

Breast-feeding practices in Mexico: Results from the Second National Nutrition Survey 1999

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Abstract

Objective. To assess breast-feeding (BF) practices and determinants of exclusive BF (EBF) <4 and <6 months (mo) among women and infants <23 mo in the NNS-1999. **Material and Methods.** BF practices from the day and night before the interview were ascertained, and median duration estimated. Determinants of EBF<4 and <6 mo were analysed by logistic regression models for complex surveys. **Results.** Prevalence of EBF<4 mo was 25.7%, and of <6 mo 20.3%. The overall rate of continued BF (second year) was 30.9%, median duration of BF 9 mo, and the national proportion of children ever breast-fed 92.3%. The probability (*p*) of EBF<4 mo was determined by infant age and sex, by maternal socio-economic level (SEL) and ethnicity, and by the interaction between infant sex and SEL. The *p*EBF<6 mo was determined by infant age and length, by maternal ethnicity, and employment. **Conclusions.** EBF rates and duration are low in Mexico and have improved only slightly in the last 20 y. Infant and maternal characteristics determine the *p*EBF. If improvements in infant health are a national priority, aggressive interventions to promote and protect BF are urgently needed in Mexico, as well as formal evaluation of current initiatives. The English version of this paper is available too at: <http://www.insp.mx/salud/index.html>

Key words: breast-feeding practices; exclusive breast-feeding; breast-feeding duration; Mexico

Resumen

Objetivo. Evaluar las prácticas de lactancia y los determinantes de la lactancia exclusiva (LE) hasta <4 y <6 m, en mujeres con hijos menores de 24 m de la segunda Encuesta Nacional de Nutrición 1999. **Material y métodos.** Las prácticas de lactancia se estimaron del día y la noche anteriores a la entrevista. Los determinantes de LE<4m y LE<6m fueron analizados mediante regresión logística para muestras complejas. **Resultados.** La prevalencia de LE<4m fue 25.7%, y <6 m 20.3%. La tasa de lactancia continuada (segundo año) 30.9%, mediana de duración de lactancia 9 m, y proporción de amamantados alguna vez 92.3%. La probabilidad (*p*)LE<4m estuvo determinada por edad, y el sexo del infante, por el nivel socioeconómico y etnicidad maternas, y por la interacción entre el sexo y el nivel socioeconómico. La *p* LE<6m estuvo determinada por edad y la longitud del infante y por el empleo, etnicidad y nivel socioeconómico de la madre. **Conclusiones.** La duración y prevalencia de LE son bajas en México, poco mejores que hace 20 años. Las características del infante y de la madre determinan la *p* LME. Para promover la salud del niño, es urgente implementar programas agresivos de protección y promoción de la lactancia, así como evaluar y adecuar formalmente los existentes. El texto completo en inglés de este artículo también está disponible en: <http://www.insp.mx/salud/index.html>

Palabras clave: prácticas de lactancia materna; lactancia materna exclusiva; duración de la lactancia materna; México

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Human milk is the most appropriate food for infants, and contains highly nutritive substances.¹ Breast-feeding increases the infant's opportunities for survival^{2,3} promotes better health⁴⁻⁶ nutritional status⁷ and cognitive development⁸ and appears to be a protective factor against overweight later in life.⁹ Breast-feeding also brings advantages to maternal health. Women who breast-feed have a reduced risk of breast cancer.¹⁰⁻¹² Lactating mothers experience a lowered fertility¹³⁻¹⁵ which has implications for population growth. And those who nurse exclusively for 6 mo, loose more weight and at higher speed after delivery¹⁶ than those who do not breast-feed as intensely. This effect of exclusive breast-feeding on weight loss is of public health importance in the face of a dramatic increase in the prevalence of obesity over the last decade in Mexico, and of the present nutritional transition the country is experimenting.¹⁷

Breast-feeding practices in Mexico are poor relative to other countries in Latin America.¹⁸ Median duration of lactation has been reported to be under 9 months in Mexico,^{19,20} when other countries reported 18 months.¹⁸ The only previous Mexican national data documenting exclusive breast-feeding patterns were collected in 1979²¹ and for infants below 3 mo of age, it was estimated to be 15.3%. Five national surveys conducted during the 70's and 80's^{19,20,22-24} offer information on infant feeding behaviour by maternal recall, and describe poor lactation practices in the country. Low rate of initiation (between 89.3% in 1976 to 77.6% in 1979) and a short (≤ 8.7 mo) median duration of breast-feeding (reported for two surveys: 1.1 mo for infants <12 mo in 1986, from the National Health Survey (Encuesta Nacional de Salud -ENSA-)²⁰ and 8.7 mo in the Mexican Fertility Survey (Encuesta Mexicana de Fecundidad -EMF-) in 1976).¹⁹ However, infant feeding practices had improved somewhat in the past two decades. For example, the percentage of infants never breast-fed, had declined from close to 22% in 1979²² to approximately 14% in the first National Nutrition Survey 1988.²⁴

According to the World Health Organization (WHO),²⁵ infants should be fed exclusively at the breast for the first 6 mo of life, and continue breast-feeding for 2 y or more if the mother-infant dyad so desire. The country's progress should be measured against this target.

In this paper we report the breast-feeding practices estimated from the National Nutrition Survey-1999 (NNS-1999) conducted in Mexico from October 1998 through March 1999. The survey was representative at

the national level, for 4 regions, and for rural and urban populations.²⁶ Relevant nutritional, demographic and socio-economic variables were used to describe the practices for different groups within the country, and used as predictors of exclusive-breast-feeding (EBF) for <4 and <6 months.

Material and Methods

Materials. We used digital baby scales (Tanita, Tokyo, Japón Model 1583) to measure weight in children weighing up to 10 kg with a lecture precision of 10g, and of 20g for weight between 10 and 20 kg. Fibre glass stadiometers (locally constructed) were used to measure length (<2y) or height (>2y). Standardisation procedures were conducted prior to data collection to minimise technical measurement error.

