendidyourMilkArriveh	1		1		
Repeated Effects	Visit	6	Compound Symmetry	2	ID	42
Total		12		7		

Test-Weighing (T-W)

The table below (8.6) is the Type III Test for fixed effects. It shows that none of the fixed effects are significant with respect to the dependent variable Test Weighing (g/h). The p-value for Sex of child is .344, the p-value for Age of Mother is .370, the p-value of Multiparity is .481, and the p-value for When did your milk arrive is .758. All p-values are above .05. In conclusion, there was no relationship between the biological model and the Test Weighing (g/h).

Table 8. 6 Biological Model: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	36.002	12.828	.001
SexofChild	1	36.258	.920	.344
Ageofmother	1	36.028	.823	.370
Multiparity	1	35.378	.507	.481
WhendidyourMilkArriveh	1	35.812	.097	.758

a. Dependent Variable: Test Weighing (g/h).

The table below (8.7) provides the grand mean for this model. Test weighing grand mean for this model was 23.491(g/h). It showed the mean for all the mothers considered in this analysis. And table 8.8 showed the mean test weighing (g/h) of mothers with female infants versus mothers with male infants. Female infants were consuming 3.052 g/h (36.62g/12h) more than male infants; nevertheless it was not statistically significant.

Table 8.7 T-W (g/h) Grand Mean a

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
23.491	1.460	35.947	20.529	26.453

a. Dependent Variable: Test Weighing (g/h).

Table 8.8 T-W and Sex of Child b

Sex of Child	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
F	25.017	2.420	35.930	20.110	29.925
M	21.965	1.864	36.431	18.185	25.744

b. Dependent Variable: Test Weighing (g/h).

Milk Production Per Minute (MPPM)

MPPM (g/min) is the dependent variable in the biological model. The table below (8.9) is the Type III Test for fixed effects. The p-value for Sex of child is .944, the p-value for Age of Mother is .587, the p-value of Multiparity is .541, and the p-value for When did your milk arrive is .272. All p-values are above .05. Results showed that none of the fixed effects were significant with respect to the dependent variable MPPM (g/min).

Table 8.9 MPPM (g/min) and Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	36.681	13.233	.001
SexofChild	1	37.032	.005	.944
Ageofmother	1	36.703	.300	.587
Multiparity	1	35.726	.381	.541
WhendidyourMilkArriveh	1	36.313	1.246	.272

a. Dependent Variable: MPPM (g/min).

The table 8.10 provides the grand mean for this model. The grand mean for this model was 6.166 g/min. The next table (8.11) provides the mean MPPM (g/min) of Mothers with female infants versus mothers with male infants. There was almost no difference in MPPM (g/min) between male and female.

Table 8.10 MPPM (g/min) Grand Mean a

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
6.166	.374	36.605	5.409	6.923

a. Dependent Variable: MPPM (g/min).

Tale 8.11 MPPM (g/min) and Sex of Child b

Sex of Child	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
F	6.194	.619	36.529	4.940	7.449
M	6.137	.478	37.358	5.169	7.106

b. Dependent Variable: MPPM (g/min).

Average Milk Produced Per Average Session (AMPPAS)

AMPPAS (g), as the dependent variable versus the biological model, has similar results to the other two variables, T-W (g/h) and MPPM (g/min). The biological model did not show statistical significance with respect to the dependent variable AMPPAS (g). The p-value for sex of child is .267; the p-value for age of mother is .760; the p-value of parity is .841; and the p-value for when did your milk arrive is .536. The table 8.12 showed the mean AMPPAS (g) for all the mothers considered in this analysis.

Table 8.12 AMPPAS (g) and Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	35.245	13.685	.001
SexofChild	1	35.615	1.273	.267
Ageofmother	1	35.264	.095	.760
Multiparity	1	33.687	.056	.814
WhendidyourMilkArriveh	1	34.444	.391	.536

a. Dependent Variable: AMPPAS (g).

The table 8.13 provides the grand mean for this model. It show the mean AMPPAS of 51.429 g for all the mothers considered in this analysis, Table 8.14 provided the mean AMPPAS (g) of Mothers with female infants versus mothers with male infants. It showed a difference of 5.282 g. However, this is not statistically significant.

Table 8.13 AMPPAS (g) Grand Mean a

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
51.429	2.142	35.023	47.082	55.777

a. Dependent Variable: AMPPAS (g).

Table 8.14 AMPPAS (g) and sex of Child b

Sex of Child	Mean	Std. Error	df	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
F	54.071	3.545	34.904	46.873	61.268
M	48.788	2.751	36.090	43.209	54.367

b. Dependent Variable: AMPPAS (g).

I summarized as follow: There is no correlation between age and parity and MIC. There is no correlation between age and parity and BCS. Interestingly, contrary to the literature, T-W and AMPPAS were greater for female infants than for male infants in Esmeraldas city, but not significantly so.

7. IS THERE ANY DIFFERENCE IN NUTRITIONAL STATUS (BMI) AND MILK INSUFFICIENCY COMPLAINTS, AND WHAT IS THE RELATIONSHIP OF NUTRITIONAL STATUS AND MILK PRODUCTION AND FAT?

A repeated measures analysis using Linear Mixed Models was then used to test if there was a statistically significant relationship between BMI and means of MIC level, supplement levels, Test weighing, MPPM, AMPPAS. For each mother, the mean BMI was calculated using the BMI recorded for each visit. The mean BMI was then categorized based on the CDC guidelines. From the total sample of 72 mothers, the BMI categorizes 39 of the mothers as normal, while 21 were overweight and 11 were obese. Only one mother, from the first group, was classifying as underweight (see chapter 6 for more). Only G2 was used for the following statistical analysis. The sample size is 42.

Milk Insufficiency Complaint Level and BMI

The table 8.15 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and BMI (dependent variable). The p-value of .182 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean BMI between mothers who have Low MI Complaint Level versus those with High MI Complaint Level.

Table 8.15 BMI and MIC: Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.956	1375.414	.000
MIComplaintLevel	1	39.956	1.846	.182

a. Dependent Variable: BMI (kg/m).

Supplement Level and BMI

The table 8.16 is the Type III Test for fixed effects between the variables Supplement Level (fixed effect) and BMI (dependent variable). The p-value of .865 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean BMI between mothers who have Low Supplement Level versus those with High Supplement Level.

Table 8.16 BMI and Supplement Level: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.963	1489.356	.000
SupplementLevel	1	39.963	.029	.865

a. Dependent Variable: BMI (kg/m).

BMI and Test Weighing (T-W)

The table 8.17 is the Type III Test for fixed effects between the variables BMI (fixed effect) and Test Weighing (dependent variable). The p-value of .884 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean Test Weighing for the different Weight Status categories.

Table 8.17 BMI and T-W: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	37.688	223.207	.000
WeightStatus	2	37.716	.124	.884

a. Dependent Variable: Test Weighing (g/h).

BMI and Milk Production Per Minute (MPPM)

The table 8.18 is the Type III Test for fixed effects between the variables Weight Status (fixed effect) and MPPM (dependent variable). The p-value of .584 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean MPPM for the different Weight Status categories.

Table 8.18 BMI and MPPM: Type III Tests of Fixed Effect a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	38.840	253.824	.000
WeightStatus	2	38.885	.545	.584

a. Dependent Variable: MPPM (g/mins).

BMI and Average Milk Produced Per Average Session (AMPPAS)

The table 8.19 is the Type III Test for fixed effects between the variables Weight Status (fixed effect) and AMPPAS (dependent variable). The p-value of .816 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean AMPPAS for the different Weight Status categories.

Table 8.19 BMI and AMPPAS: Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	36.585	546.094	.000
WeightStatus	2	36.653	.204	.816

a. Dependent Variable: AMPPAS (g).

Again, there were no statistically significant differences between women who differ in BMI for the three variables: T-W, MPPM and AMPPAS.

BMI and Milk-Fat

Fat is a variable derived from creamatocrit. I calculated the effects of the variables BMI (fixed effect) and Fat (dependent variable) by using linear mixed models. The p-value of .897 proved that there was no statistically significant difference in mean Fat for the different weight status categories (see table 8.20). The total fat average for the first six months was 44 g/l (see chapter 6), which was higher than the 41g/l reported by Kent et al. (2006) among Australian women. In both of my study and Kent et al., the milk fat content was not considered as low.

Table 8.20 BMI and Milk Fat: Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.365	453.231	.000
WeightStatus	2	39.315	.109	.897

a. Dependent Variable: Fat (g/l).

That is apparently not the case among Turkana mothers in Kenya (Gray 1998). The poor dietary intake during the dry season resulted in low fat concentration in breastmilk. (No milk fat value was cited for comparison). According to the literature (Frisancho 1993; Gray 1998; Jelliffe & Jelliffe 1978; Prentice et al.1981a, 1981b), malnourishment of mothers may negatively affect the production and fat composition of breastmilk.

In conclusion, there was no correlation between weight status of the mother and other variables presented above: milk insufficiency complaint; supplements level; test weighing; milk production per minute; average milk produced per average-session and milk fat composition. Perhaps this was due to the fact that no mothers in this study could be considered malnourished. In addition, there was no difference in the nutritional status between mothers who complain of milk insufficiency and those who did not. And there was no relationship between mothers' nutritional status (BMI) and milk production.

8. ARE MOTHERS WHO COMPLAIN OF MILK INSUFFICIENCY ACTUALLY PRODUCING LESS MILK? HOW IS THE PERCEPTION OF MILK INSUFFICIENCY RELATED LONGITUDINALLY TO AN ACTUAL REDUCTION IN MILK SUPPLY?

When asked whether or not they produced or had enough milk, mothers who complained of milk insufficiency, or believed that they did not have enough milk, or felt the lack of milk in their breasts, would quickly and easily answer the question with a "no." However, a complaint of milk insufficiency by mothers should not necessarily be translated as a lack of production of breast milk. The opposite may also be true. There are cases when mothers complain of milk insufficiency, but they may actually produce a sufficient amount of breast milk measured by the breastfeeding consumption structure (BCS).

In other cases, we found the milk insufficiency complaints were legitimate and true. As one of my assistants noted, the collection of milk sample could be difficult. "You could see that the breast did not have milk," showing some lack of breast milk at that particular moment, as the mothers had felt. We also found that some mothers in this study had a stable production of milk, frequency of breastfeeding sessions, and never complained of milk insufficiency.

In another variation to those above, there was one mother that produced plenty of milk, yet at some point she showed a decline in milk production and began complaining of milk insufficiency. This mother was still able to produce more milk than the previously mentioned case. These findings revealed three things: first, there is certain subjectivity to the complaint; second, there exists a certain ambiguity or "puzzlement" by the mothers about their own milk production, or breastfeeding awareness; and third, there are certain criteria to be taken into consideration in how we define milk insufficiency in terms of milk volume (see next question for an answer).

For example, in case 33, a 38 year old mother, poor, who never complained of milk insufficiency, began introducing formula a few months after the baby was born. She explained to us that the baby did not get full with her breast milk alone. However, the mother never complained of milk insufficiency. During our third visit, she had a few long breastfeeding sessions and one of those lasted 29 minutes (perhaps because the baby was sick during this visit). The mother's total production of milk at this time was 228 g/12h, with a MPPM of 2.9gr/min; low in comparison with the average.

During our next visit, she breastfed for the longest period of time (from her all visits) with a TSD of 104 minutes/12h, in 7 sessions, with an AMS of 14.8 minutes. The total production of milk was 644g/12h, which was above average. Also during this visit, her milk production had increased almost three times, in comparison with our previous visit. This particular mother continued to have long sessions for the next series of visits.

When I came back in May 2001 (see research schedule chapter 4), we learned that she had breastfed for a year and nine months. She told us she continued to breastfeed because she was still producing milk. This was a successful breastfeeding case. However, it easily could have been a case of complaint of milk insufficiency with early weaning. This was in part due to the mother's persistence in coping with forces that work against breastfeeding, such as age, poverty, early introduction of supplements, and initial inadequate production of milk.

Undoubtedly, it is not just the mother's point of view which matters; it is also the way in which each complaint is translated. The complaint of milk insufficiency is subjective and complex; it has to be analyzed from different angles. And there should be certain parameters to measure low production of milk within a specified age range (which should be the at least the first six months of infant age).

MIC Level and Breastfeeding Structure

Among the variables that compose breastfeeding structure, inferential statistics showed a statistically significant relationship between MIC level and NSS (times) and MID (minutes). And there were not a statistically significant relationship between MIC level and TSD (minutes) and AMS (minutes).

MIC Level and Number of Suckling Sessions (NSS)

The table 8.21 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and NSS (dependent variable). There is a statistically significant difference in mean NSS between mothers who have low MIC level versus those with high MIC level (p-value = .008). For mothers who have high MIC level, as the reader could see, the mean NSS is 1.57 lower than that of mothers with low MIC level.

Table 8.21 MIC Level and NSS (times):Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.981	355.619	.000
MIComplaintLevel	1	39.981	7.787	.008

a. Dependent Variable: NSS.

The table 8.22 shows estimates of the fixed effect. For mothers who have High MI Complaint Level, mean NSS is 1.57 (times) lower than that of mothers with Low MI Complaint Level.

Table 8.22 MIC Level and NSS (times): Estimates of Fixed Effects b

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	6.074705	.310560	39.304	19.560	.000	5.4467	6.7027
[MIComplaintLevel=HIG	-1.566097	.561215	39.981	-2.791	.008	-2.7004	-.43182
[MIComplaintLevel=LOw	0[a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: NSS.

MIC Level and Total Suckling Duration (TSD)

The table 8.23 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and TSD (dependent variable). The p-value of .076 is greater than the significance level of .05. Thus, there was no statistically significant difference in mean TSD (minutes) between mothers who have Low MIC level versus those with high MIC level.

Table 8.23 MIC Level and TSD (min): Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	40.176	194.284	.000
MIComplaintLevel	1	40.176	3.329	.076

a. Dependent Variable: TSD (min).

MIC Level and Average Minutes Suckling (AMS)

The table 8.24 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and AMS (dependent variable). The p-value of .807 is greater than the significance level of .05. Thus, there is no statistically significant difference in mean AMS of mothers who have low MIC level versus those with high MIC level.

Table 8.24 MIC Level and AMS (min): Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	40.233	435.792	.000
MIComplaintLevel	1	40.233	.061	.807

a. Dependent Variable: AMS (min).

MIC Level and Mean Intersession Duration (MID)

There is a statistically significant difference in mean MID of mothers who have Low MI Complaint Level versus those with High MI Complaint Level (p = .022). The table below shows estimates of the fixed effect. For mothers who had High MI Complaint Level, mean MID was 87.14 minutes (almost one hour and a half) higher than that of mothers with Low MI Complaint Level. This means that women who complain of milk insufficiency do breastfeed less frequently than those who complained less. And one could expect that MID is increased among women who have a high milk insufficiency complain level. The table below (8.25) is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and MID (dependent variable).

Table 8.25 MIC Level and MID (min): Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	39.367	109.833	.000
MIComplaintLevel	1	39.367	5.708	.022

a. Dependent Variable: MID (min).

The table (8.26) below shows estimates of the fixed effect. For mothers who have High MI Complaint Level, mean MID was higher than that of mothers with Low MI Complaint Level.

Table 8.26 MIC Level and MID (min): Estimates of Fixed Effects b

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	147.5607	20.209855	38.825	7.301	.000	106.68	188.44
[MIComplaintLevel=HIG	87.143301	36.475236	39.367	2.389	.022	13.387	160.90
[MIComplaintLevel=LOW	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: MID (min).

Breastmilk Consumption Structure (BCS)

Presented here are individual profiles of the mothers' test weighing, MPPM, and AMPPAS measurements paneled by MIC level. Each line represents a different mother and the figures show the mother's measurement for the above variables at each visit. For each of the three variables (T-W, MPPM and AMPPAS), mothers with high MI Complaint Levels had lower mean measurements than mothers with low MI Complaint Levels.

MIC Level and Test Weighing

The table (8.27) below is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and Test Weighing (dependent variable). The p-value of .001 is less than the significance level of .05. Thus, there is a statistically significant difference in mean Test Weighing of mothers who have Low MI Complaint Level versus those with High MI Complaint Level. Table 8.28 shows estimates of the fixed effect. For mothers who have high MIC level, mean test weighing is 9.49 g/h (113.88 g/12h), lower than those with low MIC level.

Table 8.27 MIC Level and T-W (g/h): Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	40.362	264.025	.000
MIComplaintLevel	1	40.362	13.097	.001

a. Dependent Variable: Test Weighing (g/h).

Table 8.28 MIC Level and T-W (g/h): Estimates of Fixed Effects [b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	26.036303	1.446139	39.158	18.004	.000	23.112	28.961
[MIComplaintLevel=HIGH	-9.485285	2.620944	40.362	-3.619	.001	-14.781	-4.1896
[MIComplaintLevel=LOW	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: Test Weighing (g/h).

Looking at the figures below (8.1 and 8.2) we could see clearly that mothers who had a high MIC tend to have a lower test weighing, or I could say that mothers with a low MI complain level produce more milk than mothers with a high MI complaint level. Notice also the number of line in the two categories; low MIC has the higher number.

Figure 8.1 Line Graphs: MIC Level by T-W

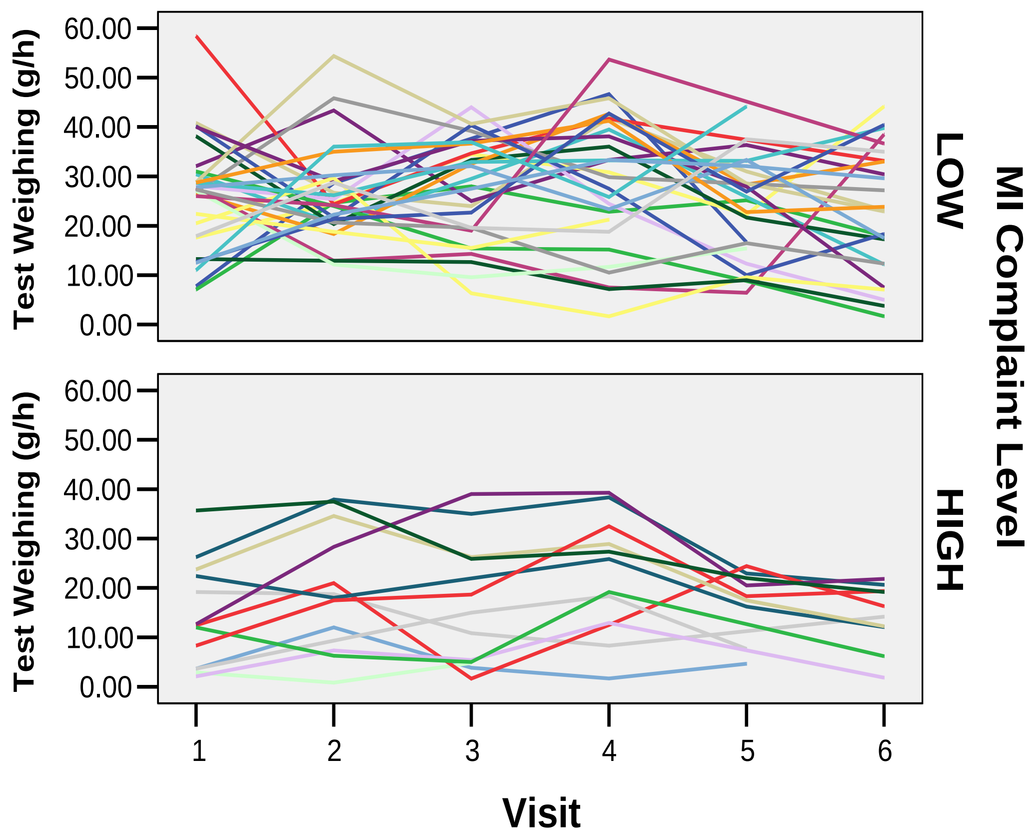
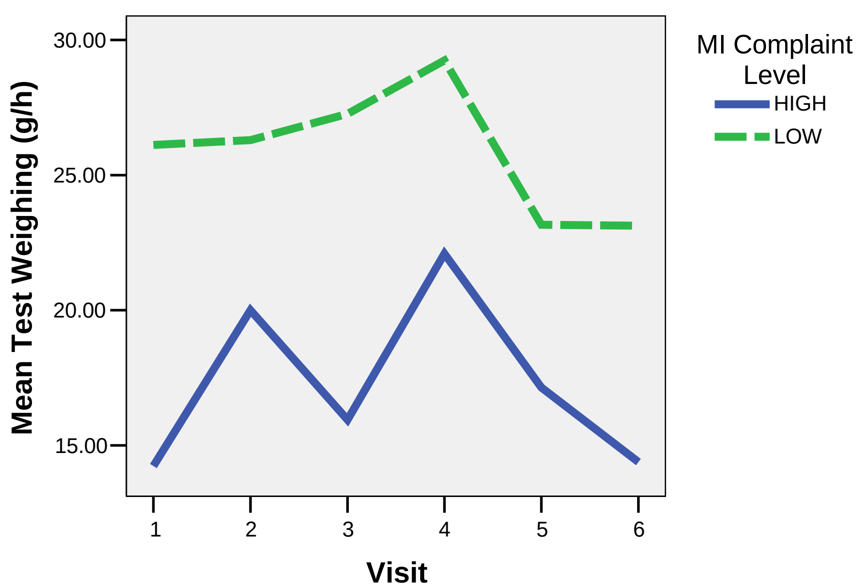


Figure 8.2 MIC Level by Mean T-W



MIC Level and Milk Production Per Minute (MPPM)

The table 8.29 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and MPPM (dependent variable). The p-value of .216 is greater than the significance level of .05. Although mothers with high MIC levels had lower mean measurements than mothers with low MIC complain level, there were no statistically significant difference in mean MPPM between mothers who have low MIC level versus those with high MIC level.

Table 8.29 MIC Level and MPPM (g/min): Type III Tests of Fixed Effects a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	40.914	240.771	.000
MIComplaintLevel	1	40.914	1.581	.216

a. Dependent Variable: MPPM (g/min).

Notice in figure 8.3, there were fewer cases on the high MIC level than low MIC level. The figure below (8.4) shows the relationship between MPPM (g/min) and MIC level. Again the mothers with a low MIC level did produce more milk per minute than the mothers that have a high MIC level. Notice a drop in the 5th visit, which may be related to the 5th month factor (see answer to question 3).

Figure 8.3 Line Graphs: MIC Level By MPPM (g/min)

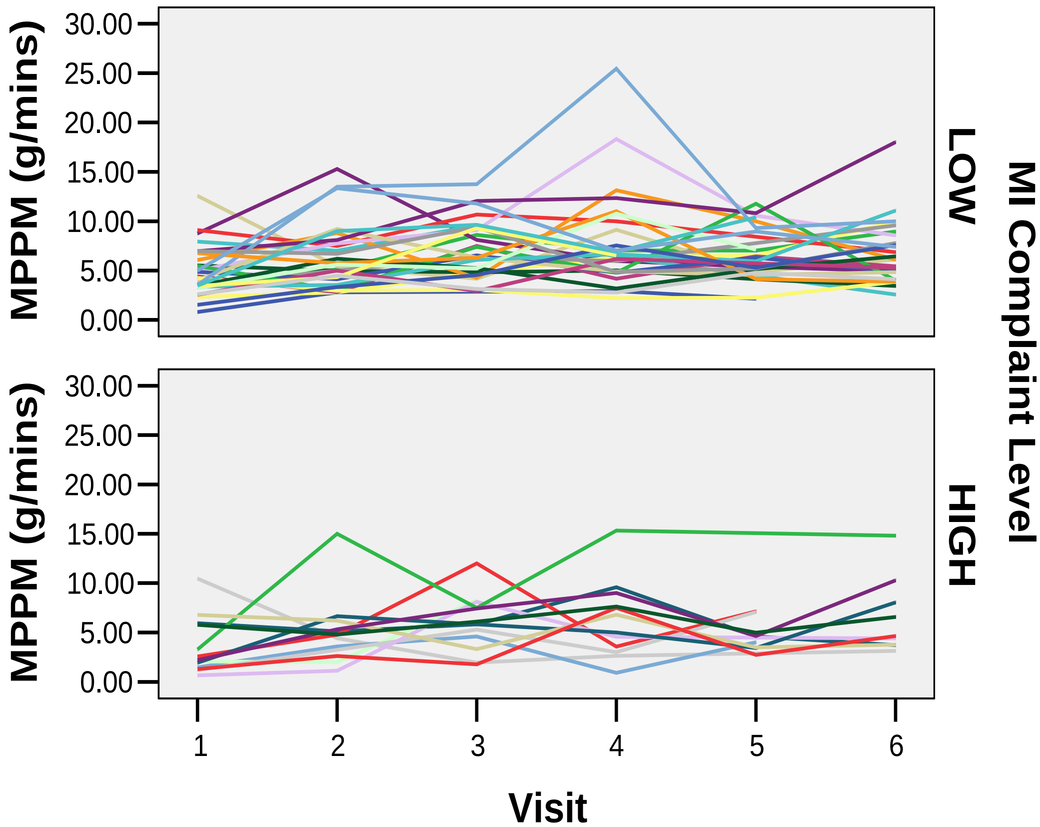
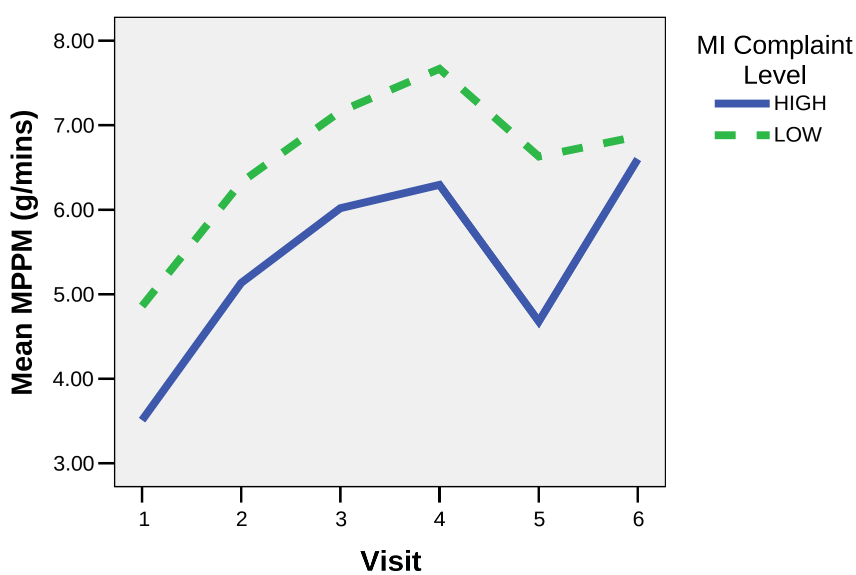


Figure 8.4 MIC Level by Mean MPPM (g/min)



MIC Level and Average Milk Produced Per Average Session (AMPPAS)

The table 8.30 is the Type III Test for fixed effects between the variables MI Complaint Level (fixed effect) and AMPPAS (dependent variable). The p-value of .018 is less than the significance level of .05. Thus, there is a statistically significant difference in mean AMPPAS (g) between mothers who have Low MI Complaint Level versus those with High MI Complaint Level Level. The table 8.31 shows estimates of the fixed effect. For mothers who have High MI Complaint Level, mean AMPPAS is 10.12 g, lower than that of mothers with Low MI Complaint Level.

Table 8.30 MIC Level and AMPPAS (g): Type III Tests of Fixed Effects [a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	40.066	584.312	.000
MIComplaintLevel	1	40.066	6.134	.018

a. Dependent Variable: AMPPAS (g).

Table 8.31 MIC Level and AMPPAS (g): Estimates of Fixed Effects [b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	54.424803	2.228110	37.532	24.426	.000	49.912	58.937
[MIComplaintLevel=HIGH]	-10.1159	4.084540	40.066	-2.477	.018	-18.371	-1.8612
[MIComplaintLevel=LOW]	0 [a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: AMPPAS (g).

Next, in the figures below (8.5 and 8.6) we could see a similar picture as with TW above. Low MIC has the higher number of women. Clearly, mothers who had a high MIC tended to have a lower AMPPAS (g).

