Breastfeeding in Mexico Was Stable, on Average, but Deteriorated among the Poor, whereas Complementary Feeding Improved: Results from the 1999 to 2006 National Health and Nutrition Surveys

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Abstract

We present: 1) indicators of infant and young child feeding practices (IYCFP) and median age of introduction of foods analyzed by geographic and socioeconomic variables for the 2006 national probabilistic Health Nutrition Survey (ENSANUT-2006); and 2) changes in IYCFP indicators between the 1999 national probabilistic Nutrition Survey and ENSANUT-2006, analyzed by the same variables. Participants were women 12–49 y and their <2-y-old children (2953 in 2006 and 3191 in 1999). Indicators were estimated with the status quo method. The median age of introduction of foods was calculated by the Kaplan-Meier method using recall data. The national median duration of breastfeeding was similar in both surveys, 9.7 mo in 1999 and 10.4 mo in 2006, but decreased in the vulnerable population. In 1999 indigenous women breastfed 20.8 mo but did so for only 13.0 mo in 2006. The national percentage of those exclusively breastfeeding <6 mo also remained stable: 20% in 1999 and 22.3% in 2006. Nevertheless, exclusively breastfeeding <6 mo changed within the indigenous population, from 46% in 1999 to 34.5% in 2006. Between surveys, most breastfeeding indicators had lower values in vulnerable populations than in those better-off. Complementary feeding, however, improved overall. Complementary feeding was inadequately timed: median age of introduction of plain water was 3 mo, formula and non-human milk was 5 mo, and cereals, legumes, and animal foods was 5 mo. Late introduction of animal foods occurred among vulnerable indigenous population when 50% consumed these products at 8 mo. Mexican IYCFP indicate that public policy must protect breastfeeding while promoting the timely introduction of complementary feeding. J. Nutr. 143: 664–671, 2013.

Introduction

Infant feeding profoundly influences survival and health (1). We have reported that by 1999, infant and young child feeding practices (IYCFP) in Mexico were poorly complied with (2) and that breastfeeding had not improved in the 20 y preceding the National Nutrition Survey in 1999 (ENN-99) (3). There are vast benefits from breastfeeding both for the infant and mother (4). Infants experience less morbidity (5), especially not exclusively from gastrointestinal infections, and when sick, illness is less severe (6). Also, breast-fed infants have a greater survival compared with their formula-fed counterparts (7–9) and lower risk of sudden infant death (4). Breastfeeding mothers experience better health as well as lower risk of mammary and ovarian cancer (10), type 2 diabetes, and depression (11). Furthermore, breastfeeding is a wise economic behavior, associated with far less expense than bottle-feeding due to lower medical costs, fewer medicines, and less equipment and maternal absenteeism from work (12,13).

Important improvements in child nutritional status have occurred in the past decade given the country’s investment in nutrition programs and its degree of development (14), but salient inequities still remain, with indigenous groups and lower socioeconomic status infants and children still suffering from higher prevalence of undernutrition.

Several national initiatives were implemented in Mexico, the largest is the human development program Oportunidades.
of these programs, along with fluctuations in economic changes and food prices, could have had an effect on the country’s IYCFP. Profound economic changes have also occurred in Latin America (15) and it may be expected that IYCFP have been modified accordingly in relation to the priorities of each country (16).

This article presents information on IYCFP from the nationally representative Health and Nutrition Survey 2006 (ENSANUT-2006) (17) and compares it with similar data previously published from the ENN-99 (3). Our objectives are to: 1) present IYCFP expressed in 10 indicators recommended by the WHO with relevant socioeconomic and demographic variables within 2006 survey; and 2) assess changes in these indicators between the 1999 and 2006 surveys with the same set of variables. The purpose of this publication is to offer evidence of infant and young child feeding in Mexico, so that national programs and organizations involved in the nutrition and health of infants and young children can be aware of the challenge these practices pose and identify their potential role in shaping such practices to improve the health and survival of Mexican children, while reducing health risks for their mothers.

Methods

Design. We used data from the last 2 national nutrition surveys whose design and methods have been published elsewhere (3,18). These surveys were designed to evaluate the health and nutritional status of the Mexican population.

