ORIGINAL ARTICLE

Maternal & Child Nutrition WILEY

Breastfeeding practices in Mexico: Results from the National Demographic Dynamic Survey 2006–2018

Mishel Unar-Munguía | Ana Lilia Lozada-Tequeanes |
Dinorah González-Castell | Manuel A. Cervantes-Armenta | Anabelle Bonvecchio

Center for Research on Health and Nutrition, National Institute of Public Health, Cuernavaca, Mexico

Correspondence
Ana Lilia Lozada-Tequeanes, Center for Research on Health and Nutrition, National Institute of Public Health, Av. Universidad 655 Col. Santa María Ahuacatitlán, C.P. 62100 Cuernavaca, Mexico.
Email: alilote@gmail.com

Funding information
None

Abstract

Although actions have been taken to improve breastfeeding in Mexico, trends over the last decade and their associated factors have not been analysed. We estimated trends in breastfeeding practices at the national, rural/urban, and regional level indigenous ethnicity and socio-economic level, and their associated factors using the National Demographic Dynamics Survey (2006, 2009, 2014 and 2018). We assessed breastfeeding indicators of women with children <24 months according to The World Health Organization recommendations. Logistic regressions models of pooled data were used to estimate trends and associations with biological and sociodemographic characteristics. Between 2006 and 2018, the prevalence of ever breastfed increased from 91.8% to 94.2% ($p < 0.001$), whereas early initiation of breastfeeding increased from 40.8% to 59.7% ($p < 0.001$), with similar increments by urban/rural level. Between 2009 and 2018, the prevalence of exclusive breastfeeding in children <6 months increased from 13.0% to 20.7% ($p < 0.001$). The largest increase was seen in Mexico City, in nonindigenous women and those with a high socio-economic status, whereas indigenous women and those from the South had the lowest or no improvements. Breastfeeding education during pregnancy [odds ratio (OR) 1.3; 95% confidence interval (CI) 1.1–1.5] was positively associated with exclusive breastfeeding, whereas being employed (OR 0.8; 95% CI 0.6–0.9) was negatively associated. Breastfeeding practices improved but are still far from recommendations. Implementing strategies like breastfeeding counselling and programmes and policies that promote and support breastfeeding for poor, indigenous, single and working mothers should be a priority for the government to ensure that all children have the best start in life.

KEYWORDS
breastfeeding education, breastfeeding practices, Mexico, social determinants, trends

1 | INTRODUCTION

The first 1,000 days of life, from pregnancy to the first 2 years, is the most critical period to achieve optimal child development and ensure health during childhood and later in life (Mameli, Mazzantini, & Zuccotti, 2016; Schwarzenberg & Georgieff, 2018). Breastfeeding during this period is essential for infant feeding because it provides all nutrients and energy required (World Health Organization (WHO), 2002) and also contains biologically active components that boost the immune system (Andreas, Kampmann, & Le-Doare, 2015).

Breastfeeding reduces infant morbidity and mortality (Sankar et al., 2015; Victora et al., 2016) and the risk of chronic diseases during adolescence and adulthood (Horta, Loret De Mola, & Victora, 2015), and increases intelligence in children (Victora et al., 2015). Conversely, feeding infants with infant formula has a deleterious effect on their health (Anttila-Hughes, Fernald, Gertler, Krause, & Wydick, 2018; Mameli et al., 2016). Breastfeeding has important health benefits for the mother who breastfeeds (Chowdhury et al., 2015; Mazariegos et al., 2019; Unar-Munguia, Torres-Mejia, Colchero, & Gonzalez de Cosio, 2017), and only a small percentage of women are unable to breastfeed (∼5%) due to serious disease or adoption (Lawrence & Lawrence, 2005).

In addition, breastfeeding is environmentally friendly, has a lower carbon footprint compared with feeding children with breast milk substitutes (Karlsson, Garnett, Rollins, & Röös, 2019) and does not require the amount of water compared with producing infant formula (4,700 L/kg) (Joffe, Webster, & Shenker, 2019). Therefore, exclusive breastfeeding in the first 6 months of age and continued breastfeeding up to 2 years or more, as recommended by the WHO (2002), is a triple-duty action that contributes to the prevention of undernutrition/infectious diseases, overnutrition/chronic diseases and fosters cognitive development (Pérez-Escamilla & Segura-Pérez, 2018), while contributing to reduce climate change (Swinburn et al., 2019) and is key to achieve many of the Sustainable Development Goals (United Nations, 2017).

In Mexico, the Nutrition and Health National Surveys (ENSANUT for its Spanish acronym) performed between 2006 and 2012, evidenced that breastfeeding practices decreased by half, especially in rural areas (González de Cosío, Escobar-Zaragoza, Gonzalez-Castell, & Rivera-Dommarco, 2013), causing a health and economic burden estimated around 3,000 million dollars per year (Colchero, Contreras-Loya, Lopez-Gatell, & De Cosío, 2015; Unar-Munguía, Stern, Colchero, & González De Cosío, 2019). Consistent with the experiences in other countries (Pérez-Escamilla, 2020), several factors at different socioecological levels, such as perceived insufficient milk or young motherhood, lack of family support and health services, as well as the working environment and lack of legislation to support breastfeeding among working women, led to this decline (Bonvecchio Arenas et al., 2016). Hence, since 2014, actions were taken by government, civil society and academia to increase breastfeeding, including the Becoming Breastfeeding Friendly Initiative (Buccini et al., 2020; González de Cosío, Ferré, Mazariegos, Pérez-Escamilla, & Mexico Committee, 2018; Safon, Buccini, Ferré, de Cosío, & Pérez-

Key messages

- Between 2009 and 2018, the prevalence of exclusive breastfeeding increased from 13.0% to 20.7%, and between 2006 and 2018, early initiation of breastfeeding increased from 40.8% to 59.7%.
- The largest increase in breastfeeding practices was seen in Mexico City, in nonindigenous women and those with a high socio-economic status, whereas indigenous women and those from the South had the lowest or no improvements.
- Education or counselling about breastfeeding during pregnancy was positively associated with exclusive breastfeeding, whereas being employed and single mother were negatively associated.
- Improvements in breastfeeding practices between 2009 and 2018 coincide with some progress made in legislation and policies to favour breastfeeding but are still far from recommendations.
- Implementing strategies like breastfeeding counselling and programmes/policies that promote and support breastfeeding for indigenous, single and working mothers should be a priority for the government and society.

Escamilla, 2018). Although improvements in breastfeeding practices have been reported, they are still far from recommendations (González-Castell, Unar-Munguía, Quezada-Sánchez, Bonvecchio Arenas, & Rivera-Dommarco, 2020).

Although the ENSANUT surveys have been used as a reference for estimating breastfeeding indicators in Mexico, in the last years, the sample size of children <24 months, and particularly children lower than 6 months of age, has been decreasing mainly due to budget restrictions, leading to inaccurate estimations of breastfeeding indicators when disaggregating by urban/rural or region level. However, an alternative to estimate breastfeeding practices and its trends is the National Demographic Dynamics Survey (ENADID for its Spanish acronym), which has a large sample sizes for different settings and age groups, allowing to obtain representative estimates. The ENADID is a cross-sectional survey that has been carried out in Mexico since 1992 and provides statistical and demographic information, such as fertility, mortality and migration (internal and international), population growth, reproduction, sexuality, contraception use and pregnancy, among others. Since 1997, a module on maternal and child health, including breastfeeding practices of children born in the last 5 years prior to the survey, was incorporated in the survey. All rounds of the ENADID have a probabilistic, stratified two-stage cluster sampling design allowing disaggregation by federal entity, region and urban or rural level, and adjusted by demographic projections to allow comparability over time (INEGI, 2020).

As far as we know, no study has estimated the trends in breastfeeding indicators in the last decade and their associated factors in Mexico. Thus, to document any change in breastfeeding over time, we estimated the prevalence of breastfeeding indicators in children <24 months at the national, rural/urban and regional level, indigenous ethnicity and socio-economic level, according to the WHO (2010) definitions, and analysed its trends using four rounds (2006, 2009, 2014 and 2018) of the ENADID. We also estimated the association between breastfeeding practices and prenatal care, breastfeeding education or counselling at pregnancy, type of delivery and sociodemographic characteristics.

2 | METHODS

2.1 | Study design and sample size

We analysed women 15 to 54 years old with a child <24 months who had information on breastfeeding practices and pooled four cross-sectional rounds (2006, 2009, 2014 and 2018) of the ENADID. The 1997 survey was not included in the analyses due to missing variables that did not allow for the estimation of a living condition index comparable with the other rounds.

The ENADID 2009, 2014 and 2018 surveys were carried out by the National Institute of Statistics and Geography (INEGI for its Spanish acronym), and the 2006 survey was carried out by the National Institute of Public Health (INSP for its Spanish acronym), the Ministry of Health and the National Population Council (CONAPO for its Spanish acronym). INEGI and CONAPO trained, standardized and supervised field staff before and during data collection. All procedures for the ENADID surveys related to the design, data collection, data management and dissemination are stated in the National System of Information, Statistics and Geography protocols (INEGI, 2015).

The sampling frame used by the ENADID 2018 and 2014 is the INEGI's National Housing Framework 2012, which was built from the cartographic and demographic information obtained from the 2010 Population and Housing Census (INEGI, 2014, 2020). For the year 2009, the ENADID used the updated information from the 2010 Population and Housing Census (INEGI, 2009). The sampling frame used for ENADID 2006 is the INEGI's National Housing Framework 2002, built from the cartographic and demographic information obtained from the XII General Population and Housing Census 2000 (CONAPO, 2006).

The ENADID data are always adjusted to demographic projections, which makes it possible to eliminate fluctuations in the estimated data that are inherent to the probabilistic sampling schemes, enabling comparisons between surveys over time. In each survey, the expansion factors for women between 15 and 54 years old are adjusted for the non-response rate of the fertility module questionnaire in each primary sampling unit, and corrected by demographic projections at household, primary sampling unit, strata and federal entity, in order to ensure that in each domain of interest of the survey, the total population is obtained according to the established

population projection by the National Population Council, which is referred to the midpoint of the survey. (INEGI, 2020).

2.2 | Breastfeeding practices

Breastfeeding indicators were estimated according to WHO definitions to allow for comparability with other surveys. The observations of children <24 months in each survey and the subsamples included to construct each breastfeeding indicator can be found in Figure 1.