Figure 8.5 Line Graphs: MIC Level by AMPPAS (g)

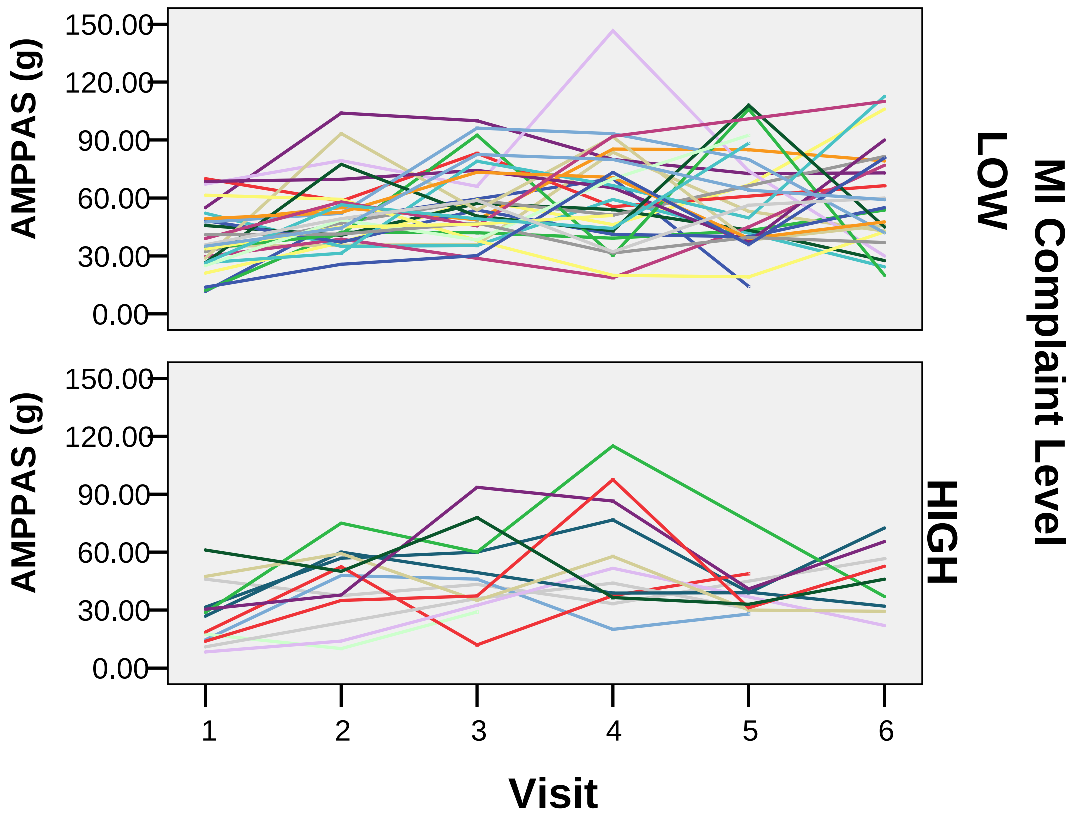
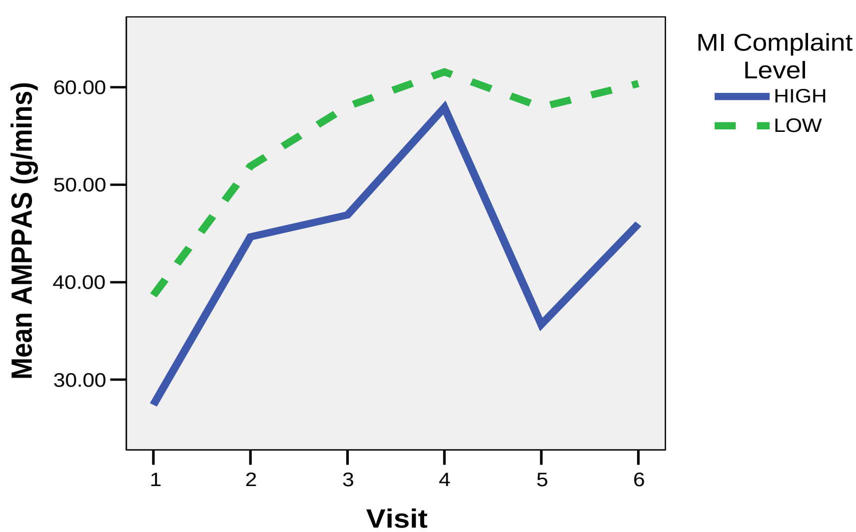


Figure 8.6 MIC Level by Mean AMPPAS (g)



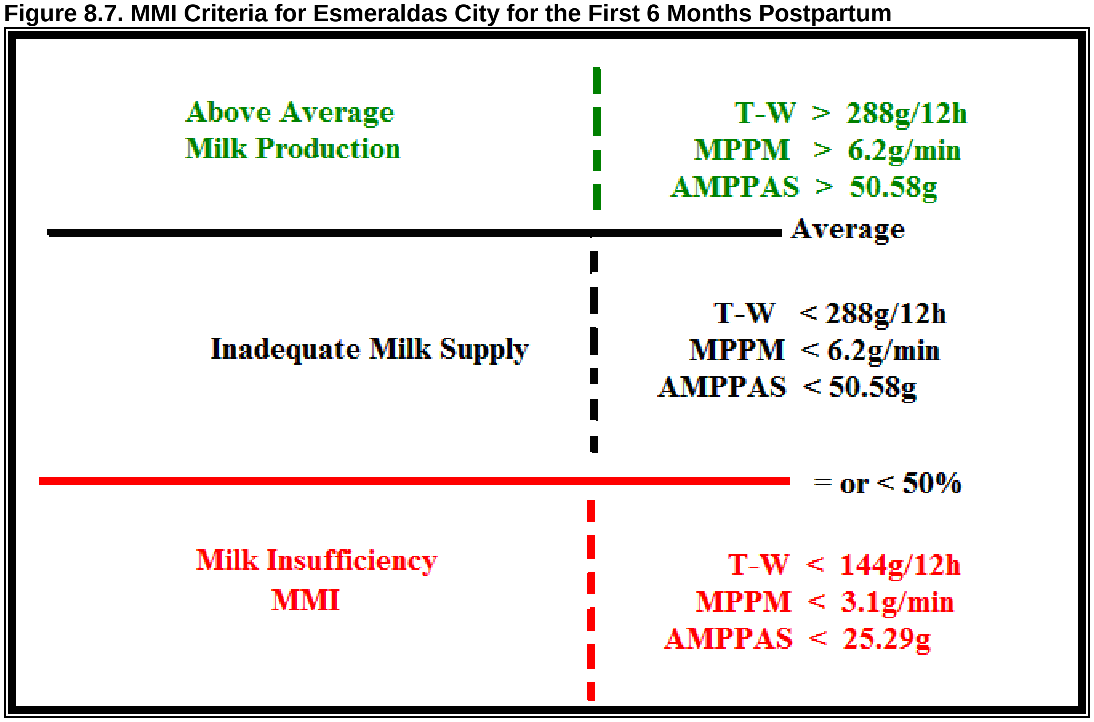
In summary, there is a statistically significant relationship among MIC (milk insufficiency complaints), NSS and MID. Mothers with more MI complaints breastfed the least and had longer intersessions. In addition, there is a statistically significant difference between BCS and MIC. In other words, mothers who complained about milk insufficiency did produce less breast milk and breastfed less frequently. In terms of a biological model, I did not find a relationship among the age of mother, parity, BCS, BMI, milk fat and MIC.

9. IS THERE A MEASURABLE PHENOMENON THAT WE CAN LABEL AS MILK INSUFFICIENCY INDEPENDENT OF A MOTHER'S PERCEPTION OR COMPLAINT?

Defining milk insufficiency in general, and indeed in Esmeraldas, has been difficult. There should not be a general assessment on milk insufficiency. We may want to look at the mother-baby-point of view, T-W measurements or the production of milk, nutritional status, creamatocrit, and/or the literature. The amount of breastmilk an infant drinks is based on mother's milk production, baby's hunger, time of the day, session length time, mid-intersession duration time, left or right breast, milk fat quantity and other factors not described here. Any of these factors can change the amount of milk that a baby consumes or mother produces. There are a lot of factors playing in just one feeding session, including mother-infant dyad's adaptation.

In order to answer this last question, I first review some of the literature as a departing point for this particular analysis to set up some parameters for discussion. I am going to use Hill et al.'s (2006) criteria and terminology. According to Hill et al., "inadequate" milk supply at 6 weeks is defined as $\leq$ 500 ml/day (which they also called milk insufficiency). From there I assume that "adequate" milk supply at 6 weeks is anything $\geq$ 500 ml/day. To me, "inadequate" milk supply is not equivalent to milk "insufficiency," rather it represents "less" milk supply, from the mother to the infant, than the average produced by a particular group of mothers, at any particular time but not necessarily chronically. Based on this research, I am going to define measured milk insufficiency (MMI) as when a mother "chronically" or "overall average" produced half the average or less, on more than one average variable of T-W (g), MPPM (g/min) or AMPPAS (g), within a particular time and culture. Therefore, in Esmeraldas, inadequate milk supply will be less than 288g/12/h (24g/h) at any particular time in the first 6 months. And milk insufficiency will be equal or less than half of the average which would be 144g/12h (12g/h) within the first 6 months. For that matter, milk adequacy per month in Esmeraldas is ≥ 288g/12h within the first 6 months of infant's age. Based on the above MI criteria, any cases with MPPM ≤ 3.1g/min (average for the first 6 months was 6.2 g/min), and AMPPAS ≤ 25.29g (average for the first 6 months was 50.58g) could be considered as MMI cases. (See figure 8.7, below.)

Figure 8.7. MMI Criteria for Esmeraldas City for the First 6 Months Postpartum



Three Cases

Now, I will present three cases, 23, 30, and 43 that could be considered, at some point, as having MI (see figures 8.8, 8.9 and 8.10). Let's start with 1. Case (30): a 40 year old mother with five children including our subject, weight 59kg and height 1m 62cm.

The mother works as a teacher and is neither poor nor Afro–Ecuadorian. She considers herself to be white. The mother complains from the start that she is not producing enough milk. On our first visit, we found the mother using massive amounts of formula to feed her 15 day old baby. The baby consumed a total of 25g of breastmilk and 85g of formula. Notice that 3 times more formula is given than the amount of breastmilk. Although she breastfed the baby for a total of 38 minutes in 3 sessions, her total milk production was just 25g, with a MPPM of 0.6 g/min which is certainly a low amount. Comparing these results with those of the other mothers, we find the AMS to be an average of 12 minutes per session, but her MID was prolonged. Giving the baby formula resulted in fewer breastfeeding sessions and longer intercessions between each individual breastfeeding session.

On our second visit, the mother began breastfeeding and ended with a bottle. The baby then fell asleep. The mother also put the bottle in the baby's mouth when he was asleep. When the baby inadvertently sucked on the bottle with formula, he would wake up crying. The mother would normally begin breastfeeding with one breast, then after 11minutes change to the other breast and finish with a bottle. Nevertheless, she only produced 44g within a TSD of 62 minutes in 5 sessions, with a MPPM of 1.1gr/min. The creamatocrit was low, only 2.3%. This result demonstrates that she clearly produced very little breast milk. Even though the average length of session was the same when compared to that of the other mothers, 12 minutes.

On our third visit, the mother only breastfed twice. The T-W was only 65g, and the ceamatocrit was 1%. By now we notice that the baby became restless, and as a result we had many difficulties measuring it. There is some correlation between supplements and baby's behavior. This baby grew very quickly and became large (see anthropometry). As I previously mentioned, the mother was a school teacher, and needed to get back to work at some point. Therefore, she had to make the decision to feed the baby formula from this point on. This is one explanation for the use of formula in this case.

On our fourth visit, the mother informed the assistant that *el bebé ya no quiere coger el seno* ("the baby doesn't want to take the breast," which was a common explanation by the mothers for their infants' behavior). We found this to be an interesting statement because we noticed the opposite. The baby did not want formula at first, and cried when he was fed the formula. The mother then began the practice of giving the baby formula when he was asleep. And now, at 3½ months, the baby only wants formula. This is true in three other cases. During this fourth visit, the baby received 290g of formula versus 155g of breastmilk, for a total intake of 445g/12h.

During the fifth visit, the infant's sister tried to give the baby formula but the infant rejected it. The family informed us that the infant will drink formula only when the mother begins breastfeeding and ends with formula. We saw the above as an adaptation to the bottle, or we can allege to supplements. Because of a transportation strike taking place during this visit, no cars were allowed on the streets, which prevented us from bringing our scale, and therefore there was no T-W done this trip.

On our sixth visit, the mother only breastfed once for 5 minutes with a total breastmilk production of 22g, a MPPM of 4.4g, and creamatocrit of 2.5%. On our seventh visit, there was no breastfeeding, only formula. In May 2001, the mother told us that she breastfed until 1y 2m, because she had to go back to work. In addition, she now has another child. She told us that she was not breastfeeding this new child because she did not produce breastmilk.

2. Second case (23): A 34 year old mother, with 6 children including our subject, one child was deaf. Her weight was 80kg and height 1m 58cm. The mother is Afro-Ecuadorian, who complained of milk insufficiency, and also had an inverted nipple. During the first visit, she used formula even though she was very poor. She sold grilled plantains called *maduros*, on the corner near her house. The baby was brought to the mother to breastfeed during the day because she worked so close to home. The baby was then taken back home by family members. During the first visit, the mother had a total of 246g of breastmilk, with an MPPM of 4.2g/min, for which in this study was not considered as too low. On our second visit, she breastfed for a long time, 120 minutes in 12h, with an average of 20 minutes per session, but her MPPM was only 2.9 g/min.

On our third visit, the mother's total milk production per 12h was only 76g, with a TSD of 25 minutes. Sessions were becoming longer, not shorter. The baby was sick with the flu, and had a fever, making it difficult to breath, so she took the baby to the *Subcentro*. The mother came back with some medication and some vitamins. The mother fumigated the house with diesel fuel because there were so many flies and insects, including mosquitoes, in the house. Since she lives close to the river, her house frequently gets flooded during the rainy season. The mother worked the whole day taking care of her family. She worked extra hours in the afternoon so she could afford the medication needed for her infant. Later on during the day, she helped some of the other children with their homework. She also fed the baby a supplement, *colada de arroz de cebada y zanahoria* (cracked barley and carrot porridge).

During our fourth visit, the mother breastfed for a long session. The mother told us that she did not have enough money to buy formula, and that is why she gave *coladas* to the baby. The mother only had one breastfeeding session of 9 minutes during the observation, with a production of only 20g, and a MPPM of 2.2g/min, which was low. She also gave a total of 586g of supplements to the baby, with a supplement consumption per minute of 20.9gr/min. Interestingly, this mother did not produce enough milk, and yet she did not complain anymore. In any case, the creamatocrit was above the average, 10%.

On the fifth visit, the mother gave the baby supplements, with help from the baby's brother who prepared the bottle with *colada de verde* and cow's milk. The mother reported to us that the baby had a fever, and she gave him acetaminophen (mother did not know why the baby was sick, and could not take the baby to the doctor because she did not have any money). We also learned that her eldest daughter gave birth 10 days ago. The daughter lived close to the mother's house, and the mother was also helping her daughter with her new grandchild.

During our sixth visit, the mother had rather long breastfeeding sessions of 11 minutes, and a low milk production of 85g, with a low MPPM of 3.8g/minute, and a creamatocrit of 4%. The baby had a fever, and we noted that this baby had been sick during almost all our visits (see anthropometry). The mother gave the baby *temprax* for its fever. The mother was exhausted at the end of this visit.

In the interview of May 2001, mother told us that she breastfed her baby for 1y 6m because she got pregnant again. At the time of this interview, she already had the new baby, who was 4m old. Now, at this point, she said she was producing a lot of milk. In addition, she had moved one block down from where she had been living previously.

<u>3. Last case (43)</u>: A 40 year old mother, with 14 children including our subject, poor, and mother with a weight of 58kg and height 1m 60cm. They were not Afro-Ecuadorian, nor white (the house was so small that in the living room where we stayed, there was hardly enough space to place one of our scales). The mother complained of MI, and said that she had breast milk until she had her fourth daughter, and then she didn't have enough anymore. This mother showed low numbers for all variables, including a creamatocrit average of 4.7%.

On our first visit, for the creamatocrit we were only able to collect a couple of drops. She also demonstrated a very low MPPM of 1.2g/min, even though the rest of our results such as TSD of 75 minutes in 7 sessions, with an AMS of 10.7 minutes, showed us that the mother did spend some time breastfeeding the baby. Also during this visit, the mother gave tea (*agua de ruda* 2 Oz) to her 6 day old baby daughter. On our second visit, we got a creamatocrit of 3.5%, with the total production of breastmilk a relatively low 210g/12h. The average sessions were 13 minutes with the TSD of 80 minutes which gave us a low MPPM of 2.6g/minute.

On our next visit, the mother breastfed for a longer period of time, with a TSD of 120 minutes, with average sessions of 21 minutes, every 1h1/2. Total production of milk (using both breasts) was 224g, which was low for fourth month averages, however the significant number here was her MPPM of just 1.7g/minute. In addition, at one point during this visit, the mother used formula, and the baby drank 108g of formula in 7 minutes, with a SCPM of 15.4g/minute. This is nine times more than that of breastmilk. The amount of formula the baby drank, 108g in 7 minutes, was almost half the total breastmilk intake. It took the mother 12h to produce the same volume (of breastmilk).

This mother used both breasts to breastfeed in all sessions. Many mothers used just one breast, or at least for the entire duration of any single session. She clearly has low milk production.

On this day, both the mother and the baby were not feeling well. The mother was tired and complained of having a headache, as well as the flu. The baby also had the flu, which explained why the baby was crying a lot. During this visit, the mother let the baby cry for a while, because as she explained it, when she finally did start to breastfeeding, the baby "would eat with desire." According to the mother, *"que llore por un rato, para después amamantarla y como con ganas."* This was a common assumption among many Esmeraldan mothers. They assumed infants were not really hungry, or they did not have much of an appetite as the first sign of crying. According to the mothers, the infants liked to be attached to the breast, so the mothers simply let them cry for awhile before feeding them. This education in which the babies "learn to be hungry," or rather, "learn to eat with desire," may also be seen as a justification or an explanation for breastfeeding less frequently (see anthropometry).

Our fifth observation was only for 8h1/2. This was due to a religious service which was taking place below the house. During this visit, we had a consistently low creamatocrit of 4%, with a low MPPM of 2.7g/min. However, we found that the AMS was of 11.4 minutes, which was enhanced relative to the average time for a session. On our next visit, the numbers were more or less the same as the ones taken during our previous visit. There was an increase on the MPPM to 4.6g/min, which was still on the low side, and an AMS of 11.3 minutes.

Figure 8.8 T-W (g/h):Three Cases

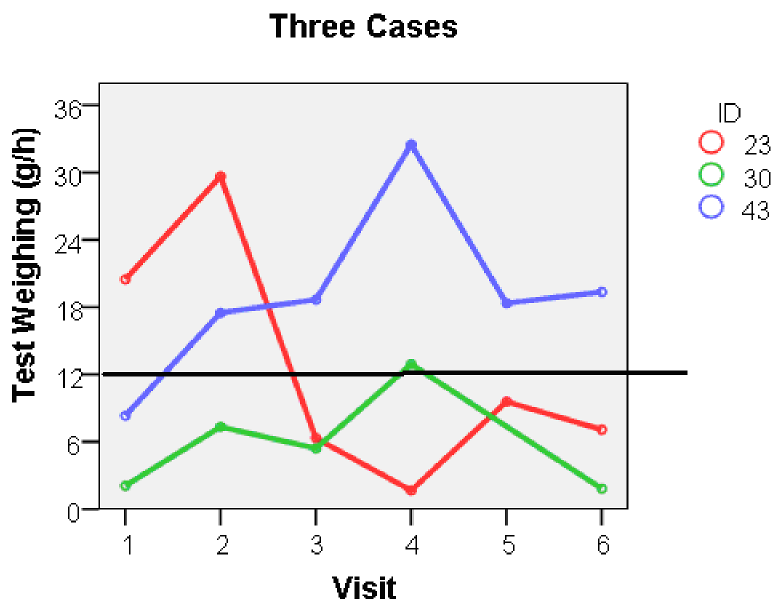
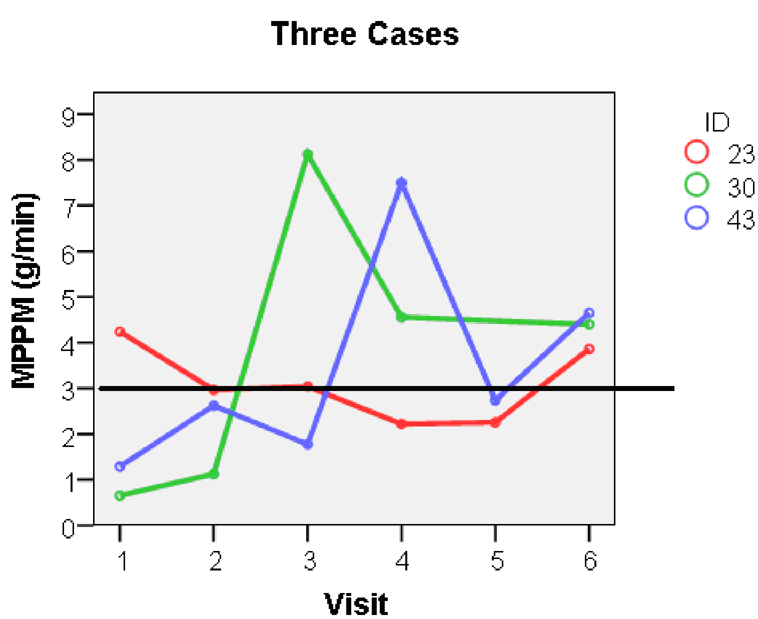
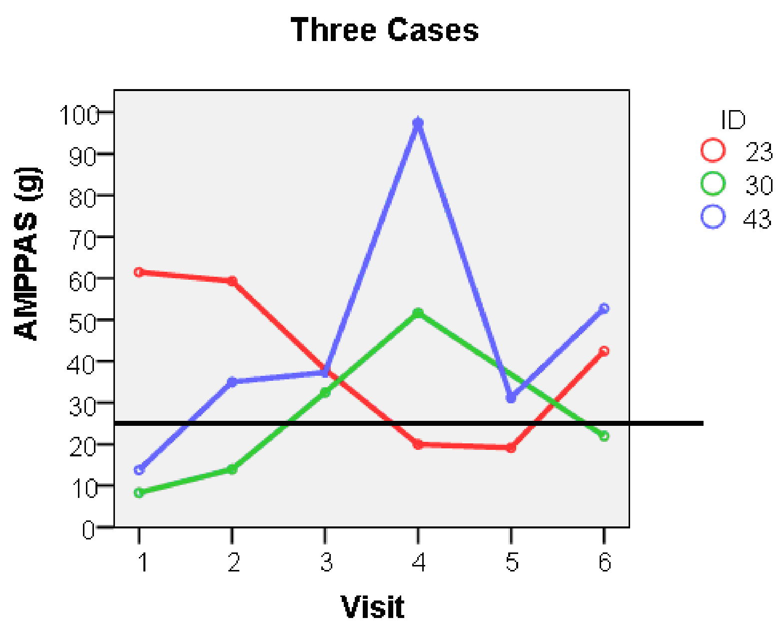


Figure 8.9 MPPM (g/min): Three Cases



There were no further visits with this family. They told us that the mother had left Emeraldas for another town but I suspected that mother did not want us to be at her house anymore. Perhaps she did not want to be part of the research for some other reason that I was never able to find out. This explained why we had some gaps in information during the third month of the infant's life.

Figure 8.10 AMPPAS (g): Three Cases



We were able to locate this mother and child again after 1 ½ years. She was now five months pregnant (it will be her 15th child). She told us that she breastfed our subject for 1y and 7m, because the baby did not want to breastfeed anymore.

Potential MI Cases

Next I present seven cases that had, from the entire sample, the lowest average on Test weighing (g/12h) during the course of this research. Case 1 and case 28 had a low MIC, the rest had a high MIC. Case 26 and 16 were also discussed in the supplementation section in question 5.

Figure 8.11 Potential MI Cases, A

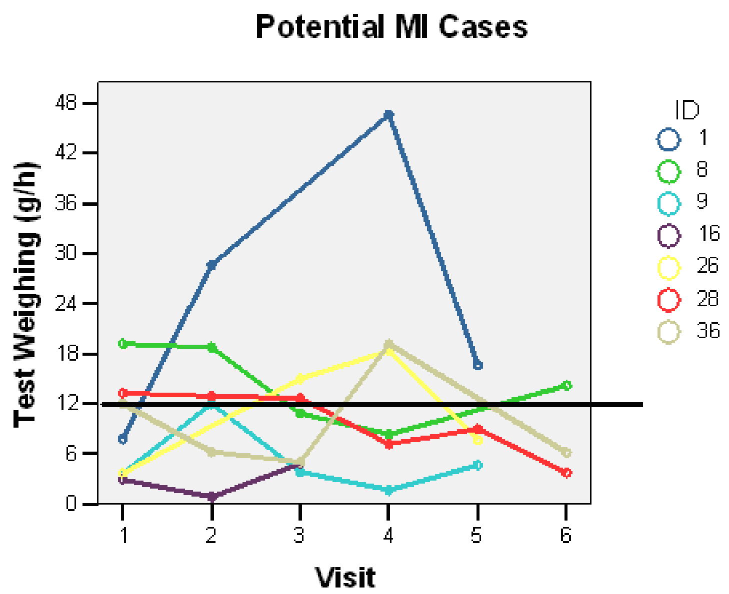
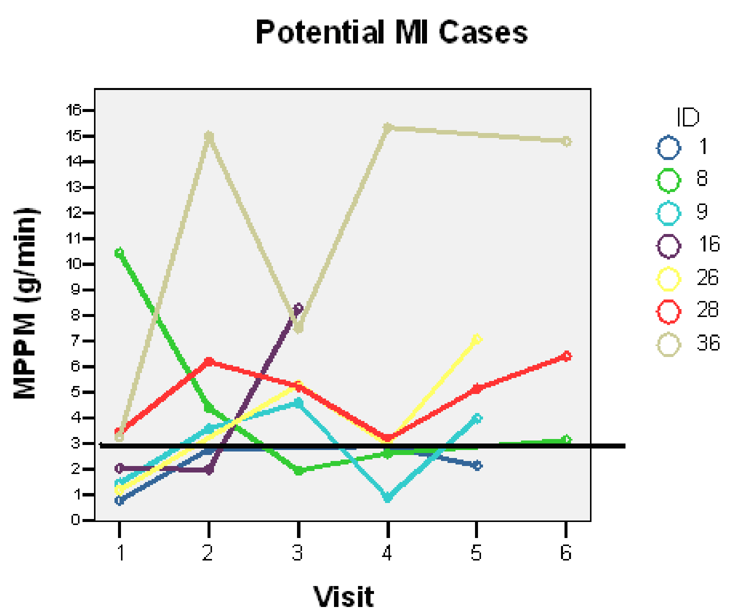
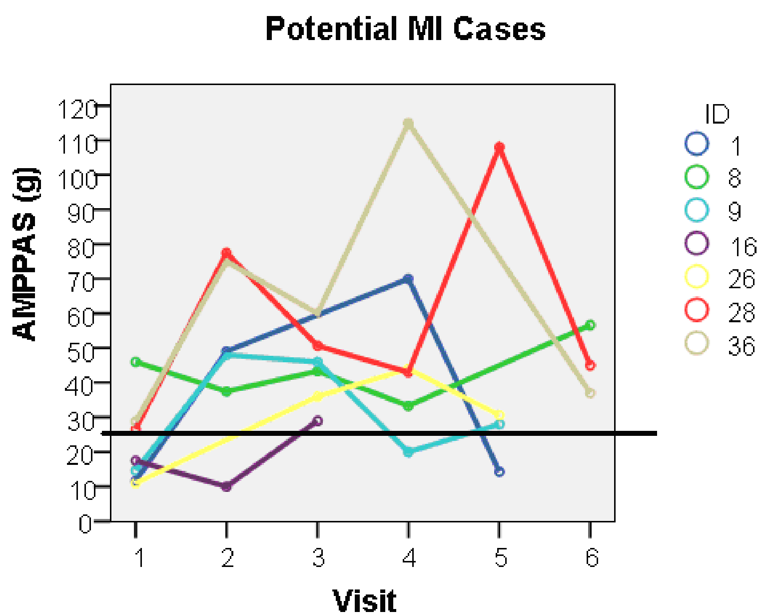


Figure 8.12 Potential MI Cases, B



As presented in question 8, there is statistical significant among between Milk Insufficiency Complaint and NSS and MID. Mothers with more MI complaints breastfed the least and had a longer intersession. In addition, mothers who complained the most about milk insufficiency did produce less breast milk and breastfed less frequently. Figures 8.11 to 8.13 present these seven cases; the black line represents the criteria for MMI. Cases below the line are potential cases for MMI.

Figure 8.13 Potential MI Cases, C



In conclusion, based on my own criteria, there is something that we could measure as milk insufficiency or MMI. Again, MMI is defined as when the means for at least two variables in BCS are chronically lower than 50% of the average. As a consequence, the average breastmilk intake for that infant is lower than the average breastmilk intake in that particular infant population or culture. From these figures, many of the potential MI cases could be considered as measurable milk insufficiency (MMI) cases, at least at some point during the research. This is because they were consistently low on more than one of the three variables, T-W, MPPM and AMPPAS. Although those measurements may not feasible in other environments, the MI criteria can be applied to any population.

Extrapolating Breastmilk Consumption Structure (BCS)

Based on the breastfeeding data from Esmeraldas, I extrapolated BCS in order to have an idea of how much breastmilk mothers "should" give to their infants. The graphs presented below are extrapolations based on the data for the variables, MPPM and AMPPAS. The smooth Blue Line (BL) curves shows what "should" be milk production per infants' age in the case of Esmeraldas. For instance, at the 5th month, both graphs show small sinks in actual production. Figures 8.14 and 8.15 could be used to extrapolate what the MPPM (~7.5g/min) and AMPPAS (~60g) should be at this particular (5th month) juncture in time.

Figure 8.14 Blue Line: MPPM (g/min) Extrapolation

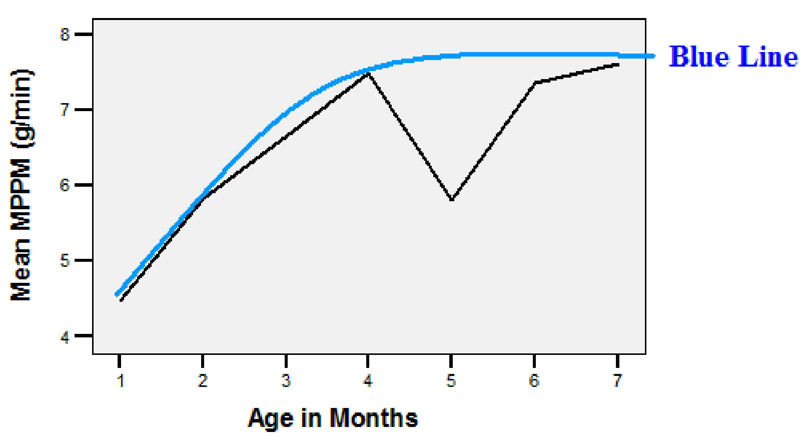
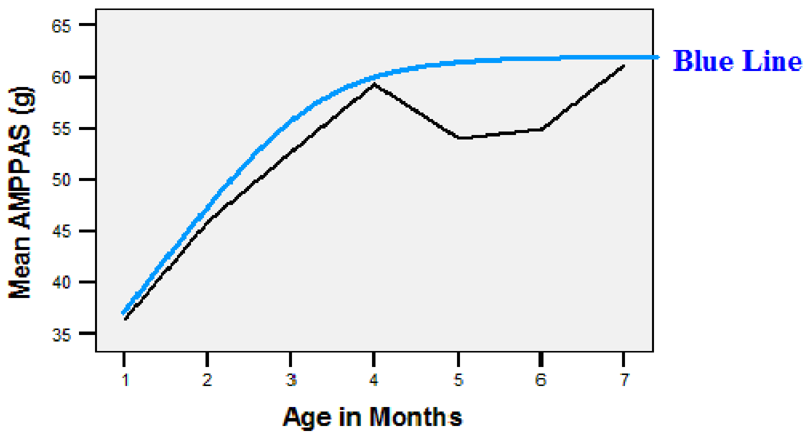


Figure 8.15 Blue Line: AMPPAS (g) Extrapolation



This extrapolation allows us to determine how much milk mothers “should” give to their infants based on their breastfeeding pattern. In other words, how much milk an infant drinks per average session at a particular age. Using the Jelliffes’ statistics, for example, in order to achieve the 300g/12h milk intake at 6th month of age, women in Esmeraldas should breastfeed at least 5 times per 12 hours, assuming that breastmilk production and consumption by the infants are constant. MPPM tell us how much milk per minute a mother is producing regardless of her breastfeeding length and frequency. For example, we could have the same MPPM result in two mothers with a totally different breastfeeding structure. This type of extrapolations should be population and culture specific.

SUMMARY

In this chapter, the questions have an emphasis more on biology than on culture. I presented a biological model which include age of the mother, parity, onset of lactation, sex of the infant and BMI. I found no relationship between the biological model and milk insufficiency complaints (MIC). There was no correlation between BMI and milk fat composition. There was also no relationship between MIC and milk fat composition.