Participants and data collection. The ENN-99 included women of reproductive age (12–49 y) and their live children <2 y. All indicators were computed in subgroups of children <2 y. Data on IYCFP are based on an interviewer’s recall of the previous day of the interview, which will be hereafter referred to as status quo, and were collected from mothers or children’s caretakers as recommended by the WHO (19). The ENSANUT-2006 included women of reproductive age (12–49 y) and their live children <3 y. In this case, the median duration of breastfeeding was computed for <3 y. In ENSANUT-2006, we analyzed IYCFP by status quo only for infants <1 y. For older children, feeding data were derived from an FFQ that gathered information on the 7 d before the interview, which also applied to the mother or the child’s caretaker. Thus, for children 1–2 y, IYCFP from both surveys were obtained within somewhat different time frames: 7 d in the ENSANUT-2006 and 1 d in the ENN-99. For the ENSANUT-2006, children’s caretakers were asked if the child was fed at least one food item from each of 7 food groups. The food groups were similar for both surveys. For ENN-99, these were: 1) plain water; 2) formula and non-human milks; 3) non-nutritive liquids (sugared water, water-based drinks, teas, beans, chicken broth, coffee, soft drinks, but not fruit juices); 4) nutritive liquids (thinned, cereal-based gruel with water or milk, coffee with milk, fruit juices); 5) cereals and legumes (pastas, rice, tortillas, bread, oats, beans, lentils, fava, and similar beans); 6) fruits and vegetables; and 7) animal product foods except milk (meat, eggs, cheese, yogurt, etc.). The same information on food groups for the ENSANUT-2006 were collected, although somewhat more disaggregated; we collected information on consumption of Nutrisano, the micronutrient-rich complementary food offered by Oportunidades for children 6–24 mo, and on the consumption of the LICOSNA milk distributed by that program. Also, for ENSANUT-2006, we excluded eggs from the meat group to differentiate the type of iron in each food source.

Observers were trained in all areas of data collection by qualified and standardized supervisors. In previous publications of Mexico’s IYCFP for ENN-99 (3), data on both recall and status quo methodologies were merged and presented. In the present paper, IYCFP were recalculated for the ENN-99 for comparative purposes with those of the ENSANUT-2006. To estimate the ages at which 25, 50, and 75% of the children were consuming diverse food groups for the ENSANUT-2006, we used recall and current status data, as explained below.

Informed consent was obtained from interviewed adults and children’s tutors. Ethical approval was acquired from the Ethics Committee of the National Institute of Public Health, the institution responsible for both surveys.

Variable definitions. Most of the breastfeeding variables were calculated by status quo, except when noted. Any breastfeeding was when the baby received human milk, regardless of the consumption of any other beverage or solid or semi-solid food. The combination of the information on breastfeeding and consumption of other food items during the previous day was used to estimate the duration of exclusive breastfeeding. Median duration of breastfeeding was defined as the age in months when 50% of studied children received human milk. Children ever breastfed was considered (by recall) children <24 mo who ever sucked at the breast to receive colostrum or human milk. Exclusively breastfeeding <6 mo was defined as when a child of that age consumed nothing but human milk; predominant breastfeeding <6 mo was defined similarly but allowed the consumption of non-nutritive liquids such as water and nonsugared, water-based drinks such as teas and juices. Proportions of the latter 2 indicators were calculated for infants <6 mo and monthly by completed months as recommended by the WHO (20). Continued breastfeeding at 1 (12–15 mo) and 2 y (20–23 mo) was defined as infants who received human milk at those ages. Introduction of solid, semi-solid, or soft foods (6–8 mo) was considered as infants who received solid, semi-solid, or soft foods. Age-appropriate breastfeeding (<1 y) was constructed with 2 indicators: infants 0–5 mo who received only human milk and infants 6–11 mo who received human milk as well as solid, semi-solid, or soft foods. Due to the data gathering methodology, we conducted a slight adjustment in the calculation of the indicator “minimum dietary diversity (6–11 mo) only” for infants 6–11 mo as follows: an infant was classified as consuming a diverse diet if s/he consumed ≥3 food groups and not ≥4 as WHO recommends, because the questionnaire we used had no sufficient food group disaggregation at this age. For children 12–23 mo, we followed the WHO-2008 recommendations exactly. Consumption of iron-rich or iron-fortified foods (6–11 mo) was calculated as recommended by WHO IYCFP recommendations published in 2008 (WHO-2008) (20). Socioeconomic and demographic variables are for household variables. A household was defined as indigenous if ≥1 woman 12–49 y in the household spoke an indigenous language; if not, it was considered nonindigenous and was defined similarly for both surveys. Socioeconomic level (SEL) was obtained using the first component resulting from a principal components analysis validated in both surveys (17,18). Currently, the Program Oportunidades serves 5.8 million families. This is a multicomponent program including conditional cash transfers, health services, scholarships for the young, and nutrition supplements for children and pregnant and lactating mothers. Other food programs considered were LICOSNA, Programa Apoyo Alimentario, Family’s Integral Development, or any nongovernmental organizations that distribute foods. Affiliation to health services was reported according to the interviewer’s information and included the Mexican Social Security Institute, social security for federal workers, Mexican Health Secretariat, Petroleos Mexicanos, Mexican Army, Mexican Navy, and others. The area was classified as urban for localities ≥2500 inhabitants and was rural otherwise. Both surveys considered 4 national regions: north, central, south, and Mexico City. Of the maternal variables, a woman was considered employed if she held an employment, or reported some economic activity from which she perceived money in exchange, the week prior to the interview. Maternal age was reported in years and education in approved years of school.