2.2.1 | Definitions

Ever breastfeeding is the prevalence of infants <24 months who were given breast milk at least once, and early initiation of breastfeeding was defined as the prevalence of children <24 months who were breastfed in the first hour of life after birth. These indicators were assessed by mother's recall. Exclusive breastfeeding is the prevalence of children <6 months who were still breastfeeding at the time of the survey (status quo) and who did not report introducing other foods or liquids before 6 months of age (by recall of the mother). Predominant breastfeeding is the prevalence of children <6 months who were still breastfeeding and consumed non-nutritive liquids such as water and sugar-free drinks in addition to breast milk, but no other food or liquids. Both indicators were assessed only for 2009, 2014 and 2018 rounds, since the 2006 survey did not have information regarding current breastfeeding status at the time of the survey.

2.3 | Prenatal and sociodemographic variables

We analysed mother's prenatal variables including (a) the number of medical check-ups during pregnancy; (b) breastfeeding education/counselling during prenatal care (Yes/No); for 2014 and 2018 rounds, women were asked the question "Were you taught or explained how to give your baby breast milk?", whereas for the 2006 and 2009 rounds, women were asked "Did you receive education/counseling to breastfeed?"; (c) the type of delivery (natural or caesarean) and (d) health care access defined by affiliation to any health care institution (private, public or none).

The following sociodemographic variables of the mother were also analysed: (a) mother's age (years), (b) indigenous ethnicity defined as speaking an indigenous language (Yes/No), (c) marital status (single, free union/married and separated/divorced/widow), (d) parity (number of children born alive), (e) employment (formal or informal) defined as having worked at least 1 h during the last week (Yes/No) and (f) education (none, primary, secondary, high school, university or superior). Additionally, the mother's status of overweight and obesity before the last pregnancy (diagnosed by doctor or health personnel) and being a beneficiary of Prospera were included only in the 2014 and 2018 surveys. Prospera is a conditional cash transfer programme
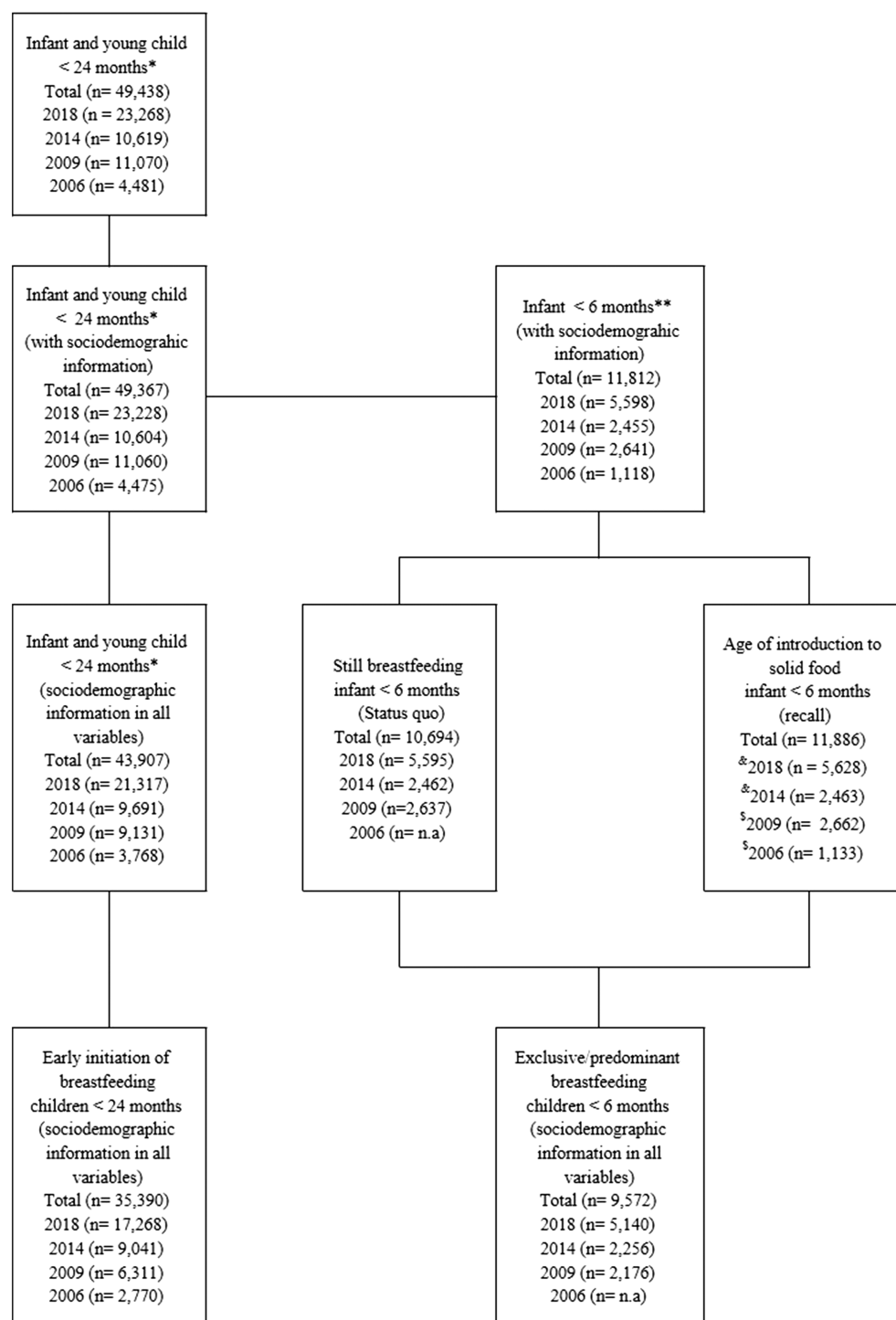
FIGURE 1 Flow diagram of sample sizes to estimate breastfeeding indicators. Symbol '*' includes infants and young children with breastfeeding information. '&' denotes age of introduction: water or tea, formula, milk powder, cow's milk, etc.; juices or broth, porridge or purees, atoles, cereals, tortillas or bread and eggs. '$' denotes age of introduction: water or tea, powdered milk, cow's milk, etc.; atole or cereals, juice (fruits or vegetables, broth beans, beef or chicken), pureed fruit or vegetables, beef or chicken puree, soup, omelette or bread and egg. 'n.a.' means information of breastfeeding by status quo not available

that granted benefits to families in poverty and delivered micronutrient supplements to pregnant and lactating women during the first year postpartum, conditional on attendance to health services (Dávila Lárraga, 2016).

Also, *a living condition index* was calculated for each survey year, considering the information provided on the dwelling's material, including the roof (waste material, cardboard, metal or asbestos sheet, palm or straw, wood, tiles or concrete slabs), the floor (dirt, cement, wood planks, ceramic tiles or other covering), number of rooms, exclusive kitchen (Yes/No), access to drinking water and drainage (Yes/No), type of fuel used for cooking (firewood, coal, gas) and possession of material goods such as a car or electrical appliances (washing machine, refrigerator, stove, television, telephone, etc.). A principal component analysis was performed for each of the surveys, and the factor that explained the highest percentage of the total variability (36.0%–39.6%) was maintained, which was classified into socio-economic status (SES) tertiles (low, medium and high) (Vyas & Kumaranayake, 2006).

TABLE 1 Characteristics of mothers and their children <24 months with breastfeeding information

Characteristics	2018 Sample size (N)	2018 Expanded (N)	2014 Sample size (n)	2014 Expanded (N)	2009 Sample size (n)	2009 Expanded (N)	2006 Sample size (N)	2006 Expanded (N)	Pearson chi-squared p value
Children < 24 months	23,228	7,613,416	10,604	3,641,164	11,060	3,685,175	4,475	3,353,241	
Children < 6 months	5,598	1,892,594	2,455	857,074	2,641	882,177	1,118	853,538	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Children's age (months)[a]	11.8±0.1	(11.7–11.9)	12.0±0.1	(11.8–12.1)	11.9±0.1	(11.7–12.1)	11.6±0.1	(11.3–11.8)	0.0833
Mother's age (years)[a]	28.7±0.1	(28.6–28.8)	26.5±0.1	(26.3–26.6)	26.5±0.1	(26.4–26.7)	26.9±0.1	(26.7–27.2)	0.0000
Parity (number of children born alive)[a]	2.8±0.0	(2.8–2.8)	2.1±0.0	(2.1–2.2)	2.3±0.0	(2.2–2.3)	2.5±0.1	(2.3–2.6)	0.0000
Number of medical check-ups during pregnancy									
<5	7.5	(7.1–8.0)	7.3	(6.6–8.0)	12.3	(11.5–13.3)	15.6	(14.2–17.1)	0.000
5+	90.4	(89.9–90.9)	91.8	(91.1–92.5)	86.6	(85.6–87.5)	81.2	(79.6–82.7)	
No information	2.1	(1.9–2.4)	0.9	(0.7–1.2)	1.1	(0.9–1.4)	3.2	(2.6–4.0)	
Breastfeeding education/counselling during pregnancy (yes = 1)	80.6	(79.9–81.2)	83.1	(82.2–84.0)	94.9	(94.3–95.5)	92.0	(90.8–93.0)	0.000
Type of delivery									
Natural	58.1	(57.3–58.9)	54.2	(52.9–55.4)	58.1	(56.7–59.5)	62.7	(60.8–64.7)	0.000
Caesarean section	41.9	(41.1–42.7)	45.8	(44.6–47.1)	41.9	(40.5–43.3)	37.1	(35.2–39.1)	
No information	0.0		0.0		0.0		0.1	(0.0–0.4)	
Health care access									
None	11.7	(11.1–12.2)	14.1	(13.2–15.0)	32.5	(31.1–33.9)	52.7	(50.8–54.7)	0.000
Public	86.4	(85.8–86.9)	84.0	(83.0–84.9)	64.6	(63.2–66.0)	44.5	(42.5–46.4)	
Private	2.0	(1.7–2.2)	1.9	(1.6–2.3)	2.9	(2.4–3.4)	2.8	(2.2–3.5)	
Civil status									
Free union/married	87.0	(86.4–87.5)	84.8	(83.9–85.7)	85.9	(84.9–86.8)	85.0	(83.4–86.4)	0.000
Separated/divorced/widow	7.5	(7.1–8.0)	7.1	(6.5–7.7)	5.7	(5.1–6.4)	6.0	(5.2–7.0)	
Single	5.5	(5.1–5.9)	8.2	(7.5–8.9)	8.4	(7.7–9.1)	9.0	(7.9–10.3)	
Mother's education									
No education	2.3	(2.04–2.5)	1.9	(1.6–2.3)	3.0	(2.6–3.5)	3.4	(2.8–4.2)	0.000
Primary	17.7	(17.1–18.4)	18.1	(17.2–19.0)	26.3	(25.1–27.5)	32.5	(30.7–34.3)	
Middle school	39.8	(39.0–40.6)	38.2	(37.0–39.4)	36.7	(35.4–38.1)	33.6	(31.7–35.5)	
Senior high school	23.6	(22.9–24.3)	24.1	(23.0–25.2)	17.9	(16.9–19.0)	13.9	(12.6–15.3)	
College or superior	15.4	(14.8–16.0)	15.8	(14.9–16.7)	16.1	(15.1–17.2)	16.2	(14.8–17.7)	
No information	1.3	(1.2–1.51)	1.9	(1.6–2.3)	0.0		0.5	(.31–0.9)	