Women with high level MIC tended to produce less milk. As we found in chapter 7, these women with high level MIC used supplements. They also produce less milk than women who has less MIC. Women who complain about milk insufficiency do change their breastfeeding behavior or they have MIC because they changed their breastfeeding behavior.

In conclusion, based on the 3 variables (T-W, MPPM and AMPPAS), I formulate a criteria to define measured milk insufficiency or MMI: mothers who produce less than or equal to half of the average amount of breast milk in that particular population are considered as having MMI. I propose using the term Milk Inadequacy to describe those who produce a less than average amount of breast milk and yet produce more than those who meet the criteria for MMI. Further research still needs to be done on this subject.

CHAPTER 9

DISCUSSION AND CONCLUSIONS

This research in Esmeraldas has shown that it is quite difficult to define milk insufficiency. Nevertheless, in this thesis and based on the variables T-W, MPPM and AMPPAS, I defined milk insufficiency as when mothers produced less than or equal to half of the average amount of breastmilk produced in a particular population. Then these mothers are considered as having measurable milk insufficiency (MMI). However, in this dissertation, I also looked at the milk insufficiency problem from cultural, psychological and biocultural perspectives, so I would like to include a discussion on the topic that considers more than just measurable variables. I conclude with a narrative presentation and table presenting the unique findings of this research in Esmeraldas.

MY OWN PERSPECTIVE

Neither Bio Nor Folk

Theories of diseases' causation vary amongst peoples, and between regions. This is not supposed to occur with biomedical and pathological entities or diseases, although it does happen. Biomedical professionals therefore try to fit the above-mentioned occurrences into a category of their own. The highest goal in biomedicine is to reach the correct diagnosis. In contrast, different folk beliefs accommodate this cultural plasticity, in the quest for health. As we saw in the case of Esmeraldas, folk medicine and biomedicine are not different milieus, but rather ethnomedicines. Mothers consult with both. Furthermore, their visions of health and illness have incorporated both explanatory models. Interestingly, folk medicine incorporates biomedical explanations in its explanatory models today, and increasingly biomedicine is trying to incorporate traditional healing processes and therapies into its domain. In attempting to understand the dynamics of these ethnomedicines, the study of milk insufficiency in Esmeraldas demonstrated that strategies for breastfeeding success and handling breastfeeding problems are complex matters. The women have their own cultural interpretations of breastfeeding problems and they are lactating in a particular environment within a specific historical, political and economic context, which has to be taken into account. In the folk sector, we should continue to gather information on how cures or remedies develop, and in the process, how people come to believe what is the correct treatment for illness.

Who is Lodging the Complaints?

Is there milk insufficiency, or not? The answer could be; it depends on which point of view we are asking the question from. What does it mean to define milk insufficiency from “different points of view”? In order to answer this, I first must ask the question, who is doing the complaining? The “complaint” of milk insufficiency can come from the mother/infant and the local professionals including physicians as well as social scientists. In the first case, milk insufficiency complaint could be asserted simply because the mother perceives this is the case. From the mother’s point of view, breastfeeding is obvious within her own cultural assumptions: Obvious in the sense that it is just a natural mammalian response that she experiences as part of her natural life course after having a child; and yet she has her own cultural assumptions about what is happening.

What the mothers think and say about their milk insufficiency problems is important. They create their own explanatory models. In response to external factors, such as the economic crisis in Ecuador, mothers conjure up their own explanation of illnesses. MIC is very important because it triggers a chain of events that can end in early weaning and lack of milk production (see inferential statistic results).

Professional advice can be a source of the problem. Sometimes professionals create confusion among mothers who are breastfeeding or considering breastfeeding. Mothers accept/adopt some of the professionals' recommendations, about supplements for example, without a sense of bewilderment. Advice from professionals that has inconsistency has also made mothers confused about breastfeeding.

Pre and Post Onset of Lactation

Three important factors may play a role in postpartum milk insufficiency. First, onset of lactation may not necessarily occur during the first hours after birth. Second, the infant's stomach capacity itself is very small. According to La Leche League (2006) and Minchin (1985), the infant's stomach size at birth is as small as a marble (size 5-7ml), and by day seven, the newborn's stomach capacity is just about 1.5-2 oz, the size of a ping-pong ball. Third, mothers as well as health personnel (due to lack of knowledge) get worried and introduce immediately any kind of pre-onset or post-onset supplementation. By doing so, it may potentially cause mothers to lose confidence in their ability to produce milk and in turn trigger MIC (although statistical analysis did not show a significant relationship between supplement level and MIC in this study). An early milk insufficiency complaint could change the behavior of breastfeeding very early with unwanted consequences. Formula (or for that matter any other supplements) is more difficult to metabolize than breastmilk (Lawrence 1994). I observed in this study for example that infants tend to sleep more and suckle less when they are given formula.

Left or Right

Milk Insufficiency complaints could also be linked to the "autocrine" breast factor, which is an "independent" capacity of each breast to produce milk (lactogenesis III). Mothers used mostly one breast to breastfeed, whether left or right. In Esmeraldas, it is common that mothers use one breast more frequently than the other. Interestingly, every mother/infant pair has their own pattern of breastfeeding; in time, sessions with approximately the same minutes; choice of breast either right or left (mostly right), or both. The production of breastmilk may be different between breasts.

Let us consider some examples about infant rejection of one breast in favor of the other breast. According to one mother, her baby likes the right breast more than the left breast. Or, as another mother reports, the milk from the right breast is clearer and less thick than the milk of the left breast, so she breastfeeds the baby mostly from the left breast. A third example is a mother with a fussy baby who alternates both breasts because she does not produce enough milk. Infants in one way or other communicate with their mothers with clear signals. For example, an infant appears uncomfortable, so the mother changes breasts because she thinks that there may not be more milk in that breast, she uses the other breast, where apparently there was not much milk. Mother alternates her breasts from one to the other, balancing production or intake, but oftentimes infants are the ones who decide to end the breastfeeding sessions.

The Night Factor

Twelve-hour observation and measurements will not yield the complete picture of breastfeeding behavior without knowing what happens during the other 12h during the night. We should look at this data as such; just what happens during the day, but breastfeeding could be more intense during the night. As the daytime activities have ceased, the mother is less stressed, and she can spend more time with the baby including sleeping with the baby. Breastfeeding during the nighttime is important in coping with the lack of breastfeeding during the day. Children can sleep while they are suckling (Ball 2007; McKenna and Volpe 2007).

Extrapolating, I may assume that the behavior of the day is the same during the night (it may be true in certain cases, but it is definitely not the rule). Mother and child have to come into consensus on breastfeeding patterns. Furthermore, a mechanism of compensation or adaptation may be in place. Extrapolation could not be a correct approach. Each mother-child dyad develops an adaptation or compensation mechanism that goes with their particular life activities.

Velocity of Breastmilk Production and Consumption

We need to consider the velocity of milk production by the mother and consumption by the baby. For example, I saw an 18-day-old baby that consumed as much formula as 30g per minute and as little as 5g of breastmilk in 8 minutes of lactation. Breastmilk consumption was very little in comparison to the amount that this baby could drink from a bottle of formula. Certainly, mothers cannot “deliver” as quickly as a bottle can; however, the question is how much a baby can consume in one session. As infants grow, their capacity for milk intake increases tremendously. Mothers could also produce a lot of milk in just one small session (i.e., 54g in 2 minutes). However, they may not produce much even though they have a prolonged session (i.e., 58g in 15 minutes that is a session over 7 times longer than the previous example).

The duration of the breastfeeding session is not a factor in calculating milk production. I think the velocity of milk production may play a bigger role in MIC. Milk insufficiency will exist only at particular moments of time and under particular conditions. Again, I think some times the complaint could be about speed of production rather than inadequate milk-production.

Stress Theory and Plasticity

There is an adaptation process to the mother's pattern of breastfeeding, so that even a scheduled pattern will function as a normal way of breastfeeding between mother and child as long as both adapt to these patterns. While Gussler and Breisemeister (1980) in their article on "Insufficient Milk Syndrome" argue that scheduling is part of the problem, I think scheduling should not matter. Because the important thing is not so much one particular moment of behavior that the mother spends or shares with the baby breastfeeding, but the mother-child adaptation to the whole breastfeeding pattern that a particular mother and infant develop during lactation. Each mother has her own way of breastfeeding. While sessions differ between mothers, sessions are clearly defined for each mother. Some breastfeed continuously for short or long periods, while other mothers breastfeed just for a few occasions or few times, separated by a long hiatus. In this sense, breastfeeding is totally "on demand" in Esmeraldas. Each mother-child develops a pattern of breastfeeding, within a larger cultural pattern of breastfeeding. What matters at the end is the ability of both mother and infant to cope with different pattern of milk production, in other words, the differences in duration and frequency of the breastfeeding session as well as the differences in daytime vs. nighttime milk-production.

Age of weaning does not depend on the production of milk, rather on the beliefs of the mother. It could be a case of lack of milk (as many cases presented here) but mothers continue to breastfeed. It could also be a case of good milk production but the mother decides to stop breastfeeding due to work. Biology does not determine culture. Everything points to behavior. Adaptations to different behavior lead to successful breastfeeding. Stress theory can give us a clue to cultural-biological dynamics. Stress is a force that triggers a plastic process in human, to adapt and re-adapt.

For McEwen (2002), stress is seen as a force that changes homeostasis or equilibrium. Alternatively, in the words of Sapolsky (1998:7) stress refers to the notion that different circumstances demand different homeostatic set points. The first component of the stress response, also called the fight-or-flight response, triggers a chain of biological changes. The hypothalamus triggers a signal to the adrenal glands, which in turn secretes the first stress hormones epinephrine or adrenalin. The second response is triggered by the hypothalamic-pituitary-adrenal axis (HPA axis). The axis also exerts influence on oxytocin secretion and milk let down. According to Newton (Hill et al. 1999; McEwen 2002; Lawrence 1994), stress may interfere with adequate lactation by suppressing oxytocin and prolactin. In summary, chronic stress has a negative impact on homeostasis.

On the other hand, plasticity is an ongoing process where culture interacts with biology. The brain possesses extraordinary structural and functional plasticity that allows the environment and culture to exert influences on it. This modeling and remodeling, tuning and adaptation, occurs throughout the life span. "The closely interconnected interactions and plasticity across levels, thus, form an integral whole of biocultural constructive influences on human development" (Li 2003). Nevertheless, stress interrupts the normal time that the mother uses to breastfeed the infant. Mother and infant may adapt to the schedule to cope with this lack of time from the mother. These stress interruptions and adaptation and again interruptions remodel the biology that occurs during the life span of the mother. A population under historically chronic strain will also have the same changes over time. Armelagos et al. (1996) made the point that humans, through history, have been constantly adapting to environmental changes, but that the changes are not always an improvement. I think, unfortunately, that milk insufficiency is a "real problem" in this way that is already here, just not in large numbers, yet. We should pay attention to it.

CONCLUSIONS

As part of the conclusions, I present next the unique findings of this research that may help future researchers to understand better milk insufficiency and lactation in humans. First, I will present summary statistics of important findings related to childbirth in Esmeraldas, Breastfeeding Structure (BS) and Breastfeeding Consumption Structure (BCS). Finally, I present in the form of a table (9.1) inferential statistics showing the unique findings of this research summarizing answers to the basic research questions.

Childbirth and Early Lactation in Esmeraldas

About the Delivery Site, in Esmeraldas the former practice of usually giving birth at home has changed. There is a marked decline in children delivered by *parteras* (or traditional birth attendants) at home, in favor of delivering children by doctors, at the hospital. I found that 45 of the 72 mothers (62.5%) delivered at a hospital, 19 mothers (26.4%) delivered at home, 7 (9.7%) delivered at a clinic, 2.8%, and 1 mother (1.4%) delivered her child at a doctor's office.

In Esmeraldas, Co-Sleeping or bed sharing with the infant is the rule. Sixty-five (65) of the seventy-two mothers (representing 90.3%) slept with their infants on the first night and seven (7) mothers (representing 9.7%) did not sleep with their infants on the first night. The majority of the mothers did not follow the old practice in the hospital, where the newborns were kept away from their mothers right after birth. And interestingly, even though some mothers did believe that Colostrum was bad for their infants, in this research, all the mothers fed colostrum to their infants.

I find very important the Onset of Lactation results and its behavioral implications. The time of onset of lactation was of particular interest because some mothers had milk before they gave birth and others produced milk as late as six days after birth. Here are the summary statistics for the variable When Did Your Milk Arrive for the First Time in hours. The mean time was 40.24 hours (almost two days). The earliest arrival time of mother's milk was before delivery and the longest was 144 hours (6 days). The timing of onset of lactation is critical in the mother's confidence and attitudes. It is particularly important to how mothers establish their lactation behavior towards their infant (Grajeda and Perez-Escamilla 2002).

Last, about the Sex of Child, thirty-eight of the 72 children (52.8%) were male and 34 (47.2%) were female. As I mentioned before, in Esmeraldas families wish for a boy more than a girl.

Breastfeeding Structure (BS)

Results for Breastfeeding Structure were presented in four variables, Number of Suckling Sessions (NSS), Total Suckling Duration (TSD), Average Minutes Suckling (AMS) and Mean Intercession Duration (MID). The mean average for NSS in Esmeraldas in the first seven months was 5.6 times or sessions per 12/hour. The mean average of TSD in Esmeraldas in the first seven months was 50 minutes (almost one hour). The mean average length of time a baby was attached to the breast per session, or AMS was 9 minutes. And the mean average MID in the first seven months was 170 minutes (or 2 hours and 50 minutes).

Breastfeeding Consumption Structure (BCS)

As part of Breastfeeding Consumption Structure I presented results of Test Weighing (TW), Milk Production Per Minute (MPPM) and Average Milk Produced Per Average Session (AMPPAS). The importance of BCS variables is that they represent both behavior and biology. Hill and Aldag (2005) and Hill et al. (2005), defined adequate milk supply as maternal milk production of equal or more than 500ml/day (at 6 weeks postpartum). In this study, the mean value of maternal milk production (T-W) was 263g/12h (at 8 weeks postpartum) or the equivalent to 526ml/day, similar to those of Hill and Aldag and Hill et al. The mean for Milk Production Per Minute (MPPM) was 6.4

g/minutes. And the Average Milk Produced Per Average Session (AMPPAS), the overall mean was 52.11g.

Creamatocrit

About the Creamatocrit test, I have to remind the reader that creamatocrit has a linear relationship with fat and kilocalories. The average creamatocrit from all cases in the first 7 months was 6.9% equivalent to total fat average of 43.3 g/l, and ~758 Kcal/l, for the first seven months.

Anthropometry

Mothers' Anthropometry showed that most of the mothers in Esmeraldas were within the normal BMI range. Although most mothers (39) in Esmeraldas are within the BMI range categorized as normal, there are a large number that are in the overweight and obese categorization (32). Perhaps this is a new trend in poor countries where we are now finding overweight mothers in impoverished areas (Dufour 1994; Valeggia and Ellison 2003). I think this contradicts general assumptions about impoverished areas and nutritional status.

Economic Crisis

Mothers in this study were under tremendous stress triggered by the economic crisis of 1999. MIC increased in the month of March when the economic crisis began. Beginning in the month of March in 1999, the supplementation level increased from ~30% to more than 50% within a month. There was also an increase in MI complaints during the same period. The mean NSS had a precipitous descending trend from February to April, the crisis period. The mean TSD of 66.08 (minutes) was highest in March, the crisis month. The mean TSD had a general downward trend, with a peak in March and a small peak in June. In addition, the mean AMS (minutes) had a steep ascending trend from February to March and April and bounced back and forth for the rest of the months. In terms of BCS, we saw that T-W dipped to a low level in March, the month of the economic crisis. In March, as well, the mean MPPM was 3.78 g/min, which was very low for MPPM range. AMPPAS shows almost the same pattern as MPPM.

Stress has caused Esmeraldan women to produce a low average of milk in the first six months. BCS was definitely low during the crisis month, with MPPM being the lowest, followed by AMPPAS and then T-W. The effects of acute and chronic emotional stress on lactation are not known. Until now, stress measured by behavioral responses to crisis have been scarce; certainly this is an open window for future research. I think "new" stress theories may help to explore better the biological and behavioral pathways which could influence lactation.

Milk Insufficiency Has Been Defined

Based on this research, I was able to define measured milk insufficiency (MMI) as when a mother "chronically" or as an "overall average" produced half the average or less, on more than one average variable of T-W (g), MPPM (g/min) or AMPPAS (g), within a particular time and culture. Therefore, in Esmeraldas, milk insufficiency will be equal or less than half of the average amount of breastmilk produced during any 12h observation, which would be 144g/12h (12g/h), within the first 6 months.

	BS				BCS			CREAMA-TOCRIT	ANTHRO-POMETRY	MI COM-PLAINT	SUPPLE-MEN-TATION
	NSS	**TSD**	**AMS**	**MID**	**T-W**	**MPPM**	**AMPPAS**	**FAT**	**BMI**	**MIC Level**	**SUPP Level**
AGE OF MOTHER					n.s p=.370	n.s p=.587	n.s p=.760			n.s p=.435	
PARITY					n.s p=.481	n.s p=.541	n.s p=.841			n.s p=.901	
EDUCATION LEVEL					n.s p=.499	n.s p=.352	n.s p=.652				
INCOME LEVEL					n.s p=.857	n.s p=.528	n.s p=.599			y.s P=.043	n.s p=.058
SEX OF CHILD					n.s p=.344	n.s p=.944	n.s p=.267				
ONSET OF LACTATION					n.s p=.758	n.s p=.272	n.s p=.536			n.s p=.532	n.s p=.720
BMI					n.s p=.884	n.s p=.584	n.s p=.816	n.s p=.897			
MILK INSUFFICIENCY COMPLAINT LEVEL	y.s p=.008	n.s p=.076	n.s p=.807	y.s p=.022	y.s p=.001	n.s p=.216	y.s p=.018		n.s p=.182		n.s p=.180
SUPPLEMENT LEVEL	y.s p=.000	n.s p=.088	n.s p=.208	y.s p=.003	y.s p=.000	y.s p=.047	n.s p=055		n.s p=.865		

Table 9.1 Inferential Statistics Results and p-values.
y.s = Yes, Statistically Significant Relationship
n.s = No Statistically Significant Relationship
p = p-value

Table 9.1, above, presents the relationship among all major variables researched in this investigation and their statistical significance in relation to Breastfeeding Structure and Breastfeeding Consumption Structure, Fat, BMI, MIC Level and Supplement Level.

Income Level is statistically significant in relation to MIC Level, as women who had the highest Income Level also have a high Compaint Level. Interestingly, the results indicate that mothers in the middle Income Level do not complain of milk insufficiency as much as mothers in the lowest and the highest Income Levels. I also found out that MIC is statistically significant in relation to Breastfeeding Structure variables (NSS and MID) and to Breastfeeding Consumption Structure variables (T-W and AMPPAS). That means that women who complain of having milk insufficiency did breastfeed for fewer sessions and did produce less breastmilk than women who did not complain. Lastly, Supplement Level was significant to NSS and MID, as well as to T-W and MPPM, meaning that women with a high supplement level do breastfeed less often, producing less breastmilk. These results are telling us that what the mothers are saying about milk insufficiency is “true” certainly. While we need to do more research on the topic, the least that we could do is to listen to what these mothers are saying.

To end, a multidisciplinary approach among many disciplines is already taking place in our days, where we take into account disciplines that were far apart in the past to construct a biocultural framework in which behavioral and physiological explanations of phenomena complement each other; we just have to cross the corridor and knock at each other’s doors. Among humans, behavior without physiology and physiology without behavior is like cause without effect, or effect without cause. Biomedicine still has to walk the corridors of behavior.

APPENDIX A

LIST OF OTHER FOODS OR SUPPLEMENTS

Presented here it is a list of other foods (aside from breast milk) or supplements that mothers in Esmeraldas gave to their babies during our observations, including some medicines. These were not necessarily prepared just for the infant, but were often part of a family's regular diet.

Table A.1 - Food and Other Supplements[70] Used in Esmeraldas

Coladas (thicker than a soup)	**Porridge** (English Translation)
1. Banasoya, una harina hecha de banano y soya para hacer coladas	*Banasoya*, banana + soya used to make porridges
2. Colada de manzana	Apple porridge
3. Colada de harina de plátano con leche.	Banana flour porridge with milk
4. Colada de harina de verde	Green plantain flour porridge
5. Colada de arroz de cebada y zanahoria	Cracked barley and carrot porridge
6. Colada de avena con leche	Oat meal porridge and milk
7. Colada de borojo	Borojo porridge
8. Colada de maicena con leche	Corn flour porridge with milk
9. Colada de machica	Wheat flour porridge
10. Colada de tapioca con leche	Tapioca porridge and milk
11. Colada de tapioca y formula	Tapioca porridge and formula
12. Colada de verde con guayaba	Green plantain porridge and guava
13. Colada de verde con leche	Green plantain porridge and milk
14. Colada de verde crudo con leche	Raw green plantain porridge and milk
15. Coladas de verde con zanahoria cocidas con hojas de nogal	Green plantain porridge and carrots boiled with *nogal* leaves
16. Pure de papa	Mashed potatoes
17. Harina de maiz y leche	Corn flour and milk
18. Masato	*Masato*
19. Papilla de zanahoria	Mashed carrots

[70] Anything ingested by the infant, aside from breast milk.

Sopas	**Soups** (English Translation)
1. Caldo de patas de vaca, con puré de habas y papas.	Cow foot soup with mashed fava beans and potatoes
2. Sopa de hueso de vaca	Beef bone soup
3. Sopa de hueso	Bone soup
4. Sopa de hueso-sopa de carne	Bone-meat soup
5. Sopa de pollo	Chicken soup
6. Sopa de pescado	Fish soup
7. Caldo de patas	Cow foot soup
8. Guatita con maní	Honeycomb tripe soup with peanut sauce
9. Sopa de fideo y vegetales	Noodle and vegetable soup
10. Sopa de papa con fideos	Noodle and potato soup
11. Sopa de lenteja	Lentil soup
12. Sopa de frijoles	Bean soup
13. Sopa de calabaza con leche	Pumpkin soup with milk.

Tes, Jugos & Aguas	**Teas & Juices** (English Translation)
1. Avena Quaker	Quaker Oatmeal
2. Agua de manzanilla	Chamomile tea
3. Agua de ruda	*Ruda* tea
4. Agua de anís	Anise tea
5. Leche de vaca hervida	Boiled cow's milk
6. Fresco con zanahoria y canela.	Carrot juice with cinnamon
8. Jugo de frutilla	Strawberry juice
9. Fresco	Flavored Juice
10. Limonada	Lemonade
11. Jugo de masato	*Masato* juice
12. Jugo de tomate de árbol con formula	Tree-tomato juice with formula
14. Jugo de naranja y agua	Orange juice and water
15. Agua de anís con azúcar	Anise tea with some sugar
16. Agua embotellada	Bottle water

Comida solida - No Sopas	**Solid food -Non Soups** (English)
1. Picadillo de chancho con papas	Sliced pork with potatoes
2. Chocolate	Chocolate
3. Arroz	Rice
4. Arroz y carne	Rice and meat
6. Pequeños trozos de yuca	Small pieces of yuca
6. Zapallo	Squash

Frutas	**Fruits** (English)
1. Manzana	Apple
2. Naranja	Orange
3. Banano	Banana
4. Uvas	Grapes
5. Papaya	Papaya
6. Puré de manzana rallada.	Mashed apples

Formula	**Formula** (English Translation)
1. NAN1	NAN 1
2. Nestogeno 1	Nestogeno 1
3. Nid	Nid
4. Nido Crecimiento	Nido Growth

Medicinas	**Medicines (**English Translation)
1. Blevid	Blevid
2. Dos goteros de agua de menta tibia.	Two mint brew drops.
3. Gastromet gotero	Gastromet drops
4. Valium	Valium
5. Vitamina C	Vitamin C
6. Vitaminas = vitacyl	Vitamins = vitacyl
7. Vitaminas infantiles (servisol)	Children's vitamins (servisol)

***Receta de Colada de verde Por Johanna*.**
"Hervir agua, con canela o anís en una olla. *Licuar un verde o dos, dependiendo la cantidad de colada que se quiera hacer.* *Luego que hierve el agua, se pone el verde licuado pero ya cernido en un cedazo.* *Se le da movimiento por algunos minutos y está listo para tomar. En algunas ocasiones se le pone leche para que quede más gustosa, pero hay familias que la toman solo con leche, o reemplazan la leche por maracuyá o solo con el sabor de la canela."*
Johanna's Recipe for *Colada de verde* (English Translation)
Bring water to a boil with cinnamon or anis. Blend 1or 2 green plantains, depending on the amount of porridge to be made. Once the water is boiled, add the blended green plantain strained through a colander. Stir for a few minutes and it is ready to serve. Sometimes you can add milk to make it tastier, but there are families who drink it with milk only, or even replace the milk with passionfruit or just the cinnamon flavor.

More Recipes	
Recetas	**Recipes** (English Translation)
Colada de verde crudo con leche	Raw green plantain porridge and milk
1. 1 litro de agua hervida	1 liter of boiled water
2. 2 pedazos de canela	2 small pieces of cinammon
3. 6 cucharas de harina de verde	6 spoons of green plantain flour
4. ¼ de 1 litro de leche	1/4 liter of milk
Colada de verde con leche	Green plantain porridge and milk
1. Un plátano verde licuado y luego cocido en un medio litro de agua, Después agregar ½ litro de leche de vaca	One green plantain blended and cooked in a ½ liter of water, then add ½ liter of cow's milk

APPENDIX B

QUESTIONNAIRES AND CONSENT FORM USED IN THE FIELD SITE

I. First questionnaire Pre-partum

Number of interview:
Date:
Start and end time:

A. Demographic

1. What is your full name?
2. Address?
3. Age?
4. What is your estimated date of delivery?
5. Your number of siblings and which number are you among your siblings?
6. Were you born and raised here (neighborhood) or somewhere else?
7. How long have you lived here (house, neighborhood)?
8. Do you live with the father of the child? If not, where does he live?
9. Are your parents still living? Where do they live?
10. Are your partner's/father of child's parents still living? Where?
11. How many children have you had? Any death?
12. How old are they (from the oldest child to the youngest child)?
13. Are all your children living with you?
14. How many people are in your household?
15. Who are they and what is their relationship to you?

B. Future Plans

16. Where do you plan to deliver? At home, hospital, clinic other?
17. Who will assist you/attend at the delivery? And at home?
18. How do you plan to feed your child?
19. Why are you planning to use this method?
20. How long will you use this method?
21. When do you plan to begin giving supplements?
22. Which supplements will you use? When? Why?
23. Have others given you advice about feeding your infant? What advice have you received? From whom?
24. What are you thinking about feeding your infant? What do partner/ mother/mother-in-law/other relatives and friends feel or advise?
25. Any advice from doctors, nurses, health workers, midwives? About the delivery or about breastfeeding.

C. Costumes and Ideas (it should be call: Attitudinal/ Knowledge/Beliefs)

26. Do you know how you mother feed you when you were a little girl? What do you think about it?
27. How did you feed your previous children?
28. How have you learned about breastfeeding?
29. How do people here usually feed their infants?
30. Why do women here wean their infants?
31. When women start supplementing their infants?
32. Are there any restrictions/taboos/prescriptions on a new or breastfeeding mother's behavior?
33. What can prohibit to breastfeed the infant in the first days?
34. Are there circumstances in which it is inappropriate to breastfeed the infant?
35. Are there differences in how boy and girl babies should be fed?
36. Do you know of people who have had problems feeding their infants?
37. Do you know of any solutions or cures for infant feeding problems?
38. Can anything assure a woman produces good milk? What will you do?
39. Can anything or any circumstances ruin or dry milk? Can other people affect the milk?
40. Can the mother's emotions affect milk? How?
41. Who here knows the most about how to feed infants? Anyone else who knows a lot? Why?

II. Second Questionnaire for first visit post-partum.

Number of questionnaire:
Date:
Start and end time:

A. Demographic

1. Name
2. Has anyone joined your household since we spoke last? Has anyone left your household since we spoke last?

B. Delivery Information (it should also be call: Behavioral)

3. When did you deliver (date/day/month/year)? Baby's age.
4. Was, a boy or a girl? What is his/her name?
5. Where did you deliver (hospital/clinic/house/other)?
6. Who was with you attending at the birth? (hospital or home)
7. Who was with you assisting at the birth, any family member?
8. How was the delivery? (normal- with/without episiotomy)
9. How did the delivery go? How many hours? What other people think about the delivery?
10. APGAR. How did your infant look (color, movement, response)? Did your infant cry? Right away or after how many minutes?
11. What was your infant's weight? (If home birth, how did others assisting/attending feel or tell you about your infant's size?)
12. When did you first hold your infant?
13. Did you sleep with the infant the first night? (home or hospital)
14. When did your milk arrive? What did you feel?
15. Did you feed (*prostrera*/colostrum) to your infant? Why / why not?
16. Tell me in detail how did you feed your infant on first days after birth, which method did you used and why?
17. Did you give formula, bottle, or any other kind of food, what kind, when, how many times?
18. Did anyone give your baby formula, water, tea, or other kinds of food? Where, who?
19. How are you feeding your infant now? What have you fed your infant in the last 24 hours?
20. How often do you feed your infant during the day?
21. How often do you feed infant at night?
22. How often does your infant want to be fed?
23. Where does infant sleep?
24. Has anyone given you advice about feeding your infant?
25. Any restrictions on behavior as new mother? Any food or diet?
26. In general how do you feel after given birth? Happy or sad?
27. Are you and your infant well? Have you been ill? Have you seen a doctor, midwife or health worker since the birth, for what reason?

28. You or your infant has used any medication, waters, and remedies? Why, who give you and where?
29. What advice you will give a mother that is going to give birth?

C. Costumes and Ideas (it should be call: Attitudinal/ Knowledge/Beliefs)

30. What are you feeling about feeding your infant? How do you feel when feeding your infant? What do partner/ mother/mother-in-law/other relatives and friends feel or advise?
31. How long do you plan to feed your infant by present method?
32. When do you plan to supplement? Or why decided to?
33. Is infant doing well, thriving, good appetite, gaining weight?
34. Any advice for others/things you do to produce good milk?
35. Have you had any problems with your milk? Has your infant?
36. Do you produce a lot of milk? How do you know? Any engorgement?
37. Have you learn anything new about how to feed your infant? From whom, why it is important?
38. What advice would you give a mother who has problems with milk?

III. Questionnaire for (monthly visits) biweekly visits.

Number of interview:
Date:
Start and end time:

A. Demographic

1. What is your full name?
2. What is the name and age of the baby? (male or female)
3. Has anyone joined your household since we spoke last? Or, has anyone left your household since we spoke last?