Subjects

Women of reproductive age (12 to 49y) and their live children <2y of age who lived in the selected household at the time of the survey, were included in the analyses. Information on diseased children was not collected, thus not included in any calculation.

Methods. This was a national cross-sectional survey conducted in Mexico to evaluate the nutritional status, and its main determinants, of Mexican children and women of reproductive age.

Definitions. Exclusive breast-feeding was defined as consuming nothing but breast milk. Rates were calculated for <4 and <6 mo of age (i.e., for 0 to 123 days (d) and 0 to < 183 d of life), and monthly by completed months as recommended by Lung'aho *et al*²³ (i.e., 0 mo=0-30 d, 1 mo=31-61 d, 2 mo=62-91 d, 3 mo=92-122 d, 4 mo=123-152 d, 5 mo=153-182 d). Ever breast-fed was defined as having ever suckled at the breast to receive colostrum or breast milk. Continued breast-feeding rates were calculated as recommended, from the number of children aged 12 to <16 mo and from 20 to <24 mo who received breast milk the day before the interview. Median duration of any breast-feeding was estimated through moving averages, and by the Kaplan-Meier method. Results were the same, and moving averages are presented.

Independent variables included anthropometric and demographic characteristics of mothers and their infants, and are presented in Table I.

Sampling technique. A national probabilistic sample was collected, representative of 4 regions (North, Center,

Table I
**DESCRIPTIVE CHARACTERISTICS OF THE MOTHERS AND CHILDREN < 24 MONTHS PARTICIPATING
 IN THE NATIONAL NUTRITION SURVEY, MEXICO, 1999**

	% or Mean (SD) National	Region*				Stratum		Indigenous [†]	
		North	Center	Mexico City	South	Urban	Rural	Yes	No
n [§]	3,192	921	1,003	239	1,029	1,891	1,301	319	2,772
N [#]	3 757 542	733 134	1 270 980	504 477	1 248 951	2 614 896	1 142 646	365 131	3 264 027
National (%)	100	19.5	33.8	13.3	33.2	69.6	30.4	10.1	89.9
Number of children	2.7 (2.0) ^{&}	2.3 (1.5)	2.9 (2.2)	2.1 (1.4)	3.0 ^o (2.2)	2.4 (1.7)	3.4 (2.4)	3.6 (2.4)	2.6 ^o (1.9)
Employed* (% yes)	30.5	31.3	29.1	31.4	31.1	33.6	23.3	35.8	29.9
Schooling (y)	7.4 (4.4)	8.6 (3.7)	7.2 (4.2)	9.4 (4.5)	6.2 (4.4)	8.5 (4.3)	4.9 (3.4)	4.3 (3.9)	7.9 ^o (4.2)
Age (y)	26.6 (6.2)	25.9 (6.0)	26.9 (6.2)	26.8 (6.0)	26.7 ^o (6.5)	26.7 (6.1)	26.5 (6.6)	26.8 (6.7)	26.6 (6.2)
Spouse (% present)	88.8	90.5	88.5	84.5	89.9 ^o	87.7	91.5	92.6	88.7 ^o
Health services	48.3	66.5	44.8	61.8	35.9 ^o	57.2	28.2 ^o	35.4	49.5 ^o
Food aid (% receiving)	26.4	14.0	21.2	34.4	35.6 ^o	19.6	41.8 ^o	42.3	24.9 ^o
Child gender (% males)	50.7	48.9	50.2	54.4	50.8	49.8	48.4	52.7	50.5
SES (score) ^o % lower tertile	32.9	12.0	30.7	14.5	54.9 ^o	18.3	66.3	73.9	28.2 ^o
% upper tertile	31.5	46.8	30.2	43.7	18.9	41.8	7.9	8.1	34.5
Weight (kg)	60.4 (12.2)	65.4 (13.3)	61.5 (11.6)	60.3 (11.3)	56.3 ^o (10.4)	62.0 (12.1)	56.7 (10.9)	53.8 (9.5)	61.1 ^o (12.0)
Height (cm)	152.7 (6.6)	155.4 (6.4)	153.8 (6.3)	153.1 (6.3)	149.7 ^o (6)	153.7 (6.4)	150.3 (6.6)	147.6 (5.8)	153.2 ^o (6.4)
BMI (kg/m ²)	25.7 (4.6)	27.0 (5.1)	25.9 (4.5)	25.7 (4.4)	24.9 ^o (4.1)	26.2 (4.6)	24.9 (4.2)	24.5 (3.9)	25.9 ^o (4.6)

* Region: North, Center, Mexico City, and South (for specific states within each region, see in text)

[†] Mother speaks an indigenous language

[§] Sample size

[#] Estimated population size

[&] Mean (SD)

^{*} Reports holding a job or having some economic activity from which she perceived money in exchange, the week prior to the interview

^o Calculated through principal components analysis

^o $p < 0.05$

Mexico City, and South),* and rural (pop <2500) and urban areas (pop ≥ 2500). Families were selected according to a sampling frame developed by INEGI (acronym from its Spanish name; Mexican National Institute of Statistics, Geography and Information), described in detail elsewhere.²⁶ All households with women between the ages of 12 and 49y, and or children <12 y of age, were included in the population from which

the sample was drawn. The data presented here pertain to children <2 y of age living in the selected families. There were no exclusion criteria. Uninhabited (9.8%), non identified households (1.9%), and non-response (5.9%), were the causes of no data collection. Data were collected from the 82.4% of the households in the sample frame who responded. Written informed consent was obtained after explaining the purpose and methods of the survey from all adult participants, and from children's guardians, before data were collected.