(Continues)

TABLE 1 (Continued)

	Survey year								
	2018		2014		2009		2006		Pearson chi-squared p value
	Sample size (N)	Expanded (N)	Sample size (n)	Expanded (N)	Sample size (n)	Expanded (N)	Sample size (N)	Expanded (N)	
Indigenous (speaks an indigenous language)	9.3	(8.9–9.8)	7.0	(6.4–7.6)	7.7	(7.0–8.5)	7.8	(6.8–8.8)	0.000
Employment (having worked at least 1 h during the last week)	28.5	(27.7–29.2)	27.1	(26.0–28.2)	25.1	(23.9–26.3)	21.4	(19.8–23.1)	0.000
Overweight and obesity (before pregnancy)	10.5	(10.0–11.0)	8.3	(7.6–9.0)	n.a	n.a	n.a	n.a	0.000
Socio-economic Status (SES)									
Low	43.5	(42.7–44.4)	41.3	(40.1–42.6)	43.0	(41.6–44.4)	39.3	(37.4–41.2)	0.000
Medium	31.4	(30.6–32.2)	32.2	(31.0–33.3)	28.0	(26.7–29.2)	30.3	(28.5–32.1)	
High	21.4	(20.7–22.1)	21.8	(20.8–22.9)	15.6	(14.6–16.6)	24.0	(22.3–25.8)	
No information	3.7	(3.4–4.0)	4.7	(4.2–5.2)	13.5	(12.5–14.4)	6.5	(5.6–7.4)	
Social program (Prospera)	4.6	(4.3–4.9)	2.3	(2.0–2.63)	n.a	n.a	n.a	n.a	0.000
Area of residence (rural)	31.0	(30.3–31.7)	27.7	(26.7–28.8)	27.6	(26.4–28.8)	26.8	(25.2–28.4)	0.000
Region[b]									
North	19.7	(19.1–20.2)	19.9	(19.0, 20.7)	18.9	(18.0–19.8)	18.3	(16.9–19.8)	0.000
Center	41.7	(40.9–42.6)	43.1	(41.9–44.4)	42.4	(41.0–43.8)	43.8	(41.8–45.8)	
Mexico City	3.9	(3.5–4.3)	4.4	(3.9–5.0)	6.4	(5.7–7.1)	6.0	(5.0–7.3)	
South	34.7	(34.0–35.5)	32.6	(31.5–33.7)	32.4	(31.1–33.6)	31.9	(30.2–33.7)	

Note. Results from the National Demographic Dynamic Survey 2006–2018, Mexico.

Abbreviation: CI, confidence interval; n.a, not available.

[a]Mean ± standard error.

[b]North (Baja California, Baja California Sur, Coahuila, Chihuahua, Durango, Nuevo León, Sonora and Tamaulipas), Central (Morelos, Tlaxcala, Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, Nayarit, Querétaro, San Luis Potosí, Zacatecas, Estado de México and Sinaloa), Mexico City and South (Campeche, Chiapas, Guerrero, Hidalgo, Oaxaca, Puebla, Quintana Roo, Tabasco, Tlaxcala, Veracruz and Yucatán).

Rural and urban classifications were made according to community size (≤2,500 inhabitants for rural and >2,500 inhabitants for urban), whereas geographic regions were defined according to INEGI as North, Center, Mexico City and South (INEGI, 2020).

2.4 | Statistical analysis

The prevalence of breastfeeding practices was assessed at the national, rural/urban and regional level, along with indigenous/non-indigenous ethnicity and SES for each survey. Descriptive statistics of continuous (mean ± standard deviations) and categorical variables (proportions) of prenatal and sociodemographic characteristics were also examined in each survey. To explore differences between surveys among categorical variables, we used a Pearson's chi-square test, whereas a Wald test was used to analyse differences among continuous variables. Differences in the prevalence of breastfeeding between surveys and linear trends were assessed using simple logistic regression models; a p value < 0.05 was defined as statistically significant.

Adjusted logistic regression models were used to estimate the association between each indicator of breastfeeding and the prenatal/

sociodemographic variables mentioned above. Odds ratios (OR) and their 95% confidence intervals (95% CI) were presented. As an additional analysis, we performed the same models including the status of overweight/obesity before pregnancy, as well as belonging to the Prospera programme for the 2014 and 2018 survey.

All analyses were performed using Stata 14.0 statistical programme (Stata Corporation, College Station, TX, USA). The SVY module was used for complex samples and individual expansion factors for women between 15 and 54 years were used, and the 'contrast' postestimation command was used to estimate p trends.

3 | RESULTS

The sample characteristics by year are presented in Table 1. The analysed sample with complete sociodemographic information had no difference in breastfeeding indicators but had a higher SES, higher education, higher proportion of women being employed, higher proportion of caesarean delivery, higher proportion of women with health access and were younger than women without complete information (results not shown).
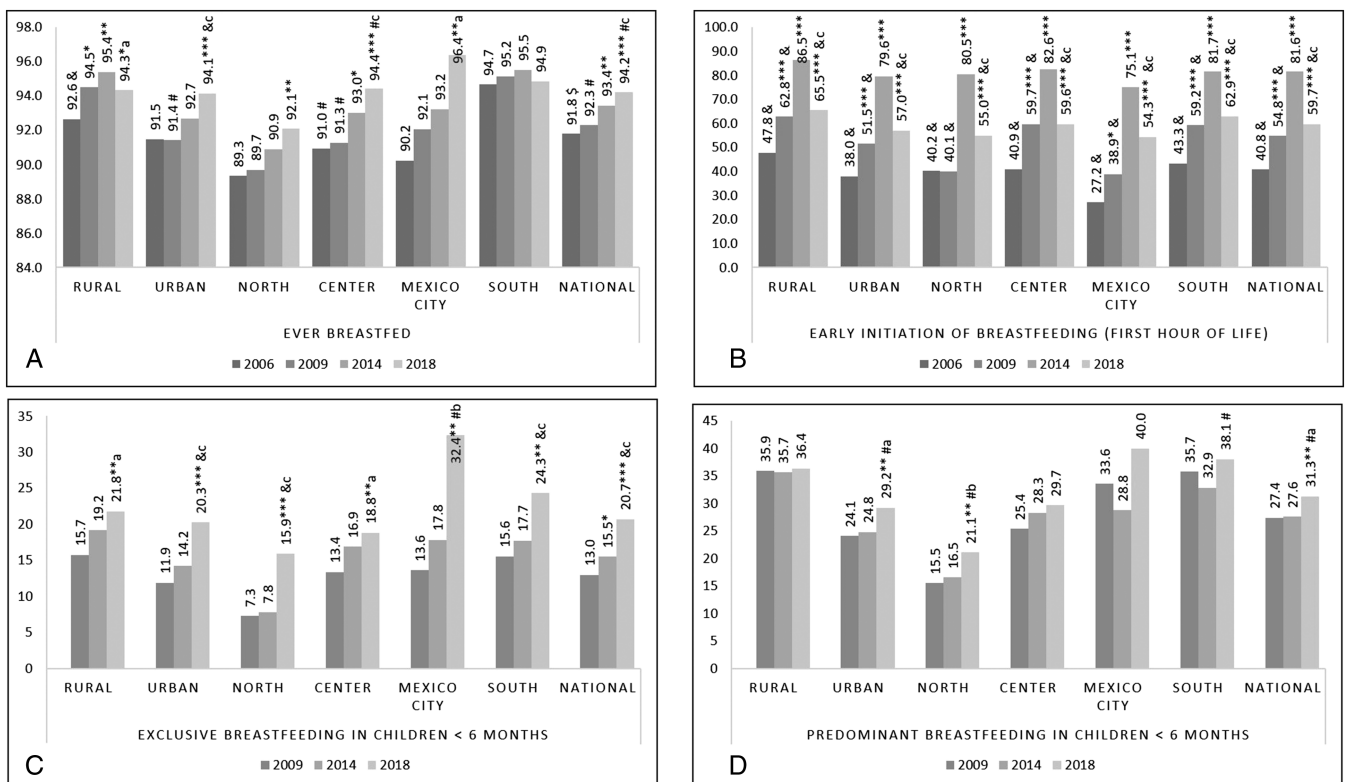

FIGURE 2 Prevalence of breastfeeding practices at national, rural/urban and regional level, by survey year. Results from the National Demographic Dynamics Survey (ENADID) 2006–2018, Mexico. *p < 0.05, **p < 0.01, ***p < 0.001 statistically significant differences for ever breastfed and early initiation of breastfeeding compared with 2006 year and for exclusive and predominant breastfeeding compared with 2009 year. #p < 0.05, \$$p$ < 0.01, &p < 0.001 statistically significant differences for all breastfeeding indicators compared with year 2014. a = p trend < 0.05, b = p trend < 0.01 and c = p trend < 0.001 statistically significant differences for linear trends between survey years. SES, socioeconomic status

The trends in the prevalence of breastfeeding indicators at country, rural/urban and regional level by survey are shown in Figure 2. The prevalence of ever breastfeeding at the national level increased 1.6 pp in 2014 ($p < 0.01$) and 2.4 pp in 2018 ($p < 0.001$), compared with 2006 (p trend < 0.001), with similar increments in rural/urban level, while the greatest increase was seen in Mexico City between 2006 and 2018 (6.2 pp; $p < 0.01$) and no differences between years were observed in the South. When compared with 2014, the prevalence of ever breastfeeding in 2018 increased only in the Center (1.4 pp; $p < 0.05$), at the urban level (1.4 pp; $p < 0.001$) and nationally (0.8 pp; $p < 0.05$) (Figure 2a).

Nationwide, the prevalence of early initiation of breastfeeding increased 14.2 pp in 2009 ($p < 0.001$), 38.7 pp in 2014 ($p < 0.001$) and 18.7 pp in 2018 ($p < 0.001$) in relation to 2006 (p trend < 0.001), with comparable increases by rural/urban level and in the North, Center and South of the country, with the largest increase observed in Mexico City, whereas the prevalence was lower in 2018 compared with 2014 in all levels ($p < 0.001$) (Figure 2b).