B. Behavioral

4. Where does the child sleep?
5. How are you feeding your infant? Why are you using this method?
6. How often do you breastfeed during daytime and for how long?
7. How often do you breastfeed during nighttime and for how long?
8. How often does the child want to be fed?
9. Have you given your infant any formula, bottle or supplements in the last two weeks? What supplements? Have you started feeding your infant a different supplement in this last two weeks? If first introduction of anything, when in last two weeks started?
10. Does the infant use a pacifier or a toy for the teeth?
11. What do you feel about breastfeeding your child or what do you feel about giving the child supplements? What does your husband or partner think about how to feed the child? Are there other people like a mother-in-law, mother, sisters or neighbors that give you advice on how to feed your child?
12. For how long do you think you would breastfeed your child, or why have you chosen to stop breastfeeding?
13. When do you plant to give supplements to your child, or why have you chosen to give supplements to your child?
14. Has someone given you advice regarding how to feed your child since the last time we spoke? Who and what was the advice?
15. Would you like to ask some advice on how to feed your child? What do you want to ask?
16. Are you healthy? Have you visited a doctor, or a person who heals in the last weeks? Are you following a special diet or eating special food?
17. Is your child healthy? Has the child seen a doctor, or a person who heals in the last weeks? Is your child breastfeeding normally, gaining weight, looking better?

C. Knowledge/Beliefs

18. Do you produce enough milk? How do you know?
19. Have you had problems with your milk? What about your child?
20. Any congestion or fullness or pain in the breasts?

21. What advice have you received to produce good milk?
22. Have you learn new things or stories on how to feed your child since the last time we spoke? What have you learned from your personal experience of brestfeeding your child since the last time we spoke?
23. What advice would you give to a mother that has problems producing good milk?

D. Socioeconomic (only after rapport well established)

24. What racial group do you think you belong to: Black, White, Creole, Mixed, Indian or other race?
25. What is your marital status: free union, married, single or divorce?
26. What is your educational background: primary school, secondary school or higher? Do you have educational plans for the future?
27. Do you live in your own house or you pay rent? How much do you pay?
28. Are you currently working? If not, where did you work before?
29. Who works in the household? What is the approximate household income?
30. Do you receive economic help from other people? Receive the “bono solidario”?

IV. Fourth Questionary (III questionary modified) for monthly visits

Number of interview:
Date:
Start and end time:

A. Demographics

1. What is the mother's name?
2. What are the name, age and sex of the infant?
3. Has anyone joined or left the home where you live since we spoke last?

B. Behavioral (Information on breastfeeding and nutrition)

4. Where does the child sleep?
5. How have you been feeding your child during the last weeks? Have you given the child supplements or formula? What have you given the child? Why?
6. How often do you breastfeed during daytime and for how long? If you don't breastfeed, how often do you give the child other food during daytime? What food do you give?
7. How often do you breastfeed during nighttime and for how long? If you don't breastfeed, how often do you give the child other food during nighttime? What food do you give?
8. How often does the child want to be fed?
9. What do you feel about breastfeeding your child or what do you feel about giving the child supplements? What does the child's father think about how to feed the child? Are there other people like a mother-in-law, mother, sisters or neighbors that give you advice?
10. How long are you going to breastfeed your child, or why have you chosen to stop breastfeeding?
11. When do you plant to give supplements to your child, or why have you chosen to give supplements to your child?
12. Are you healthy? Have you visited a doctor, or a person who heals in the last weeks? Are you following a special diet or eating special food?
13. Is your child healthy? Has the child seen a doctor, or a person who heals in the last weeks? What is the child's immunization history?
14. Does the infant use a pacifier or a toy for the teeth?
15. Has someone given you advice regarding how to feed your child since the last time we spoke? Who and what was the advice?
16. Would you like to ask some advice on how to feed your child? What do you want to ask?

C. Knowledge/Beliefs (read what is between parentheses in the case that the mother has stopped breastfeeding)

17. Do (did) you produce enough milk? How do (did) you know?

18. (Have you had) Any congestion or fullness or pain in the breasts?
19. Have (did) you had (have) any problems with the milk? What about your child?
20. Have you learn new things on how to feed your child since the last time we spoke?
21. What have you learned from your personal experience of brestfeeding your child since the last time we spoke?
22. What advice have (did) you received (receive) to produce good milk?
23. What advice would you give to a mother that has problems producing good milk?

D. Socioeconomic (only after rapport well established)

24. Has your marital status or educational attaintment changed since we spoke last?
25. Has your economic situation changed since we spoke last?
26. Whose house do you live in? If you pay rent can you tell me much do you pay?
27. Who works in the household? What is the approximate household income?
28. Do you receive economic help from other people? What about the “bono solidario”?

V. Fifth Questionnaire (III questionnaire modified) for monthly visits

Number of interview:
Date:
Start and end time:

A. Demographics

1. What is the mother's name?
2. What are the name, age and sex of the infant?
3. Has anyone joined or left the home where you live since we spoke last?

B. Information on breastfeeding and nutrition

4. Where does the child sleep?
5. How have you been feeding your child during the last weeks? Have you given the child supplements or formula? What have you given the child? Why?
6. How often do you breastfeed during daytime and for how long? If you don't breastfeed, how often do you give the child other food during daytime? What food do you give?
7. How often do you breastfeed during nighttime and for how long? If you don't breastfeed, how often do you give the child other food during nighttime? What food do you give?
8. How often does the child want to be fed?
9. What do you feel about breastfeeding your child or what do you feel about giving the child supplements? What does the child's father think about how to feed the child? Are there other people like a mother-in-law, mother, sisters or neighbors that give you advice?
10. How long are you going to breastfeed your child, or why have you chosen to stop breastfeeding?
11. When do you plant to give supplements to your child, or why have you chosen to give supplements to your child?
12. Are you healthy? Have you visited a doctor, or a person who heals in the last weeks? Are you following a special diet or eating special food?
13. Is your child healthy? Has the child seen a doctor, or a person who heals in the last weeks? What is the child's immunization history?
14. Does the infant use a pacifier or a toy for the teeth?
15. Has someone given you advice regarding how to feed your child since the last time we spoke? Who and what was the advice?
16. Would you like to ask some advice on how to feed your child? What do you want to ask?

C. Knowledge/Beliefs (read what is between parenthesis in the case that the mother has stopped breastfeeding)

17. Do (did) you produce enough milk? How do (did) you know?
18. (Have you had) Any congestion or fullness or pain in the breasts?
19. Have (did) you had (have) any problems with the milk? What about your child?
20. Have you learn new things on how to feed your child since the last time we spoke?
21. What have you learned from your personal experience of breastfeeding your child since the last time we spoke?
22. What advice have (did) you received (receive) to produce good milk?
23. What advice would you give to a mother that has problems producing good milk?

D. Socioeconomic (only after rapport well established)

24. Has your marital status or educational attainment changed since we spoke last? How has it changed?
25. Has your economic situation changed since we spoke last? How has it changed?
26. Whose house do you live in? If you pay rent can you tell me much do you pay?
27. Who works in the household? What is the approximate household income?

Appendix

A. How would you like the health care, that you and you baby receive in this city, to be?
B. What health center do you like to go to? Why?
C. If you could directly talk with the health authorities, including the health minister and the president also, what would you ask them?

VI. Sixth Questionnaire

A. Interview

1. How is “our” boy/girl?
2. Do you still breastfeed him/her?
3. When did you stop breastfeeding?
4. Why did you choose that date?
5. Have you had another child? If yes, what’s that child’s age?
6. Are you breastfeeding your child now?
7. Do you have enough milk now?
8. If you are having problems breastfeeding, what are they?
9. Are you pregnant? How many months?
10. Did you have an account in any bank that was frozen in 1999 by Jamil?
11. Do you receive the “*bono solidario*”

B. Anthropometry

Date____________________________________ #______________________
(day month year)

Mother:

Date of birth ____
(day month year)

Name___________________________________ Age____________________

Weight (Kg)________________

Notes:

Child:

Name______________________________________ Age____________________

Sex: Male______ Female______

Weight (Kg)______________________ Height (cm)____________________

Notes:

<u>EXPLANATION OF RESEARCH PROJECT AND CONSENT FORM</u>
(Translated from the Spanish version)

The Graduate School and University Center
The City University of New York
Ph.D. Program in Anthropology

May 18, 1998 - April 19, 1999
Esmeraldas, 1999

Dear Madame,

My name is Milton Herrera and I am an anthropology student at the Graduate Center of the City University of New York. My assistants and I are conducting a research project on breastfeeding that will be carried out from September of 1998 to September of 1999. Part of the research involves interviewing mothers about breastfeeding and observing and measuring infants and mothers to assess the nutritional status of both.

This letter is to ask you for your enrollment into our research project on breastfeeding and infant nutrition for a period of approximately 8 months. Research will start in February and end in September. There will be two visits each month. In one of the visits, we will take measurement of you and your baby. In the baby, we measure weight, height and circumferences of the arm and head. In the mother, we will measure weight, height, circumference of the arm, and folds of the skin in the arm and back. We will also perform a simple test called creamatocrit, which measures the amount of fat in the milk. For this, we will need a very small sample of your milk. Finally, we will do weight tests to evaluate the milk production by weighing the infant before and after each breastfeeding event. To do this, one of our assistants will stay at your house (if possible) for 12 hours of a selected day. Together with this test we will observe and take notes on activities related to breastfeeding. The weighting test and observation will be done by female assistants; but, it is possible that I will conduct some of these activities for this, and so I ask you for your consent. These measurements will be done once in the month. The other monthly visit will be to interview you about your experiences related to the delivery of the baby and, in general, breastfeeding.

In our work we will have all respect for your anonymity and privacy, as well your confidentiality, as I will not reveal any names of the participating women to any health workers or in any public forum or publication following from this research. Also, personal information from any participant will never be shared with anyone else in the community.

Dear mother, I assure you that respect for your anonymity and privacy is part of our work ethic. No names would be revealed to anyone in any oral or written form; we will use numbers instead of the name of the persons. We guarantee, then, your total confidentiality. You could terminate your participation at any moment. Also, let me tell you that there is no problem if you decide not to participate in the research project.

If you have any questions regarding the research project you can call or write to my supervisor, Dr. Sara Stinson. The address is Queens College, City University of New York, Flushing, NY 11367, U.S.A. The telephone number is: 718-997-2893. If you have any questions regarding your rights as a participant of this study you could write to: Office of Sponsored Research, City University of New York New York, NY 10036, U.S.A., or call the number: 212-642-2059. In Quito the number is: (02) 895-723, ext 233, in the Universidad San Francisco de Quito.

This investigation will be used to assess how mothers in Esmeraldas breastfeed their children; problems and worries. We compromise to be advocates and share this information with the members of the community as well as with the health authorities. This is done in search of a better care for mothers and their new-born children. In my behalf and behalf of my assistants I would like to thank you very much for your cooperation.

Sincerely,

Milton Herrera

After reading this letter, I confirm my enrollment in this study.

Name____

Signature____

Date____

METHODS RECOMMENDATIONS FOR FUTURE RESEARCH

In conclusion, I learned that there are many factors that need to be taken into account in terms of data collection. One needs to be very clear about what one expects to obtain from data collection, as well as the way in which data is collected. Some recommendations are:

1. For this kind of research on breastfeeding, I recommend a study that follows the mother and child for one year. My study lasted to the 8th-9th month but this research took me a lot of extra time because of the specific sample required, testing methods and my inexperience.

2. Select the assistants from a larger and more diverse pool. I learned that it is important to be flexible initially but to then create rigid/stable structures to be used during the research. Prospective assistants should have written an essay so that I could have judged their writing skills.

3. Teach assistants techniques of how to create a quick and easy rapport with the subjects perhaps by asking direct questions. For each household there are several member of the immediate and extended families that are present at any given time. If the assistant doesn’t know who the family members are in relation to the mother and infant, she will continue to record information based on guesswork. It is important to standardize the points of views and the accuracy/uniformity of records created.

4. Do not change or make accommodations to an established schedule; assistants should start recording data at the appointed hour. Require that the assistants give you all of the documentation in order to maintain the accuracy of the data. To minimize errors, the assistants should be assessed for performance on a case by case basis.

5. Time used to record events should be in standard time, 12am-12pm. I used continuous hours 1-24 and I became confused with the translation of the differing time scales.

6. Scales that use printouts are useful, but the paper is another feature that has been taken into account. Portable scales have to be small enough in order to be moved easily.

7. Questionnaires should be minimized and focused and if possible coded. Copy the questionnaires and leave enough room for responses.

8. This research shows that a longitudinal study of breastfeeding with a 6 hour time frame could be useful if we also collected ethnographic data. This gave us the idea that shorter time frames may be workable if other data-gathering methods, such as ethnography, were combined or if we increased the visit frequency. A 12 hour framework for a longitudinal study was intrusive and a 24 hour framework is not feasible for this kind of study.

9. Observations should be expanded to include more behavioral details of the mother and family in terms of health related issues. For example, if a mother is worried about her or the baby's physical well being, we should ask about the outcome and even have follow-up discussions about it on subsequent visits.

10. Creamatocrit is a simple and very useful method that needs to be explored in future research. I regret not paying closer attention to this method.

11. In July of 1999, I took a picture of the families and gave a framed copy to them. They were thrilled. The copies of the photos helped me to remember the mother and the child and their home environment. I recommend the use of photography as an

important research or method’s tool.

12. One should not underestimate, overestimate, nor reject outright any research techniques. Some methods are not very applicable to certain cultures and could prove to be a waste of time. For instance, LATCH technique was not important in Esmeraldas and Apgar Score would be more relevant in a hospital environment.

13. Since mothers watch several hours of TV every day, TV could be use as the media information for issues related to BF.

14. Creamatocrit is the easiest and a very good method to measure more than fat in breast milk.

15. MUAC, is a good indicator to see micromanagement of the infants nutritional status, open for new examination.

16. Take a basic course on statistics and reaserch methods before building the research proposal, consult with an statistician, you will save time.

APPENDIX C

PHOTOS OF PLANTS COLLECTED IN THE FIELD

These medicinal plants were collected by the mothers or their relatives. The scale of the samples (photos) is more or less in relationship with the letter size of a page, width 8.5” and height 11”. Names of the plants are first presented in the local or common name, then identified and traced to their respective scientific names, using as botanical guides Gentry 1993 and Caballero Muñoz 1995 .

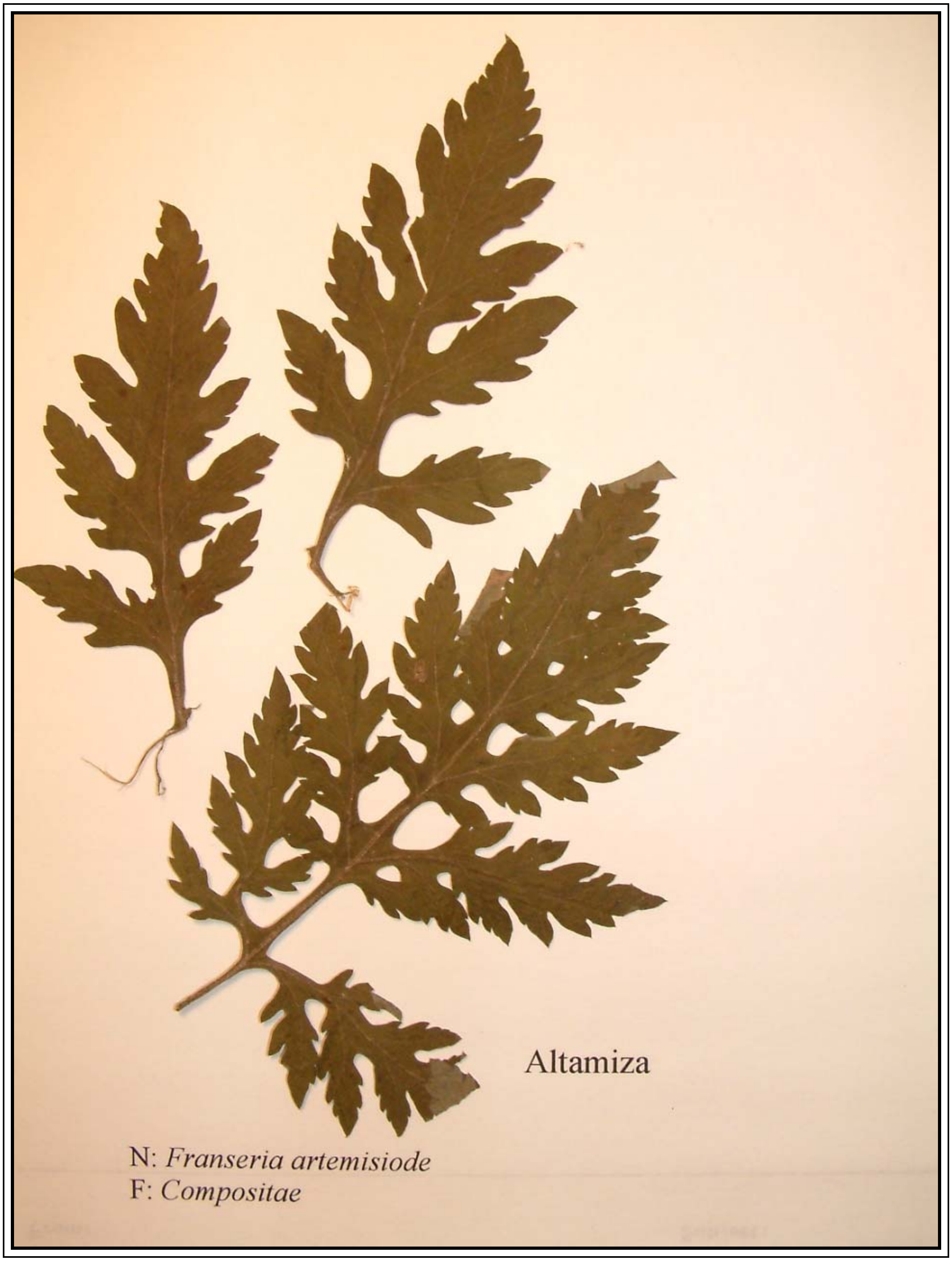


Photo C. 1Leaves of the *Altamiza* Plant.

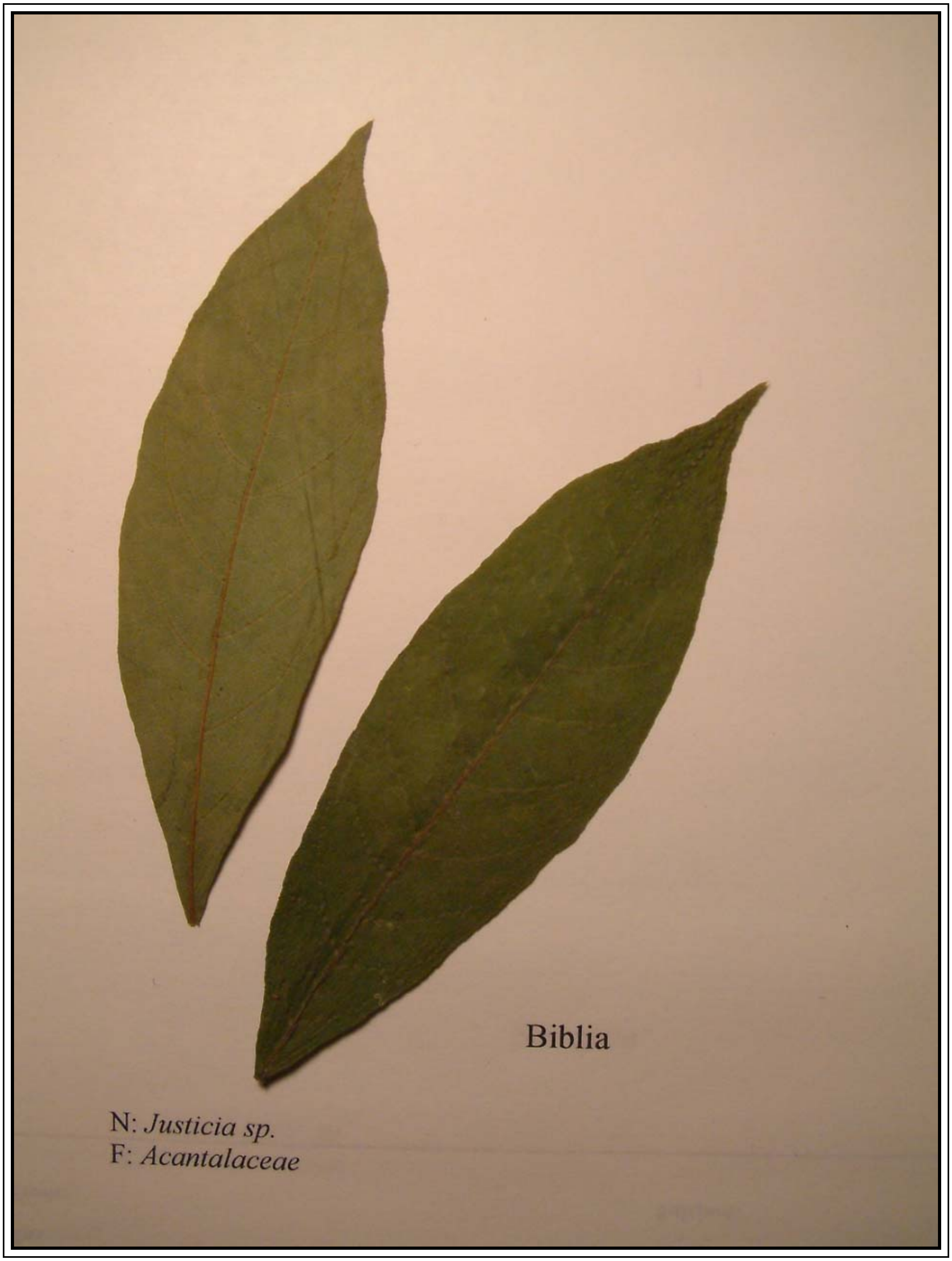


Photo C. 2 Leaves of the *Biblia* Plant.

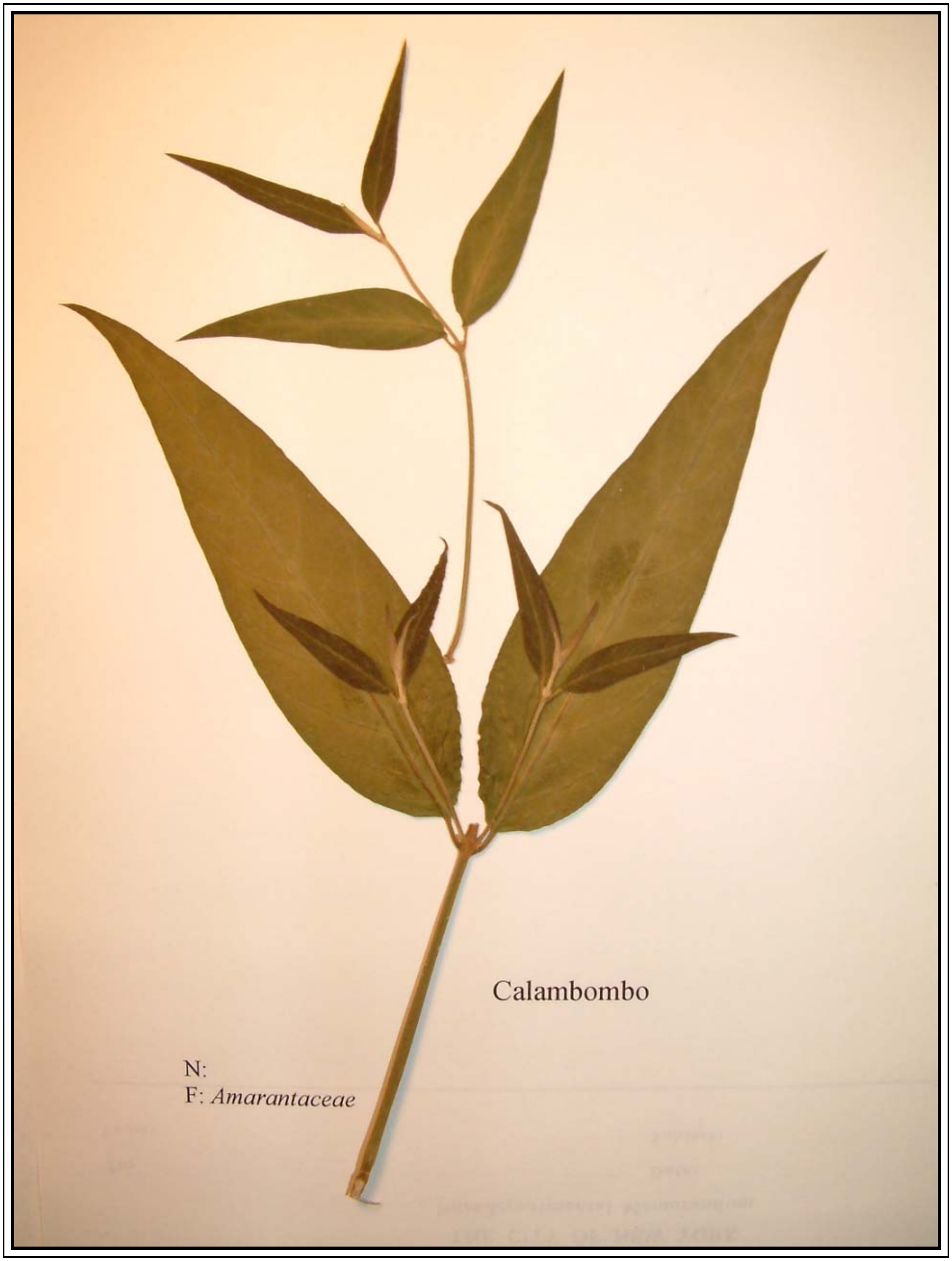


Photo C. 3 Leaves of the *Calambombo* Plant.

Photo C. 4 Leaves of the *Guayaba* Plant.

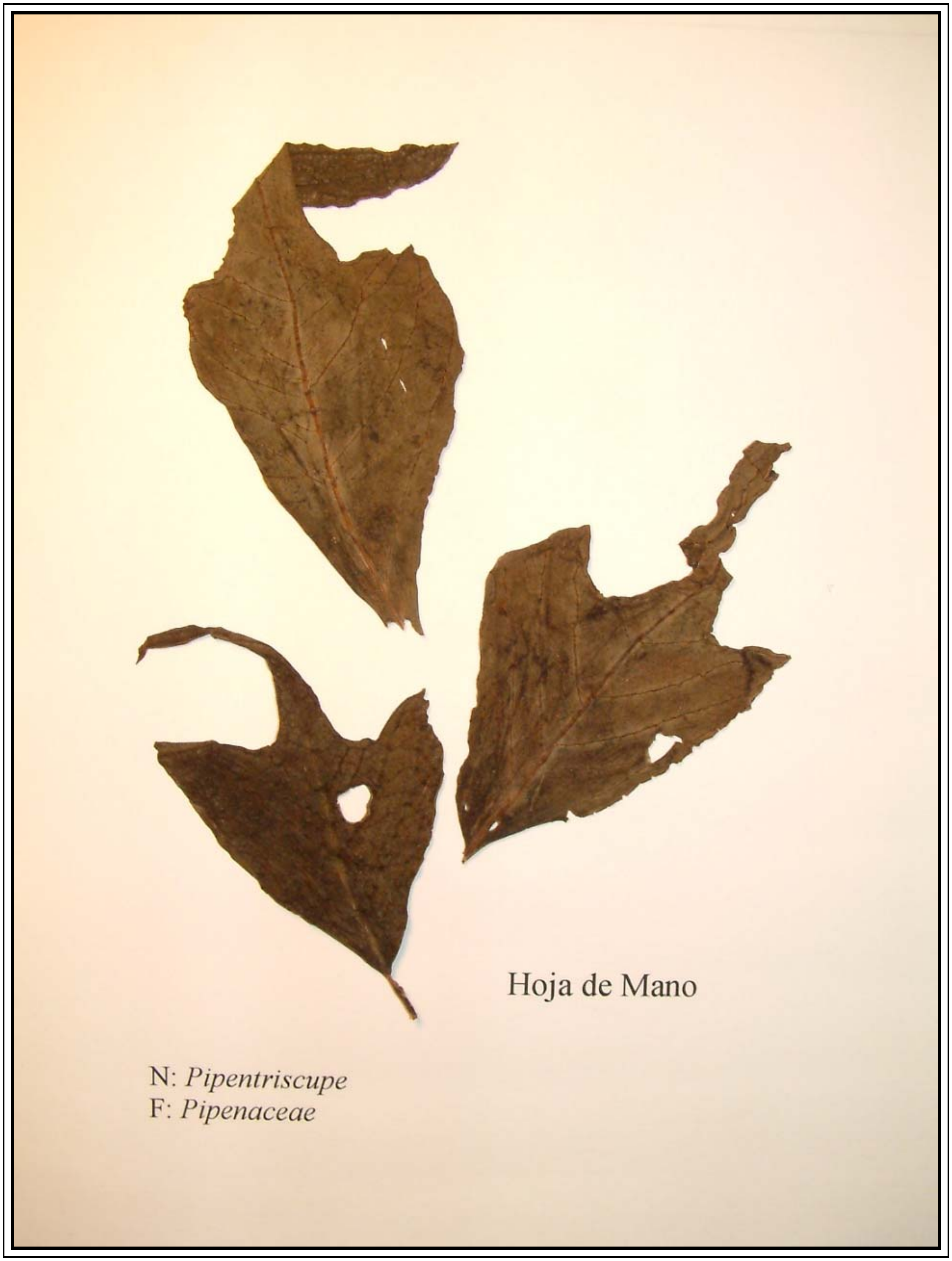


Photo C. 5 Leaves of the *Hoja de Mano* Plant.

Photo C. 6 Leaves of the *Lechera* Plant.

