



Published in final edited form as:

*Top Clin Nutr.* 2008 October 1; 23(4): 333–339. doi:10.1097/01.TIN.0000341345.50589.45.

## Predictors of Infant Feeding Frequency by Mexican Immigrant Mothers

**John Worobey, PhD, Maria Islas Lopez, MA, and Daniel J. Hoffman, PhD**

Department of Nutritional Sciences Rutgers, The State University of New Jersey New Brunswick, NJ 08901-2882

### Abstract

With an increase in the prevalence of overweight being seen as early as infancy, it is essential that the factors which account for early excess weight gain be identified. In this study, maternal and infant characteristics were examined to determine their relation to the frequency of infants being fed. A cohort of 67 low-educated Mexican mothers who formula-fed their infants were recruited at a WIC Center and home-visited when their infants were 6-months-old. Mothers were surveyed with regard to their feeding attitudes and perception of their infant's temperament, and kept a 24-hour diary of their infant's behavior. Nearly 30% of the 6-month-old infants were at or above the 85<sup>th</sup> percentile of weight-for length. A regression analysis revealed only one factor, the number of infant crying episodes, as predictive of infant feeding ( $Beta = .246, p < .07$ ), with the correlation even stronger ( $r = .35, p < .01$ ). As crying appeared to elicit feeding among these mothers, pediatricians, nurses, and WIC educators should consider discussing alternate strategies for quieting infants with the mothers they counsel.

### Key terms

Infant feeding; temperament; Mexican mothers

---

The prevalence of overweight for low-income Hispanic children 5 years and younger in the United States is significantly higher than for non-Hispanic black and white children(1). By 6-months of age, the percentage of Hispanic infants who are overweight or at-risk for overweight has also been reported as higher than for black infants, who in turn are higher than for white infants (2). In such reports, overweight is defined as weight for length  $\geq$  the 95<sup>th</sup> percentile for age and sex, with at-risk for overweight as weight for length  $\geq$  the 85<sup>th</sup> percentile for age and sex. Such trends speak to the need for examining the factors that may contribute to excess weight gain in infants, especially minority infants.

Finding that infants who gained the most weight from 6- to 12-months were also perceived by their mothers as more "difficult," Carey(3) suggested that such infants might have been fed more often in order to quiet them. Difficultness is an infant temperament dimension that is manifested by fussing, crying or general irritability (4). Complementing this observation, Wells and colleagues (5) reported that infants rated by their mothers as easier to soothe at 12-weeks were leaner when seen again at 2½ years. Recently, Darlington and Wright(6) found that temperament as whole related significantly to weight gained by 8-week-old infants, explaining 11% of the variance. Rapid weight gain, specifically, was related to higher scores on distress to limitations, a temperament dimension reflecting irritability in response to everyday

situations like waiting for food or being dressed. These reports are intriguing, but in neither of these investigations was maternal feeding behavior actually recorded.

In another vein, Baker et al.(7) found that maternal pre-pregnant BMI was strongly associated with infant birth weight and infant weight gain from birth to 1-year, with women whose BMI was greater than 30 having infants who grew an average of 135 grams more over the first year than those of normal weight mothers. Although recent analyses suggest that formula feeding may be associated with a greater risk of childhood obesity, it is not clear whether the composition of formula, of breast milk, or maternal feeding style plays a greater role in warding off excess early weight gain (8).

To illustrate, infants with a vigorous sucking style exhibit higher energy intake, which has been correlated with greater adiposity in early childhood—even for breast fed infants(9,10). However, overfeeding can likelier occur when infants are formula-fed, where the mother may ignore her infant’s satiety signals and persist in presenting the bottle in order for the infant to finish what she perceives as the recommended amount. A number of reports verify that formula feeding has been associated with predisposing infants to becoming overweight in childhood (11,12).

From another perspective, among black and Hispanic families (where higher levels of child obesity already exist), accelerated growth in infancy may be viewed positively as a sign that the infant is eating well, developing properly, and is in good health(13,14). In such cases, it is conceivable that a mother may “push feeding” whether the infant is hungry or not(15). If feeding is “pushed,” the real possibility exists for overconsumption of calories which may induce adipose tissue hyper-cellularity(16), wherein the infant in turn self-regulates its energy intake at a higher level, resulting in more body fat(17). Indeed, it has been commonly reported that formula-fed infants begin to surpass breast-fed infants in terms of weight gain by 2–3-months(18).