Between 2009 and 2018, the prevalence of exclusive breastfeeding in children <6 months (EB < 6mo) increased 7.7, 6.1 and 8.4 pp at the national, rural and urban level, respectively ($p < 0.001$) (Figure 2c). Similar increments were observed in the North, Center and the South regions, whereas in Mexico City, the prevalence increased 18.8 pp ($p < 0.01$) in the same period. Between 2014 and 2018, EB < 6mo increased 6.1 pp at urban level ($p < 0.001$), 8.1 pp in the North ($p < 0.001$), 14.6 pp in Mexico City ($p < 0.05$), 6.6 pp in the South ($p < 0.05$) and 5.2 pp at national level ($p < 0.001$) (Figure 2c).

The prevalence of predominant breastfeeding (PB < 6mo) between 2009 and 2018 increased 3.9 pp nationally (p trend < 0.05): 5.1 pp ($p < 0.01$) in urban areas and 5.5 pp in the North ($p < 0.01$), whereas between 2014 and 2018, the prevalence increased 3.7 pp nationally ($p < 0.05$): 4.4 pp at urban level ($p < 0.05$), 4.6 pp in the North ($p < 0.05$) and 5.2 pp in the South ($p < 0.05$) (Figure 2d).

Among indigenous women, only early initiation of breastfeeding increased in the analysed period, while all breastfeeding practices improved for nonindigenous women (Figure 3). Ever breastfeeding, early initiation of breastfeeding and EB < 6mo had a positive trend among women of all SES levels (Figure 3a–c), whereas PB < 6mo increased only among women of low and high SES. (Figure 3d). The greatest increase in breastfeeding prevalence was observed in high SES.

The variables associated with breastfeeding indicators are presented in Table 2. The trends among surveys show that the chance of ever breastfeeding increased 30% in 2014 ($p < 0.05$) and 50% in 2018
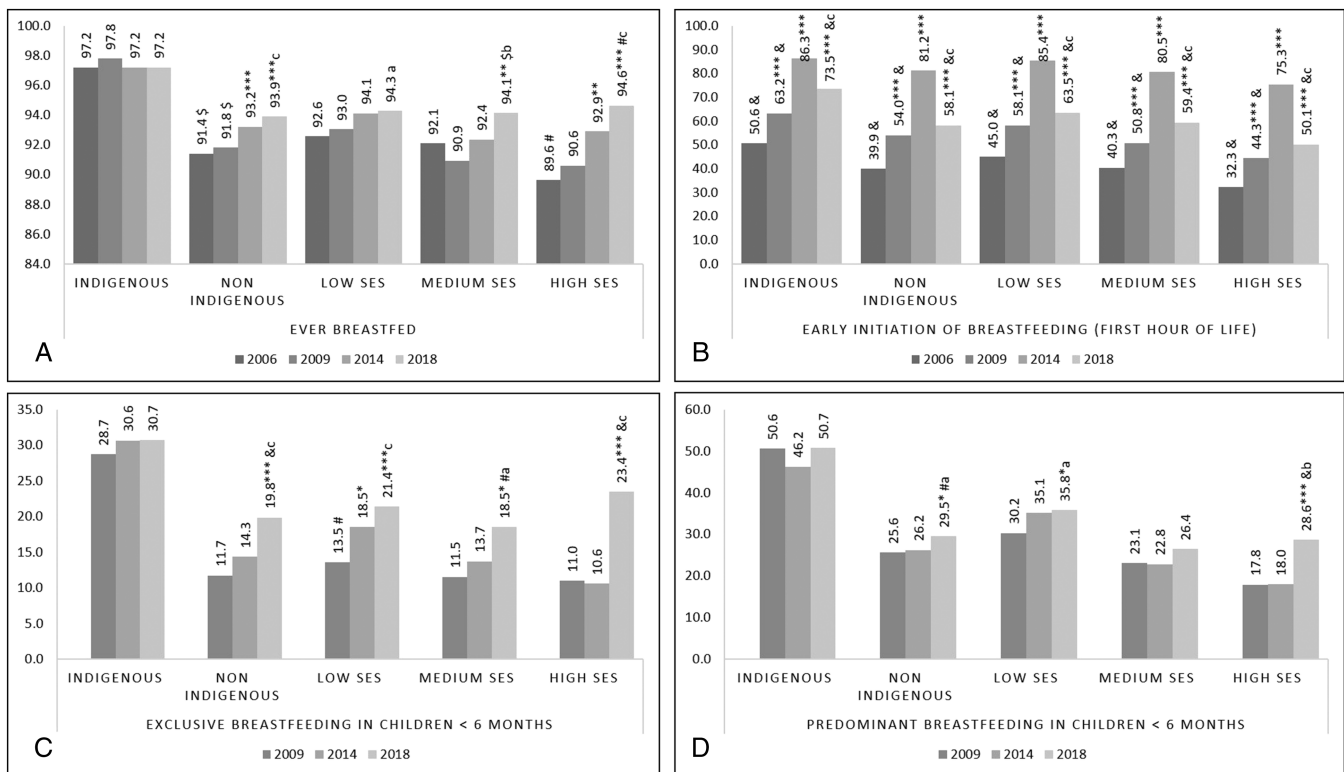

FIGURE 3 Prevalence of breastfeeding practices in indigenous/nonindigenous and socio-economic status, by survey year. Results from the National Demographic Dynamics Survey (ENADID) 2006–2018, Mexico. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ statistically significant differences for ever breastfed and early initiation of breastfeeding compared with year 2006 and for exclusive and predominant breastfeeding compared with year 2009. #$p < 0.05$, \$$p < 0.01$, &$p < 0.001$ statistically significant differences for all breastfeeding indicators compared with year 2014. a = p trend < 0.05, b = p trend < 0.01, c = p trend < 0.001 statistically significant differences for linear trends between survey years. SES, socio-economic status

TABLE 2 Association between prenatal and sociodemographic characteristics and breastfeeding indicators among children <24 months

Characteristics	Ever breastfed (children <24 months)		Early initiation breastfeeding (children <24 months)		Exclusive breastfeeding (children <6 months) (status quo)		Predominant breastfeeding (children <6 months) (status quo)	
	n	N	n	N	n	N	n	N
	43,907	16,218,936	35,390	12,949,014	9,572	3,264,404	9,572	3,264,404
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Survey year								
2006	1		1		n.a	n.a	n.a	n.a
2009	1.0	(0.8–1.3)	1.8	(1.6–2.0)***	1		1	
2014	1.3	(1.0–1.5)*	7.6	(6.6-8.6)***	1.2	(0.9–1.6)	1.1	(0.9–1.3)
2018	1.5	(1.2–1.8)***	2.2	(2.0-2.5)***	1.9	(1.4–2.4)***	1.3	(1.1–1.6)**
Health care access								
None	1		1		1		1	
Public	1.1	(1.0–1.3)	1.0	(0.9–1.1)	1.1	(0.9–1.5)	1.1	(0.9–1.3)
Private	1.0	(0.7–1.4)	1.1	(0.8–1.4)	1.8	(0.1–2.9)*	1.3	(0.8-1.9)
Number of check-ups during pregnancy								
<5	1		1		1		1	
5+	1.2	(1.0–1.5)*	0.9	(0.8–1.0)*	0.9	(0.7–1.1)	0.9	(0.7–1.1)
Type of delivery								
Natural	1		1		1		1	
Caesarean section	0.6	(0.5–0.7)***	0.6	(0.5–0.6)***	0.8	(0.7–0.9)**	0.8	(0.7–0.9)***
Breastfeeding education/counselling during pregnancy								
No	1		1		1		1	
Yes	1.5	(1.3–1.7)***	1.0	(0.9–1.1)	1.3	(1.1–1.5)*	1.3	(1.1–1.6)***
Parity (number of children)	1.1	(1.0–1.1)**	1.1	(1.0–1.1)***	1.0	(1.0–1.1)	1.0	(1.0–1.1)
Mother's education								
No education	1		1		1		1	
Primary	0.7	(0.4–1.0)	1.5	(1.2–1.9)***	0.5	(0.3–0.8)**	0.7	(0.4–1.2)
Middle school	0.9	(0.6–1.4)	1.6	(1.2–2.0)***	0.6	(0.3–1.0)	0.8	(0.4–1.3)
Senior high school	1.1	(0.7–1.7)	1.4	(1.1–1.8)**	0.6	(0.3–1.1)	0.8	(0.4–1.3)
College or superior	1.2	(0.8–2.0)	1.6	(1.2–2.0)**	0.6	(0.4–1.3)	0.8	(0.4–1.4)
Employment								
No	1		1		1		1	
Yes	0.8	(0.7–1.0)**	0.9	(0.8–0.9)***	0.8	(0.6–0.9)*	0.6	(0.5–0.7)***
Socio-economic Status (SES)								
Low	1		1		1		1	
Medium	1.0	(0.9–1.1)	1.0	(0.9–1.1)	1.0	(0.8–1.3)	0.9	(0.7–1.0)
High	1.0	(0.8–1.2)*	0.8	(0.7–0.9)***	1.1	(0.9–1.5)	0.9	(0.7–1.1)
Indigenous (speaking an indigenous language)								
No	1		1		1		1	
Yes	2.2	(1.6–2.9)***	1.3	(1.1–1.5)***	1.8	(1.4–2.3)***	1.7	(1.3–2.1)***
Mother's age								
< =25	1		1		1		1	
26–40	1.0	(0.9–1.1)	0.9	(0.8–1.0)**	1.1	(0.9–1.3)	1.1	(0.9–1.2)
>40	0.4	(0.3–0.6)***	0.7	(0.5–0.8)***	1.8	(1.5-2.8)*	1.3	(0.9–2.1)

(Continues)

TABLE 2 (Continued)

Characteristics	Ever breastfed (children <24 months)		Early initiation breastfeeding (children <24 months)		Exclusive breastfeeding (children <6 months) (status quo)		Predominant breastfeeding (children <6 months) (status quo)	
	n	*N*	*n*	*N*	*n*	*N*	*n*	*N*
	43,907	16,218,936	35,390	12,949,014	9,572	3,264,404	9,572	3,264,404
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Civil status								
Single	1		1		1		1	
Free union/married	1.4	(1.2–1.7)***	0.8	(0.7–0.9)**	1.2	(0.9–1.6)	1.2	(0.9–1.5)
Divorced/widow/separated	1.1	(0.9–1.5)	0.7	(0.6–0.9)***	0.7	(0.4–1.1)	0.7	(0.5–1.0)*
Area of residence								
Rural	1		1		1		1	
Urban	1.0	(0.9–1.1)	0.8	(0.8–0.9)***	1.0	(0.8–1.2)	1.0	(0.8–1.1)
Region								
North	1		1		1		1	
Center	1.4	(1.2–1.6)***	1.3	(1.2–1.4)***	1.6	(1.3–1.9)***	1.6	(1.4–1.9)***
Mexico City	1.6	(1.2–2.2)**	0.9	(0.7–1.0)	2.4	(1.7–3.3)***	2.6	(1.9–3.5)***
South	1.9	(1.7–2.2)***	1.1	(1.0–1.2)**	1.2	(1.5–2.2)***	2.0	(1.7–2.3)***

Note. Results from the National Demographic Dynamic Survey 2006–2018, Mexico.
Abbreviations: CI, confidence interval; OR, odds ratio.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

($p < 0.001$) compared with 2006, whereas the chance of early initiation of breastfeeding increased in all surveys ($p < 0.001$) compared with the reference year. In 2018, the chance of EB < 6mo increased by 90% ($p < 0.001$), whereas for PB < 6mo, it increased by 30% ($p < 0.01$) compared with 2009.