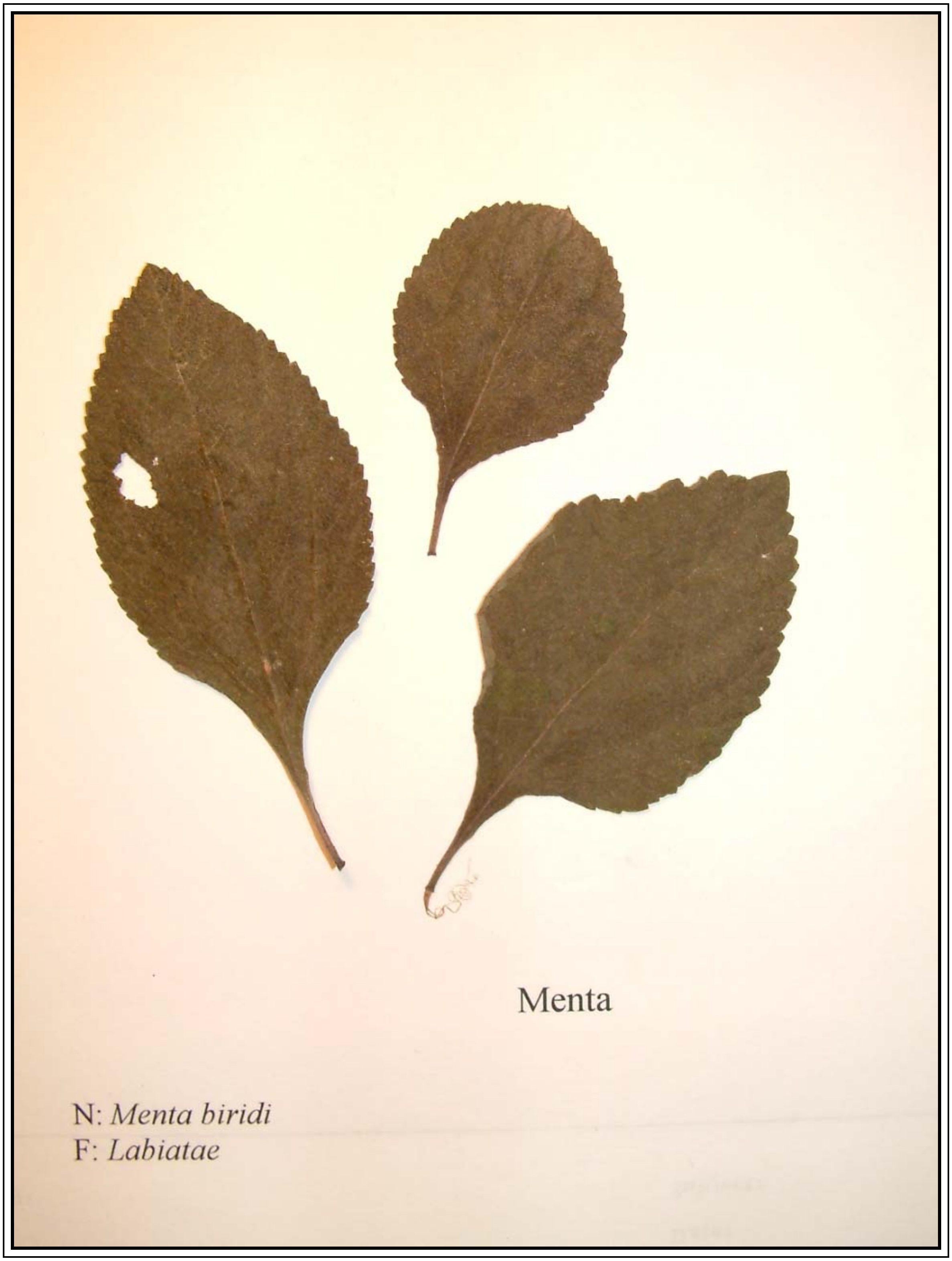


Photo C. 7 Leaves of the *Menta* Plant.

Photo C. 8 Leaves of the *Nacedera* Plant.

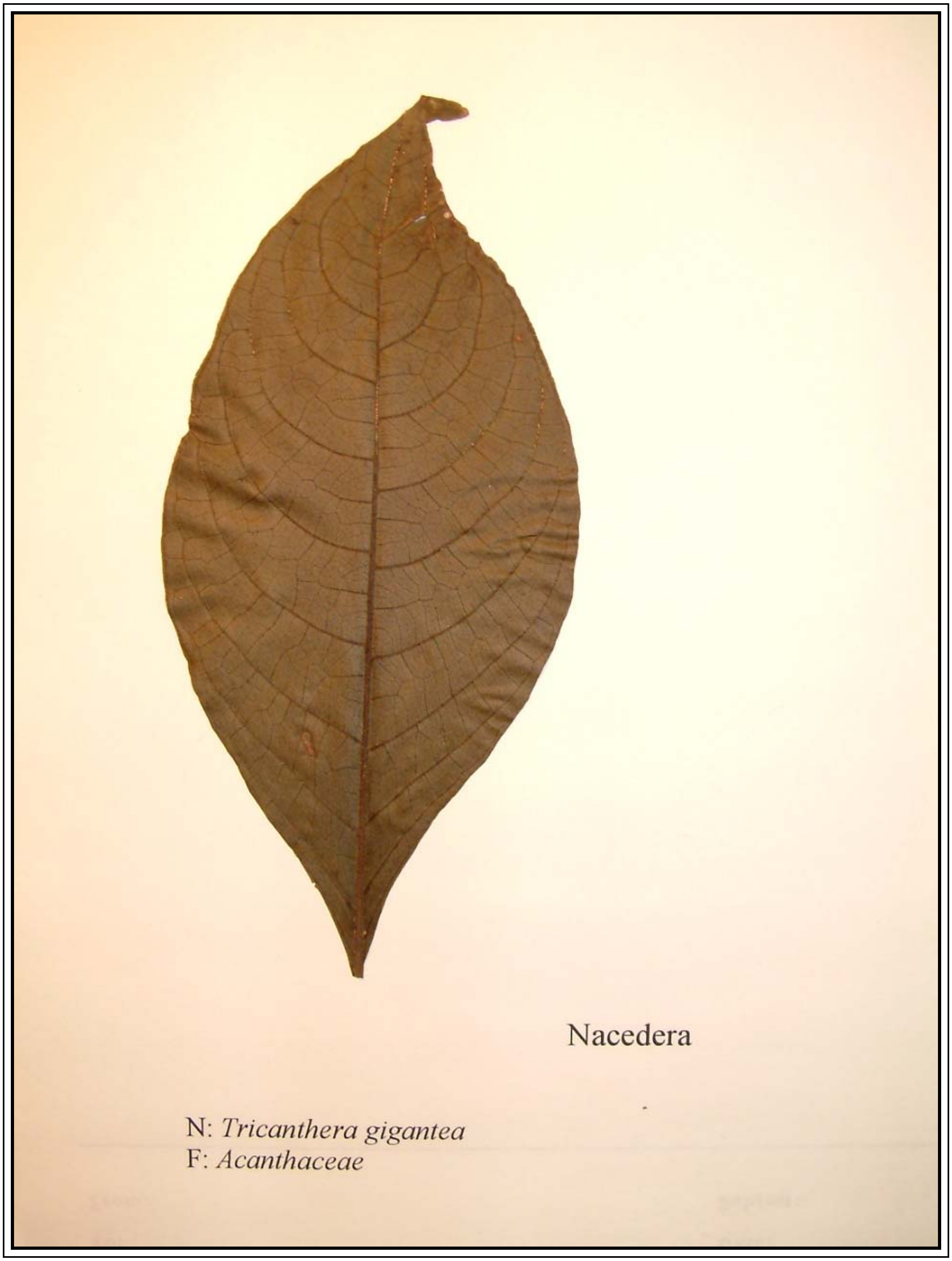


Photo C. 9 Leaves of the *Nacedera* Plant.

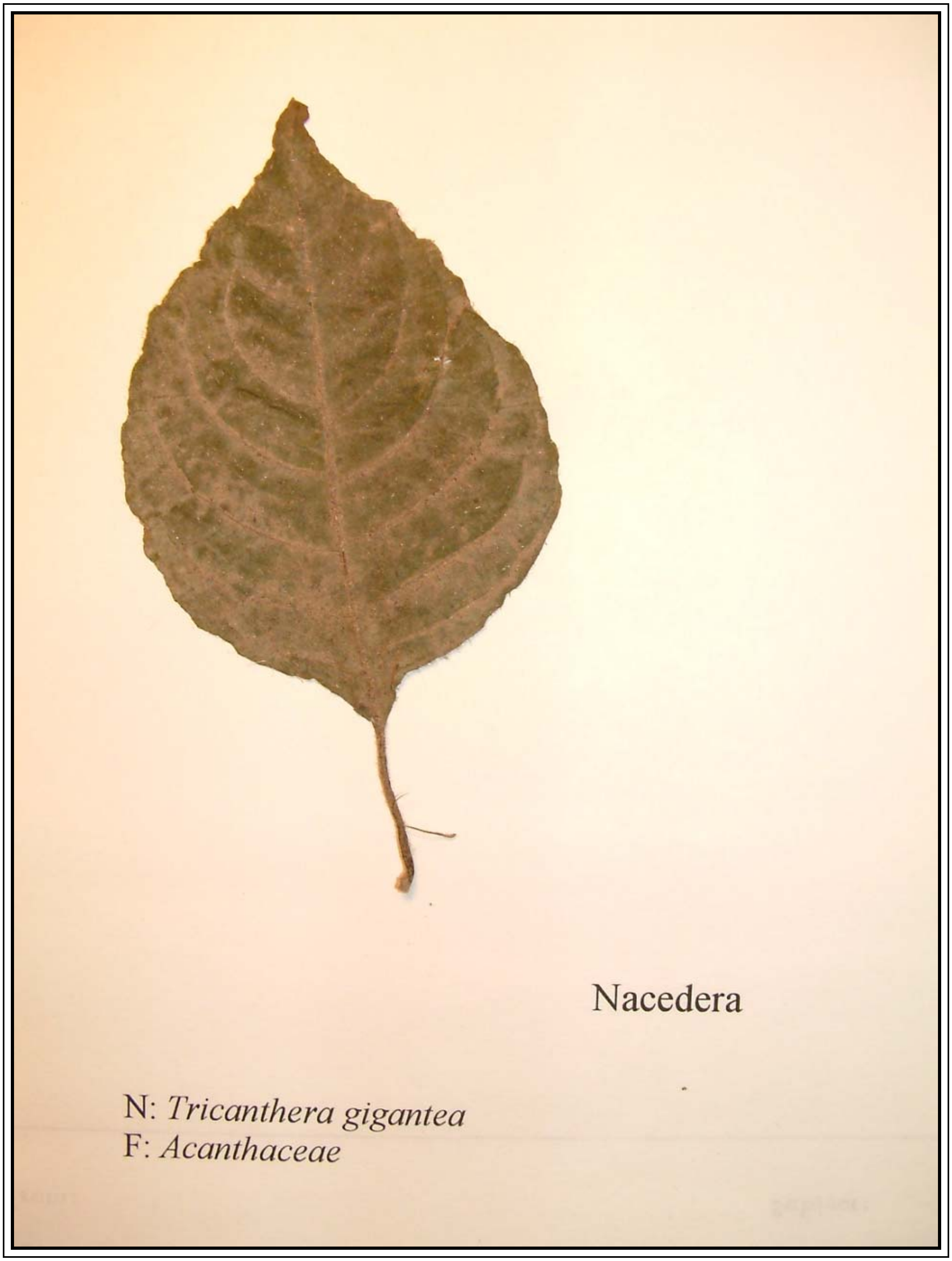


Photo C. 10 Leaves of the *Nacedera* Plant.

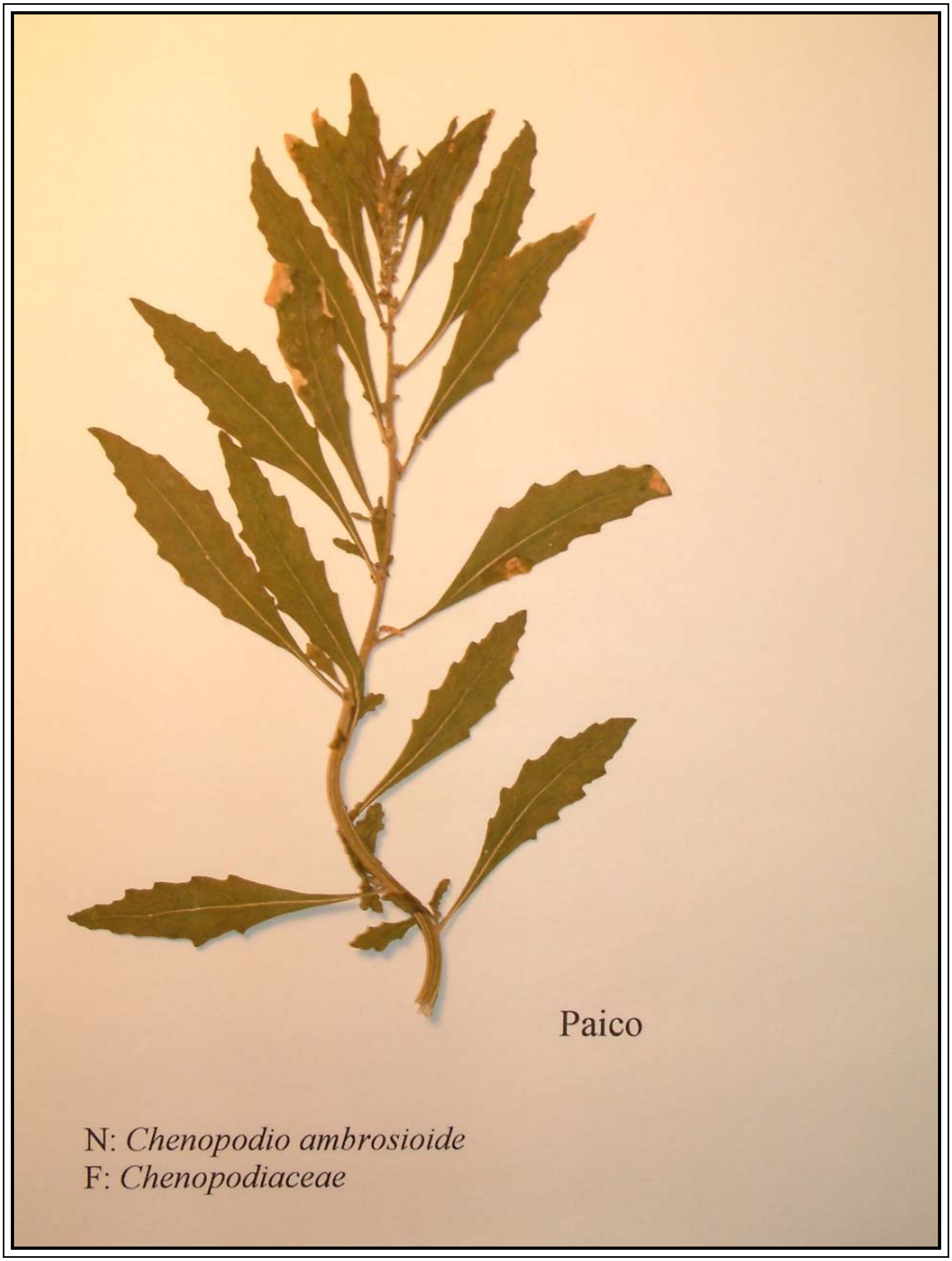


Photo C. 11 Leaves of the *Paico* Plant.

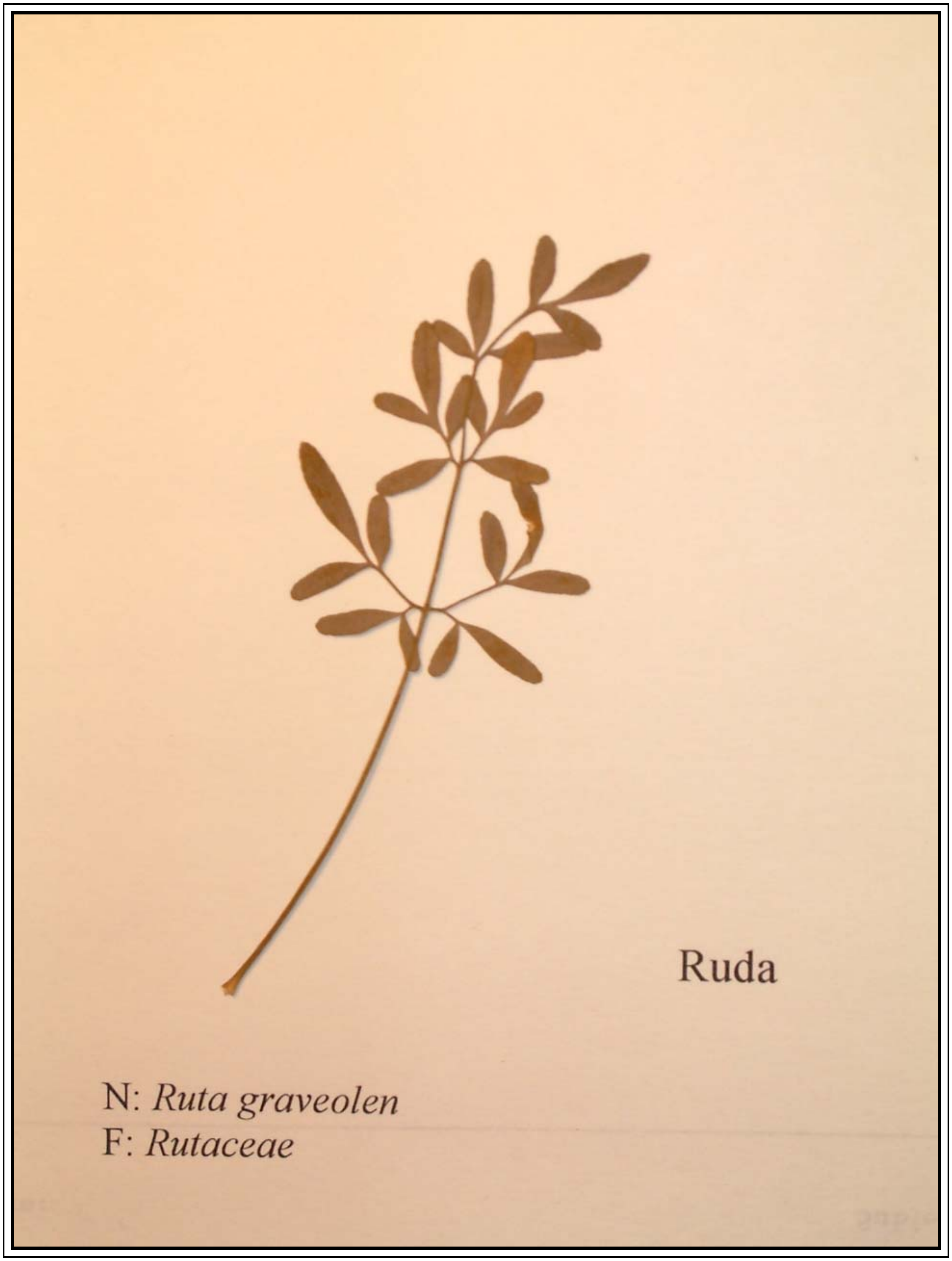


Photo C. 12 Leaves of the *Ruda* Plant.

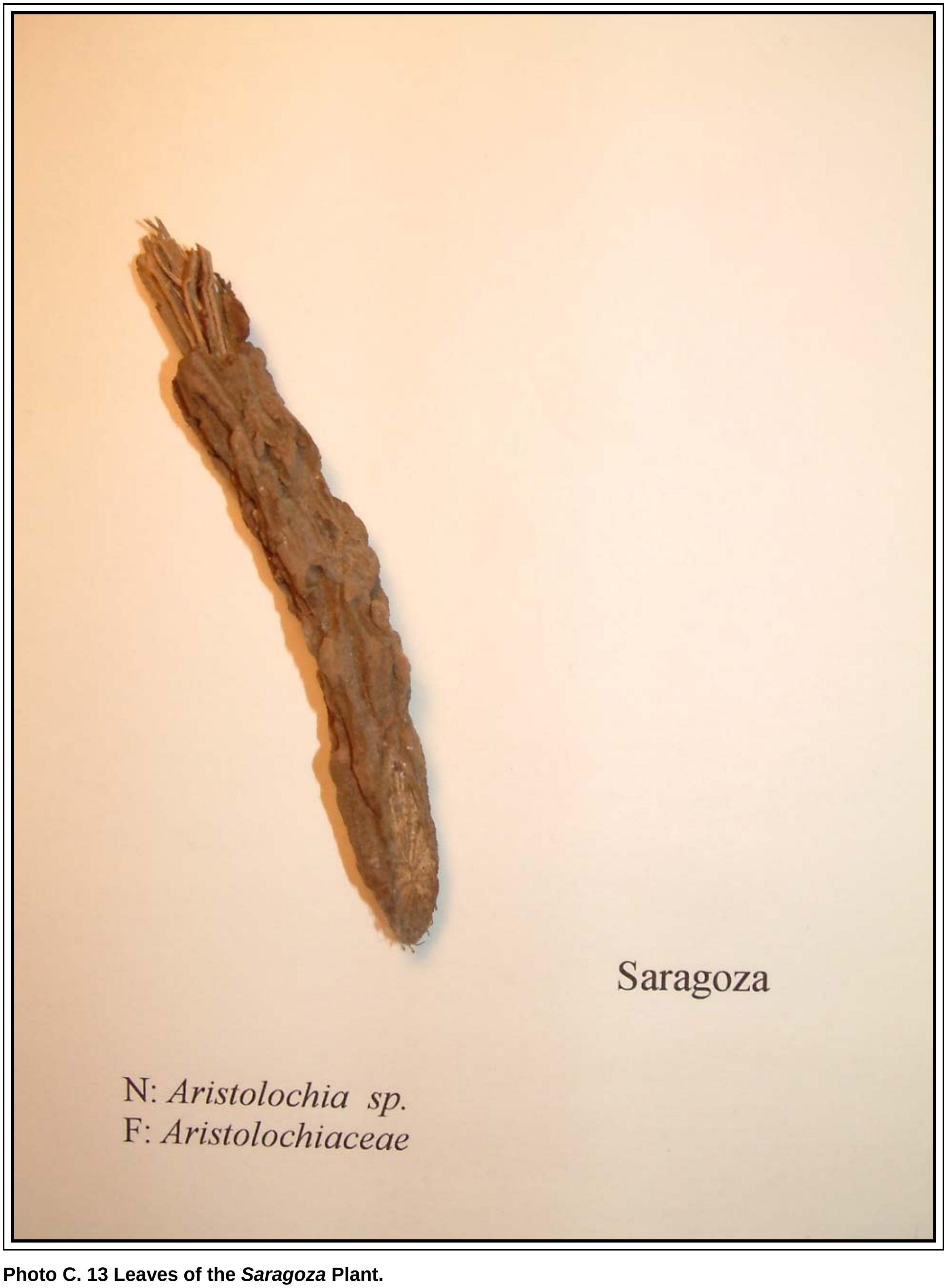


Photo C. 13 Leaves of the *Saragoza* Plant.

APPENDIX D

PHOTOS OF VOLUME-CONTAINERS

It shows photographs of different volume/containers, to give the reader an idea of the volume of breastmilk consumed by the infant (linked to chapter 6). Just to have an idea of comparable volume, see photo 6.1 of a Greek's *karafaki* of 100, 250,500 and 1000 grams and a New York City 224g cup of coffee, which is the equivalent of 8oz. and a bottle of water equivalent to 500 grams.

Photo D.1-5 Wine's Handycup and Coffee Cup Within a 5cm Scale Relationship

Milton Herrera 2004

Photo D.1-6 Wine's Handycup and Coffee Cup Within a 5cm Scale Relations

Photo D.1-7 Wine's Handycups within a 5cm Scale Relation

Photo D.1-8 Wine's Handycup and Bottle of Water Within a 5cm Scale Relations

Photo D.1-9 Wine's Handycup Within a 5cm Scale Relations

APPENDIX E

INFANTS Z SCORES AND PERCENTILES

Here are Z-score reports reports for each infant case by case as well as percentile figures. The data presented here are age, weight-for-length, length-for-age, weight-for-age, and head circumference. The data collected in this study were analyzed using the 2000 CDC Growth Reference Curves.

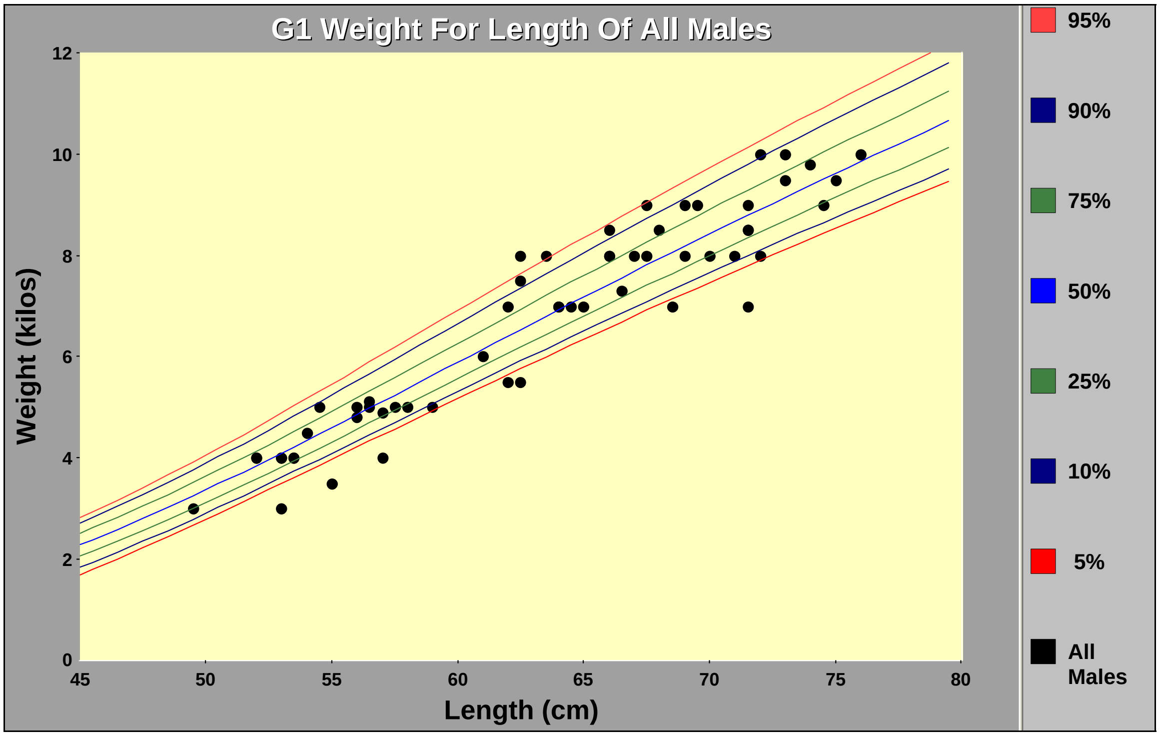


Figure E.1 Weight-for-Length of Males A number of infants fall below the 5th percentile, classifies them as wasting.

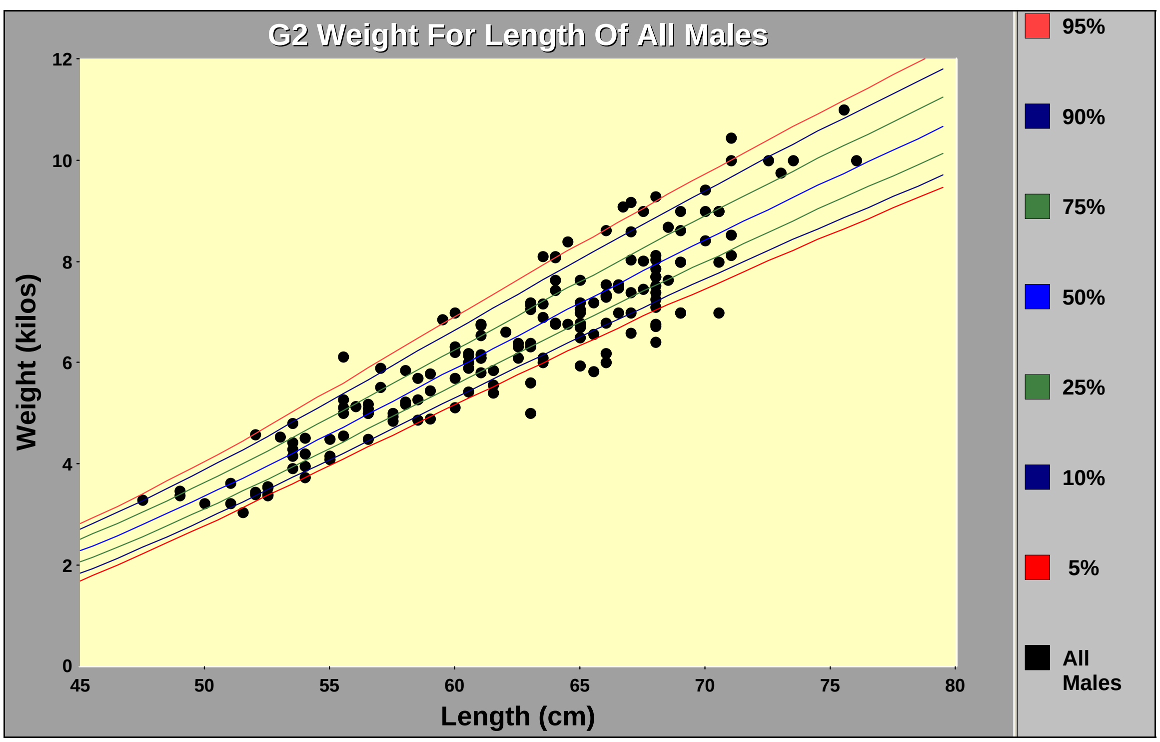


Figure E.2 Weight-for-Length of Males **A number of infants fall below the 5th percentile, classifies them as wasting.**

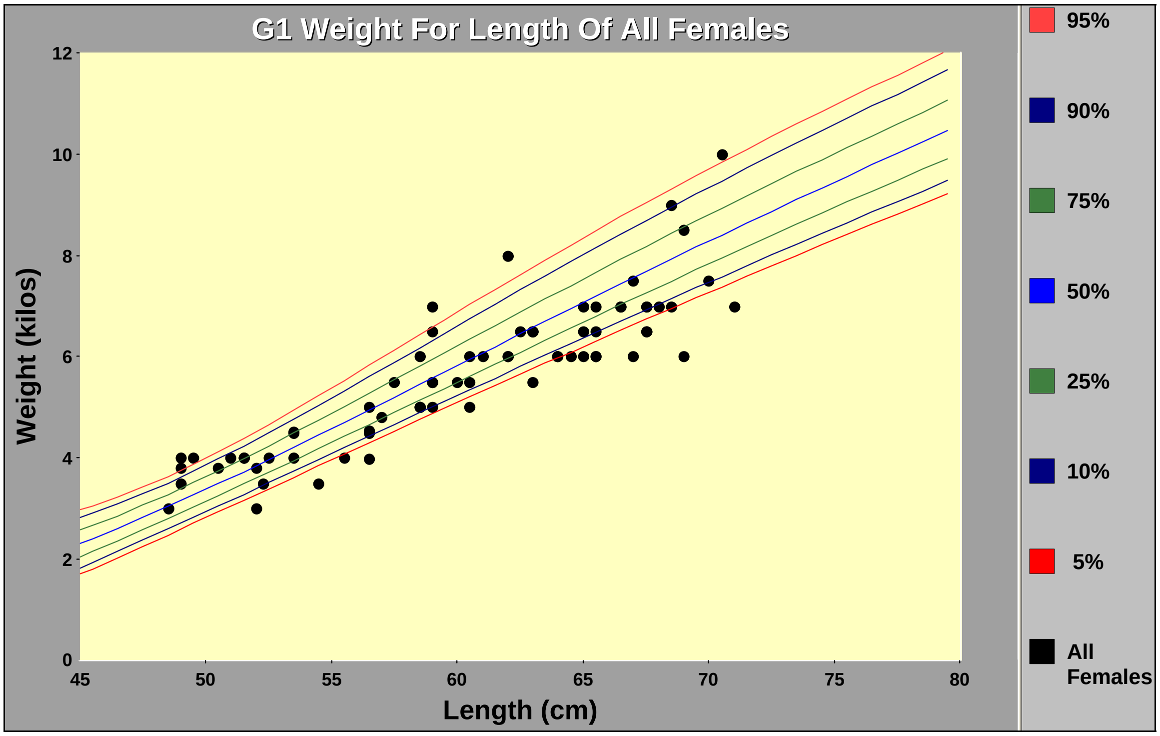


Figure E.3 Weight-for-Length of all Females

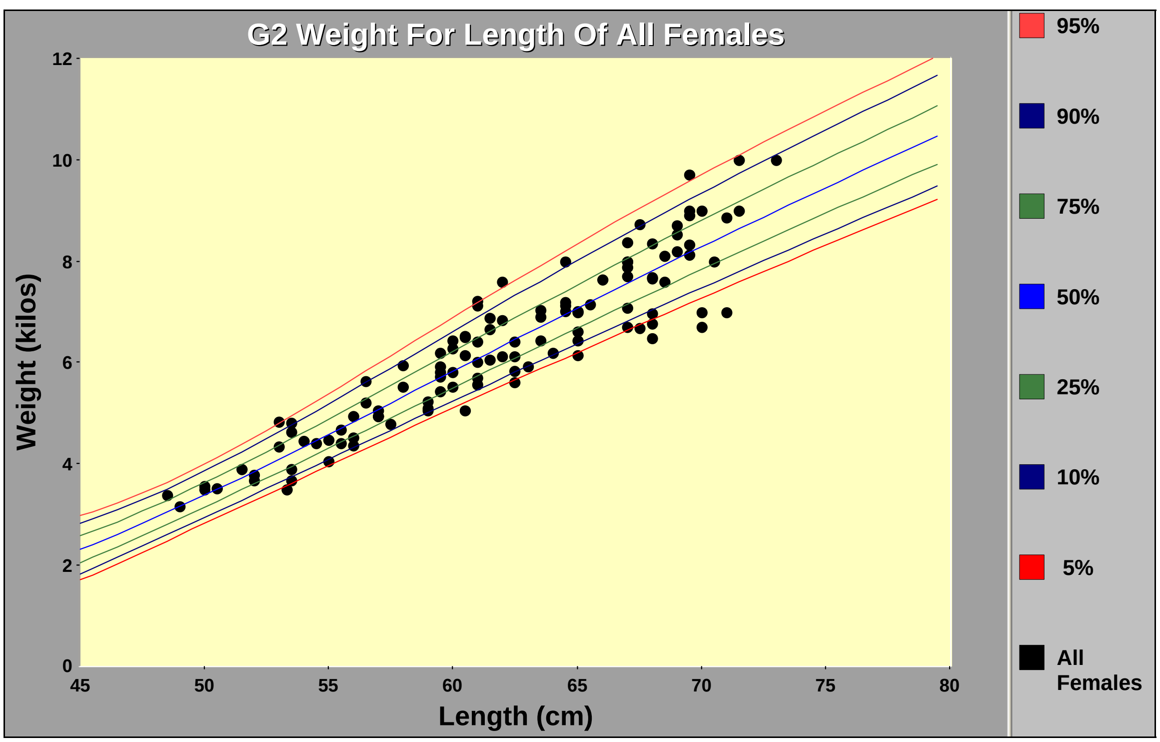


Figure E.4 Weight-for-Length of all Females Similar to males, a number of female infants also fell below the 5th percentile, but in fewer numbers.