Data collection. Data on breast-feeding practices were collected using two methodologies: status quo and recall data, as recommended by the WHO.²⁵ Briefly, status quo data describe what the child under 2y of age was fed the day and the night before the interview. For recall data the mother is asked to recall the age when specific infant feeding practices occurred. Mothers were asked at what age their child was fed consistent-

* North (Baja California, Baja California Sur, Coahuila, Chihuahua, Durango, Nuevo León, Sonora and Tamaulipas). Center (Aguascalientes, Colima, Guanajuato, Jalisco, México (excludes urbanised counties and localities adjacent to Mexico City), Michoacán, Morelos, Nayarit, Querétaro, San Luis Potosí, Sinaloa, Zacatecas). Mexico City (includes Federal District and urbanised counties from the state of Mexico). South (Campeche, Chiapas, Guerrero, Hidalgo, Oaxaca, Puebla, Quintana Roo, Tabasco, Tlaxcala, Veracruz, Yucatán).

ly at least one food item from each of 7 food groups. The 7 groups were as follows: 1) plain water, 2) non-breast milk, 3) non-nutritive liquids (sugared water and other water-based drinks including teas, bean or chicken broth, coffee, soft drinks, or 'agua miel';* but not fruit juices, 4) other liquids (thinned gruel with water or milk, another cereal with water or milk, coffee with milk, fruit juices), 5) cereals and legumes (pastas, rice, tortillas, bread, oats, beans, lentils, fava beans and similar beans); 6) fruits and vegetables; and 7) meat, milk products, and eggs).

Because recall data are based on asking the mother at what specific age she fed her child a certain food group, we used data from all children <2y to estimate breast-feeding duration. Alternatively, status quo data uses the information provided by the mother, to define her infant feeding practices the day and night before the interview. Thus the recall method provides larger sample size but has potential recall biases. The status quo method (also called current data) is based on a smaller sample size but assumed to have greater validity to describe breast-feeding practices.²⁷ We only used recall data to estimate *median duration* of breast-feeding of children <24 mo. This way we had information on those infants who had been breastfed but had stopped breast-feeding at the time of the survey. We used status quo data for prevalences and to estimate the probabilities of exclusive breast-feeding.

Prior to the survey, observers were trained in all areas of data collection by trained and standardised supervisors. During data collection, supervisors reviewed data every night, and if inconsistencies or missing data were identified, the observer was asked to return the next day to the designated households. This strategy was implemented to minimise inconsistencies and missing data in the field.

Statistical analyses. The outcome variables were breast-feeding practices analysed either: a) as proportions, b) as medians, or c) as dependent variables in logistic regression models.

- a) The proportion of exclusive breast-feeding infants <4 months was calculated by dividing the total number of children exclusively breast-fed from birth to <123 d (<4 mo) by the total number of infants <123 d, regardless of their feeding mode. Proportions for <6 mo were calculated similarly, but for <183 d. The indicator of early (12 to <16 mo) and late (20 to <24 mo) rates for continuation

of breast-feeding, as well as the overall rate of continued breast-feeding in the complete second year of life (>365 to <731 d), were calculated as recommended.²⁷

We used status quo data to estimate these proportions.

- b) Median duration of breast-feeding was calculated by two methods: Kaplan-Meier²⁸ and 3-month-running averages, assigned to the middle month. We used recall data. Because we collected data on children <2y, and there are children who breast-feed longer, calculated medians may underestimate the true duration. This underestimation is usually not large because most of the breast-feeding takes place during the first 2y of life. The magnitude of the underestimation depends on the distribution of feeding practices by age.
- c) Logistic regression models for complex surveys²⁹ were used to predict the probability of being exclusively breast-fed for 4 mo or less ($p_{EBF}<4$) and for 6 mo or less ($p_{EBF}<6$) using status quo data. Probabilities of exclusive breast-feeding were calculated. The inverse of the sample probabilities of being selected were used as sample weights.

For many years, the WHO recommendations regarding the duration of exclusive breast-feeding provided a range of 4 to 6 mo rather than a specific duration. Since March 2001, the recommendation is specific: 6 mo of EBF. Thus, for some time, reaching at least 4 mo was the target, which has changed to 6 mo now. For this reason, we analysed the probabilities of being exclusively breast-fed for both age targets: <4 and <6 mo.

Several biologically meaningful and socially important determinants of breast-feeding practices were considered to describe the sample and to construct the regression models. For women these were: number of children, ethnicity (whether or not she speaks a native language), maternal schooling (last grade approved at school, in y), age (y), employment (yes/no),* if living with a partner (yes/no), family's socio-economic level (SEL, an index constructed through a principal components analysis)³⁰ nutritional status: (weight (kg), height (m), and body mass index (kg/m^2)), being a beneficiary of any kind of government food

* Agua miel: unfermented syrup from the agave core.

* Reports holding a job or having some economic activity from which she perceived money in exchange, the week prior to the interview.

aid* (yes/no), and access to health care system† (insured or not). Infants' characteristics considered were: gender, weight and length. We also took into consideration the family's place of residence: region (North, Center, South, and Mexico City), and type of setting (rural/urban). Meaningful interactions were evaluated as well. These included two-way interactions of any of the following two variables: SEL, maternal schooling, place of residence, ethnicity, number of children, maternal employment, and infant gender and length. Quadratic relationships were evaluated for the relationship between the $pEBF < 4$ or $pEBF < 6$ mo, and maternal age, maternal schooling, SEL, number of children, and infant age.

Bivariate relationships were first evaluated. Those associations with p values < 0.25 were entered into a full model. A backwards elimination procedure was followed to reach a model which contained independent variables with a statistical association with breast-feeding practices of $p < 0.05$. Forward procedure was used to test the backward selection. The models' goodness of fit was tested with the Hosmer-Lemeshow test.³¹ Both models had a $p > 0.23$. Multicollinearity was evaluated through decomposing the models' matrix of eigenvalues, and evaluating the ratio of the highest over the lowest eigenvalue.³² Models with values over 10 were not accepted.

Final models contain variables that were statistically significant after the procedure described above and variables that, based on subject matter considerations, are considered important regardless of their statistically significant level.

Descriptive statistics of the study population are presented (Table II); means \pm standard deviations (SD) for continuous, and percentages for categorical variables. Student's t tests for means, and χ^2 for proportions, were performed to compare data among the strata for each exclusive breast feeding group. Data entry was done with Fox Pro[§] and statistical analysis with Stata[#] (version 7.0, 2001)

* Any person of the household receiving from the government one or more of the following food items: milk, tortillas, maize or wheat flour, rice, beans, oil, pasta, sugar, salt, school breakfast, Progresia infant or maternal supplement, sardines, crackers or cookies, or other).