In the present study, a cohort of low-income, Mexican-immigrant mothers who chose to formula-feed exclusively were recruited at a WIC center and later visited at home. These selection criteria were used because of previous findings that established low-income, minority status and formula-feeding as factors that heighten the risk for childhood obesity. Mothers were questioned regarding their feeding attitudes and their infants’ temperament, and kept a diary of their infants’ behavior. Demographic information, as well as information on maternal and infant weight, was also collected. The purpose of the study was to examine the relative contributions of maternal attitudes and infant behaviors in predicting the number of feedings the mothers provided on the occasion of a home visit at 6-months.

## Methods

All the procedures of the present investigation were approved by the Institutional Review Board of Rutgers University prior to the start of any subject recruitment or data collection. Permission for subject recruitment was also obtained through a letter of agreement from the cooperating WIC center. Recruiters were bilingual in English and Spanish. Two females conducted each home visit, at least one of whom was Hispanic or bilingual. All materials were available in English and Spanish, and questions were read to Hispanic mothers who were not able to read Spanish.

## Subjects and Procedures

One hundred three mothers were recruited at their initial visit to a community WIC Center, which served a low income and largely minority population, many of whom were recent immigrants from Mexico. For the present investigation, data for women who reported having

been born in Mexico, and their infants, are included. Hence, the present sample consists of the 67 Mexican mother-infant dyads who were seen at enrollment and for whom home visits were completed at 6-months postpartum.

As part of their intake interview, the staff receptionist at the center solicited demographic information from each mother and additionally asked what method of feeding she employed. If a mother indicated formula-feeding, the receptionist alerted the research recruiter of her eligibility, and the recruiter approached the mother at the completion of the WIC visit. Mothers were told that we were studying maternal feeding practices and infant growth and development, and were offered a \$10 gift certificate for use at a local grocery store for their participation. At the conclusion of the 6-month home visit, the mother was also paid \$30 in cash.

## Questionnaires

**Maternal Feeding Attitudes(MFA)**—The MFA is a 10-item questionnaire with established reliability that asks the mother what type of behavior she would exercise with respect to 10 feeding issues (15). A maximum score of 20 indicates a “pushy” feeding attitude—pushy as in an inclination to feed the infant irrespective of the infant’s expressed hunger. The MFA has been validated in studies of infant weight as well as with minority samples (19,20). The questionnaire was completed at the time of recruitment.

**Pictorial Assessment of Temperament(PAT)**—The PAT is a 10-item measure (21) that requires the mother to select how she would categorize her infant’s reaction to some everyday situations as represented by drawings, and provides a mean score of infant difficulty from ranging from 1 to 3. The device has been shown to have convergent validity with more widely utilized temperament questionnaires, and has been validated with at-risk infants (22). The PAT was also completed at the time of recruitment.

**Infant Behavior Diary**—At the home visit, mothers were asked to complete a 24-hour grid on which they indicated the times at which their infants were sleeping, awake/playing, crying, and were being fed. The grid was organized in ½-hour intervals, with the activity checked if it occurred at any time during that time segment. The grid was developed based on formats used by other investigators in studies of infant feeding and fussing (23,24). The mother’s total score represented the number of intervals that were checked.

After gaining informed consent, maternal feeding attitudes and temperament ratings were obtained. The mothers’ height and weight and infants’ weight and length as determined by the WIC staff were then recorded, as well as demographic and contact information. Home visits were conducted when the infants reached the age of 6-months. For each mother–infant dyad, a 2-day visit was arranged, with the mother interviewed on day 1 with regard to feeding and instructed in completing the 24-hour diary. On day 2 the infant was weighed and measured following the assessment procedures described by Gibson(25), and the diary was checked for omissions or to clarify ambiguities.

Statistics were run using the Statistical Package for the Social Sciences (26, SPSS, Version 15.0), with multiple regression and Pearson correlations as the primary methods of analysis.

## Results

Descriptive statistics for the sample appear in Table 1. With an average BMI of over 25, the sample of mothers would be classified as overweight. In terms of schooling, the average mother reported less than an 8<sup>th</sup> grade education. Infants were about 7 weeks of age at the time of recruitment, and 6 months of age at the time of the home visit. Weights-for-length for the sample of infants were at about the 52<sup>nd</sup> percentile at birth and at the 56<sup>th</sup> percentile at 6-

months. Over one-fourth of the infants were at or above the 85<sup>th</sup> percentile of weight-for-length at both times of measurement. However, the jump from 13.2% to 16.5% in the proportion of infants  $\geq$  the 95<sup>th</sup> percentile of weight-for-length from birth to 6-months reflected a 25% increase in infants who would be classified as overweight. The mothers reported fewer than 3 crying episodes per day, and their temperament ratings substantiated this, as infants were rated as slightly below average in difficultness.