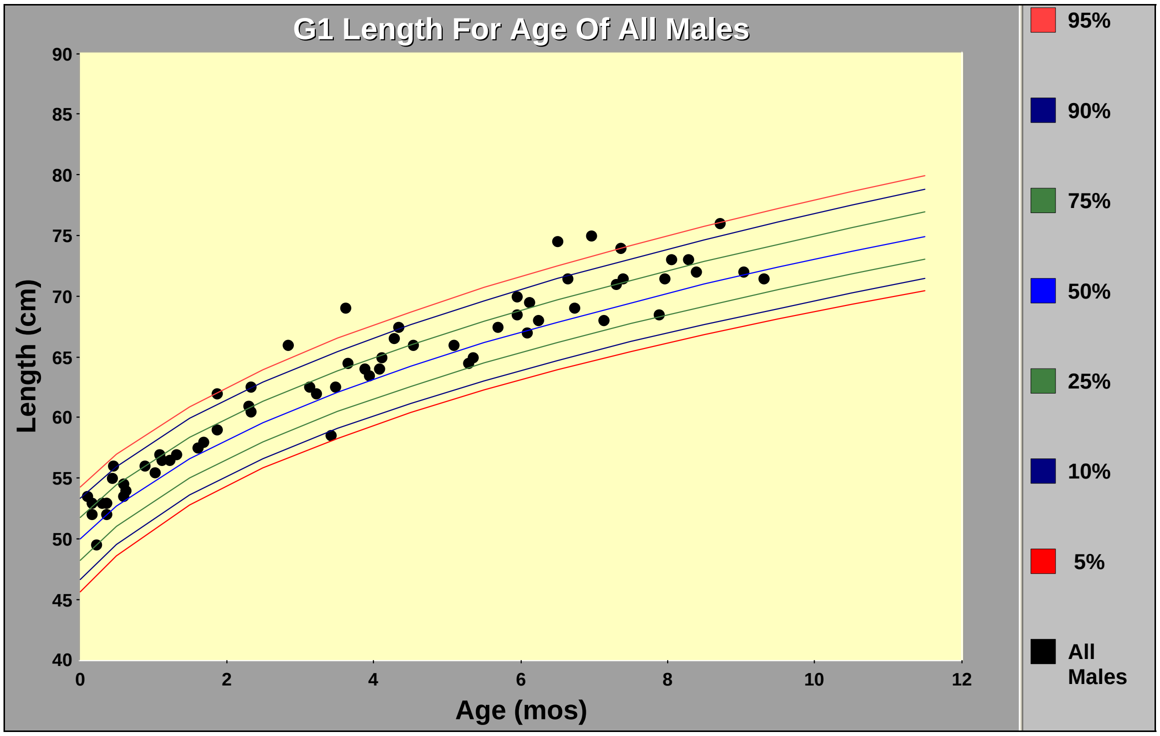


Figure E.5 Length for Age of Males In this group a few children grew above the 90th percentile, taller than the average child.

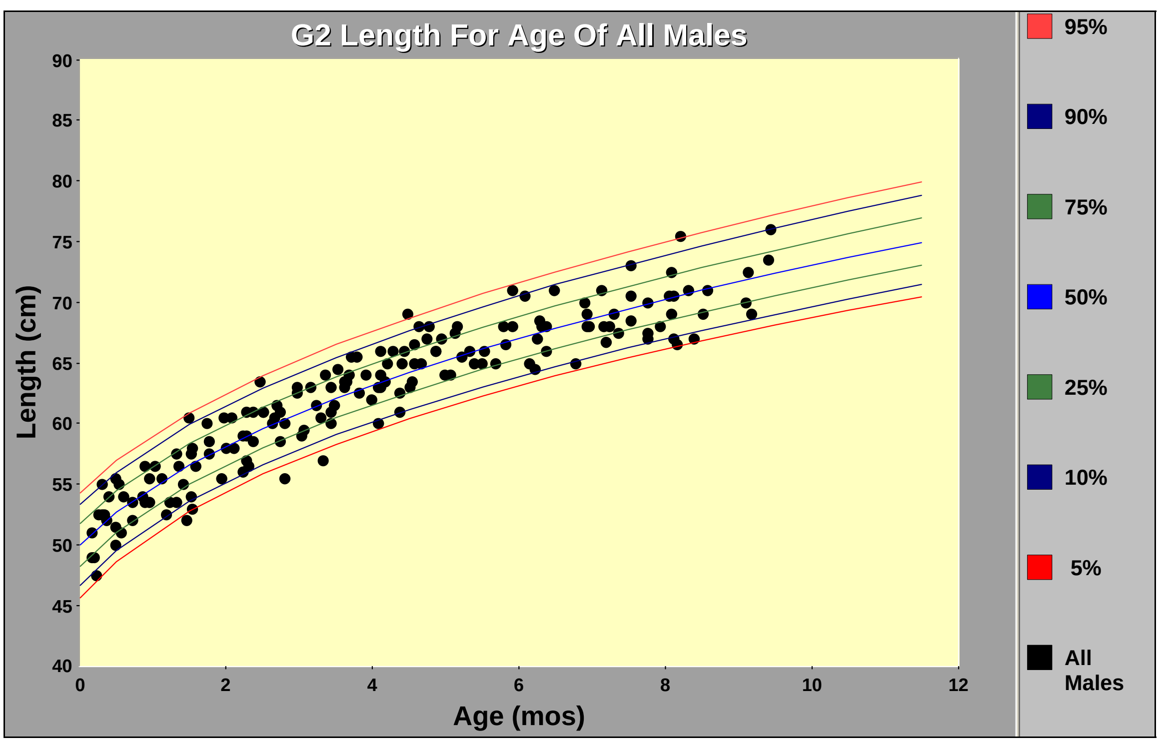


Figure E.6 Length for Age of Males In this group almost all male children fall within the median range, with a small number considered stunted who fall below the 5th percentile.

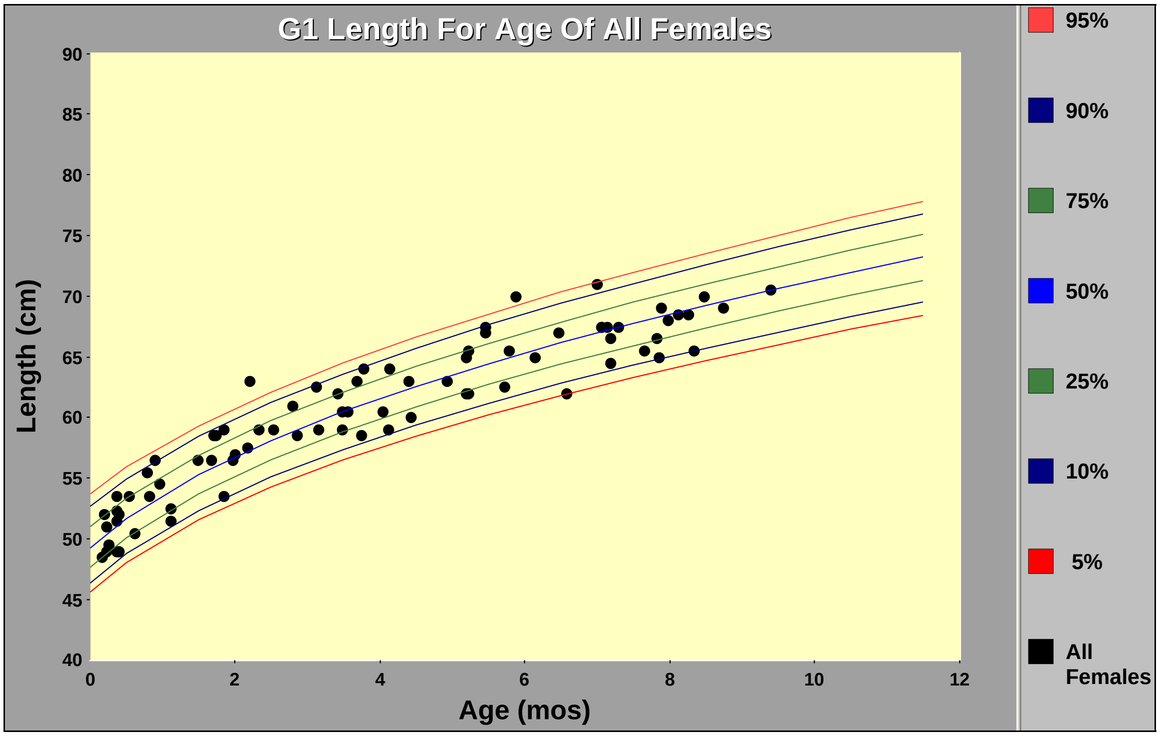


Figure E.7 G1 Length for Age of Females Similar to males, a small number of females in this group fall above the 90th percentile, taller than average.

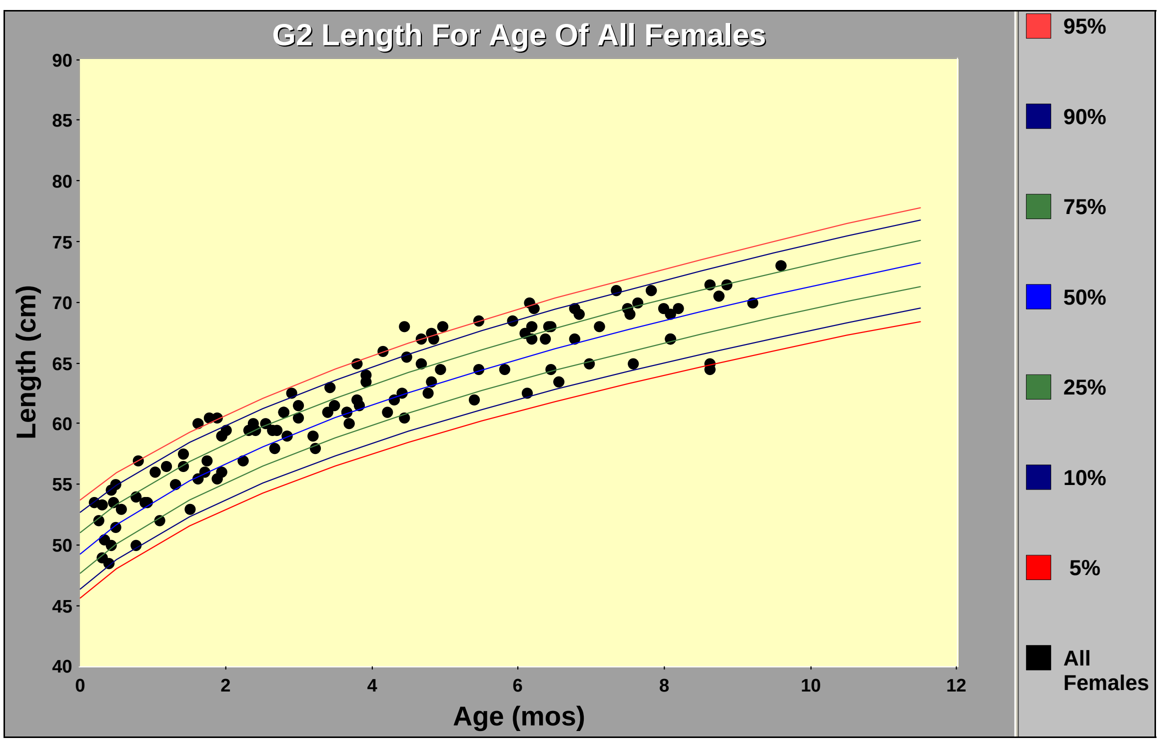


Figure E.8 Age of Females This group had the largest number of taller infants falling within the 90th percentile.

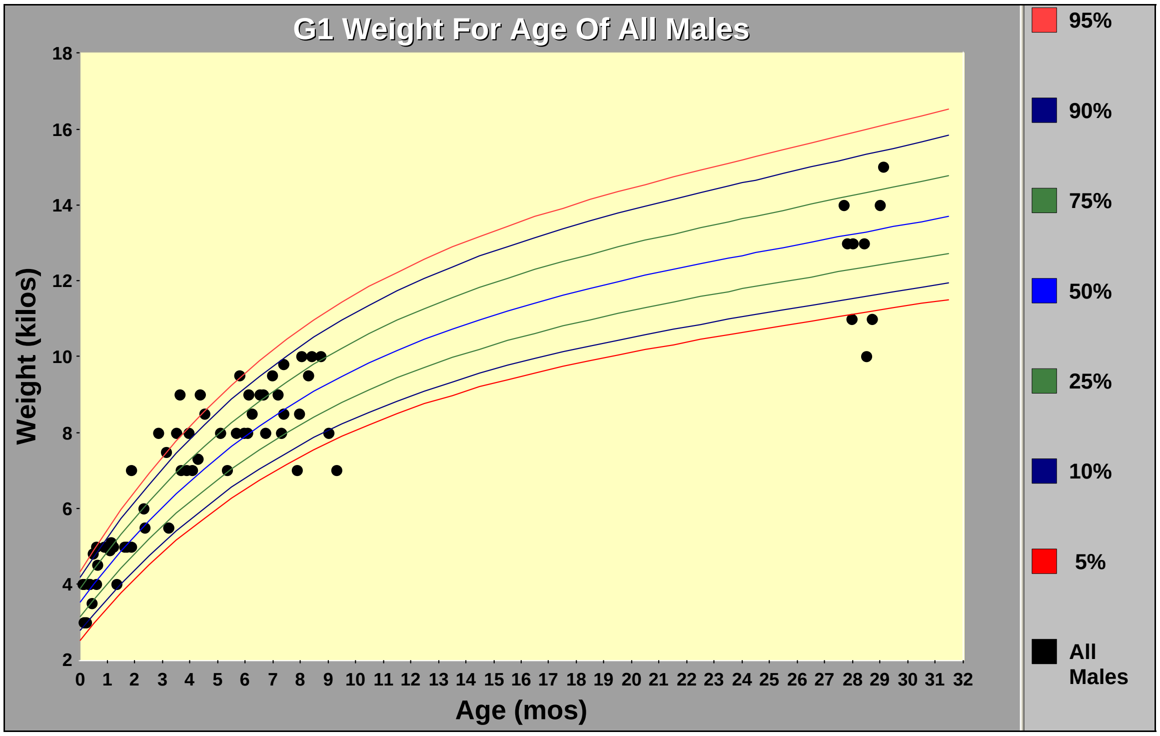


Figure E.9 Weight-for-Age of Males Data presented over a 32 month period show a portion of the male infants in this group falling below the 5th percentile. Also a few infants fall above the 90th percentile in the first 9 months.

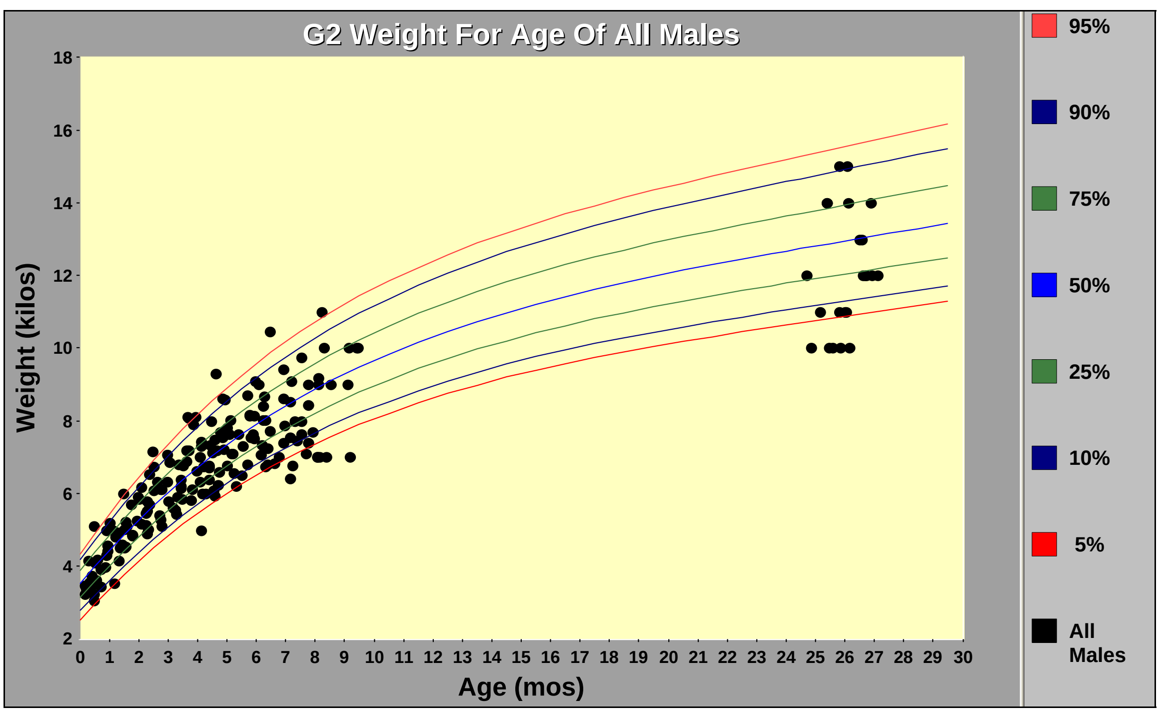


Figure E.10 Weight-for-Age of Males Data presented over a 32 month period show a small number of male infants falling below the 5th percentile. Also a few infants fall above the 90th percentile in the first 9 months.

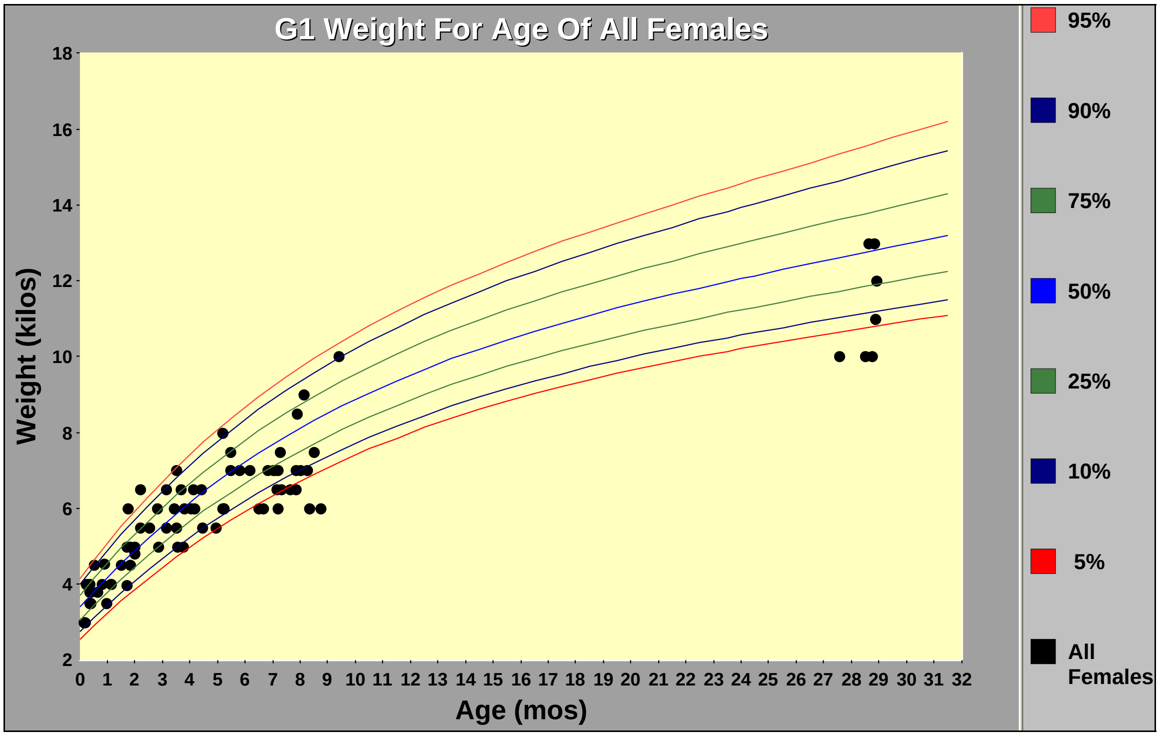


Figure E.11 Weight-for-Age of Females Among female infants in this group a number fall below the 25th percentile during the first 9 months.

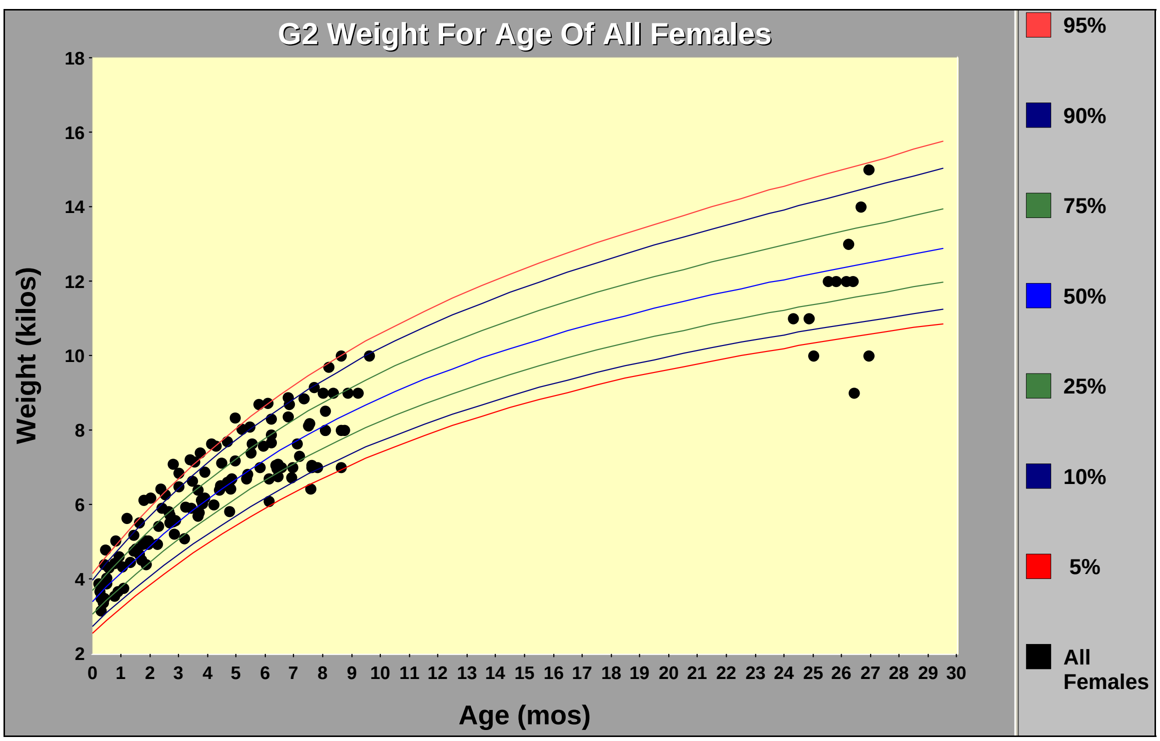


Figure E.122 Weight-for-Age of Females In this group, a large number of infants fall above the 75th percentile during the first 9 months.

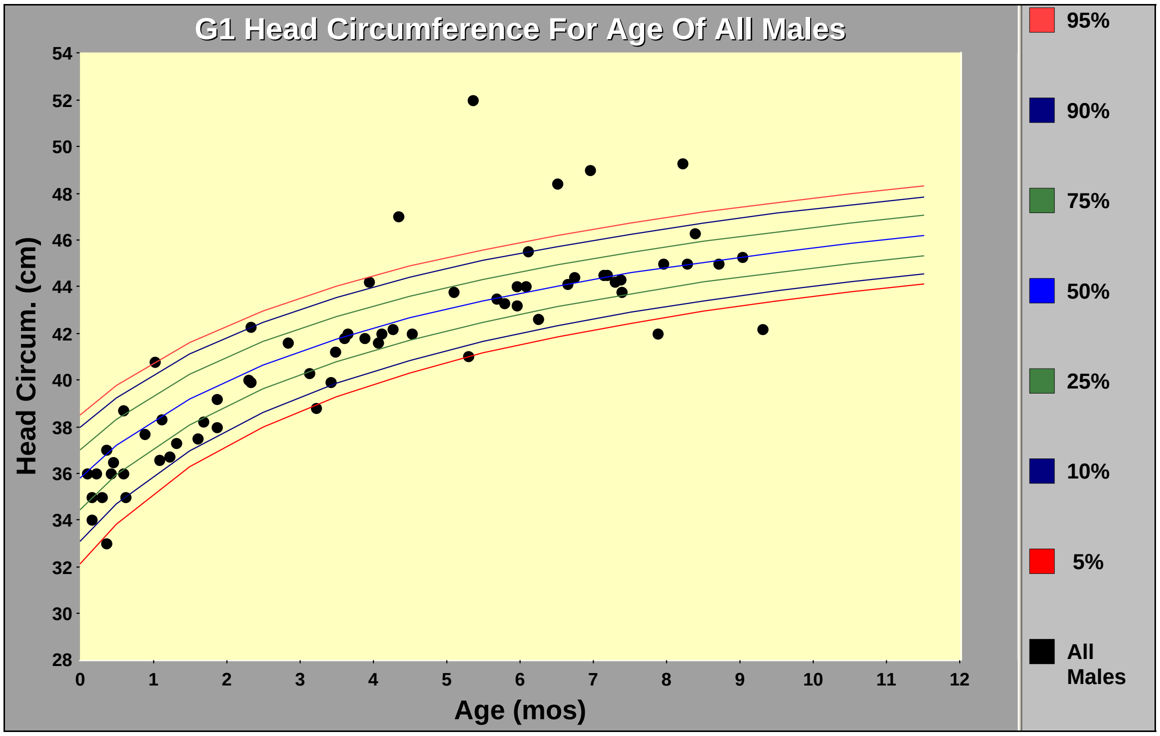


Figure E.13 Head Circumference for Age all Males Head circumference in infants is measured to track growth. A single case of hydrocephaly generated marks seen above the 95th percentile.