† Access to a partial or complete health insurance provided either by the government (IMSS, SSA ISSSTE, Pemex, Army or Navy), or by a private employer.

§ Microsoft Visual Fox Pro Release 6. Seattle (WA): Microsoft Corporation, 1998-1999.

Stata Statistical Software: Release 7.0 College Station (TX): Stata Corporation, 2001.

Results

Characteristics of study subjects. Table I presents the demographic, social and anthropometric characteristics of the families with children < 24 mo of age, stratified by region, urban or rural stratum, and ethnic group (indigenous yes/no). Families have less than three children on the average; this is highest for indigenous families. Slightly less than one out of every 3 (30.5%) women in reproductive age reported to have been employed in the last week in Mexico; this was also highest (35.8%) for indigenous women. The average number of years of maternal schooling was one year above completed primary (7.4y). While in Mexico City it was slightly above secondary school (9.4y), for indigenous mothers it was only 4.3y. The average maternal age was 26.6y. Almost 9 out of every 10 mothers (88.8%) in the sample had a spouse at the time of the survey. Half of the families had any kind of pre-arranged health service (48.3%) with large differences among the categories, but rural areas, indigenous families, and the south region had much lower percent families with health service coverage than comparable strata.

Somewhat over one quarter (26.4%) of the families received some kind of government food aid* with larger proportions among families from the rural or of indigenous origin. Combining all types of governmental food aid, a very similar proportion of families received it in the metropolitan than in the south region, but analysing food aid by urban or rural location, the percent of beneficiaries in rural area (41.8%) was twice as high as that in the urban area (19.6%). As expected, half the children were males. Mothers were somewhat heavy (60.4 kg) and short (152.7 cm on the average), and had an average body mass index (kg/m^2 , BMI) of 25.7; above the cut-off point used to classify overweight.

Breast-feeding proportions. Figure 1 presents breast-feeding practices by completed months through the first two years of life. Proportions are presented for exclusive, full, and any type of breast-feeding, as reported by the status quo method. Data show that breast-feeding practices decline rapidly with age, the largest decline occurring during the first six months of life. Exclusive breast-feeding is the most rare of the prac-

* Any person of the household receiving from the government one or more of the following food items: milk, tortillas, maize or wheat flour, rice, beans, oil, pasta, sugar, salt, school breakfast, Progresia infant or maternal supplement, sardines, crackers or cookies).

Table II
BREAST-FEEDING PRACTICES BY SOCIO-ECONOMIC, DEMOGRAPHIC AND ANTHROPOMETRIC CHARACTERISTICS.
NATIONAL NUTRITION SURVEY, MEXICO, 1999

	Duration of breast-feeding (months, median)	Ever breast-fed (%)	Exclusive breast-feeding* (%)		Duration of breast-feeding (months, median)	Ever breast-fed (%)	Exclusive breast-feeding* (%)	
			<4 months (<123 d)	<6 months (<183 d)			<4 months (<123 d)	<6 months (<183 d)
n [†]			502	750				
N [‡]			591 841	900 207				
National	9	92.3	25.7	20.3				
Region [#]								
North	6	91.8	16.5	10.5				
Center	8	91.6	25.0	19.1				
Metropolitan Area	7	92.0	11.6	12.3				
South	15	93.5	36.5 ^o	30.5 ^o				
Locality								
Urban	7	92.3	20.9	15.0				
Rural	14	92.2	36.1 ^o	33.2 ^o				
Ethnicity [#]								
Indigenous	>24	93.5	48.2	48.4				
Non-indigenous	8	92.3	23.2 ^o	17.8 ^o				
Socio-economic level [*]								
Low	15	92.3	39.8	33.8				
Midde	8	91.6	17.3	14.2				
High	6	93.1	20.7 ^o	14.3 ^o				
Maternal employment ^{**}								
Yes	7	93.0	18.0	13.4				
No	11	92.2	28.6 ^o	22.7 ^o				
Spouse present								
Yes	10	92.9	26.7	21.2				
No	6	90.4	19.4	14.1				
Number of children								
1	7	94.1	22.8	16.6				
2	8	91.6	26.1	19.9				
≥3	12	91.5	27.8	23.6				
Maternal age (y)								
<19	12	92.2	27.6	23.1				
19 to <25	10	93.5	24.5	21.6				
25 to <35	8	92.2	25.9	18.3				
≥35	9	89.9	26.5	20.8				
Schooling (y completed in school)								
<1	14	88.9	41.5	37.2				
1 to <6	12	90.8	29.2	23.9				
6 to <9	12	92.8	29.3	23.3				
9 to 12	7	92.7	23.7	17.1				
12 to <14	6	93.9	27.0	20.2				
≥14	6	94.0 ^o	3.7 ^o	2.6 ^o				
Health Services								
Yes	7	93.5	23.9	17.8				
No	12	91.5 ^o	28.3 ^o	23.4 ^o				
Maternal height (cm)								
< mean	14	93.0	34.2	28.3				
≥mean	7	91.8	18.2 ^o	13.8 ^o				
Body mass index (kg/m ²)								
<mean	10	93.6	33.2	25.7				
≥ mean	8	91.2 ^o	16.9 ^o	14.7 ^o				
Child gender								
Girl	9	92.6	31.7	24.0				
Boy	9	92	20.2 ^o	16.9 ^o				
Infant length (cm)								
< mean	>20	92.9	31.7	24.0				
≥ mean	8	92.0	21.2 ^o	15.8 ^o				

* Exclusive breast-feeding: receiving ONLY breast-milk (consumption of pharmaceutical products (medicines or vitamin-mineral preparations) were not explored)

[†] Sample size

[‡] Estimated population size

[#] Region: North, Center, Mexico City, and South (for specific states within each region, see in text)

[&] Indigenous: mother speaks a native language

^{*} Calculated through principal components analysis

^{**} Reports holding a job or having some economic activity from which she perceived money in exchange, the week prior to the interview

^o p<0.05

tices; slightly over one third (39%) of infants <1 month were fed exclusively at the breast, and only 86.9% of them receive breast milk at this age.