To identify the maternal and infant characteristics that predicted the number of infant feedings over the 24-hour period gleaned from the diary at 6-months, a regression analysis was run. Predictor variables entered in the analysis included maternal BMI before pregnancy, maternal feeding attitudes, maternal ratings of temperamental difficultness, infant weight-for-length at birth, and the number of infant crying episodes. As shown in part A of Table 2, the only variable that approached significance in predicting the number of feedings at 6-months was the number of crying episodes ( $p < .07$ ). To confirm this association, a backward regression was then executed, and number of crying episodes again emerged as the best predictor of infant feeds (part B of Table 2). As a further substantiation, the Pearson correlation coefficient between infant feeds and crying episodes was  $r = .350$  ( $p < .01$ ).

## Discussion

The causes of childhood overweight are many and varied. The wide availability of energy dense foods at relatively low prices, coupled with lessened physical activity and recreational sedentary pursuits like videogames by our youngsters, have created a situation that can be arguably called an obesity epidemic(27). Most sobering, it has become apparent that infants younger than a year old are exhibiting worrisome weight, with nearly 1 in 6 infants exceeding the 85<sup>th</sup> percentile of weight for length (2). Unlike children, the explanations for overweight in infancy may be simpler, though still numerous. Butte(28), for example, lists genetic predisposition, poor intake regulation, underactivity, maternal attitudes toward feeding, and excessive feeding as suggested antecedents of infant obesity. The present study was undertaken in order to identify what factors might be at work in predicting the frequency of mothers' feeding of their infants at 6-months of age. Weight of both mother and infant was considered, but the mother's conception of her infant's difficultness as well as her attitude toward feeding her infant irrespective of hunger cues were also of interest.

The primary finding was that crying episodes were the best predictor of feeding frequency. Given the logical relationship of these two events, it is remarkable that previous studies have not examined, or at least not reported this association (29,30). Feeding a crying infant in order to alleviate distress might be considered the most natural soothing strategy of all, and this result was by no means unanticipated. What was more surprising was the absence of any other predictor from the assortment of candidates that were also measured. Indeed, the infant's weight-for-length did not relate to the frequency of his or her being fed, nor did the mother's perception of her infant being difficult. But perhaps most unexpected, a "pushy" feeding attitude, where feeding should commence irrespective of hunger, schedule, illness, or food neophobia, did not predict the frequency of feeds. In a focus group study by Baughcum et al. (31), low-income mothers "believed that a heavy infant was a healthy infant." In their view, overweight mothers further assumed a genetic predisposition where their infant's being heavy was both acceptable and inevitable. From this perspective, and with the present sample of low-income and mostly overweight mothers, it was expected that maternal feeding attitudes would bear on feeding frequency, yet crying frequency appeared to be the only determinant.

This study has its limitations. The sample size was relatively small; however, the reader must appreciate the difficulties inherent in recruiting mother-infant dyads of this nature. Most of our participants were recent immigrants, new to this country, and not well acquainted with the

purposes of academic or scientific research. Not versed in speaking English, and not highly educated, their responses to standardized questions developed for and used with white middle-class women may therefore be a compromised approximation of their actual feeding attitudes or perceptions of temperament. Beyond their attitudes, their behaviors may also not generalize to other populations. They were additionally of low-income and mostly overweight, and most significantly formula-fed rather than breastfed their infants which may make them different from mothers who choose to breastfeed. As a pertinent aspect of this study concerned changes in infant weight, an assessment of the energy intake of the infants would also have been useful—a direct link between feeding frequency and infant weight gain has not been demonstrated here.

Alternately, temperament might have been predictive if the infants were rated as more difficult instead of less than average. Aside from the report by Thomas and Chess(32) on the lower intensity displayed by their supplementary sample of Puerto Rican infants, little is known about temperament ratings as made by Hispanic mothers. Whether Hispanic infants are simply less difficult remains an empirical question. Regardless, the present study does provide some practical information with regard to the feeding practices of an understudied population, namely Mexican mothers and infants. If crying is what triggers feeding among these mothers, then pediatricians, nurses, and even WIC educators might consider discussing or even demonstrating alternate strategies for quieting infants with the mothers they counsel feeding is not the only effective way to soothe a crying baby.