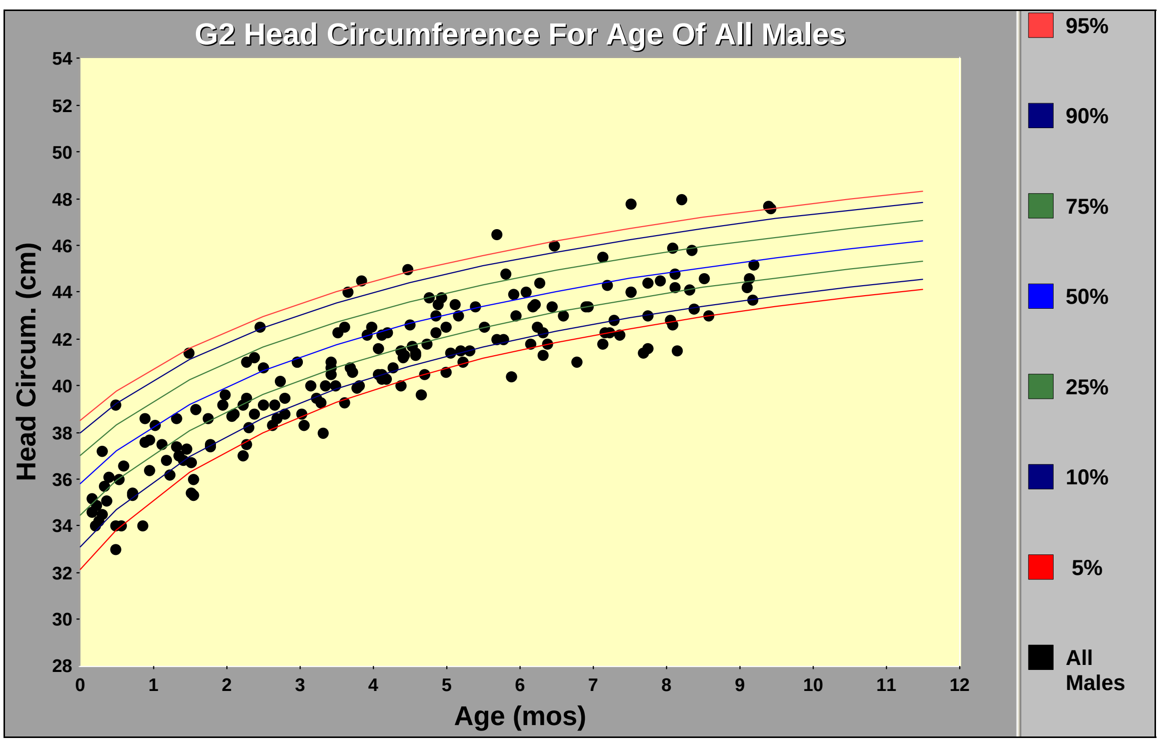


Figure E.14 Head Circumference for Age all Males

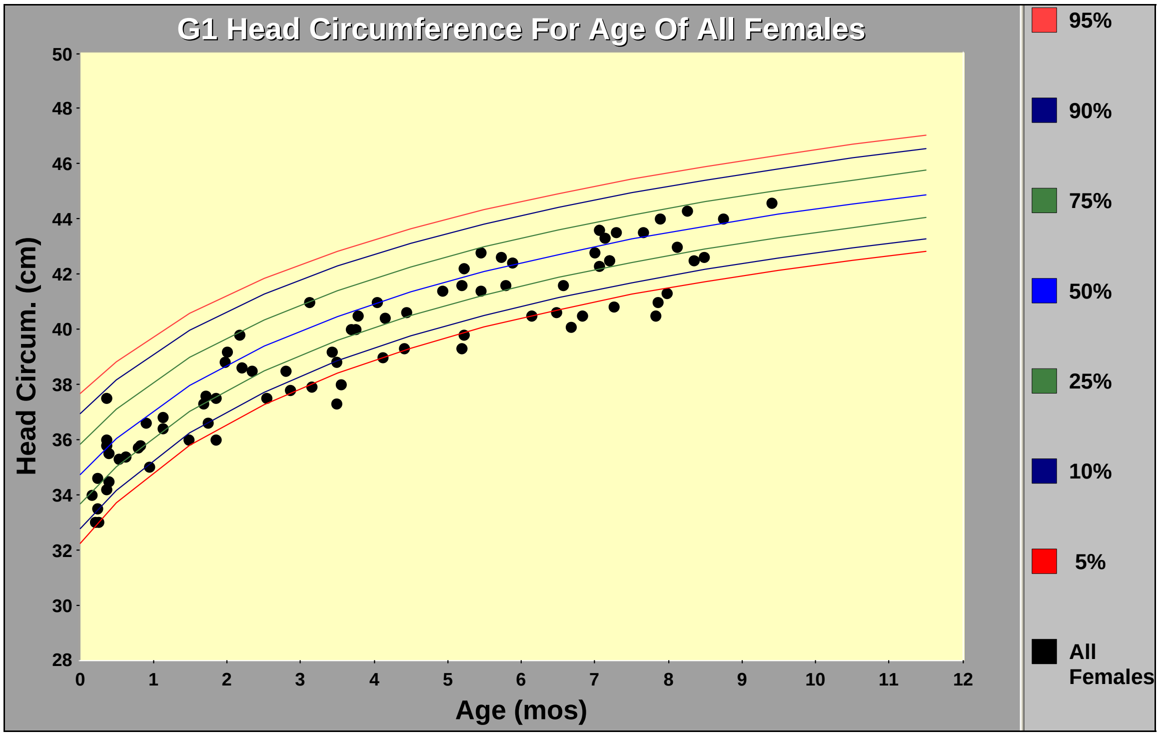


Figure E.15 Head Circumference for Age all Females

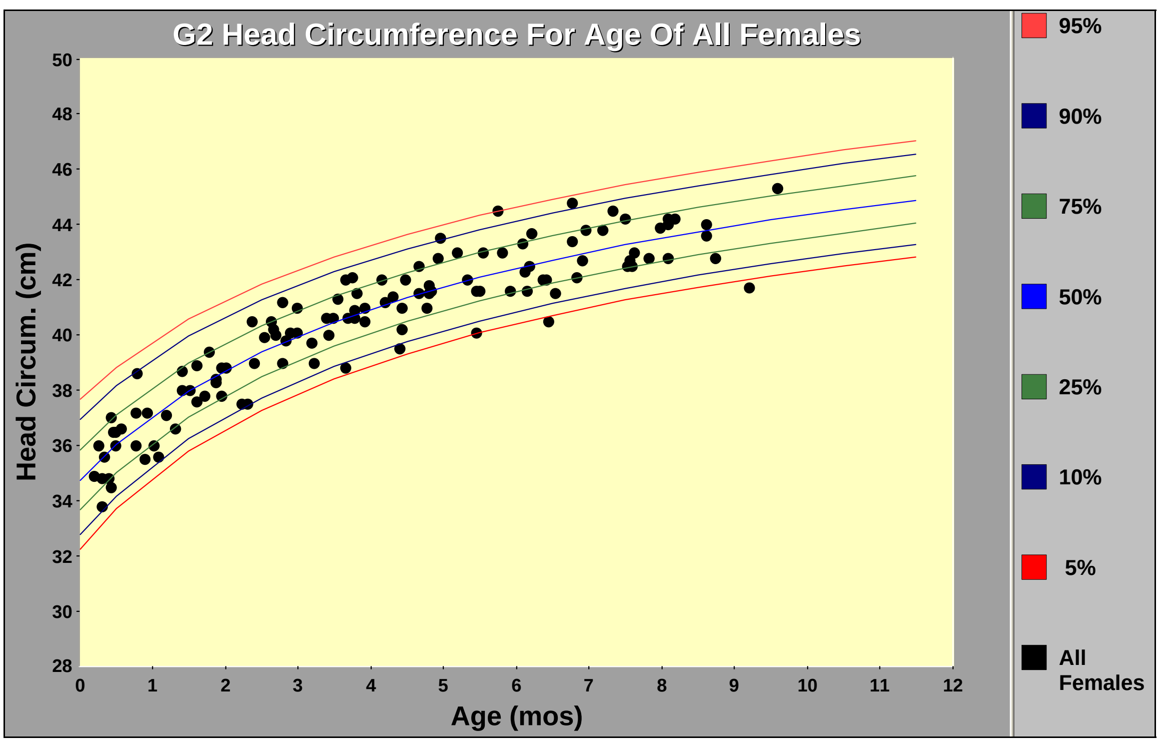


Figure E.16 Head Circumference for Age all Females

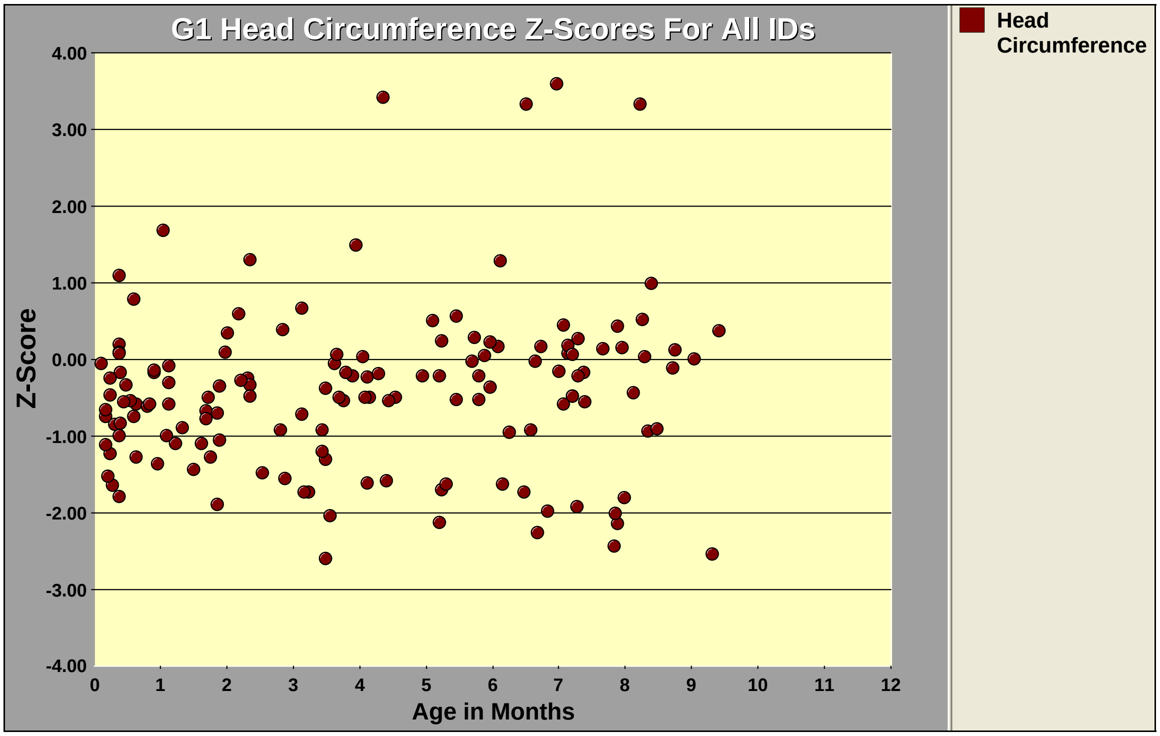


Figure E.17Head Circumference Z-Scores for all IDs – A single case of hydrocephaly shows >3SD above the mean.

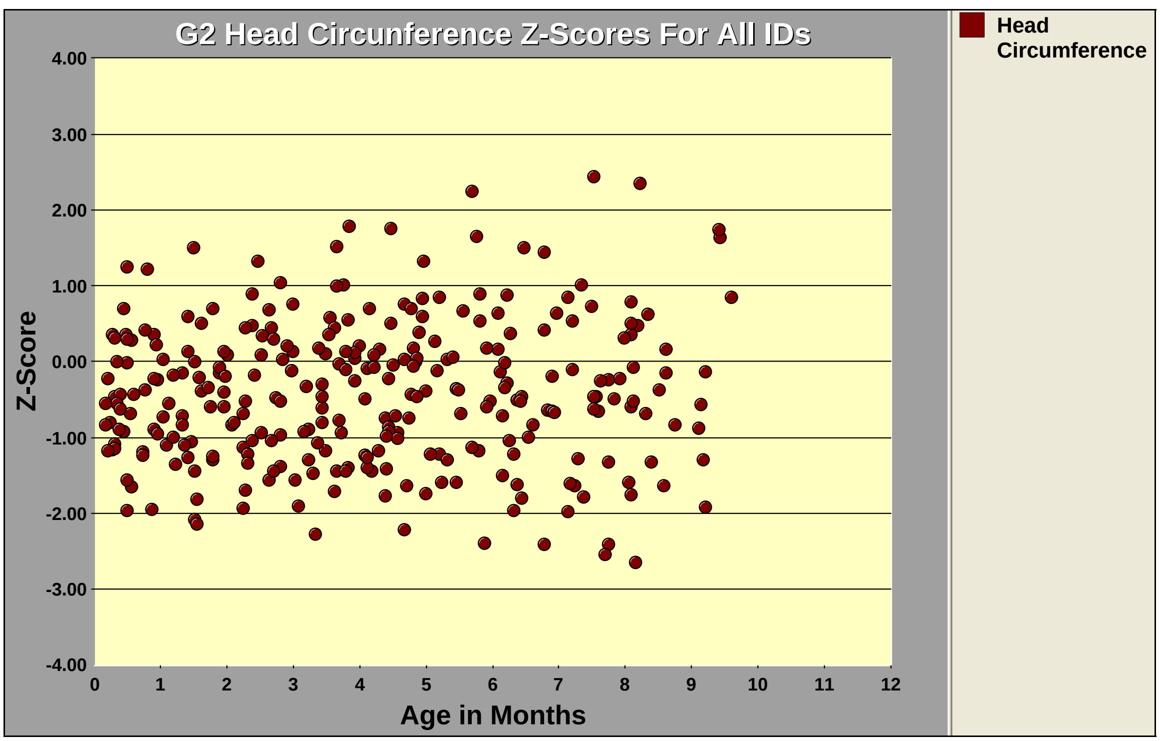


Figure E.18 Head Circumference Z-Scores for all IDs

Table E.1

G1 Z-SCORES REPORT

1

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	4.80	56.00	36.50	11.50	-0.11	1.35	1.52	-0.32			
1.90	7.00	62.00	39.20	14.50	0.98	1.61	2.61	-0.34			
3.60	9.00	69.00	41.80	15.50	1.11	2.37	2.85	-0.04	0.41		
5.80	9.50		43.30	16.10			1.71	-0.21			
7.40	9.80	74.00	44.30	16.30	0.53	1.64	1.16	-0.16	0.74	0.98	
8.70	10.00	76.00	45.00	14.60	0.18	1.61	0.77	-0.11	-0.85	-0.6	
29.10	15.00	94.50			0.61	1.11	1.03				0.37

2

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.40	3.80	52.00	35.50	11.00	-0.11	0.34	0.18	-0.16			
1.80	5.00	59.00	37.50	12.60	-1.29	1.12	0.36	-0.69			
4.10	6.00	64.00	40.40	13.60	-1.59	0.89	-0.31	-0.49			
5.20	6.00	65.50	42.20	12.50	-2.35	0.64	-1.05	0.25	-1.64		
7.30	6.50	67.50	43.50	13.30	-2.15	0.05	-1.58	0.28	-1.1	-0.77	
8.70	6.00	69.00	44.00	12.60	-4.15	-0.19	-2.97	0.13	-1.97	-1.61	
29.50											

3

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.60	3.80	50.50	35.40	10.50	0.84	-0.69	-0.16	-0.58			
2.00	4.80	57.00	39.20	12.60	-0.61	0.13	-0.14	0.36			
3.80	5.00	58.50	40.00	12.50	-0.99	-1	-1.41	-0.53			
4.90	5.50	63.00	41.40	13.00	-2.29	-0.13	-1.54	-0.2			
7.20	6.00	64.50	42.50	14.60	-1.85	-1.02	-2.19	-0.47		0.35	
8.30	6.00	65.50	42.50	12.80	-2.35	-1.26	-2.78	-0.93	-1.32	-1.38	
29.40											

4

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	4.50	53.50	35.30		0.71	0.69	1.33	-0.53			
1.70	6.00	58.50	36.60	14.60	1.01	1.03	2.11	-1.27			
3.50	7.00	59.00	38.80	14.40	2.17	-0.58	1.56	-1.29			
5.20	8.00	62.00	41.60	16.00	2.20	-0.72	1.43	-0.2			
8.10	9.07	68.5	43.00	16.80	1.33	-0.04	0.89	-0.43	1.91	2.01	
28.90	12.08	83.8			0.43	-1.44	-0.6				0.70

5											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	4.00	52.00	33.00	10.00	0.38	0.02	0.23	-1.79			
1.90	5.00	59.00	38.00	13.80	-1.46	0.50	-0.25	-1.05			
4.10	7.00	64.00	41.60	15.50	0.14	0.27	0.28	-0.48			
5.70	8.00	67.50	43.50	14.80	0.29	0.40	0.30	-0.01	-0.06		
7.10		68.00	44.50	15.10		-0.33		0.09	0.15	-0.01	
8.30	9.50	73.00	45.00	15.50	0.46	0.84	0.49	0.04	0.13	0.19	
29.00	14.00	91.00			0.51	0.20	0.43				0.45

6											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.80	49.00	36.00	11.00	1.78	-0.86	0.22	0.21			
2.00	5.00	56.50	38.80	12.20	0.13	-0.04	0.21	0.11			
4.00	6.00	60.50	41.00	13.00	0.10	-0.44	-0.23	0.04			
5.70		62.50	42.60	13.00		-0.88		0.29			
7.10	6.50	67.50	43.30	12.60	-2.15	0.14	-1.49	0.19	-1.8	-1.33	
8.30	7.00	68.50	44.30	13.50	-1.55	-0.12	-1.41	0.53	-1.02	-0.78	
29.30											

7											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.50	52.30	34.20	11.00	-1.15	0.52	-0.36	-0.98			
1.70	4.00	56.50	37.30	13.30	-2.63	0.29	-1.1	-0.67			
3.40	6.00	62.00	39.20	13.20	-0.61	0.70	0.26	-0.91			
5.50	7.00	67.50	41.40	15.60	-1.14	1.26	0.07	-0.51	1.02		
7.10	7.00	67.50	42.30	15.50	-1.14	0.19	-0.83	-0.57	0.94	1.15	
8.50	7.50	70.00	42.60	13.80	-1.23	0.31	-0.91	-0.9	-0.9	-0.57	
28.80	13.00	85.30			1.06	-1.02	0.14				1.18

8											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	4.00	51.50	37.50	11.50	0.72	0.20	0.62	1.10			
2.20	5.50	57.50	39.80	13.00	0.61	0.14	0.77	0.61			
3.10	6.50	62.50	41.00	13.60	0.08	1.19	1.24	0.68			
5.50	7.50	67.00	42.80	15.60	-0.1	1.06	0.67	0.57	1.09		
7.10		67.50	43.60	13.90		0.19		0.45	-0.49	-0.21	
7.90	8.50	69.00	44.00	14.60	0.60	0.27	0.48	0.44	0.00	0.21	
9.40	10.07	70.5	44.60	14.50	1.79	0.02	1.32	0.38	-0.28	-0.14	
28.90	11.08	83.5			-0.61	-1.51	-1.46				-0.25

9											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	4.00	53.00	35.00	10.00	-0.22	0.53	0.33	-0.84			
1.60	5.00	57.50	37.50	12.30	-0.53	0.22	0.05	-1.09			
3.20	5.50	62.00	38.80	12.10	-2.03	0.24	-0.91	-1.72			
5.40	7.00	65.00		13.60	-0.31	-0.33	-0.63		-1.01		
6.90				12.80						-1.94	
7.90	7.00	68.50	42.00	12.50	-1.94	-0.58	-2.04	-2.14	-2.44	-2.28	
9.30	7.00	71.50	42.20	13.50	-3.35	-0.21	-2.68	-2.53	-1.65	-1.56	
28.70	11.00	85.80			-1.5	-1.17	-1.81				-1.26

10											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	4.00	49.50	33.00	10.50	2.00	-0.43	0.80	-1.64			
1.50	4.50	56.50	36.00	12.00	-1.08	0.53	-0.05	-1.43			
3.60	5.00	60.50	38.00	12.30	-2.2	-0.03	-1.26	-2.04			
5.20	6.00	65.00	39.30	12.00	-2.1	0.46	-1.03	-2.12	-2.09		
6.70	6.00		40.10	12.30			-1.91	-2.26		-1.49	
7.80	7.00	66.50	40.50	12.50	-0.72	-0.62	-1.21	-2.43	-1.78	-1.54	
28.90											

11											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	4.00	49.00	33.50	9.00	2.30	-0.58	0.85	-1.22			
1.80	4.50	53.50	36.00	12.50	0.73	-1.16	-0.43	-1.88			
3.20	5.50	59.00	37.90		-0.14	-0.26	-0.2	-1.73			
5.20	6.00	62.00	39.80	14.60	-0.61	-0.74	-1.05	-1.7			
6.80	7.00		40.50	14.00			-0.71	-1.98		-0.08	
8.00	7.00	68.00	41.30	13.80	-1.34	-0.16	-1.28	-1.8	-0.66	-0.48	
28.60	13.00	85.30			1.06	-0.97	0.16				1.17

12											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.10	4.00	53.50	36.00	10.30	-0.53	1.13	0.71	-0.05			
1.70	5.00	58.00	38.20	13.50	-0.83	0.33	-0.03	-0.76			
3.70	7.00	64.50	42.00	14.80	-0.09	0.80	0.62	0.07			
5.10	8.00	66.00	43.80	15.00	0.85	0.25	0.67	0.52	0.26		
6.70	8.00	69.00	44.40	14.40	-0.28	0.29	-0.29	0.18	-0.61	-0.56	
8.00	8.50	71.50	45.00	15.00	-0.44	0.50	-0.35	0.16	-0.22	-0.19	
9.00	8.00	72.00	45.30	15.60	-1.47	0.11	-1.34	0.01	0.27	0.20	
28.50	10.00	85.00			-2.7	-1.36	-2.74				-2.51

13											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	3.00	49.50	36.00	10.00	-0.67	-0.66	-1.24	-0.24			
1.30	4.00	57.00	37.30	13.50	-3.12	0.44	-1.08	-0.88			
3.50	8.00	62.50	41.20	15.40	2.06	0.19	1.91	-0.37			
4.50	8.50	66.00	42.00	15.00	1.49	0.66	1.57	-0.49	0.26		
6.60	9.00	71.50	44.10	15.70	0.29	1.22	0.77	-0.01	0.39	0.56	
8.10	10.00	73.00		15.30	1.07	0.96	1.03		-0.04	0.05	
28.40	13.00	89.30			-0.06	-0.15	-0.2				-0.04

14											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	3.00	48.50	34.00	10.00	-0.1	-0.65	-1.02	-0.74			
1.10	4.00	51.50	36.80	12.00	0.72	-1.03	-0.45	-0.3			
2.90	5.00	58.50	37.80	12.00	-0.99	-0.18	-0.67	-1.54			
4.40	5.50	60.00	40.60	12.70	-0.66	-0.95	-1.2	-0.53			
6.60		62.00	41.60	13.00		-1.6		-0.92		-0.87	
7.70	6.50	65.50	43.50	14.20	-1.24	-0.9	-1.76	0.14	0.12	-0.08	
28.80											

15											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.80	4.00	55.50	35.70	11.00	-1.86	1.10	-0.03	-0.61			
1.70	5.00	58.50	37.60	12.50	-0.99	1.07	0.51	-0.48			
2.80	6.00	61.00	38.50	12.70	-0.14	0.90	0.86	-0.91			
4.40	6.50	63.00	39.30	13.50	-0.13	0.27	0.16	-1.58			
6.50	6.00	67.00	40.60	13.30	-3.12	0.36	-1.8	-1.72	-1.03	-0.59	
7.90	6.50	65.00	41.00	12.60	-1.01	-1.19	-1.86	-2	-1.45	-1.46	
28.50	10.00	80.00			-0.94	-2.4	-2.43				-0.39

16											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.60	4.00	53.50	36.00	11.00	-0.53	0.18	-0.14	-0.74			
1.20	5.00	56.50	36.70	13.00	0.05	0.38	0.57	-1.09			
3.10	7.50	62.50	40.30	13.00	1.47	0.53	1.70	-0.7			
5.30		64.50	41.00	14.30		-0.49		-1.62			
6.20	8.50	68.00	42.60	15.40	0.82	0.22	0.49	-0.95	0.41	0.36	
7.40	8.57	71.5	43.80	15.30	-0.44	0.80	-0.09	-0.55	0.05	0.13	
28.00	11.09	86.0			-1.55	-0.98	-1.74				-1.35

17											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	3.00	52.00	33.00	9.20	-2.52	0.69	-1.08	-1.52			
1.00	3.50	54.50	35.00	12.00	-2.78	0.49	-1.11	-1.36			
3.50	5.50	60.50	37.30	12.50	-0.92	0.04	-0.49	-2.6			
28.00											

18											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.50	49.00	34.50	11.50	0.98	-0.92	-0.4	-0.83			
1.10	4.00	52.50	36.40	14.50	0.10	-0.6	-0.45	-0.58			
2.50	5.50	59.00	37.50	14.00	-0.14	0.34	0.38	-1.48			
4.10	6.50	59.00	39.00	14.70	1.54	-1.1	0.38	-1.61			
6.10	7.00	65.00	40.50	15.10	-0.12	-0.19	-0.34	-1.62	0.95	1.03	
7.30	7.50		40.80	15.00			-0.34	-1.92		0.68	
28.30											

19											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	4.00	53.00	37.00	12.50	-0.22	0.41	0.23	0.11			
1.10	5.10	56.50	38.30	14.00	0.30	0.53	0.91	-0.08			
3.40		58.50	39.90	13.00		-1.43		-1.19			
4.10		65.00	42.00	14.90		0.62		-0.22	0.29		
6.10	8.00	67.00	44.00	15.30	0.48	-0.05	0.07	0.17	0.42	0.30	
27.80											

20											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.60	5.00	54.50	38.70	12.80	1.10	0.56	1.63	0.80			
1.00		55.50	40.80	13.40		0.30		1.69			
2.30		60.50	42.30	14.30		0.55		1.31			
3.90	8.00	63.50	44.20	14.40	1.73	0.19	1.51	1.50			
6.10	9.00	69.50	45.50	16.00	0.95	0.85	1.06	1.29	0.79	0.89	
8.40	10.00	72.00	46.30	15.20	1.36	0.44	0.90	1.00	-0.07	-0.07	
27.90											

21

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.40	3.50	55.00	36.00	12.00	-3.25	1.03	-0.73	-0.54			
0.90	5.00	56.00	37.70	13.60	0.32	0.69	1.09	-0.16			
2.30	6.00	61.00	40.00	14.50	-0.29	0.77	0.67	-0.24			
3.90	7.00	64.00	41.80	14.90	0.14	0.43	0.43	-0.21			
6.00		68.50	44.00	15.00		0.59		0.23	0.03		
7.30	8.00	71.00	44.20	15.80	-1.07	0.68	-0.57	-0.2	0.51	0.56	
27.80	13.00	89.00			0.01	-0.11	-0.14				0.03

22

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	3.00	53.00	35.00	9.50	-3.36	0.82	-1.15	-0.65			
1.10	4.90	57.00	36.60	13.50	-0.47	0.78	0.62	-0.98			
2.30	5.50	62.50	39.90	13.70	-2.34	1.29	-0.05	-0.33			
4.30	7.30	66.50	42.20	15.60	-0.44	1.04	0.48	-0.18	0.72		
6.00	8.00	70.00	43.20		-0.68	1.12	0.14	-0.36			
7.20	9.00		44.50	16.60			0.50	0.07		1.25	
28.00	13.00	88.80			0.05	-0.21	-0.16				0.09

23

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.40	4.00	53.50	35.80	11.70	-0.53	0.98	0.62	0.09			
0.90	4.50	56.50	36.60	13.40	-0.98	1.35	0.82	-0.13			
2.20	6.50	63.00	386	12.70	-0.13	2.30	2.28	-0.26			
3.80	6.00	64.00	40.50	13.50	-1.59	1.19	-0.03	-0.16			
5.90		70.00	42.40	15.20		1.94		0.06	0.39		
7.00	7.00	71.00	42.80	14.80	-2.6	1.57	-0.8	-0.14	-0.05	0.57	
28.80	10.00	85.50			-2.5	-0.95	-2.46				-2.24

24

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	4.00	52.00	34.00	10.30	0.38	0.44	0.59	-1.11			
0.60	4.50	54.00	35.00	12.00	0.36	0.32	0.67	-1.26			
2.80	8.00	66.00	41.60	15.00	0.85	2.04	2.60	0.40	0.26		
4.30	9.00	67.50	47.00	14.40	1.59	1.34	2.21	3.43	-0.47		
5.40			52.00					6.91			
6.50	9.00	74.50	48.40	14.50	-0.73	2.25	0.84	3.34	-0.87	-0.44	
7.00	9.50	75.00	49.00	15.60	-0.17	2.16	1.08	3.61	0.10	0.43	
8.20			49.30	15.00				3.34		-0.22	
27.70	14.00	91.90			0.31	0.70	0.55				0.15

25											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	4.00	51.00	34.60	11.70	1.03	0.25	0.85	-0.46			
0.80		53.50	35.80	12.80		0.27		-0.58			
2.30		59.00	38.50	13.60		0.57		-0.47			
3.70	6.50	63.00	40.00	13.50	-0.13	0.88	0.72	-0.48			
5.80	7.00	65.50	41.60	13.30	-0.32	0.24	-0.13	-0.52	-0.8		
7.20	7.00	66.50	42.50	14.80	-0.72	-0.27	-0.9	-0.47	0.48	0.52	
27.60	10.00	82.40			-1.61	-1.55	-2.32				-1.21

Table E.2

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1

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
1.30	4.50	55.00	36.60	13.50	-0.24	0.16	0.11	-0.71			
2.60	5.80	59.50	40.50	14.60	0.24	0.45	0.75	0.69			
3.70	6.40	61.00	42.00		0.58	0.09	0.63	1.01			
4.90	7.20	64.50	42.80	15.00	0.39	0.46	0.66	0.84			
6.20	7.70	68.00			-0.17	0.94	0.46				
7.50	8.10	69.50	44.20	15.40	-0.05	0.68	0.26	0.73	0.62	0.97	
9.60	10.00	73.00	45.30	15.50	1.17	0.83	1.25	0.86	0.36	0.65	

2

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
1.20	3.50	52.50	36.80	12.20	-1.13	-1.17	-1.61	-0.99			
2.70	5.30	58.50		13.50	-0.47	-0.69	-0.76				
4.00	6.60	62.00	42.50	14.50	0.38	-0.45	-0.1	0.22			
4.90	7.20		43.50	15.20			-0.07	0.40			
5.80	7.60	66.50	44.80	14.90	0.00	-0.06	-0.26	0.90	0.13		
7.00	7.90	68.00			-0.12	-0.23	-0.56				
9.20			45.20	14.00				-0.12		-1.14	

3

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
1.10	5.00	55.50	37.50	13.30	0.59	0.14	0.72	-0.54			
2.50	6.70	61.00	39.20	15.50	1.00	0.55	1.41	-0.93			
3.70	8.10	64.00	40.80	16.60	1.66	0.59	1.82	-0.77			
4.90	8.60	66.00	42.30	16.20	1.63	0.42	1.46	-0.46	1.28		
6.00	9.10		43.00	16.30			1.22	-0.51			
6.90	9.40	70.00	43.40	16.50	1.30	0.55	1.04	-0.65	1.17	1.21	
9.10	10.00	72.50	44.60	17.60	1.21	0.24	0.61	-0.56	1.92	1.85	
27.10	12.00	82.30			0.58	-1.84	-0.82				0.92