Data analyses. The median duration of breastfeeding (mo) was estimated by moving averages of 3 adjoining months, adjusted by the methodology suggested by WHO-2008 (20). Significant differences were calculated with nonparametric bootstrap percentile (95% CI). For infants who were still being breastfed at the time of the survey, breastfeeding duration was set as the age of the infant (mo). The median age of introduction of complementary feeding (mo) was estimated by the Kaplan-Meier method (21); this procedure used both recall data for children who had been weaned or were receiving other foods at the time of the survey and status quo data for those who were still receiving the studied food group.
Box plots describe the estimated ages at which 25, 50, and 75% of infants were regularly consuming ≥1 food from each of the studied food groups (21). Data were analyzed using the SVY module of STATA to account for the complex sampling design as well as the statistical software R (22,23). Two main analyses were conducted: IYCFP analysis within the ENSANUT-2006, stratified by relevant variables and comparisons between the 2 surveys, 1999 and 2006; data for the ENN-99 survey were published elsewhere (2,3). We compared the median duration of breastfeeding for both surveys with nonparametric bootstrap percentile estimations (95% CI) and used the 1000 bootstrap replications for the 95% CI construction by subgroups (24). The proportion of children who received foods from each food group at the national level and for selected subgroups was estimated using Kaplan-Meier Survival Analysis weighted by sample design. For plotting purposes, these values were smoothed and expressed as complete months. Cox regression models, adjusting by the complex survey design, were used to estimate differences among the selected subgroups. For survival analysis, if a particular child was not yet consuming any food regularly from each food group or if the infant was still breastfeeding, this information was recorded and used as censored data. The age at which 50% of the children regularly consumed ≥1 foods from a particular group was defined as the median age of introduction of that particular food group. We tested the differences between categories of infant feeding, using Pearson statistical test for categorical variables and Wald statistical test for continuous variables, all with Bonferroni’s adjustment when necessary. Differences in proportions or percentages between ENSANUT-99 and ENSANUT-2006 data were analyzed by Z test (25) and P values < 0.05 were considered significant. We developed an arbitrary categorization of observed differences between surveys. A difference between 0 and <5 percentage points was referred to as a small change, from 5 to <10 as moderate, and from 10 to ≥20 as large. The number code is similar for duration of breastfeeding, expressed in months rather than percentage points. Codes point to meaningful changes.

Results

Table 1 describes the general characteristics for the ENSANUT-2006 sample. The studied sample consists of households with children <24 mo of age, most of whom were urban nonindigenous. Close to one-third of the households were affiliated with any health service and just under one-half received food programs, mostly the rural population. The mean of maternal education level was relatively low: ~8 completed school years.

Complete information was available for 3191 and 2953 mother-child pairs from the ENN-99 and ENSANUT-2006, respectively.