As indicators of early (12 to <16 mo) and late (20 to <24 mo) rates for continuation of breast-feeding, the percentage of children still at the breast at these ages

was estimated. One third (36.2%)²⁷ and one quarter (25.3%) of the children continue to breast-feed in these two stages respectively. The overall rate of continued breast-feeding in the complete second year of life (>365 to < 731 d) is 30.9%.

Breast-feeding practices by categories of demographic, socio-economic and anthropometric char-

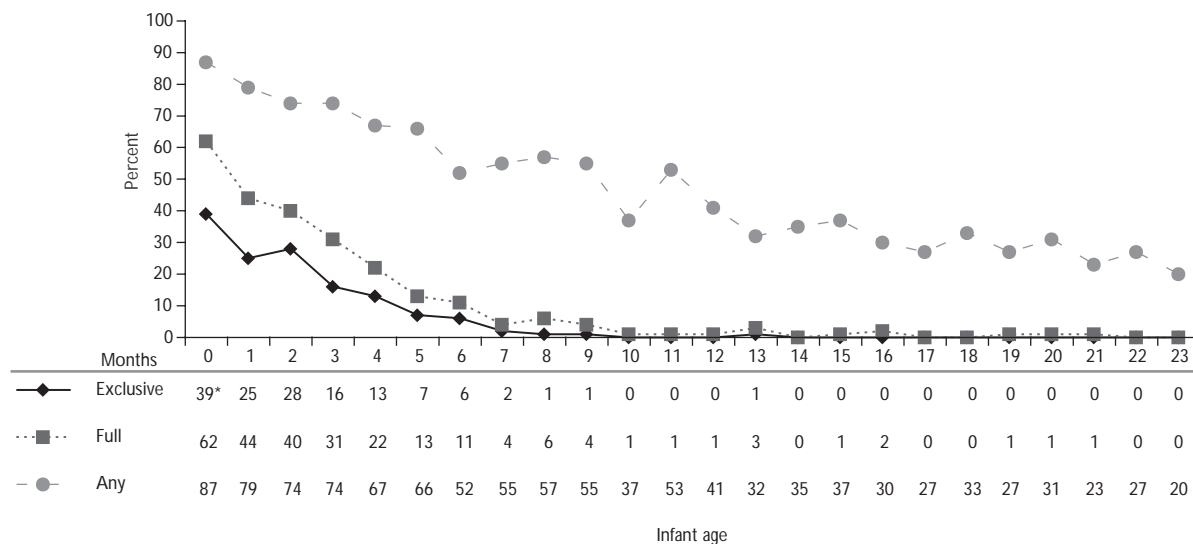


FIGURE 1. BREAST-FEEDING PRACTICES IN MEXICO. NATIONAL NUTRITION SURVEY, MEXICO, 1999. PROPORTION OF EXCLUSIVE, FULL AND ANY BREAST-FEEDING BY COMPLETED MONTH OF INFANT AGE (*%, ROUNDED UP TO THE NEAREST INTEGER)

acteristics are presented in Table II. The estimated national median duration of breast-feeding was 9 months. Duration was longest in the group of indigenous mothers where more than 50% of the children were still breast-fed at 24 mo; thus median duration could not be calculated in these ethnic group, but it is certainly longer than 24 mo. The next longest breast-feeding duration was for those mothers whose infants were below the population median length (>20 mo)* followed by those in the south and in the low SEL (15 mo), the rural area, mothers without formal schooling, and whose height was below the sample mean (14 mo). The shortest median breast-feeding duration (6 mo) was found in the north region, in the high SEL, in those not having a spouse present, and in those with ≥ 12y of maternal schooling. The national percent of children in Mexico who were ever breast-fed was 92.3%. This figure ranged from 88.9% (those with no maternal schooling) and 94.0-94.1% (those with 1 child and those with >14y of maternal schooling), with little differences among subgroups. However, the differences in proportions within categories of schooling, availability of health services, and maternal BMI, were

* Infants under median length were younger than the rest of the sample. The oldest in this sample was 20 mo old.

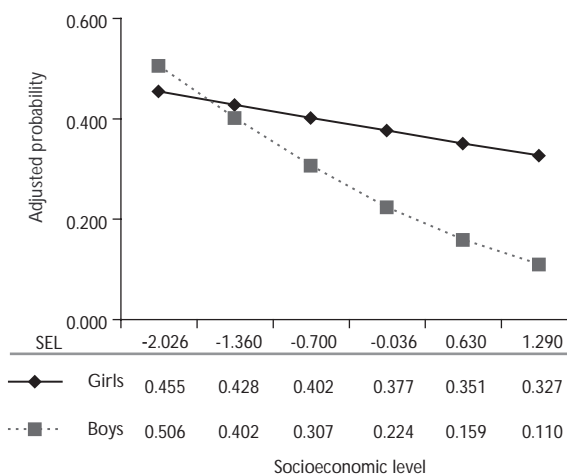


FIGURE 2. EXCLUSIVE BREAST-FEEDING <4 MONTHS IN MEXICO. NATIONAL NUTRITION SURVEY, MEXICO, 1999. INTERACTION BETWEEN SOCIO-ECONOMIC LEVEL AND INFANT SEX (CALCULATED THROUGH A COMPLEX SURVEY REGRESSION MODEL. ADJUSTED FOR MATERNAL ETHNICITY AND INFANT AGE, SEE TABLE III)

statistically significant ($p \leq 0.05$). A clear trend of increasing proportions of children ever breast-fed with increasing years of maternal schooling was observed.

There was a lower proportion of ever breast-fed children in the group of heavier mothers and in those with no health service available.