4											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.90	4.60	53.50	37.20	12.50	1.00	0.13	0.95	0.23			
2.50	6.30	60.00	39.90	14.10	0.80	0.75	1.53	0.35			
3.60	7.20		41.30	15.60			1.74	0.58			
4.70	7.70	67.00	42.50	14.90	0.20	1.66	1.46	0.77	0.50		
6.10	8.70	67.50	43.30	15.50	1.32	0.82	1.66	0.65	0.94	1.38	
8.20	9.70	69.50	44.20	15.50	1.77	0.29	1.56	0.48	0.70	0.91	
26.90	15.00	91.50			1.37	1.10	1.54				1.12

5											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.90	5.00	56.50	38.60	12.60	0.05	0.88	1.09	0.37			
2.40	6.50	61.00	41.20	14.20	0.69	0.69	1.31	0.49			
3.70	8.10	63.50	44.00	16.50	1.85	0.43	1.87	1.53			
4.60	9.30	68.00		16.80	1.76	1.30	2.28		1.59		
6.50	10.50	71.00	46.00	17.50	2.09	1.15	2.14	1.51	1.94	2.12	
9.40	10.00	76.00	47.60	18.00	0.18	1.28	0.50	1.65	2.04	2.14	
26.90	14.00	88.90			0.98	0.05	0.63				0.90

6											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.90	3.70	53.50	35.50	12.70	-1.47	0.17	-0.75	-0.89			
2.20	5.00	57.00	37.50	12.60	-0.26	-0.14	-0.15	-1.13			
3.70	5.70	61.00	38.80		-0.72	0.09	-0.33	-1.43			
4.40	6.40	62.50	39.50	13.40	-0.05	0.07	0.05	-1.41			
5.50		64.50	40.10	13.30		0.07		-1.59			
6.40	6.80	68.00	40.50	14.50	-1.78	0.77	-0.78	-1.79	0.03	0.44	
9.20	9.00	70.00	41.70	14.00	0.90	-0.06	0.43	-1.91	-0.71	-0.52	
26.90	10.00	79.80			-0.88	-2.13	-2.24				-0.4

7											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
1.00	4.40	53.50	36.40	12.40	0.47	-0.38	0.04	-0.94			
2.20	5.50	59.00	39.20	13.60	-0.35	0.08	0.00	-0.67			
3.50	5.90	61.50	40.00		-0.85	-0.21	-0.67	-1.17			
4.60	5.90	65.00	41.40		-2.66	0.25	-1.43	-0.93			
5.50	6.50	65.00		13.20	-1.3	-0.44	-1.34		-1.43		
6.60	6.80		43.00	13.50			-1.59	-0.82		-1.31	
9.20	7.00	69.00	43.70	13.00	-2.18	-1.09	-2.63	-1.29	-1.98	-1.97	
26.90	12.00	82.60			0.50	-1.72	-0.8				0.83

8											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
1.00	4.60	55.50	37.70	12.40	-0.35	0.40	0.28	-0.23			
2.30	5.50	57.00	39.50	13.00	0.79	-0.8	0.03	-0.52			
3.40	6.20	61.00	40.80	13.30	0.03	-0.36	-0.22	-0.60			
4.40	6.40	62.50	41.50	13.50	-0.29	-0.58	-0.71	-0.74			
7.50	7.60	68.50	44.00	13.90	-0.71	-0.37	-1.11	-0.45	-1.06	-1.07	
9.10	9.00	70.00	44.20	14.30	0.79	-0.66	-0.31	-0.87	-0.78	-0.88	
26.70	12.00	84.00			0.16	-1.28	-0.78				0.43

9											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
1.50	4.80	53.00	38.00	13.50	1.72	-0.99	0.47	0.01			
2.70	5.50	58.00	40.20	13.50	0.42	-0.19	0.29	0.46			
3.80	6.10	61.50	41.50		-0.26	0.16	0.03	0.56			
4.80	6.40	63.50	41.80	15.00	-0.46	0.16	-0.2	0.18			
5.80	7.00	64.50	43.00	14.50	0.11	-0.17	-0.12	0.55			
7.00	7.00	65.00	43.80	13.60	-0.09	-0.7	-0.76	0.65	-0.39	-0.44	

10											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
1.10	3.85	52.0	35.6	11.5	-0.19	-0.75	-0.8	-1.10			

11

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.80	5.10	57.00	38.60	13.60	-0.02	1.66	1.98	1.23			
2.80	7.10	61.00	41.20	14.60	1.57	0.90	2.46	1.05			
3.80	7.40		42.10	15.40			1.84	1.02			
5.00	8.40	68.00	43.50	14.50	0.73	1.83	2.00	1.33	0.03		
5.80	8.70		44.50	14.60			1.84	1.66			
6.80	8.90	69.50	44.80	15.50	0.93	1.14	1.45	1.45	0.70	1.21	
7.70	9.20			15.40			1.26			0.92	
8.80	9.00	71.50		15.70	0.46	0.68	0.58		0.66	0.95	
26.60	14.00	86.60			1.63	-0.19	1.01				1.54

12

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.90	4.30	53.50	37.60	12.00	0.20	-0.29	-0.07	-0.22			
2.70	6.10	61.00	40.20	13.00	-0.07	0.33	0.36	-0.47			
4.10	7.30	66.00	42.20	15.00	-0.19	0.99	0.62	-0.08	0.26		
5.10	8.00	67.50	43.50	15.00	0.32	0.79	0.67	0.28	0.12		
6.30	8.70	68.50	44.40	14.80	0.88	0.39	0.66	0.38	-0.17	-0.16	
8.30			45.80	15.00				0.63		-0.23	
9.40	10.00	73.50	47.70	16.40	0.92	0.46	0.51	1.74	0.85	0.82	
26.70	12.00	87.50			-0.71	-0.29	-0.78				-0.63

13

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
1.50	4.60	52.00	37.30	13.00	1.63	-1.88	-0.37	-1.05			
2.80	6.10	55.50	39.50	14.60	2.40	-2.11	0.31	-0.96			
4.10	7.00	60.00	41.60	14.80	1.76	-1.39	0.28	-0.48			
5.00	7.80		42.50	15.40			0.52	-0.38			
6.20	8.40	64.50	43.50	16.00	1.86	-1.15	0.41	-0.27		0.88	
7.20	9.10	66.70	44.30		1.92	-0.88	0.59	-0.09			
8.10	9.20	67.00	44.80	17.00	1.92	-1.31	0.25	-0.06	1.85	1.47	
26.60	12.00	81.40			0.80	-2.00	-0.77				1.13

14

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
1.00	4.46	56.0	36.00	13.00	-1.14	0.98	0.31	-0.72			
2.30	5.46	59.5	37.50	13.50	-0.53	0.80	0.53	-1.21			

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F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.40	3.50	50.00	34.50	11.30	0.35	-0.57	-0.46	-0.91			
1.90	5.00	56.00	37.80	12.70	0.29	-0.22	0.16	-0.58			
3.20	6.00	58.00	39.00	14.60	1.15	-0.74	0.38	-0.89			
4.40	6.50	60.50	40.20	14.80	0.95	-0.75	0.16	-0.85			
5.40	6.80	62.00		14.10	0.81	-0.86	-0.1				
6.50	7.00	63.50	41.50	15.50	0.52	-1.02	-0.53	-0.99		1.27	
7.60	7.10		42.50	15.00			-1.01	-0.64		0.61	
8.60	8.00	64.50		15.40	1.42	-1.75	-0.39			0.74	
26.40	9.00	78.50			-1.94	-2.38	-3.38				-1.37

16

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.60	4.20	54.00	36.60	12.50	-0.34	0.37	0.20	-0.43			
1.70	5.70	60.00	38.60	14.00	-0.38	1.03	0.92	-0.58			
3.00	7.10	63.00	41.00	16.00	0.67	0.87	1.35	-0.11			
3.90	8.10	64.00	42.20	15.50	1.68	0.41	1.64	0.05			
4.90	8.60	67.00	43.80	15.40	1.28	0.74	1.39	0.60	0.50		
6.10	9.00	70.50	44.00	16.60	0.62	1.21	1.07	0.17	1.22	1.41	
26.60	13.00	87.70			0.31	-0.22	-0.02				0.35

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F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.80	3.60	50.00	36.00	11.00	0.51	-1.13	-0.78	-0.36			
1.90	4.40	55.50	38.30	11.50	-0.72	-0.34	-0.64	-0.14			
3.20	5.10	59.00	39.70	12.20	-1.04	-0.3	-0.81	-0.32			
4.80	5.80	62.50	41.00	13.50	-1.22	-0.21	-0.98	-0.42			
6.10	6.10	62.50	42.30	13.50	-0.61	-1.13	-1.43	-0.13		-0.34	
7.60	6.40	65.00	42.70	13.50	-1.15	-1.04	-1.81	-0.46	-0.5	-0.65	
8.60	7.00	65.00	43.60	14.50	-0.12	-1.57	-1.57	-0.14	0.44	-0.01	

18

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.70	3.90	53.50	35.40	13.30	-0.74	-0.02	-0.45	-1.18			
2.70	6.20	60.50	39.20	15.50	0.25	0.20	0.48	-1.04			
3.40	6.80	64.00	40.00	15.50	-0.22	0.88	0.64	-1.07			
4.40	7.30	66.00	41.30	14.50	-0.15	0.73	0.40	-0.92	-0.19		
6.20	8.00	67.00	42.50	14.60	0.53	-0.16	0.01	-1.03	-0.21	-0.33	

26.50	13.00	86.50			0.59	-0.53	-0.01				0.67

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F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	3.90	51.50	36.00	12.00	0.47	-0.06	0.21	-0.01			
2.40	5.90	59.50	39.00	14.60	0.43	0.69	1.16	-0.17			
3.50	6.70	61.50	40.60	15.00	0.76	0.44	1.11	0.11			
4.50	7.10	65.50	42.00	14.00	-0.09	1.21	0.91	0.51	-0.07		
5.60	7.70		43.00				0.80	0.67			
6.80	8.40	67.00	43.40	14.00	1.08	0.17	0.90	0.42	-0.32	-0.06	
8.10	8.50	69.00	44.00	15.50	0.65	0.16	0.43	0.37	0.76	0.93	
26.40	12.00	85.00			0.15	-0.57	-0.32				0.25

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F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	4.80	53.50	36.50	13.30	1.36	0.80	2.08	0.36			
2.00	6.20	59.50	38.80	12.00	0.87	1.14	2.06	0.09			
3.40	7.20	61.00	40.60	16.00	1.70	0.33	1.95	0.19			
4.30	7.60	62.00	41.40	15.70	1.79	-0.05	1.62	0.17			
5.50	8.10	68.50	41.60	16.80	0.24	1.65	1.37	-0.35	1.91		
6.80	8.70	69.00	42.10	17.00	0.87	0.90	1.23	-0.63	2.02	2.47	
8.60	10.00	71.50	44.00	16.70	1.55	0.80	1.64	0.17	1.50	1.82	
26.10	12.00	85.40			0.05	-0.41	-0.3				0.13

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M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	4.10	55.00	36.00	12.00	-1.25	0.84	0.12	-0.68			
2.10	6.20	60.50	38.70	14.00	0.32	0.84	1.20	-0.82			
3.70	7.20	65.50	40.60	15.00	-0.19	1.12	0.79	-0.93	0.32		
4.60	7.50	66.50	41.30	14.50	-0.11	0.81	0.47	-1	-0.25		
5.80	8.10	68.00	42.00	15.30	0.31	0.52	0.39	-1.17	0.32		
6.90	8.60	69.00		16.00	0.63	0.17	0.25		0.83	0.78	
8.60		71.00	43.00	16.30		-0.02		-1.63	0.93	0.83	
26.10	14.00	86.00			1.61	-0.6	0.70				1.56

22											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	4.40	54.50	37.00	12.70	-0.11	1.23	1.31	0.71			
1.80	6.10	60.50	39.40	14.20	0.35	1.79	2.30	0.71			
3.00	6.90	61.50	41.00	15.50	1.06	0.91	1.88	0.77			
4.10	7.60	66.00	42.00	16.40	0.47	1.69	1.80	0.71	1.90		
5.20	8.10		43.00	15.00			1.50	0.85			
6.20	8.30	69.50	43.70	15.50	0.21	1.51	1.14	0.89	0.70	1.35	
7.30	8.90	71.00	44.50	16.00	44	1.36	1.11	1.02	0.96	1.51	
8.30	9.00			15.70			0.79			1.04	
26.20	13.00	85.00			1.13	-0.53	0.42				1.13

23											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.40	52.00	35.10	10.30	-1.16	0.02	-0.77	-0.88			
2.10	5.20	58.00	38.80	12.30	-0.4	-0.17	-0.25	-0.79			
3.20	5.60	63.00	40.00	12.40	-2.35	0.69	-0.7	-0.91			
4.50	6.10	63.50	41.70	12.50	-1.4	-0.31	-1.19	-0.7			
5.70	6.80	65.00	42.00	13.30	-0.68	-0.57	-1.08	-1.12	-1.33		
6.90	7.40	68.00	43.40	14.90	-0.93	-0.21	-1.08	-0.66	-0.02	-0.16	
7.90	7.70	68.00	44.50		-0.38	-0.8	-1.21	-0.22			
26.00	11.00	84.30			-1.1	-1.05	-1.54				-0.83

24											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	3.40	52.50	34.20	12.20	-1.52	0.42	-0.63	-1.15			
1.50	5.00	57.50	36.70	13.30	-0.5	0.33	0.18	-1.43			
4.30	6.00	66.00	40.80	13.80	-3.09	0.86	-1.12	-1.16	-0.92		
5.20	7.10		41.50	13.80			-0.39	-1.21			
6.30	8.00	68.00	42.30	14.30	0.15	0.18	-0.03	-1.21	-0.62	-0.59	
7.30	8.00	69.00	42.80	16.00	-0.28	-0.05	-0.57	-1.27	0.83	0.73	
8.30	10.07	71.0	44.10	16.00	1.64	0.12	0.92	-0.67	0.68	0.61	
26.10	15.09	87.3			2.14	-0.22	1.32				1.92

25

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.60	3.60	51.00	34.00	11.80	0.05	-0.76	-0.72	-1.64			
1.50	4.50	54.00	35.40		0.38	-1.1	-0.56	-2.07			
3.00	5.80	59.00	38.80	13.40	0.30	-0.78	-0.35	-1.56			
4.10	6.30	63.00	40.50	14.00	-0.66	-0.12	-0.55	-1.23			
5.00	6.80	64.00	40.60	13.60	-0.29	-0.46	-0.67	-1.73			
6.40	6.80	66.00	41.80	14.40	-1.16	-0.64	-1.5	-1.61	-0.3	-0.51	
7.80	7.40	67.00	43.00	14.80	-0.48	-1.1	-1.48	-1.31	-0.01	-0.34	
8.40	7.00	67.00	43.30	15.50	-1.23	-1.47	-2.28	-1.32	0.59	0.18	
26.10	10.00	77.60			-0.53	-2.99	-2.48				0.11

26

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	3.30	47.50	34.90	11.00	1.36	-1.43	-0.77	-0.79			
2.30	5.00	56.50	38.20	12.80	0.07	-1.05	-0.71	-1.33			
3.30	5.40	60.50	39.30	13.50	-1.26	-0.43	-1.06	-1.46			
4.20	6.00	63.50	40.30	14.00	-1.64	0.00	-1.04	-1.43			
5.20	6.60	65.50	41.00	13.00	-1.42	-0.04	-1.08	-1.58	-1.70		
6.10	7.10	65.00	41.80	14.30	-0.18	-0.89	-1.03	-1.49	-0.27	-0.57	
7.40	7.50	67.50	42.20	15.00	-0.57	-0.67	-1.21	-1.77	0.12	-0.12	
26.00	11.00	83.60			-0.91	-1.25	-1.54				-0.60

27

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.60	4.30	53.00	36.60	11.80	0.61	0.45	0.94	0.29			
1.60	5.50	60.00	38.90	13.80	-0.61	1.76	1.50	0.52			
3.00	6.50	60.50	40.10	15.00	0.92	0.51	1.37	0.14			
3.90	6.90	63.50	40.50	15.50	0.32	0.88	1.06	-0.25			
5.50	7.40		41.60	15.40			0.53	-0.37			
5.90	7.60	68.50	41.60		-0.5	1.33	0.51	-0.59			
7.50	8.20	69.00	42.50	16.00	0.20	0.48	0.31	-0.61	1.18	1.47	
8.70	8.00	70.50	42.80	15.70	-0.59	0.36	-0.44	-0.83	0.76	0.97	

28											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.90	4.05	54.0	34.00	10.50	-0.94	-0.03	-0.54	-1.94			
1.80	4.96	58.5	37.40	11.50	-1.48	0.42	-0.33	-1.29			
2.80	5.10	60.00	38.80	13.50	-1.78	-0.13	-1.04	-1.38			
3.80	6.10	62.50	40.00	13.20	-0.84	-0.1	-0.61	-1.39			
4.70	6.60	67.00	41.80	14.20	-2.15	0.88	-0.72	-0.74	-0.62		
5.90	7.50	68.00		13.50	-0.69	0.44	-0.36		-1.41		
7.10	7.50		41.80	14.00			-1.01	-1.97		-0.94	
8.50	9.00	69.00	44.60	14.80	1.11	-0.74	-0.08	-0.36	-0.21	-0.41	

29											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	3.40	52.50	34.50	12.40	-1.61	0.34	-0.74	-1.08			
1.50	5.20	58.00	36.00	13.00	-0.32	0.49	0.46	-1.81			
2.60	6.30	60.00	38.30	13.80	0.79	0.03	0.75	-1.56			
3.60	6.90	63.50	39.30	15.50	0.19	0.46	0.53	-1.7			
4.70	7.20	65.00	39.60	14.20	0.04	0.19	0.07	-2.21	-0.38		
5.90	7.70		40.40	14.80			-0.2	-2.38			
7.80	8.40	70.00	41.60	15.80	0.00	0.06	-0.33	-2.4	0.58	0.51	
25.80	11.00	82.00			-0.49	-1.66	-1.52				-0.09

30											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.50	5.10	55.50	39.20	14.00	0.82	1.10	2.07	1.26			
1.50	6.00	60.50	41.40	13.00	-0.01	1.51	1.74	1.51			
2.50	7.20	63.50	42.50	14.50	0.61	1.51	2.00	1.33			
3.80	7.90		44.50	15.00			1.49	1.79			
4.50	8.00	69.00	45.00		-0.28	1.74	1.09	1.76			
5.70	8.70		46.50	15.00			1.03	2.26			
7.50	9.80	73.00	47.80	15.50	0.78	1.23	1.04	2.45	0.13	0.28	
8.20	11.00	75.50	48.00	15.60	1.46	1.69	1.79	2.36	0.08	0.29	
25.80	15.00	87.90			2.01	0.01	1.35				1.78

31											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.50	3.20	50.00	33.00	11.00	-0.38	-1.04	-1.25	-1.96			
1.50	4.60	53.00	35.30	12.80	1.01	-1.58	-0.54	-2.14			
2.20	5.20	56.00	37.00	13.80	0.62	-1.18	-0.43	-1.92			
3.30	5.90	57.00	38.00	14.50	1.44	-2.02	-0.47	-2.27			
4.40	6.80	61.00	40.00	15.30	1.06	-1.22	-0.21	-1.76			
6.80	7.00	65.00	41.00	14.50	-0.31	-1.32	-1.47	-2.4	-0.06	-0.48	
7.70	7.10		41.40	14.50			-1.84	-2.53		-0.58	
8.20	7.00	66.50	41.50	15.50	-1	-1.55	-2.17	-2.64	0.64	0.21	
25.90	10.00	77.80			-0.59	-2.87	-2.45				0.03

32											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	3.50	50.50	35.60	11.00	0.09	-0.15	-0.28	0.01			
1.90	5.10	59.00	38.80	12.70	-1.16	1.01	0.32	0.14			
2.90	5.60	62.50	40.10	12.50	-1.76	1.41	0.18	0.21			
3.90	6.20	64.00	41.00	12.60	-1.16	1.08	0.14	0.13			
4.80	6.70	67.00	41.60	13.30	-1.5	1.53	0.11	0.01	-1.03		
6.20	7.90	67.00	42.50	13.60	0.46	0.55	0.68	-0.01	-0.72	-0.27	
7.10	7.70	68.00		15.10	-0.22	0.35	-0.07		0.54	0.80	
8.00	9.00	69.50	43.90	15.60	1.04	0.40	0.95	0.32	0.78	1.03	
25.80	12.00	88.00			-0.57	0.41	-0.26				-0.62

33											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	3.20	49.00	34.80	10.50	0.04	-0.73	-0.91	-0.46			
1.60	4.70	55.50	37.60	12.00	-0.03	-0.04	0.10	-0.38			
2.80	5.20	59.00	39.80	11.50	-0.7	0.05	-0.29	0.04			
3.70	5.80	60.00	40.60	14.60	-0.04	-0.34	-0.23	-0.02			
4.20	6.00	61.00	41.20	14.50	-0.14	-0.37	-0.35	0.09			
5.30	6.70		42.00	13.80			-0.21	0.04			
6.40	7.10	64.50		14.50	0.27	-0.58	-0.36			0.44	
8.10	8.00	67.00	42.80	15.50	0.61	-0.58	-0.16	-0.58	1.00	0.93	
25.50	12.00	86.40			-0.18	0.02	-0.23				-0.18

34											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.50	3.10	51.50	34.00	10.00	-1.91	-0.45	-1.51	-1.56			
1.40	4.50	55.00	36.80	13.00	-0.22	-0.52	-0.45	-1.26			
2.40	5.70	58.50	38.80	13.70	0.40	-0.29	0.18	-1.04			
3.40	6.40	63.00	40.50	13.50	-0.5	0.44	0.08	-0.8			
4.40	6.70	65.00	41.20		-0.88	0.39	-0.33	-0.97			
5.50	7.30	66.00	42.50	14.00	-0.22	-0.06	-0.39	-0.68	-0.71		
6.40	7.30	68.00		14.00	-1.19	0.14	-0.95		-0.91	-0.86	
8.10	9.00	70.50	44.20	14.20	0.62	0.05	0.09	-0.52	-0.92	-0.88	
25.60	10.00	83.90			-2.38	-1.07	-2.42				-2.18

35											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.70	54.00	36.10	10.50	-1.63	0.73	-0.29	-0.43			
1.60	5.10	56.50	39.00	12.70	0.26	-0.15	0.23	-0.2			
2.50	6.10	61.00	40.80	13.00	-0.09	0.55	0.57	0.10			
3.60	7.20	63.00	42.50	14.40	0.87	0.27	0.89	0.45			
4.80	7.70	68.00	43.80	14.00	-0.36	1.21	0.58	0.70	-0.91		
5.90	8.10	71.00	43.90	14.00	-0.83	1.48	0.31	0.18	-1.14		
7.10	8.50	71.00	45.50		-0.19	0.77	0.08	0.86			
8.10		72.50	45.90	14.90		0.77		0.80	-0.39	-0.29	
25.40	14.00	83.00			2.26	-1.29	0.77				2.16

36											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.20	3.20	51.00	34.60	11.60	-1.03	0.06	-0.8	-0.83			
1.40	4.50	56.50	37.00	12.80	-1.16	0.18	-0.38	-1.09			
2.30	4.90	59.00	37.50	12.20	-1.73	0.03	-0.83	-1.69			
3.20	5.60	61.50	39.50	13.00	-1.56	0.05	-0.83	-1.28			
4.10	5.00	63.00	40.30	13.00	-4.31	-0.15	-2.39	-1.39			
5.30	6.20	66.00	41.50	14.20	-2.55	0.08	-1.61	-1.29	-0.50		
7.20	6.40	68.00	42.30	13.00	-3.1	-0.35	-2.46	-1.6	-1.91	-1.79	
8.10	7.00	69.00	42.60	12.80	-2.18	-0.5	-2.14	-1.75	-2.18	-2.05	
25.50	10.00	79.80			-1.19	-2.22	-2.41				-0.65

37											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.40	3.45	48.5	34.80	11.30	0.99	-1.15	-0.61	-0.62			
1.70	4.56	56.0	37.80	12.50	-0.72	0.05	-0.28	-0.33			

38											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.30	3.55	53.3	33.80	11.50	-1.89	1.00	-0.29	-1.14			

39											
F											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.80	4.40	54.00	37.20	11.80	0.28	0.56	0.84	0.42			
1.70	5.00	57.00		12.80	-0.26	0.43	0.39				
2.70	5.70	59.50	40.00	13.80	0.07	0.39	0.56	0.30			
3.80	6.10	62.00	40.90	13.80	-0.36	0.39	0.15	0.14			
4.70	6.60	65.00	41.50	13.50	-0.8	0.86	0.11	0.03	-0.5		
6.40	7.10	67.00	42.00	14.60	-0.79	0.43	-0.37	-0.5	0.24	0.54	
7.20	7.30		43.80	14.50			-0.5	0.55		0.27	
8.10	8.00	67.00	44.20	14.50	0.61	-0.58	-0.16	0.52	0.16	0.09	
24.30	11.00	81.50			-0.1	-1.07	-0.92				0.11

40											
M											
Age	**W**	**H**	**HCircu**	**MUAC**	**W-Hz**	**H-Az**	**W-Az**	**HCz**	**MU-Hz**	**MU-Az**	**BMIz**
0.70	3.50	52.00	35.30	11.00	-1.05	-0.62	-1.18	-1.22			
1.80	4.90	57.50	37.50	11.80	-0.89	0.03	-0.36	-1.24			
2.70	5.40	61.50	38.60	13.50	-1.98	0.56	-0.55	-1.43			
3.80	5.80	65.50	39.90	12.50	-3.28	1.06	-0.95	-1.43	-2.22		
4.70	6.30		40.50	14.50			-1.11	-1.63			
6.30	6.70	68.00	41.30	14.00	-2.3	0.18	-1.55	-1.95	-0.91	-0.85	
7.20	6.80	68.00	42.30	14.60	-2.23	-0.39	-2.02	-1.63	-0.32	-0.45	
8.10	7.00	70.50	42.80	13.20	-2.88	0.08	-2.12	-1.58	-1.88	-1.71	
25.20	11.00	80.50			-0.08	-1.95	-1.45				0.34

41

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.30	3.60	52.50	35.70	11.50	-1.1	0.28	-0.5	-0.54			
1.30	4.90	57.50	38.60	12.80	-0.67	0.63	0.35	-0.14			
2.30	5.80	61.00	41.00	15.40	-0.71	0.81	0.43	0.45			
3.50	6.80	64.50	42.30		-0.49	0.91	0.46	0.36			
4.90	7.60	66.00	43.00	15.00	0.21	0.42	0.35	0.05	0.26		
5.80	8.20						0.42				
25.40	14.00	91.00			0.51	0.96	0.77				0.30

42

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.30	3.70	52.00	36.00	11.60	-0.44	0.58	0.15	0.37			
1.40	5.20	56.50	38.70	13.50	0.54	0.63	1.23	0.60			
2.40	6.40	60.00	40.50	15.40	1.04	0.93	1.96	0.90			

43

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	3.90	53.50	34.90	11.00	-0.8	1.24	0.70	-0.22			
1.20	5.60	56.50	37.10	11.20	1.35	0.96	2.38	-0.17			
3.40	5.90	63.00	40.00	12.60	-1.25	1.11	0.17	-0.29			
4.40	6.50	68.00	41.00	12.80	-2.45	2.25	0.09	-0.22	-1.66		
6.10	6.70	70.00	41.60	12.50	-2.81	1.76	-0.69	-0.7	-2.16	-1.20	
6.90	6.70		42.70	12.50			-1.07	-0.18		-1.37	
7.80	7.00	71.00	42.80	12.60	-2.6	1.06	-1.21	-0.48	-2.15	-1.46	
25.00	10.00	85.00			-2.36	-0.24	-2				-2.16

44

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	3.40	49.00	34.00	11.40	0.65	-0.79	-0.59	-1.16			
1.20	4.80	53.50	36.20	13.80	1.24	-0.82	0.26	-1.35			
2.00	5.90	58.00		13.70	0.91	-0.05	0.81				
3.10	6.90	59.50	38.30		1.75	-0.61	0.98	-1.89			
4.10	7.40	64.00	40.50	16.50	0.82	0.24	0.76	-1.25			
5.10	7.60	64.00	41.40	16.50	1.10	-0.51	0.30	-1.21			

45

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.20	3.50	49.00	35.20	11.60	0.87	-0.71	-0.37	-0.55			
1.30	4.20	53.50	37.40	13.60	-0.15	-0.97	-0.86	-0.82			
1.90	5.30	55.50	39.20	13.60	1.09	-1.01	0.06	-0.4			
3.40	6.20	60.00	41.00	15.00	0.61	-0.78	-0.14	-0.46			
4.50	7.10	63.00	42.60	15.00	0.78	-0.49	0.11	-0.04			
5.40	7.60	65.00	43.40	15.20	0.71	-0.36	0.07	0.06	0.54		
6.40	7.70		43.40	15.80			-0.45	-0.45		0.67	
7.80	9.00	67.50	44.40	15.50	1.59	-0.9	0.24	-0.23	0.54	0.25	
24.80	10.00	81.50			-1.69	-1.6	-2.34				-1.28

46

F

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.50	4.10	55.00	36.50	12.50	-1.36	1.31	0.50	0.31			
1.40	4.80	57.50	38.00	12.60	-0.96	1.03	0.51	0.14			
1.90	5.10	60.50	38.40	13.60	-2.05	1.68	0.40	-0.07			
2.80	5.60	61.00	39.00	14.50	-1.05	0.90	0.22	-0.52			
3.80	6.10	65.00	40.60	14.50	-1.77	1.60	0.16	-0.09	0.44		
4.80	6.70	67.50	41.50	13.60	-1.79	1.75	0.09	-0.05	-0.79		
6.40	7.00	68.00	42.00	14.00	-1.38	0.79	-0.51	-0.52	-0.46	0.02	
7.60	7.00	70.00	43.00	12.80	-2.18	0.80	-1.11	-0.25	-1.87	-1.25	
24.80	11.00	83.20			-0.53	-0.71	-0.99				-0.35

47

M

Age	W	H	HCircu	MUAC	W-Hz	H-Az	W-Az	HCz	MU-Hz	MU-Az	BMIz
0.30	4.20	55.00	37.20	12.50	-1.06	1.29	0.65	0.32			
1.00	5.20	56.50	38.30	13.50	0.44	0.68	1.19	0.04			
2.00	5.90	60.50	39.60	13.80	-0.23	0.95	0.92	-0.18			
3.00	6.30	62.50	41.00	15.00	-0.41	0.68	0.41	-0.11			
4.20	6.80	65.00	42.30	13.80	-0.78	0.55	-0.12	-0.07	-0.80		
5.20	7.10	68.00	43.00	13.60	-1.47	0.94	-0.37	-0.11	-1.31		
6.20	7.30		43.40	15.00			-0.74	-0.33		0.03	
7.50	8.07	70.5	44.00	14.00	-0.87	0.37	-0.69	-0.45	-1.11	-0.98	
24.70	12.08	81.5			0.77	-1.57	-0.58				1.02

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