A positive association was observed between having access to a private health care institution and the prevalence of EB < 6mo ($p < 0.05$). In addition, receiving five or more medical check-ups during pregnancy was associated with a 20% increased chance of ever breastfeeding ($p < 0.05$) and a 10% decreased chance of early initiation of breastfeeding ($p < 0.05$).

On the other hand, having a caesarean delivery was associated with a 40% reduction in the chance of ever breastfeeding and early initiation of breastfeeding ($p < 0.001$) and a 20% decrease in the chance of EB < 6mo ($p < 0.01$) and PB < 6mo ($p < 0.001$).

Meanwhile, receiving breastfeeding education/counselling during pregnancy increased the chance of ever breastfeeding by 50% ($p < 0.001$) and the chance of EB < 6mo ($p < 0.05$) and PB < 6mo ($p < 0.001$) by 30%. Also, having an additional child was associated with a 10% increased chance of ever breastfeeding ($p < 0.01$) and early initiation of breastfeeding ($p < 0.001$).

Regarding mother's sociodemographic characteristics, a higher education was associated with an increased chance of early initiation of breastfeeding compared with no education ($p < 0.01$), but educated women were less likely to EB < 6mo, although it was only significant for those with a primary education level ($p < 0.01$). Women with a formal or informal employment were 20% less likely to ever breastfeed ($p < 0.01$), 10% less likely to have an early initiation of breastfeeding

($p < 0.001$), 20% less likely to EB < 6mo ($p < 0.05$), and were 40% less likely to PB < 6mo ($p < 0.001$) compared with women without employment.

On the other hand, being indigenous was positively associated with all breastfeeding practices ($p < 0.001$). With respect to age, older women had a lower chance of ever breastfeeding and early initiation of breastfeeding ($p < 0.001$) compared with women 25 years or younger, but the opposite was observed for EB < 6mo ($p < 0.05$).

Concerning marital status, women who were in a free union or married had a 40% increased chance of ever breastfeeding ($p < 0.001$), but a 20% lower chance of early breastfeeding in the first hour of birth ($p < 0.01$) compared with single women, whereas divorced, widow or separated women had a 30% lower possibility of early breastfeeding ($p < 0.001$) and PB < 6mo ($p < 0.05$) than single women.

Living in urban communities was associated with a 20% reduction in the chance of early initiation of breastfeeding ($p < 0.001$) compared with living in rural areas. The Center, Mexico City and the South regions of the country were positively associated with almost all breastfeeding indicators compared with the North.

We did not find a statistically significant association between being a beneficiary of the Prospera programme and breastfeeding indicators (Table S1). Women that reported overweight or obesity before the last pregnancy were 28% less likely to have ever breastfed ($p < 0.01$) and 48% less likely to have PB < 6mo ($p < 0.001$). The chances of early initiation of breastfeeding and EB < 6mo seemed to decrease, but the association was not statistically significant (Table S1).

4 | DISCUSSION

We estimated the trends in breastfeeding practices in children <24 months between 2006 and 2018, and in children <6 months between 2009 and 2018, at the national, rural/urban, and regional level, along with indigenous ethnicity and SES in Mexico, and its association with prenatal care, breastfeeding education/counselling, type of delivery and sociodemographic characteristics of mothers, using four rounds of ENADID.

The results show that breastfeeding practices in Mexico improved in the last decade, especially in 2018. Between 2006 and 2018, the prevalence of ever breastfeeding increased 0.2 pp/year and early initiation of breastfeeding increased 1.5 pp/year, with a particularly high increase in 2014. Meanwhile, between 2009 and 2018, the prevalence of EB < 6mo increased on average 0.85 pp/year, and the prevalence of PB < 6mo increased 0.43 pp/year. Between 2014 and 2018, the national prevalence of EB < 6mo increased 1.3 pp/year. In general, improvements in breastfeeding practices were similar in urban/rural level, with the highest increase observed in Mexico City and the lowest in the South. Nonindigenous women improved in all breastfeeding practices, whereas little improvement was observed in indigenous women.

In Mexico, information on infant feeding practices has been regularly collected in ENSANUT. Although the ENSANUT reported that breastfeeding practices deteriorated between 2006 and 2012 (González de Cosío et al., 2013), when analysing the ENADID, we observed an increase in ever breastfed and early breastfeeding practices between 2006 and 2014, and a slight increase in the prevalence of EB < 6mo between 2009 and 2014 and no improvement in PB < 6mo in the same period.

Recently, the ENSANUT 2018–19 reported that breastfeeding indicators improved in Mexico compared with the 2012 survey (González-Castell et al., 2020), which is consistent with our findings. Comparing figures from ENSANUT and ENADID in 2018, we observe that the prevalence of ever breastfeeding was similar between surveys, but the prevalence of early initiation of breastfeeding was lower in ENSANUT versus ENADID (47.7 vs. 59.7%). On the contrary, the prevalence of EB < 6mo was higher in ENSANUT versus ENADID 2018 (28.3 vs. 20.7%), and the same was observed for PB < 6mo (40.2 vs. 31.3%). Also, compared with the National Survey of children and women from 2015 (ENIM) (INSP & UNICEF, 2015), the prevalence of EB < 6mo in ENADID 2014 was lower (30.8 vs. 15.5%).

The reason for these discrepancies could be due to differences in the instruments and methodology used to measure breastfeeding practices in the surveys, whose questions vary by type and timing (i.e., the day before the interview vs. recall a longer period of time). Likewise, the training in the collection of breastfeeding information and possible differences in the sampling frame and sample selection for maternal and infant population between surveys could have influenced breastfeeding indicators.

The specificity of the food groups consumed by children required in the ENSANUT and ENIM is greater than ENADID, which contributes to the differences observed among surveys. The status quo method for estimating breastfeeding practices used in ENSANUT and ENIM underestimates breastfeeding indicators because it considers the mother's behaviour on the day before the interview, which could differ from her usual behaviour (WHO, 2010). However, the recall method used in ENADID has a greater underestimation as it depends on the mother remembering at what age she started to feed specific food and liquids to her children, which is subject to memory bias (González-Castell, González de Cosío, Rodríguez-Ramírez, & Escobar-Zaragoza, 2016). Although, due to ENADID sample size, breastfeeding practices are estimated with more confidence by sociodemographic characteristics than other surveys. Finally, ENADID uses individual expansion factors that are corrected by demographic projections to allow comparability over time, has a larger sample size of children <2 years and is representatively at different levels of disaggregation, all of which can influence the estimation of breastfeeding indicators making them more precise in comparison with the other surveys.

Although the South of Mexico, the poorest region of the country where a greater part of the indigenous population lives, has a higher prevalence of breastfeeding practices compared with other regions, our results show that this region presented the lowest improvements in breastfeeding indicators in the analysed period, except for early breastfeeding practices that increased in indigenous women. In indigenous communities of Southern Mexico, the rate of formula feeding increased significantly over time—this is because younger mothers introduced complementary foods/liquids earlier and breastfed for a shorter period than older mothers (Veile & Kramer, 2015). Likewise, social norms among low-resource communities appeared to support breastfeeding, but not exclusive breastfeeding, as well as introducing small bites of solid food a few months after birth (Swigart et al., 2017).

Our estimations show that being married or in free union were positively associated with breastfeeding, whereas being divorced, widowed or separated were negatively associated compared with single mothers. A systematic review showed a greater likelihood of supporting breastfeeding-related issues when fathers/partners played a role in decision-making (Mahesh et al., 2018); also, it has been documented that they provide emotional support to the mother (Demontigny, Gervais, Larivière-Bastien, & St-Arneault, 2018).

Having a caesarean section was also associated with a lower likelihood of breastfeeding, which has been described in Mexico for several decades (Pérez-Escamilla, Maulén-Radovan, & Dewey, 1996). In Mexico, ENIM results revealed that caesarean section deliveries were negatively associated with the initiation and exclusivity of breastfeeding (INSP & UNICEF, 2015). Similar findings were obtained from a meta-analysis, showing a negative association with continuation of breastfeeding compared with vaginal delivery, that may be due to a disruption of the mother/infant dyad, but also mothers with a planned caesarean are less likely to breastfeed and their infants are more likely to have a low gestational age (Cohen et al., 2018).

Women's employment has been documented as one of the main determinants for not breastfeeding or continue breastfeeding (Rollins et al., 2016). Our results are similar to those found with the

ENSANUT, where mothers with a formal employment were 27% less likely to breastfeed compared with unemployed mothers (Rivera-Pasquel, Escobar-Zaragoza, & González de Cosío, 2015). This finding is relevant if we consider that in recent decades, the participation of Mexican women in formal and informal remunerated work went from 19% in 1970 up to 45% in 2013 (Verick, 2014). According to the National Occupation and Employment Survey, between 2005 and 2019, the active economic participation rate among females increased 4.3 percentage points (INEGI/INMUJERES, 2019). However, paid maternity leave is not long enough to protect breastfeeding (14 weeks) and only covers women in the formal labour force (Vilar-Compte et al., 2019).