Data for 2006

Breastfeeding indicators. The median duration of breastfeeding was 10.4 mo; it was longer for the worse-off women of the south, the poorest Mexican region (26), for the rural areas, and among the indigenous, those of a low socioeconomic level, the unemployed, and also those receiving the program Oportunidades (P < 0.05) (Table 2). The national percentage of children <24 mo ever breastfed was slightly >90% and was lower in the following better-off population: those residing in the north, non-indigenous, medium socioeconomic level, employed, and in women not receiving any food programs (P < 0.05). The percentage of exclusively breastfeeding <6-mo-old infants was 22.3% and its median duration <1 mo (data not shown); this declined sharply during the first month of life (Fig. 1). Exclusively breastfeeding <6 mo was higher in most categories of the worse-off mother-infant pairs: those living in the south, in rural areas, of low socioeconomic level, unemployed women, and in those receiving Oportunidades (P < 0.05). One-third of the studied mothers continued to breastfeed their children for 1 y and close to one-half this amount continue to do so at 2 y; there were some differences between study subgroups, consistent with the other breastfeeding indicators above.

Complementary feeding indicators. The national percentage of infants receiving solid, semisolid or soft foods between 6 and 8 mo was close to 90; it was higher in the medium socioeconomic level, in younger women, and in those with the highest education (P < 0.05). Around one-third of children <1 y were age-appropriate breastfed; the percentage was higher in all the worse-off groups as well as in those receiving Oportunidades (P < 0.05). Two-thirds of children aged 6–12 mo consumed a minimally diverse diet; again, the percentage of this indicator

### Table 1: Socioeconomic and demographic characteristics for mothers of children <24 mo and their households in the ENSANUT-2006

<table>
<thead>
<tr>
<th>Region</th>
<th>National</th>
<th>North</th>
<th>Center</th>
<th>Mexico City</th>
<th>South</th>
<th>Urban</th>
<th>Rural</th>
<th>Indigenous</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>2953</td>
<td>705</td>
<td>1072</td>
<td>116</td>
<td>1060</td>
<td>2065</td>
<td>888</td>
<td>238</td>
</tr>
<tr>
<td>Mothers' education, % y</td>
<td>7.8 ± 0.1</td>
<td>8.5 ± 0.2</td>
<td>7.6 ± 0.2</td>
<td>9.3 ± 0.3</td>
<td>7.0 ± 0.2</td>
<td>8.6 ± 0.1</td>
<td>5.9 ± 0.2</td>
<td>4.5 ± 0.3</td>
</tr>
<tr>
<td>Mothers' age, y</td>
<td>26.9 ± 0.2</td>
<td>26.5 ± 0.3</td>
<td>27.0 ± 0.3</td>
<td>26.3 ± 0.7</td>
<td>27.2 ± 0.3</td>
<td>26.5 ± 0.2</td>
<td>27.7 ± 0.3</td>
<td>29.0 ± 0.6</td>
</tr>
<tr>
<td>Mothers' employment, % yes</td>
<td>23.1</td>
<td>27.5</td>
<td>23.6</td>
<td>25.5</td>
<td>19.2</td>
<td>26.7</td>
<td>14.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Household affiliated to health services</td>
<td>36.2</td>
<td>52.3</td>
<td>38.1</td>
<td>29.8</td>
<td>28.0</td>
<td>38.3</td>
<td>31.2</td>
<td>26.1</td>
</tr>
<tr>
<td>Household received food programs</td>
<td>Oportunidades</td>
<td>32.2</td>
<td>12.7</td>
<td>38.8</td>
<td>2.8</td>
<td>50.1</td>
<td>14.6</td>
<td>74.5</td>
</tr>
<tr>
<td>All other food programs</td>
<td>8.2</td>
<td>4.6</td>
<td>6.3</td>
<td>29.5</td>
<td>3.2</td>
<td>11.1</td>
<td>1.3</td>
<td>3.3</td>
</tr>
<tr>
<td>No food programs</td>
<td>56.9</td>
<td>82.7</td>
<td>55.0</td>
<td>67.7</td>
<td>46.8</td>
<td>74.3</td>
<td>24.2</td>
<td>18.5</td>
</tr>
<tr>
<td>Household socioeconomic level</td>
<td>Low</td>
<td>45.9</td>
<td>31.2</td>
<td>40.6</td>
<td>28.5</td>
<td>66.4</td>
<td>35.6</td>
<td>70.5</td>
</tr>
<tr>
<td>Medium</td>
<td>31.9</td>
<td>42.7</td>
<td>36.9</td>
<td>34.0</td>
<td>20.3</td>
<td>35.3</td>
<td>23.7</td>
<td>7.3</td>
</tr>
<tr>
<td>High</td>
<td>22.2</td>
<td>26.1</td>
<td>22.5</td>
<td>37.5</td>
<td>13.4</td>
<td>29.1</td>
<td>5.8</td>
<td>3.7</td>
</tr>
</tbody>
</table>