The percent of infants EBF < 4 mo was 25.7%, and for those EBF < 6 mo was 20.3%. As expected, prevalence of EBF < 4 mo was almost in all categories higher than for < 6 mo, except for the Mexico City and for the indigenous women, where these two sets of prevalences did not seem to be different.

There are clear differences in EBF proportions at both time intervals (< 4 and < 6 mo) within the four regions, between rural and urban settings, and between ethnic groups (all $p < 0.001$). The south has almost three times the extent of EBF as the Mexico City. There is a clear difference among SEL categories with much higher proportions of EBF in the low compared to the middle or high SEL categories. The probability that employed women feed their infants exclusively at the breast is markedly lower than the observed in those self-reported as unemployed at both time points (both $p < 0.03$). There are not statistically significant differences in the proportions of EBF, within strata of having a spouse present, number of children, or maternal age, at either studied times ($p \geq 0.17$).

The association between maternal schooling and prevalence of EBF is negative at both intervals ($p < 0.001$), with a slight disruption of the apparently linear association in the interval between 12 to 14y. The higher the maternal schooling the lower the prevalence of EBF, with a sharp decline in the rate of reduction after 14 years of maternal schooling. Over forty percent (41.5%) of the women with < 1y of maternal schooling reported EBF < 4 and only 3.7% do so in the group of mothers with ≥ 14 y of schooling. The same pattern is observed for EBF < 6. Having health service coverage is negatively associated with the proportion of EBF < 4 mo and EBF < 6 mo (both $p < 0.05$).

In terms of maternal nutritional status, there is a notably higher proportion of EBF for the shorter (< mean height) and the thinner (< mean BMI) mothers (all $p < 0.001$). EBF proportions for shorter infants (< mean length) are larger than for longer infants.

Over 10% more girls < 4 months were exclusively breast-fed (31.7%) than boys (20.2%, $p < 0.01$). At < 6 months, there was still a larger proportion of girls who were EBF, but the difference was smaller (7.1%, $p < 0.05$).

Two logistic regression models were developed for complex surveys, to describe the infant's probability of EBF < 4 mo and EBF < 6 mo (Table III).

Infant age, and sex, maternal SEL and ethnicity, and the interaction between SEL and infant sex, determined the $p(\text{EBF} < 4)$. Maternal schooling and employment were included in the model as relevant

Table III
DETERMINANTS* OF EXCLUSIVE BREAST-FEEDING[†]
OF INFANTS < THAN 4 AND < 6 MONTHS OF AGE.
NATIONAL NUTRITION SURVEY, MEXICO, 1999

Variable	Odds Ratio	P value
Model 1: Exclusive breast-feeding from birth to < 4 months (< 123d)		
Infant age (d)	0.99	0.001
Ethnicity [§] (yes=1, no=0)	2.12	0.023
Socio-economic level (score [#])	0.84	0.326
Infant sex (male=1, female=0)	0.46	0.006
Interaction: Socio-economic level* infant sex	0.61	0.050
n= 474; N=559 639 ^{**}		
Model 2: Exclusive breast-feeding from birth to < 6 months (< 183d)		
Infant age (≤ 95 d=0; < 95 d=1 ^{&})	0.47	0.044
Ethnicity [§] (yes=1, no=0)	3.09	0.000
Socio-economic level (score [#])	0.65	0.000
Maternal employment [#]	0.53	0.049
Infant length (cm)	0.94	0.056

n= 679; N=815 876^{**}

* Calculated through Complex survey regression models

[†] Exclusive breast-feeding: receiving ONLY breast-milk (consumption of pharmaceutical products (medicines or vitamin-mineral preparations) were not explored)

[§] Speaks a native language

[#] Calculated through principal components analysis

[&] Dichotomous to avoid collinearity

^{*} Reports holding a job or having some economic activity from which she perceived money in exchange, the week prior to the interview

^{**} n=Sample size, N= estimated population size

variables, but were not associated in a statistically significant way with the outcome ($p=0.97$ and $p=0.15$, respectively). Their inclusion in the regression models markedly changed the estimated regression coefficients of the rest of the variables, and increased the multicollinearity of the model. Thus, we present model $p(\text{EBF} < 4)$ without these two variables. All probabilities presented are adjusted for the statistically significant variables in the model.

At < 4 mo, the probability of being EBF declined with the child's age, from an estimated $p(\text{EBF} < 4)$ of 0.47 at 10 d of life, to 0.21 at 110 d. Infants of indigenous mothers had almost twice the $p(\text{EBF} < 4)$ ($p=0.39$) compared to those of non indigenous mothers ($p=0.24$). The association between sex and $p(\text{EBF} < 4)$ depended on the SEL of the family. In girls, this probability had a modest decline across the SEL values. It changed little from the lowest ($p(\text{EBF} < 4)= 0.46$) to the highest ($p(\text{EBF} < 4)= 0.33$) value of the SEL score. In contrast,

for boys, this probability decreased sharply, from 0.51 in the lowest to 0.11 in the highest SEL. The $p(\text{EBF}<4)$ was unaffected by maternal schooling or employment at this infant age. Maternal schooling was added to the model either as a dichotomous variable, categorized into three groups, as a line or as a curve. None of these forms were associated with $p(\text{EBF}<4)$ and inclusion of either forms created multicollinearity problems in the model.

For infants <6 mo, the $p(\text{EBF}<6)$ was determined by infant's age and length, and by maternal ethnicity, SEL and employment. Again, maternal schooling was not associated with $p(\text{EBF}<6)$. We assessed the pertinence of including age in its linear form, but through the analyses resulted better if age was categorized, using the median as the cut-off (\leq , $>$ 95 d). The $p(\text{EBF}<6)$ was larger for younger ($p=0.31$) than for older infants ($p=0.18$). The size of the infant, as estimated by length, was inversely associated with $p(\text{EBF}<6)$. The shortest infants in this age (52 cm) had a twice the $p(\text{EBF}<6)$ ($p=0.34$) than that observed for the largest (67cm) infants ($p=0.18$). Infants of indigenous mothers had three times the $p(\text{EBF}<6)$ ($p=0.34$) than those of non indigenous mothers ($p=0.15$). Maternal employment at this age was negatively associated with the outcome. Infants of employed women had a probability of $\text{EBF}<6$ of 0.19; and this value was 0.30 for infants of mothers who reported not holding a paid employment the week prior to the interview. Finally, SEL was also inversely related to the $p(\text{EBF}<6)$. This probability was 0.41 in the lowest and 0.17 in the highest SEL.