There is evidence that longer paid maternity promotes breastfeeding (Chai, Nandi, & Heymann, 2018), has health benefits for mothers and children (Andres, Baird, Bingenheimer, & Markus, 2016; Chai et al., 2020) and increases formal employment of mothers (Albagli & Rau, 2019). Therefore, paid maternity leave should be increased to 6 months (WHO, 2019), and women in the informal labour sector should be covered through cash transfers (Vilar-Compte et al., 2019). Extension of maternity leave seems feasible considering that the cost of extending 1 week of maternity leave for formally working women in Mexico is 96.15 USD, very close to the 56 USD week/child cost of social security day-care services plus a 39 USD weekly cost to provide infant formula through the Mexican Institute of Social Security hospitals (Vilar-Compte et al., 2020).

Our results show that overweight or obesity before pregnancy is associated with a lower chance of ever breastfeeding and PB < 6mo and seems to reduce EB < 6mo. There is evidence that maternal obesity negatively affects breastfeeding and the production of breast milk, which may predispose infants to early weaning and early introduction to milk formulas (Hernández Cordero & Lozada Tequeanes, 2013). Our findings are also consistent with what was previously reported (Marshall, Lau, Purnell, & Thornburg, 2019), where excess body fat impairs mammary glandular development in early pregnancy, which delays lactogenesis and provides insufficient milk supply. Beyond biological problems, obesity in women interferes with breastfeeding for sociocultural reasons, such as belonging to a social group where women are less likely to breastfeed, anatomic reasons such as having large breasts which make breastfeeding difficult and previous medical conditions and complications in pregnancy that lead to a caesarean delivery. Psychological factors may also impact breastfeeding due to low confidence and dissatisfaction with self-image (Amir & Donath, 2007). However, with adequate support, breastfeeding problems among women with obesity can be solved (Amir & Donath, 2007). This result is important given that 40.2% of Mexican women of reproductive age have obesity (INSP, 2020).

We found that receiving breastfeeding education/counselling during pregnancy increased the possibility of ever breastfeeding, EB < 6mo and PB < 6mo. Similar results were documented in a meta-analysis, which found that counselling is effective at increasing rates of any breastfeeding and EB < 6mo, especially if delivered postnatally (McFadden et al., 2019). The same way, recent evidence shows that breastfeeding counselling through home visits by community health workers in rural communities in the South of Mexico improved breastfeeding practices (Unar-Munguía et al., 2020). Also, health professionals should be trained with tools for adequate individual counselling, promotion and effective communication (Bonvecchio, Perichart, Reyes, & Rodríguez, 2018).

Meanwhile, the low quality of health services in terms of lack of access, infrastructure and insufficient resources has been reported among the main barriers to promote EB < 6mo in a qualitative study with women from indigenous groups in the southern region of Mexico (Tinoco Marquina & Caswell Pérez, 2013). In general, the poor promotion of breastfeeding is due to a variety of factors, including inadequate training of health workers in breastfeeding practices and time limitations; ignorance and mistrust of the health system; ineffective communication due to technicisms and language barriers in indigenous communities and poor working conditions for health personnel (Bonvecchio et al., 2013; Tinoco Marquina & Caswell Pérez, 2013). These barriers could explain why little improvement has been seen in breastfeeding trends, particularly among indigenous communities.

Some policies and programmes were implemented between 2014 and 2018, which could explain the increase in breastfeeding. During the implementation of the National Strategy for Breastfeeding 2014–2018 (Ministry of Health, 2014), 191 hospitals were nominated under the Baby Friendly Hospital Initiative (BFHI). However, only 11% of the country's hospitals with maternity services were certified in the last 5 years (González de Cosío et al., 2018), and additional efforts are needed to strengthen step 10 of BFHI that refers to counselling in health centres. In this sense, the Becoming Breastfeeding Friendly Committee classified the Mexican environment for breastfeeding as weak and strongly recommended to raise national awareness on breastfeeding, incorporate the Code of Marketing of Breastmilk Substitutes in the Mexican legislations, extend maternity leave to 6 months and strengthen evidence-based advocacy and hence the political will to funding and resources for a national breastfeeding strategy in Mexico (González de Cosío et al., 2018).

The Mexican Academy of Medicine issued a breastfeeding position report in 2018 (González de Cosío-Martínez, Hernández-Cordero, Rivera-Dommarco, & Hernández-Ávila, 2017) recommending the Breastfeeding Gear Model (Pérez-Escamilla, Curry, Minhas, Taylor, & Bradley, 2012) to gauge the scaling-up/tracking breastfeeding programmes that consist of eight gears scores: advocacy, political will, legislation and policies, funding and resources, training and programme delivery, promotion, research and evaluation and coordination, and goals and monitoring; however, it has not been implemented comprehensively in the country.

In the same period, a behaviour change strategy to promote EB < 6mo and complementary feeding was implemented as part of the ESIAN strategy, which aims to prevent the double burden of malnutrition (undernutrition, micronutrient deficiencies and obesity) as part of Prospera, one of the largest conditional cash transfer programmes in the world (Bonvecchio Arenas et al., 2019). The strategy included a nutrition training programme for more than 100,000 health service providers nationwide (Gonzalez et al., 2019). The evaluation of the nutrition training programme showed significant

improvements among health providers in general knowledge about breastfeeding and breastfeeding benefits. Physicians improved their knowledge about clinical aspects of breastfeeding, while registered nurses improved their ability to solve breastfeeding problems and to help mothers overcome breastfeeding challenges (Vilar-Compte, Pérez-Escamilla, Moncada, & Flores, 2020). However, an impact evaluation was not conducted to formally asses the effectiveness of the behaviour change strategy on breastfeeding practices before the programme was discontinued.

Currently, Mexico does not have a breastfeeding strategy or programme in the country, and efforts are not centralized. The interventions and actions that are available to promote and support breastfeeding are implemented by three different entities: the Ministry of Health, the National Strategy for Early Childhood Care (ENAPI) and the National Program for the Protection of Children and Adolescents (PRONAPINA), which are part of the National System for the Protection of Children and Adolescents (SIPINNA). Therefore, a breastfeeding programme with a specific budget to further increase, promote and protect breastfeeding practices is urgently needed (González-Castell et al., 2020).

Although some progress has been made in legislation and policies to favour breastfeeding in the last years, such as a reform to Article 28 of the Federal Law of Workers at the Service of the State to establish that women could enjoy 4 weeks of rest before childbirth, 4 weeks after childbirth and up to 1 h during their workday to breastfeed (Department of Finance (DOF), 2014), there are still many structural barriers that interfere with women's decision to breastfeed. Among these barriers are the lack of regulations, monitoring mechanisms and significant sanctions to ensure compliance with the International Code of Marketing of Breastmilk Substitutes (González de Cosío et al., 2018). Violations to the Code have been documented in Mexico (Hernández-Cordero et al., 2019), which is associated with increased use of infant formula. In addition, the Official Mexican Norm for the promotion, protection and support of breastfeeding should be approved (PROY-NOM-050-SSA2-2018, 2018). Changes to the Official Mexican Norm regarding nutritional criteria and specifications for infant formulas and food and beverages for infants and young children (NOM-131-SSA1-2012, 2012) must also be considered so that plain packaging, or instead front-of-pack warning labels, can be used for these products, because they are currently exempt from the recent modification to the food labelling regulation, NOM-051-SCFI/SSA1-2010 (White & Barquera, 2020).

This study has some limitations. The ENADID surveys are multithematic and thus, provide less detailed information. It has very few questions regarding breastfeeding practices, so we had to combine questions regarding current breastfeeding at the time of the survey with the mother's recall of introducing solid or liquid food to estimate exclusive and predominant breastfeeding indicators, as recommended by the WHO (2010). Because ENADID has a different methodology with respect to other nationally representative surveys, it makes it difficult to compare. This suggests that one way to moving forward and have secular information that represents breastfeeding trends in Mexico is through improving the ENADID set of questions that captures breastfeeding practices in a similar way to other health/nutrition surveys as recommended by WHO (status quo), and on the other hand, the ENSANUT and ENIM could increase their infant and young child sample size at different levels of disaggregation to allow representativeness at urban/rural and regional level. Either option requires a larger budget and time to collect the information that should be prioritized to ensure comparability and track breastfeeding practices over time to inform public policies. On the other hand, we acknowledge that there is a potential upward or downward bias in our estimations, because women in our analysed sample had a higher SES, education and access to health care services, more caesarean delivery and employment and were younger than women with incomplete information. However, we did not find differences in breastfeeding indicators between the analysed sample and the sample with incomplete sociodemographic information. Also, the non-response rate was lower than 11%, which does not imply a substantial reduction of the sample allowing us to have enough power to estimate our indicators with precision.

To the best of our knowledge, no studies have analysed the trends in breastfeeding practices in Mexico between 2006 and 2018, and their association with sociodemographic variables and women's prenatal information, which is not possible with other surveys. Also, ENADID has a large sample size of women with children <6 months and children <24 months, allowing us to estimate breastfeeding prevalence and trends at the urban/rural and regional level with more confidence than other surveys. Due to its design, the ENIM 2015 did not estimate breastfeeding practices by geographic level. In recent years, due to budget constraints, the sample size of children <24 months in ENSANUT has decreased, which caused the CI of these indicators to be very large, especially when disaggregating by urban/rural level or region. Therefore, the results from ENADID show with more confidence that the increase in breastfeeding practices was moderate, which is in line with the policies implemented in the analysed period.

5 | CONCLUSIONS

Breastfeeding practices in Mexico have improved in the last decade but are still far from WHO recommendations. Although progress was made in legislation and policies to promote, protect and support breastfeeding, public policies with an assured budget should be implemented to ensure that all Mexican women, especially poor, less educated, single and indigenous women can breastfeed according to recommended practices. This includes approving paid maternity leave during 6 months for women with formal and informal employment; improving the implementation and monitoring of the BFHI; strengthening legislation to monitor and comply with the Code of Breastmilk Substitutes; and providing breastfeeding education/counselling to women and promotion strategies to women, families and society. The analysis of surveys carried out in Mexico, such as ENADID, could support evidence-based decision-making and evaluation efforts at different levels of government.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

MUM, DGC and ALLT are responsible for conceiving the project, developing the overall research plan and overseeing the study. MACA, ALLT and MUM analysed the data. MUM wrote the first draft, and DGC, ALLT, MACA and AB added important intellectual content. MUM and ALLT are primarily responsible for the final content. All of the authors read and approved the final manuscript as submitted.