1 Values are percent or means ± SEs, n = 2963. DIF, Family's Integral Development program; ENSANUT-2006, Health and Nutrition Survey 2006.
2 Indigenous is defined as 1 woman 12–49 y speaks an indigenous language in the household.
3 Sample size.
4 Number of approved school years.
5 Reported holding a job or having some economic activity from which she received money in exchange during the week prior to the interview.
6 Access to partial or complete health insurance provided either by the government (Mexican Social Security Institute, Mexican Health Secretariat, social security for federal workers, Petroleos Mexicanos, Army, or Navy) or private insurance.
7 Any person of the household receiving from the government one or more of the following food aid programs: LICONSA, DIF, Programa Apoyo Alimentario, or any nongovernmental organization.
## Table 2: Feeding practices in children <24 mo by socioeconomic and demographic characteristics in ENN-99 and ENSANUT-2006

<table>
<thead>
<tr>
<th>Median duration of breastfeeding</th>
<th>Children ever breastfed &lt;24 mo</th>
<th>Exclusive breastfeeding &lt;6 mo</th>
<th>Predominant breastfeeding &lt;6 mo</th>
<th>Continued breastfeeding at 1 y (12–15 mo)</th>
<th>Continued breastfeeding at 2 y (20–23 mo)</th>
<th>Introduction of solid, semisolid, or soft foods (6–8 mo)</th>
<th>Age-appropriate breastfeeding &lt;1 y</th>
<th>Minimum dietary diversity &lt;6 mo</th>
<th>Consumption of iron-rich or iron-fortified foods &lt;6 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 mo</td>
<td>3191</td>
<td>4015</td>
<td>3191</td>
<td>2936</td>
<td>3191</td>
<td>2936</td>
<td>3191</td>
<td>3191</td>
<td>3191</td>
</tr>
<tr>
<td>&lt;6 mo</td>
<td>3755</td>
<td>3471</td>
<td>3755</td>
<td>3755</td>
<td>3755</td>
<td>3755</td>
<td>3755</td>
<td>3755</td>
<td>3755</td>
</tr>
</tbody>
</table>

### National

- Median duration of breastfeeding: 9.7 mo
- Children ever breastfed 24 mo: 3191
- Exclusive breastfeeding 6 mo: 20.0%
- Predominant breastfeeding 6 mo: 36.5%
- Continued breastfeeding at 1 y (12–15 mo): 25.1%
- Continued breastfeeding at 2 y (20–23 mo): 87%
- Introduction of solid, semisolid, or soft foods (6–8 mo): 30.8%
- Age-appropriate breastfeeding <1 y: 64.6%
- Minimum dietary diversity <6 mo: 50.5%

### Region

- North: Median duration of breastfeeding: 4.7 mo, Children ever breastfed 24 mo: 4.8%
- Central: Median duration of breastfeeding: 5.0 mo, Children ever breastfed 24 mo: 4.8%
- Mexico City: Median duration of breastfeeding: 5.4 mo, Children ever breastfed 24 mo: 6.2%
- South: Median duration of breastfeeding: 7.8 mo, Children ever breastfed 24 mo: 10.4%

### Area

- Urban: Median duration of breastfeeding: 4.9 mo, Children ever breastfed 24 mo: 8.5%
- Rural: Median duration of breastfeeding: 10.9 mo, Children ever breastfed 24 mo: 10.9%

### Ethnicity

- Indigenous: Median duration of breastfeeding: 20.8 mo, Children ever breastfed 24 mo: 13.0%
- Nonindigenous: Median duration of breastfeeding: 8.5 mo, Children ever breastfed 24 mo: 8.6%

### Household socioeconomic level

- Low: Median duration of breastfeeding: 14.7 mo, Children ever breastfed 24 mo: 10.8%
- Medium: Median duration of breastfeeding: 8.5 mo, Children ever breastfed 24 mo: 8.6%
- High: Median duration of breastfeeding: 4.7 mo, Children ever breastfed 24 mo: 4.8%

### Mothers' employment

- Yes: Median duration of breastfeeding: 4.8 mo, Children ever breastfed 24 mo: 6.7%
- No: Median duration of breastfeeding: 8.9 mo, Children ever breastfed 24 mo: 9.0%