Discussion

The NNS-1999 offered the opportunity to ascertain breast-feeding practices in Mexico. The proportion of exclusive breast-feeding for infants <4 mo is 25.7%, and for those <6 mo is 20.3%. The percent of infants ever breast-fed is 92.3%. National data on the proportion of exclusive breast-feeding had only been collected once in Mexico prior to 1999. It was on 1979²¹ when breast-feeding practices were evaluated by the status quo method, the same method we used in this national survey to estimate prevalences of EBF. We assume that the two surveys are relatively comparable in terms of their estimate of the rates of EBF because both used the same methodology to estimate EBF, and both were national representative surveys drawn from a probabilistic sample proportional to the size and urban: rural population in the country. For the 1979 national survey, data on exclusive breast-feeding (EBF) were presented only for those infants who were breast-fed. Our NNS-1999 data derive from all live children

<2y regardless of their feeding mode. We recalculated the proportions of EBF in 1979 based on all studied children, and estimated that 15.3% of infants below 3 months of age were fed exclusively at the breast. Over two decades later, 29.4% of infants <3 mo of age are fed exclusively at the breast in Mexico. The estimated change in the proportion of EBF over these two decades represents a two-fold increase in 22y.

Although the rate of improvement was substantial, it is below improvements achieved by other Latin American countries. For example, in Honduras and Nicaragua increases of 7.75 percent points per year were observed from 1985 to 2000 and in Brazil increases of 3.8 percent points per year were documented during the same period (UNICEF*),¹⁸ while in Mexico the increase reported above was equivalent to 0.75 percent point per year. Should these rates remain unchanged, it would take 93y for Mexico to increase to 100% of EBF <4 mo; whereas Nicaragua would need only 7.5y and Brazil 15.3y.

The percentage of infants ever breast-fed in Mexico had been ascertained more recently and increased from 86.3 in 1988 (NNS-I) to 92.3 in this National 1999 survey. This is an important improvement which is probably the result of the breast-feeding initiation promotion in maternity hospitals.

In relation to the duration of breast-feeding, two previous national surveys^{19,23} revealed a median of 8.7 mo in 1976,¹⁹ a mean of 10.5 mo in 1987.²³ The present NNS-1999 reports a median of 9 mo; i.e., no meaningful change. The 1976 and 1987 surveys had different time frames than the NNS-1999 to estimate duration of breast-feeding. In the two previous surveys, mothers in their reproductive years were asked for how long they breast-fed their last child. In the NNS-1999 we collected child feeding practices for live children <24 mo of age.

Even when 20% of the children were still breast-fed at 23 mo in the NNS-1999, half of all infants <24 months had stopped breast-feeding at 9 mo. Thus, no underestimation of the median duration could have been caused by having still 20% breast-fed infants at 23 mo.

The results of the NNS-1999 show that the proportion of exclusive breast-fed infants is higher in the south region of Mexico, in the rural communities,

* Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay, and Perú.

in the indigenous population, in the low SEL, in infants of unemployed mothers or whose mother had either no schooling, had no health services, were thinner or shorter. The percentage of exclusive breast-feeding is also larger for smaller babies and for girls. These proportions range from 28.3% to 48.2% for EBF<4, and from 22.7% to 48.4% for EBF<6 mo (See Table II).

Two groups of determinants of exclusive breast-feeding appear relevant: a) maternal characteristics (ethnicity, employment and socio-economic level), and b) infant characteristics (age, gender, and size as determined by length as opposed to by weight).

Previous research has documented better practices in rural Mexico³³ and in less educated mothers.²⁰ In our bivariate analysis, we also found these trends. However, when we use multiple regression models adjusting for several variables, factors such as rural/urban location were no longer associated with breast-feeding practices. Clearly, the analytical strategy used modifies the inferences drawn from the data.

Indigenous women are spread throughout Mexico, but concentrate in the south where 73.8% of the total indigenous population lives. Ethnicity is a strong predictor of EBF<4 in Mexico, even after controlling for the mother's socio-economic level. This finding suggests that it is not only availability of resources, as indicated by SEL, which influence feeding practices, but other factors, such as infant rearing practices or culture, determine infant feeding mode as well. The influence ethnicity has on the prevalence of exclusive breast-feeding is observed for the entire interval studied; i.e., the first 6 mo of life. The WHO recommends EBF for 6 mo, and Mexican indigenous women are more in agreement with this recommendation than their non-indigenous counterparts.

Our results also show that the probability of exclusive breast-feeding <4 mo is influenced by infant's sex. Girls are more commonly exclusively breast-fed than boys. Pérez-Escamilla and co-workers³⁴ have reported that girls are more frequently exclusively breast-fed than boys in Brazil and Honduras, but had not observed this in Mexico. Adair and co-workers³⁵ in the Philippines found that girls were fully breastfed more frequently than boys. An explanation offered by both groups of authors relate to the mothers' perception about size of the infants (boys being larger), or to gender bias.