ORCID

Mishel Unar-Munguía https://orcid.org/0000-0002-1156-9337
Ana Lilia Lozada-Tequeanes https://orcid.org/0000-0002-7371-3525
Dinorah González-Castell https://orcid.org/0000-0002-2974-3989
Anabelle Bonvecchio https://orcid.org/0000-0002-2765-0818

REFERENCES

Albagli, P., & Rau, T. (2019). The effects of a maternity leave reform on children's abilities and maternal outcomes in Chile. *The Economic Journal*, 129(619), 1015–1047. https://doi.org/10.1111/ecoj.12586

Amir, L. H., & Donath, S. (2007). A systematic review of maternal obesity and breastfeeding intention, initiation and duration. *BMC Pregnancy and Childbirth*, 7(1), 9.

Andreas, N. J., Kampmann, B., & Le-Doare, K. M. (2015). Human breast milk: A review on its composition and bioactivity. *Early Human Development*, 91(11), 629–635. https://doi.org/10.1016/j.earlhumdev.2015.08.013

Andres, E., Baird, S., Bingenheimer, J. B., & Markus, A. R. (2016). Maternity leave access and health: A systematic narrative review and conceptual framework development. *Maternal and Child Health Journal*, 20(6), 1178–1192. https://doi.org/10.1007/s10995-015-1905-9

Anttila-Hughes, J. K., Fernald, L. C. H., Gertler, P. J., Krause, P., & Wydick, B. (2018). *Mortality from Nestlé's marketing of infant formula in low and middle-income countries*. National Bureau of Economic Research.

Bonvecchio, A., Perichart, O., Reyes, H., & Rodríguez, L. (2018). Comunicación para cambios de comportamientos y promoción de estilos de vida saludables para la prevención del sobrepeso y la obesidad infantil. In Instituto Nacional de Salud Pública. (Ed.), *La obesidad en México. Estado de la política pública y recomendaciones para su prevención y control*. Cuernavaca, Mexico: Instituto Nacional de Salud Pública.

Bonvecchio, A., Reyes-Morales, H., Theodore, R. F., Lozada, A. L., Neufeld, L. M., & Pelto, G. H. (2013). Report from Mexico: Barriers to the promotion of healthy infant growth at primary healthcare in nutrition transition contexts. *Sight and Life*, 27, 76–79.

Bonvecchio Arenas, A., González, W., Théodore, F. L., Lozada-Tequeanes, A. L., Garcia-Guerra, A., Alvarado, R., ... Neufeld, L. M. (2019). Translating evidence-based program recommendations into action: The design, testing, and scaling up of the behavior change strategy EsIAN in Mexico. *The Journal of Nutrition*, 149(Supplement_1), 2310S–2322S.

Bonvecchio Arenas, A., Théodore Rowlerson, F. L., González, W., Lozada Tequeanes, A. L., Alvarado Casas, R., & Blanco García, I. (2016). Barreras de la lactancia materna en México [Barriers to breastfeeding in Mexico]. In T. González de Cosio Martínez, & S. Hernández-Cordero (Eds.), *Lactancia Materna en México [Breastfeeding in Mexico]* (1st ed.) (pp. 77–82). Mexico City: Academia Nacional de Medicina de México.

Buccini, G., Harding, K. L., Eguiluz, I. F., Safon, C. B., Hromi-Fielder, A., de Cosío, T. G., & Pérez-Escamilla, R. (2020). An analysis of stakeholder networks to support the breastfeeding scale-up environment in Mexico. *Journal of Nutritional Science*, 9, e10. https://doi.org/10.1017/jns.2020.4

Chai, Y., Nandi, A., & Heymann, J. (2018). Does extending the duration of legislated paid maternity leave improve breastfeeding practices? Evidence from 38 low-income and middle-income countries. *BMJ Global Health*, 3(5), e001032. https://doi.org/10.1136/bmjgh-2018-001032

Chai, Y., Nandi, A., & Heymann, J. (2020). Association of increased duration of legislated paid maternity leave with childhood diarrhoea prevalence in low-income and middle-income countries: Difference-in-differences analysis. *Journal of Epidemiology and Community Health*, 74(5), 437–444. https://doi.org/10.1136/jech-2019-212127

Chowdhury, R., Sinha, B., Sankar, M. J., Taneja, S., Bhandari, N., Rollins, N., ... Martines, J. (2015). Breastfeeding and maternal health outcomes: A systematic review and meta-analysis. *Acta Paediatrica*, 104(467), 96–113. https://doi.org/10.1111/apa.13102

Cohen, S. S., Alexander, D. D., Krebs, N. F., Young, B. E., Cabana, M. D., Erdmann, P., ... Turini, M. (2018). Factors associated with breastfeeding initiation and continuation: A meta-analysis. *The Journal of Pediatrics*, 203, 190–196. https://doi.org/10.1016/j.jpeds.2018.08.008

Colchero, M. A., Contreras-Loya, D., Lopez-Gatell, H., & De Cosío, T. G. (2015). The costs of inadequate breastfeeding of infants in Mexico. *American Journal of Clinical Nutrition*, 101, 579–586. https://doi.org/10.3945/ajcn.114.092775

CONAPO. (2006). Encuesta Nacional de la Dinámica Demográfica (ENADID) 2006. Consejo Nacional de Población y Vivienda. Retrieved October 26, 2020, from http://www.conapo.gob.mx/work/models/CONAPO/Enadid2006/docs/D_muestral.pdf

Dávila Lárraga, L. G. (2016). How does Prospera work?: Best practices in the implementation of conditional cash transfer programs in Latin America and the Caribbean. Inter-American Development Bank.

Demontigny, F., Gervais, C., Larivière-Bastien, D., & St-Arneault, K. (2018). The role of fathers during breastfeeding. *Midwifery*, 58, 6–12. https://doi.org/10.1016/j.midw.2017.12.001

Department of Finance (DOF). (2014). DECRETO por el que se adicionan y reforman diversas disposiciones de la Ley General de Salud; de la Ley Federal de los Trabajadores al Servicio del Estado, Reglamentaria del Apartado B del artículo 123 Constitucional; de la Ley del Seguro Social; de la L. Mexico. Retrieved from https://www.dof.gob.mx/nota_detalle.php?codigo=5339161&fecha=02/04/2014

González de Cosío, T., Escobar-Zaragoza, L., Gonzalez-Castell, L. D., & Rivera-Dommarco, J. A. (2013). Infant feeding practices and deterioration of breastfeeding in Mexico. *Salud Pública de México*, 55(Suppl 2), S170–S179. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24626693

González de Cosío, T., Ferré, I., Mazariegos, M., Pérez-Escamilla, R., & Mexico Committee, B. B. F. (2018). Scaling up breastfeeding programs in Mexico: Lessons learned from the becoming breastfeeding friendly initiative. *Current Developments in Nutrition*, 2(6), nzy018.

González de Cosío-Martínez, T., Hernández-Cordero, S., Rivera-Dommarco, J., & Hernández-Ávila, M. (2017). Recomendaciones para una política nacional de promoción de la lactancia materna en México: postura de la Academia Nacional de Medicina. *Salud Pública de México.*, 59, 106–113. https://doi.org/10.21149/8102

Gonzalez, W., Bonvecchio Arenas, A., García-Guerra, A., Vilar-Compte, M., Villa de la Vega, A., Quezada, L., ... Hernández, A. (2019). An iterative process for training design and implementation increased health workers' knowledge for taking nutrition behavior

change to scale. *The Journal of Nutrition*, *149*(Supplement_1), 2323S–2331S.

González-Castell, D., González de Cosío, T., Rodríguez-Ramírez, S., & Escobar-Zaragoza, L. (2016). Early consumption of liquids different to breast milk in Mexican infants under 1 year: Results of the probabilistic National Health and Nutrition Survey 2012. *Nutrición Hospitalaria*, *33*(1), 14–20.

González-Castell, L., Unar-Munguía, M., Quezada-Sánchez, A., Bonvecchio Arenas, A., & Rivera-Dommarco, J. (2020). Situación de las prácticas de lactancia materna y alimentación complementaria en México: resultados de la Ensanut 2018-19. *Salud Pública de México*, *62*, 704–713. https://doi.org/10.21149/11567

Hernández Cordero, S., & Lozada Tequeanes, A. (2013). Lactancia materna, retención de peso posparto (RPP) y riesgo de obesidad materna en etapas posteriores. In T. González de Cosío Martínez, & S. Hernández Cordero (Eds.), *Lactancia Materna en México*, Mexico City: Intersistemas S.A. de C.V.

Hernández-Cordero, S., Lozada-Tequeanes, A. L., Shamah-Levy, T., Lutter, C., González de Cosío, T., Saturno-Hernández, P., … Grummer-Strawn, L. (2019). Violations of the I nternational C ode of M arketing of B reast-milk S ubstitutes in M exico. *Maternal & Child Nutrition*, *15*(1), e12682. https://doi.org/10.1111/mcn.12682

Horta, B. L., Loret De Mola, C., & Victora, C. G. (2015). Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes: A systematic review and meta-analysis. *Acta Paediatrica, International Journal of Paediatrics.*, *104*, 30–37. https://doi.org/10.1111/apa.13133

INEGI. (2009). Encuesta Nacional de la Dinámica Demográfica (ENADID) 2009. Instituto Nacional de Estadística y Geografía. Retrieved October 26, 2020, from https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825001932

INEGI. (2014). Encuesta Nacional de la Dinámica Demográfica (ENADID) 2014. Instituto Nacional de Estadística y Geografía.

INEGI. (2015). Código de ética para los integrantes del Sistema Nacional de Información, Estadística y Geografía. Mexico. Retrieved from https://www.inegi.org.mx/contenidos/inegi/acercade/doc/codigo_etica.pdf

INEGI. (2020). Encuesta Nacional de la Dinámica Demográfica (ENADID) 2018. Instituto Nacional de Estadística y Geografía. Retrieved June 18, 2020, from https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825188504

INEGI/INMUJERES. (2019). Mujeres y Hombres en México. Retrieved October 26, 2020, from https://www.inegi.org.mx/contenidos/saladeprensa/aproposito/2020/mujer2020_Nal.pdf

INSP. (2020). Results from the National Health and Nutrition Survey 2018. National Institute of Public Health Mexico. Retrieved March 31, 2020, from https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf

INSP, & UNICEF. (2015). Encuesta Nacional de Niños, Niñas y Mujeres 2015. *Encuesta de Indicadores Múltiples Por Conglomerados*. https://doi.org/10.1017/CBO9781107415324.004

Joffe, N., Webster, F., & Shenker, N. (2019). Support for breastfeeding is an environmental imperative. *British Medical Journal*, *367*, l5646. https://doi.org/10.1136/bmj.l5646

Karlsson, J. O., Garnett, T., Rollins, N. C., & Röös, E. (2019). The carbon footprint of breastmilk substitutes in comparison with breastfeeding. *Journal of Cleaner Production*, *222*, 436–445. https://doi.org/10.1016/j.jclepro.2019.03.043

Lawrence, R. A., & Lawrence, R. M. (2005). In E. Mosby (Ed.), *Breastfeeding: A guide for the medical profession* (6th ed.). Philadelphia: Elsevier.