### Mothers' age, y

- <19: Median duration of breastfeeding: 12.8 mo, Children ever breastfed 24 mo: 10.5%
- 19 to <25: Median duration of breastfeeding: 8.7 mo, Children ever breastfed 24 mo: 8.6%
- 25 to <35: Median duration of breastfeeding: 8.7 mo, Children ever breastfed 24 mo: 8.9%
- ≥35: Median duration of breastfeeding: 2.1 mo, Children ever breastfed 24 mo: 8.8%

### Mothers' education, y

- <1: Median duration of breastfeeding: 12.9 mo, Children ever breastfed 24 mo: 6.9%
- 1 to <6: Median duration of breastfeeding: 12.6 mo, Children ever breastfed 24 mo: 14.6%
- 6 to <9: Median duration of breastfeeding: 8.8 mo, Children ever breastfed 24 mo: 7.0%
- 9 to <12: Median duration of breastfeeding: 6.9 mo, Children ever breastfed 24 mo: 8.7%
- 12 to <14: Median duration of breastfeeding: 4.7 mo, Children ever breastfed 24 mo: 8.6%
- ≥14: Median duration of breastfeeding: 6.6 mo, Children ever breastfed 24 mo: 8.5%

### Household affiliated with health services

- Yes: Median duration of breastfeeding: 5.0 mo, Children ever breastfed 24 mo: 8.7%
- No: Median duration of breastfeeding: 10.7 mo, Children ever breastfed 24 mo: 8.9%

(Continued)
was lower in the indigenous, those of lower socioeconomic level, and unemployed mothers ($P < 0.05$). One-half the children between 6 and 12 mo consumed iron-rich or iron-fortified foods. Consumption of iron-rich foods was homogeneous within population subgroups, except in the case for children receiving Oportunidades or other food programs, where it was higher ($P < 0.05$). Figure 2 shows the Kaplan-Meier-estimated median ages when 50% of the studied infants consumed the defined foods groups. Similar data on complementary feeding by age and disaggregated by study subgroups are presented in Figure 3. The Box-plot figure also presents the ages at which 25 and 75% of the children consumed each food group; this display allows the analysis of the early as well as late introduction of foods. Data show that the median age of introduction of plain water was $\sim 3$ mo at the national level and $\sim 4$ mo in many subgroups. In all groups except the indigenous, 25% of infants consumed plain water at $\sim 1$ mo. Formula and other nonhuman milk was introduced earlier in urban (median age was $\sim 4$ mo) than rural areas, where it was $\sim 10$ mo. However, already 25% of the infants in the urban, nonindigenous populations of medium and high socioeconomic status consumed formula and other nonhuman milks $< 1$ mo of life. There is an almost 8-mo difference between the median ages of introduction of formula and other non-human milks between nonindigenous and indigenous groups ($4 \text{ vs. } 12$ mo, respectively). The introduction of non-nutritive liquids did not vary in a relevant way among or within the studied subgroups. In general, nutritive liquids were introduced into the infant’s diet during the third trimester of life in all subgroups, except in the indigenous population, in whom the median age of introduction was slightly after 1 y. Infants also consumed fruits and vegetables during the third trimester of life, with small differences among subgroups or within categories. For cereals and legumes, the pattern was similar with that for fruits and vegetables, except for the medium and high socioeconomic level infants who consumed this food group earlier than the rest. The median age of introduction of animal food products (except milk) was $\sim 5$ mo in general. Early introduction ($< 3$ mo) was observed in the urban and nonindigenous populations and across socioeconomic levels. Late introduction of animal food products was observed in rural, indigenous, and low-socioeconomic level infants, who initiate regular consumption at 9, 11, and 8 mo, respectively.