## Acknowledgments

Supported by grants HD039697 and HD047338 to the first author. The authors wish to thank the mothers and infants who participated, and Jeanette Lopez, Jen Scully, Evelyn Escobar, Darlene Black and Monica Medina.

## References

1. Mei, Z.; Scanlon, KS.; Grummer-Strawn, LM.; Freedman, DS.; Yip, R.; Trowbridge, FL. Increasing prevalence of overweight among US low-income preschool children: The Centers for Disease Control and Prevention Pediatric Nutrition Surveillance, 1983–1995. *Pediatrics*. 1998. [www.pediatrics.org/cgi/content/full/101/1/e12](http://www.pediatrics.org/cgi/content/full/101/1/e12)
2. Kim J, Peterson KE, Scanlon KS, Mokdad AH, Grummer-Strawn LM. Trends in overweight from 1980–2001 among preschool-aged children enrolled in a health maintenance organization. *Obesity* 2006;14(7):1107–1112. [PubMed: 16899790]
3. Carey WB. Temperament and increased weight gain in infants. *J Dev Behav Pediatr* 1985;6(3):128–131. [PubMed: 4008657]
4. Bates JE, Freeland CAB, Lounsbury ML. Measurement of infant difficultness. *Child Development* 1979;50:794–803. [PubMed: 498854]
5. Wells JCK, Stanley M, Laidlaw AS, Day JM, Davies PSW. Investigation of the relationship between infant temperament and later body composition. *Int J Obesity* 1997;21:400–406.
6. Darlington A-SE, Wright CM. The influence of temperament on weight gain in early infancy. *J Dev Behav Pediatr* 2006;27(4):329–335. [PubMed: 16906009]
7. Baker JL, Michaelsen KF, Rasmussen KM, Sorenson TIA. Maternal prepregnant body mass index, duration of breastfeeding, and timing of complementary food introduction are associated with infant weight gain. *Am J Clin Nutr* 2004;80:1579–1588. [PubMed: 15585772]
8. Parsons TJ, Power C, Logan S, Summerhill CD. Childhood predictors of adult obesity: A systematic review. *Int J Obesity* 1999;23(Suppl 8):S1–S107.
9. Agras WS, Kraemer HC, Berkowitz RI, Korner AF, Hammer LD. Does a vigorous feeding style influence early development of adiposity. *J Pediatrics* 1987;110:799–804.
10. Stunkard AJ, Berkowitz RI, Stallings VA, Schoeller DA. Energy intake, not energy output, is a determinant of body size in infants. *Am J Clin Nutr* 1999;69:524–530. [PubMed: 10075340]