Mahesh, P. K. B., Gunathunga, M. W., Arnold, S. M., Jayasinghe, C., Pathirana, S., Makarim, M. F., … Senanayake, S. J. (2018). Effectiveness of targeting fathers for breastfeeding promotion: Systematic review and meta-analysis. *BMC Public Health*, *18*(1), 1140. https://doi.org/10.1186/s12889-018-6037-x

Mameli, C., Mazzantini, S., & Zuccotti, G. V. (2016). Nutrition in the first 1000 days: The origin of childhood obesity. *International Journal of Environmental Research and Public Health*, *13*(9). https://doi.org/10.3390/ijerph13090838

Marshall, N. E., Lau, B., Purnell, J. Q., & Thornburg, K. L. (2019). Impact of maternal obesity and breastfeeding intention on lactation intensity and duration. *Maternal & Child Nutrition*, *15*(2), e12732. https://doi.org/10.1111/mcn.12732

Mazariegos, M., Ortiz-Panozo, E., Stern, D., González de Cosío, T., Lajous, M., & López-Ridaura, R. (2019). Lactation and maternal risk of diabetes: Evidence from the Mexican Teachers' Cohort. *Maternal & Child Nutrition*, *15*, e12880.

McFadden, A., Siebelt, L., Marshall, J. L., Gavine, A., Girard, L.-C., Symon, A., & MacGillivray, S. (2019). Counselling interventions to enable women to initiate and continue breastfeeding: A systematic review and meta-analysis. *International Breastfeeding Journal*, *14*(1), 42.

Ministry of Health. (2014). Estrategia Nacional de Lactancia Materna 2014–2018. México [National Stategy for Breastfeeding in Mexico. 2014–2018]. Retrieved from https://www.gob.mx/cms/uploads/attachment/file/75383/ENLM_2014-2018.pdf

NOM-131-SSA1-2012. (2012). Norma Oficial Mexicana NOM-131-SSA1–2012, Productos y servicios. Fórmulas para lactantes, de continuación y para necesidades especiales de nutrición. Alimentos y bebidas no alcohólicas para lactantes y niños de corta edad. Disposiciones y especificaciones.

Pérez-Escamilla, R. (2020). Breastfeeding in the 21st century: How we can make it work. *Social Science and Medicine*, *244*, 112331. https://doi.org/10.1016/j.socscimed.2019.05.036

Pérez-Escamilla, R., Curry, L., Minhas, D., Taylor, L., & Bradley, E. (2012). Scaling up of breastfeeding promotion programs in low-and middle-income countries: The "breastfeeding gear" model. *Advances in Nutrition*, *3*(6), 790–800. https://doi.org/10.3945/an.112.002873

Pérez-Escamilla, R., Maulén-Radovan, I., & Dewey, K. G. (1996). The association between cesarean delivery and breast-feeding outcomes among Mexican women. *American Journal of Public Health*, *86*(6), 832–836. https://doi.org/10.2105/ajph.86.6.832

Pérez-Escamilla, R., & Segura-Pérez, S. (2018). Breastfeeding. A triple-duty action in the context of the double burden of malnutrition. *Sight and Life*, *32*(2), 49–54. Retrieved from https://sightandlife.org/wp-content/uploads/2018/12/12_SALMZ_0218_Research_05.pdf

PROY-NOM-050-SSA2-2018. (2018). Proyecto de Norma Oficial Mexicana PROY-NOM-050-SSA2–2018, Para el fomento, protección y apoyo a la lactancia materna. DOF 2018, México. Disponible en: https://www.dof.gob.mx/nota_detalle.php?codigo=5521251&fecha=02/05/2018

Rivera-Pasquel, M., Escobar-Zaragoza, L., & González de Cosío, T. (2015). Breastfeeding and maternal employment: Results from three national nutritional surveys in Mexico. *Maternal and Child Health Journal*, *19*(5), 1162–1172. https://doi.org/10.1007/s10995-014-1622-9

Rollins, N. C., Bhandari, N., Hajeebhoy, N., Horton, S., Lutter, C. K., Martines, J. C., … Group, TLBS. (2016). Why invest, and what it will take to improve breastfeeding practices? *Lancet*, *387*(387), 491–504. https://doi.org/10.1016/S0140-6736(15)01044-2

Safon, C., Buccini, G., Ferré, I., de Cosío, T. G., & Pérez-Escamilla, R. (2018). Can "Becoming Breastfeeding Friendly" impact breastfeeding protection, promotion, and support in Mexico? A qualitative study. *Food and Nutrition Bulletin*, *39*(3), 393–405. https://doi.org/10.1177/0379572118789772

Sankar, M. J., Sinha, B., Chowdhury, R., Bhandari, N., Taneja, S., Martines, J., & Bahl, R. (2015). Optimal breastfeeding practices and infant and child mortality: A systematic review and meta-analysis. *Acta Paediatrica*, *104*, 3–13. https://doi.org/10.1111/apa.13147

Schwarzenberg, S. J., & Georgieff, M. K. (2018). Advocacy for improving nutrition in the first 1000 days to support childhood development and adult health. *Pediatrics*, 141(2), e20173716.

Swigart, T. M., Bonvecchio, A., Théodore, F. L., Zamudio-Haas, S., Villanueva-Borbolla, M. A., & Thrasher, J. F. (2017). Breastfeeding practices, beliefs, and social norms in low-resource communities in Mexico: Insights for how to improve future promotion strategies. *PLoS ONE*, 12(7), e0180185. https://doi.org/10.1371/journal.pone.0180185

Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., ... Devarajan, R. (2019). The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, 393(10173), 791–846.

Tinoco Marquina, A., & Caswell Pérez, A. (2013). Lactancia materna y maternidad en México. Mexico. Retrieved from https://www.savethechildren.mx/sci-mx/files/68/689176ec-9526-4b8a-9344-97d5c7833552.pdf

Unar-Munguía, M., González de Cosío, T., Escalante Izeta, E. I., Ferré Eguiluz, I., Sachse Aguilera, M., & Herrera, C. (2020). Evaluating the effect of the initiative "Caring for the newborn and the mother at home" in Mexico. *Public Health Nutrition*, 1–12. https://doi.org/10.1017/S1368980020003948

Unar-Munguía, M., Stern, D., Colchero, M. A., & González De Cosío, T. (2019). The burden of suboptimal breastfeeding in Mexico: Maternal health outcomes and costs. *Maternal & Child Nutrition*, 15(1), e12661. https://doi.org/10.1111/mcn.12661

Unar-Munguia, M., Torres-Mejia, G., Colchero, M. A., & Gonzalez de Cosio, T. (2017). Breastfeeding mode and risk of breast cancer: A dose-response meta-analysis. *Journal of Human Lactation*, 33(2), 422–434. https://doi.org/10.1177/0890334416683676

United Nations. (2017). Breastfeeding is 'smartest investment' families, communities and countries can make. Retrieved June 24, 2020, from https://www.un.org/sustainabledevelopment/blog/2017/08/breastfeeding-is-smartest-investment-families-communities-and-countries-can-make-un/#:~:text=Both UN agencies emphasize that, development and education%2C SDG 4.

Veile, A., & Kramer, K. (2015). Birth and breastfeeding dynamics in a modernizing indigenous community. *Journal of Human Lactation*, 31(1), 145–155. https://doi.org/10.1177/0890334414557177

Verick, S. (2014). Female labor force participation in developing countries. *IZA World of Labor*.

Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., ... Richter, L. (2016). Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *The Lancet*, 387(10017), 475–490. https://doi.org/10.1016/S0140-6736(15)01024-7

Victora, C. G., Horta, B. L., de Mola, C. L., Quevedo, L., Pinheiro, R. T., Gigante, D. P., ... Barros, F. C. (2015). Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: A prospective birth cohort study from Brazil. *The Lancet Global Health*, 3(4), e199–e205. https://doi.org/10.1016/S2214-109X(15)70002-1

Vilar-Compte, M., Pérez-Escamilla, R., Moncada, M., & Flores, D. (2020). How much can Mexican healthcare providers learn about breastfeeding through a semi-virtual training? A propensity score matching analysis. *Infant Breastfeeding Journal.*, 15(1), 59. https://doi.org/10.1186/s13006-020-00297-6

Vilar-Compte, M., Teruel, G., Flores, D., Carroll, G. J., Buccini, G. S., & Pérez-Escamilla, R. (2019). Costing a maternity leave cash transfer to support breastfeeding among informally employed Mexican women. *Food and Nutrition Bulletin*, 40, 171–181. https://doi.org/10.1177/0379572119836582

Vilar-Compte, M., Teruel, G. M., Flores-Peregrina, D., Carroll, G. J., Buccini, G. S., & Perez-Escamilla, R. (2020). Costs of maternity leave to support breastfeeding; Brazil, Ghana and Mexico. *Bulletin of the World Health Organization*, 98(6), 382–393. https://doi.org/10.2471/BLT.19.229898

Vyas, S., & Kumaranayake, L. (2006). Constructing socio-economic status indices: How to use principal components analysis. *Health Policy and Planning*, 21(6), 459–468. https://doi.org/10.1093/heapol/czl029

White, M., & Barquera, S. (2020). Mexico adopts food warning labels, why now? *Health Systems & Reform*, 6(1), e1752063. https://doi.org/10.1080/23288604.2020.1752063

World Health Organization. (2002). The World Health Organization's infant feeding recommendation. Retrieved March 17, 2020, from http://www.who.int/nutrition/topics/infantfeeding_recommendation/en/

World Health Organization. (2010). Indicators for assessing infant and young child feeding practices: Part 2: Measurement. Retrieved from https://www.who.int/maternal_child_adolescent/documents/9789241599290/en/

World Health Organization. (2019). *Maternity leave legislation in support of breastfeeding: Case studies around the world. World Health Organization*. Retrieved from https://www.who.int/publications/i/item/WHO-NMH-NHD-19.25

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

> **How to cite this article:** Unar-Munguía M, Lozada-Tequeanes AL, González-Castell D, Cervantes-Armenta MA, Bonvecchio A. Breastfeeding practices in Mexico: Results from the National Demographic Dynamic Survey 2006–2018. *Matern Child Nutr*. 2021;17:e13119. https://doi.org/10.1111/mcn.13119