### Comparing data from 1999 to 2006

Data comparing the 1999 and 2006 surveys are presented in Table 2. The duration of breastfeeding remained similar, changing $< 1$ mo from 1999 to 2006 (9.7 to 10.4 mo, respectively). The percentage of children ever breastfed was 92.3 in 1999 and 90.4% in 2006 ($P = 0.051$). Decreases were observed within subgroups and went from small to moderate in those infants with better conditions, such as those living in the north, in urban areas, the nonindigenous, and those whose mothers were employed ($P < 0.05$). The indigenous women and also those who were educated (12 to $< 14$ y) experienced a moderate decrease in the percentage of children ever breastfed ($P < 0.05$). The change in the percentage of exclusively breastfed $< 6$ mo children in this period went from 20.0 to 22.3% ($P = 0.515$). There was a large increase (14.9 pp) in this indicator for the most educated women ($P < 0.05$), but in the group of infants whose mothers had between 25 and 34 y, the differences between surveys were not significant ($P = 0.099$). The percentage of predominant breastfeeding $< 6$ mo for the low socioeconomic group went from 49.4 to 38.0% from 1999 to 2006, respectively ($P = 0.085$). Continued breastfeeding at 1 y remained similar between surveys with no particular difference between subgroups in this period. Continued breastfeeding to 2 y remained $\sim 20\%$ in both surveys ($P = 0.84$ between times), but there was a large decrease in the south, in those in the low and medium socioeconomic levels, and in children of unemployed women ($P < 0.05$).

The consumption of solid, semisolid, or soft foods from 6 to 8 mo remained stable at the national level. It decreased in some better-off groups: those in the north and well-educated women (12 to $< 14$ y of school), with large and moderate changes,
feeding practices for the young complied poorly with what certain subgroups, most notably among the poor. Mexican breastfeeding practices either stagnated or decreased in results showed that complementary feeding improved by 2006, 2 national nutrition surveys conducted in 1999 and 2006. The This paper presents data on IYCFP in Mexico derived from the Discussion

This paper presents data on IYCFP in Mexico derived from the 2 national nutrition surveys conducted in 1999 and 2006. The results showed that complementary feeding improved by 2006, but breastfeeding practices either stagnated or decreased in certain subgroups, most notably among the poor. Mexican feeding practices for the young complied poorly with what WHO recommends as optimal for this age.

In general, the timing of introduction of complementary foods was inadequate. Both early and late introduction food items in infants’ diets were observed. Particularly worrisome was the very early consumption of formula; close to one-quarter of the Mexican children received formula or other non-human milk close to birth. Such data suggest that breastfeeding was not protected and it may have been an indirect indicator of how Mexico had gone astray from enforcing the International Code of Marketing of Breast Milk Substitutes. In Mexico, the Mexican Social Security Institute and social security for federal workers are national health programs that provide daycare centers for users among their benefits. In these daycare centers, the introduction of complementary feeding at 4 mo occurs, following the old WHO recommendations. This untimely indication not only affects infants but also sets a detrimental example to users’ families and the population at large. Early introduction of foods into the infant diet was not observed in the indigenous, rural, or low socioeconomic level populations; in these subgroups, later introduction of nutritious foods was common. Late consumption of nutrient-rich foods is probably one of the main determinants of poor growth observed in these subgroups (27). Such findings suggest that Oportunidades’ targeting the poorest with iron- and zinc-rich complementary food is an excellent nutrition policy that must be protected. However, the high prevalence of anemia among the poor in Mexico (28) implies that the program has not been efficient in tackling this deficiency. Feeding practices of the young in Mexico in 2006 indicate a coexistence of large proportions of children at risk due to untimely food introduction; the children who are better-off, are weaned early which poses them at risk of food allergies and infections (29) plus excess weight late in life (30), while the poorer, who tend to be weaned later, are at an increased risk of micronutrient deficiencies due to late introduction of nutritious foods.

Changes from 1999 to 2006. We documented some modest improvements in breastfeeding practices from 1999 to 2006. There were some subgroups that improved and others worsened. In general, the percentage of most breastfeeding indicators, though lower in the 2006 than in the 1999 survey, did not reach significance, but the shift was largely toward lower values. Particularly critical was the apparent extreme decrease in the percentage of exclusive breastfeeding in indigenous populations. Methodological issues cannot explain the observed decreases, because the same data collection methods were used for infants <1 y in both surveys. The data showed some much-needed positive trends in particular subgroups; duration of any breastfeeding moved nationally in a nonsignificant way but in the right direction from 9.7 to 10.4 mo. Also, some breastfeeding indicators seemed to have shifted toward better values in groups of upper socioeconomic level, somewhat older, and better-educated women.

Inadequate practices were found across the subgroups, so adequate infant feeding should be promoted and protected nationally. Good nutrition promotes the development of human capital, especially if improved in the first 1000 d of life (31). However, breastfeeding benefits are greatest in those who are the most vulnerable who live in communities where water and sanitation conditions are worse and where health services do not readily prevent or alleviate morbidity (32–34). This is the reason it is disturbing to observe the downward trend in the poorest, most vulnerable population.