Gender bias may be related to parental involvement with their children in different living conditions. This is explained by the Trivers and Willard³⁶ theory which predicts that parents living in good conditions will bias their investments to sons, whereas those living in poor conditions will bias their investment to-

wards girls. For the Trivers and Willard³⁶ theory to hold, an interaction between condition and gender should exist. We observed an interaction between gender and our indicator of socio-economic condition as these relate to the $pEBF<4$ mo. We do not know the reason why mothers introduce complementary foods earlier to boys than to girls; but if we assume they do so because they believe boys need more than girls, then our study finds support for this theory. Gender bias may be related to the mother trying to favor boys by feeding them other foods earlier under the assumption that it is beneficial for their growth. Paradoxically such gender bias, should it exist, would be counter-productive for boys because early introduction of foods to the infant is associated with increased morbidity.³⁷

The size of an infant may be a cue to the mother, influencing her infant's feeding practices. Size may shift her decision in either direction. In one scenario, if the exclusively breastfed child is large, the mother might interpret this as her milk production being sufficient to support such growth, and be persuaded to continue exclusive breast-feeding. This was observed in the Philippines³⁵ where fatter infants (larger ponderal index (g/cm^3)) were more likely to be EBF<6 mo than the thinner babies. But in an alternative scenario, growth (size) could be a signal for the nursing mother indicating a growing need for foods. In this case, larger infants would be fed complementary foods earlier than smaller ones.

Support for this last scenario was observed in the present analyses where the probability of being exclusively breastfed <6 mo decreased as infant length increased.

There is evidence that Latin American nursing women think that bigger babies need more food. Picado and coworkers³⁸ found that Nicaraguan lactating mothers consider exclusive breast-feeding (in infants <1y) insufficient to support growth, and inconvenient for the nursing mother. Unfortunately no information is given on the age of the child at which the mother considers EBF to be insufficient. This concept would most probably be wrong for a two-month old baby, and quite accurate for an eleven-month old one; both <1y.

Reverse causality has been documented to explain the negative association between the size (nutritional status) of the infant and prolonged breast-feeding. It has been observed that mothers decide not to wean the sicker infants and extend the duration of breast-feeding to protect the weaker child.^{7,39,40} This has been described for infants *older* than 6 mo and for *any* and not for *exclusive* breast-feeding. Thus, reverse causality cannot explain the greater $p(EBF<6)$ observed in our data.

Cultural, as well as practical issues influence maternal infant feeding practices. Employment status, a variable in our model for exclusive breast-feeding < 6 mo, impose real time constraints for mothers. The introduction of foods or liquids to the breast-fed infants' diet might be a strategy for the working mother to reduce the time spent breast-feeding, releasing more time for work. In a study of time budgets of unemployed mothers,⁴¹ the introduction of complementary feeds to the breast-fed infant observed was reported to increase, rather than decrease the time spent feeding the baby. In such context, time constraint may not be a real issue. The inferences done by Cohen and co-workers apply for mothers not working outside their home. However; in the case of employed mothers, they can be substituted by another person to bottle or complementary feed their infants releasing real time to work. There is ample evidence in the literature that employed nursing mothers or those planning to return to work, breast-feed less frequently their infants and are less likely to exclusively breast-feed.^{37,38,42} Combining nursing and employment is not a simple process. Employed mothers need accurate and practical advice, permission to breast-feed their infants, a private place to extract milk in their working place, flexible working hours, and encouragement and support from peers and family to breast-feed as recommended by the WHO. Unless decisive and targeted breast-feeding protection and promotion for employed mothers is implemented, breast-feeding rates are expected to be lower than those found for non-employed mothers. An intervention trial in Chile⁴³ shows that improving working conditions and lactation knowledge of nursing mothers, such as a place to extract and store milk, anticipatory counseling, and monthly follow-ups, can increase the percentage of exclusive breast-feeding during the first six months of life.

The Baby Friendly Hospital Initiative (BFHI), put forth by UNICEF and WHO has been implemented in Mexico for over a decade.⁴⁴ No formal evaluation of its impact has been conducted in the country, but it has probably played a role in the changes observed and reported here, especially in improving the rates of ever breast-feeding or initiation. This initiative has been observed to improve rates of initiation and duration of breast-feeding^{45,46} and the likelihood of improved rates of exclusive and full breast-feeding at 3 mo.

Clearly, a more efficient implementation of the BFHI in Mexico, as well as decisive and unambiguous breast-feeding promotion and protection is needed to improve the poor practices observed in Mexico. Otherwise, it would take us almost 100y to reach the WHO

recommendation of exclusively breast-feed all infants <4 mo.*

A limitation of our study is the lack of qualitative information regarding the reasons behind infant feeding decisions. We can confidently state who has better infant feeding practices, but we do not know why, which is an indispensable piece of information to design potentially effective breast-feeding promotion programs. Neither do we know who the actors are in these decision making process. Our data do not provide information on the specific role of the family members or the health services –private or governmental-, in the mother's decision to breast-feed. But clearly, these potential actors have not provided enough quality and timely breast-feeding protection to have had meaningful impact in the country's breast-feeding practices in the last two decades as other countries such as Honduras, Nicaragua or Brazil have probably done.

Another limitation of our study, shared by studies using the status quo method in cross sectional studies, is the inference about the prevalence of EBF. Using the status quo methodology, infants are classified as exclusively breast-fed if nothing but breast milk was consumed the day and night prior to the interview. This does not imply that these infants had never received any other liquid or food, or that they have always been fed the same way. If there is an interest in estimating the prevalence of those infants who have been EBF all their life, a modified methodology must be used, and the status quo method, as used today, would probably underestimate such prevalence. The magnitude of this bias would depend on the type and frequency of the reversibility of the infant feeding practices in the studied populations.

Nonetheless, with the available national information we have a better idea of what type of breast-feeding promotion is needed (exclusive breast-feeding all infants <6 mo), who needs it the most (employed, highly educated, non-indigenous women of medium SEL and not living in the south, as well as those bearing large babies or boys), and when is mostly needed (prior to initiate breast-feeding).

Qualitative research in nursing and non-nursing mothers is needed to tailor better breast-feeding promotion and protection programs in Mexico. Such programs are urgently needed to improve infant feeding practices. By doing so we may expect better infant health, survival, and cognitive development. Mothers

* And even longer for <6 mo, the current recommendation.

would benefit as well. Fertility may be reduced by intense breast-feeding, a powerful family planning strategy in developing countries. Also, mothers who breast-feed exclusively at the breast for the recommended WHO-duration, would lose more weight. In the face of the large overweight prevalence increase in the world and in Mexico, this may be an excellent measure against increased weight gain with pregnancy.

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