11. Neumann CG, Alpaugh M. Birthweight doubling time: a fresh look. *Pediatrics* 1976;57:469–473. [PubMed: 1264541]
12. von Kries R, Koletzko B, Sauerwald T, von Mutius E, Barnert D, Grunert V, von Voss H. Breast feeding and obesity: cross sectional study. *BMJ* 1999;319:147–150. [PubMed: 10406746]
13. Jain A, Sherman S, Chamberlain L, Carter Y, Powers S, Whitaker R. Why don't low income mothers worry about their preschoolers being overweight? *Pediatrics* 2001;107:1138–1146. [PubMed: 11331699]
14. Kaiser LL, Martinez NA, Harwood JO, Garcia LC. Child feeding strategies in low-income Latin households: Focus group observations. *J Am Dietetics Assoc* 1999;99:601–603.
15. Kramer MS, Barr RG, Leduc DG, Boisjoly C, Pless B. Maternal psychological determinants of infant obesity: Development and testing of two new instruments. *J Chronic Dis* 1983;36(4):329–335. [PubMed: 6833452]
16. Hirsch J, Fried SK, Edens NK, Leibel RL. The fat cell. *Medical Clinics North America* 1989;73(10): 83–96.
17. Dewey KG, Lonnerdal B. Infant self-regulation of breast milk intake. *Acta Paediatrica Scandinavia* 1986;75:893–898.
18. Dewey KG, Heinig MJ, Nommsen LA, Peerson JM, Lonnerdal B. Breast-fed infants are leaner than formula-fed infants at 1-year of age: The DARLING Study. *Am J Clin Nutr* 1993;57:140–145. [PubMed: 8424381]
19. Kramer MS, Barr RG, Leduc DG, Boisjoly C, Pless B. Infant determinants of childhood weight and adiposity. *J Pediatr* 1985;107:104–107. [PubMed: 4009326]
20. Banks, JM. Maternal feeding attitudes and infant obesity. Proceedings of the Sigma Tau Theta Biennial Nursing Conference; Indianapolis, IN. 2002.
21. Clarke-Stewart KA, Fitzpatrick MJ, Alhusen VD, Goldberg WA. Measuring difficult temperament the easy way. *J Dev Behav Pediatr* 2000;21:207–220. [PubMed: 10883881]
22. Hutchison BL, Hutchison LAD, Thompson JMD, Mitchell EA. Plagiocephaly and brachycephaly in the first two years of life: a prospective cohort study. *Pediatrics* 2004;114(4):970–980. [PubMed: 15466093]
23. Casiday RE, Wright CM, Panter-Brick C, Parkinson KN. Do early feeding patterns relate to breast-feeding continuation and weight gain? *Eur J Clin Nutr* 2004;58:1290–1296. [PubMed: 15054405]
24. Barr RG, Kramer MS, Boisjoly C, McVey-White L, Pless IB. Parental diary of infant cry and fuss behaviour. *Arch Dis Childhood* 1988;63:380–387. [PubMed: 3365007]
25. Gibson, RS. *Nutritional Assessment: A Laboratory Manual*. New York: Oxford University Press; 1993.
26. *SPSS [statistics program]*. Version 15.0. Chicago, ILK: SPSS Inc; 2007.
27. Strauss R, Pollack H. Epidemic increase in overweight. *JAMA* 2001;286:2845–2848. [PubMed: 11735760]
28. Butte, N. Energy requirement during infancy. In: Tsang, RC.; Nichols, BL., editors. *Nutrition during infancy*. Philadelphia, PA: Hanley & Belfus; 1988. p. 86-99.
29. Michelsson K, Rinne A. Crying, feeding and sleeping patterns in 1 to 12-month-old infants. *Child: Care, Health and Development* 1990;16(2):99–111.
30. St James-Roberts I, Plewis I. Individual differences, daily fluctuations, and developmental changes in amounts of infant waking, fussing, crying, feeding, and sleeping. *Child Development* 1996;67(5): 2527–2540. [PubMed: 9022254]
31. Baughcum AE, Burklow KA, Deeks CM, Powesr SW, Whitaker RC. Maternal feeding practices and childhood obesity: A focus group study of low-income mothers. *Arch Pediatr Adolesc Med* 1998;152:1010–1014. [PubMed: 9790612]
32. Thomas, A.; Chess, S. *Temperament and Development*. New York: Brunner/Mazel; 1977.

**Table 1**  
Descriptive Statistics for the Sample (Mean [Standard Deviation])

Mothers' age at recruitment (years)	26.25 [5.22]
Mothers' highest year of education	7.43 [2.68]
Mothers' BMI before pregnancy*	25.27 [3.98]
Maternal Feeding Attitudes (20=maximum)	12.94 [2.80]
Infants' age at recruitment (days)	36.59 [26.13]
Infants' age at home visit (days)	186.41 [18.09]
Maternal rating of infant difficultness (3=maximum)	1.57 [.31]
Infants' birth weight (kilograms)	3.28 [.54]
Infants at 85 <sup>th</sup> percentile weight/length at birth	27.9%
Infants at 95 <sup>th</sup> percentile weight/length at birth	13.2%
Infants' weight at home visit (kilograms)	8.03 [1.09]
Infants at 85 <sup>th</sup> percentile weight/length at 6-months	28.5%
Infants at 95 <sup>th</sup> percentile weight/length at 6-months	16.5%
Number of crying episodes at home visit (range=0–9)	2.60 [2.64]

\* BMI = Body Mass Index

**Table 2**  
Possible predictors of infant feeding at 6 months

A. Number of infant feeds at 6 months			
Multiple R <sup>2</sup> = 0.162			
Variables	<i>B</i> -Coefficient	Standard Error	<i>p</i> -value
(Constant)	10.283	4.107	.02
Maternal BMI before pregnancy	-.058	.092	.53
Infant's weight/length at birth	-.004	.011	.72
Maternal Feeding Attitudes	.136	.115	.24
Maternal rating of infant difficulty	-1.838	1.230	.14
Number of crying episodes	.258	.136	.07
B. Number of infant feeds at 6 months			
Multiple R <sup>2</sup> = 0.094			
Variable	<i>B</i> -Coefficient	Standard Error	<i>p</i> -value
(Constant)	7.555	.483	.00
Number of crying episodes	.246	.132	.07