Discussion

respectively (P < 0.05). This indicator increased in 2 vulnerable groups; infants of adolescent mothers experienced a moderate increase (7.3 pp; P < 0.05) and those of indigenous women, who changed from 67.5 to 94.2% (P = 0.076). The percentage of age-appropriate breastfeeding <1 y increased nationally (30.8 to 37.0%; P < 0.05) and in most studied subgroups. Increases were from moderate to large in some subgroups without a clear pattern; those in the central region and urban areas who were nonindigenous, unemployed, and relatively young (20–35 y) and had access to health services experienced a moderate increase (P = 0.05) and those in the extreme of the education years (1 to <6 y, and those with >14 y of school) experienced large increases (P < 0.05). The minimum dietary diversity and consumption of iron-rich or iron-fortified foods were not ascertained in the ENN-99, so differences between surveys cannot be evaluated.

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FIGURE 1 Breastfeeding duration for the ENN-99 and ENSANUT-2006, Mexico. Values are proportions by month for any and exclusive breastfeeding, expressed as the moving averages of 3 adjoining months, n = 3191 (ENN-99) and 2953 (ENSA1906).

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FIGURE 2 Age of regular consumption of each food group in children <24 mo in ENSANUT-2006, Mexico. Values are proportions by month for each food group, n = 2953.
There are initiatives to improve IYCFP. Research unequivocally shows that peer counseling improves a series of health outcomes, including breastfeeding exclusivity (35), initiation, and duration, and it also reduces infant diarrheal diseases and increases the duration of postpartum amenorrhea (36). Other successful strategies include the Baby-Friendly Hospital Initiative, adherence to the International Code of Marketing of Breast Milk Substitutes, or the implementation of lactation stations at employment sites, so that breastfeeding women can hygienically and comfortably extract and store their breast milk during labor hours. Successful strategies also may include mass media promotion using effective marketing techniques; culturally tailored strategies within national food and nutrition programs such as Oportunidades, Programa Apoyo Alimentario, LICONSA, and Family’s Integral Development; the inclusion of breastfeeding courses into nutrition and medical schools, which are notably absent in Mexican undergraduate programs; or the promotion of optimal IYCFP when mother take their infants for routine vaccination.

In the context of global health, breastfeeding trends in Mexico were poor in 2006 and did not improve in the years since 1999. Mexico is a country with potential to improve its population’s health. Good examples of improved health and nutrition through national programs include Oportunidades (37). Other Latin-American countries have implemented infant feeding programs with great success. Examples include Brazil, Colombia, Haiti, and Peru, which experienced large increases of exclusive breastfeeding and duration of breastfeeding, especially due to the investment in breastfeeding promotion (38). To strengthen promotion efforts, Brazil (39) has realized an evaluation of primary health care units that implement strategies to support mothers in breastfeeding. This analysis showed positive results in the percentages of exclusively breast-fed infants in those units with better compared with poor performance units (38.6 vs. 23.6%; \( P < 0.001 \)).

Our study has some limitations, the most important of which is the lack of true longitudinal data. We present data from 2 independent surveys and cannot strictly state that the observed figures were true changes. Random variability may explain at least part of the observed differences between surveys. However, the absence of any strategy to protect breastfeeding or to promote adequate infant feeding practices in Mexico during that period allows the inference that differences between surveys may reflect true declines.

These poor results open opportunities to reinitiate actions with proven efficiency to improve IYCFP. One relevant area is the identification of factors explaining the decrease in breastfeeding practices in the indigenous populations to immediately halt and reverse their negative trends. The Mexican experience at reducing child undernutrition (39) underscores the nation’s determination and ability to tackle severe health problems. The promotion and protection of breastfeeding along with timely and

**FIGURE 3** Age of regular consumption of liquid (A) and solid (B) foods in children <24 mo, ENSANUT-2006, Mexico. Values are upper and lower limits and central for food groups correspond to ages closest to 25, 75, and 50%, respectively, \( n = 2953 \).
adequate complementary feeding will not be achieved in Mexico unless it becomes a priority in the national health agenda. The publication of these results is aimed directly at that purpose.

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Literature Cited