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The Socioeconomic Disparities in Intakes and Purchases of Less-Healthy Foods and Beverages Have Changed over Time in Urban Mexico

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Abstract

Background: To our knowledge, the association between diet and socioeconomic status (SES), using both purchase and intake data, in the Mexican population has not been examined, which is particularly important given the high prevalence of diet-related diseases in Mexico.

Objective: Our objective was to examine the SES-diet relation using household food purchases and individual food intake data.

Methods: We analyzed purchases of packaged food and beverages of 5240 households with the use of the 2012–2014 Nielsen Mexico Consumer Panel Service Dataset, representative of urban areas. Likewise, we examined 9672 individuals over 2 y with food and beverage intake information collected using a single 24-h recall as part of the Mexican National Health and Nutrition Survey 2012. Multivariate linear regression models were conducted to predict per capita daily purchases and intakes of food and beverages classified as healthy and less healthy by SES, and adjusting for sociodemographic variables.

Results: Per capita daily purchases of healthy and less-healthy foods were, on average, 142% and 55% higher in high- than in low-SES households, respectively, from 2012 to 2014 ($P < 0.05$). Intakes of healthy and less-healthy foods in urban areas were, on average, 7% and 136% higher in high- than in low-SES groups ($P < 0.05$). Per capita daily purchases of healthy beverages were, on average, 56% higher in high- than in low-SES households from 2012 to 2014 ($P < 0.05$), whereas purchases of less-healthy beverages were 27% and 17% higher in low- than in high-SES households in 2012 and 2014, respectively ($P < 0.05$). Per capita daily intake of healthy beverages was 33% higher in high- than in low-SES groups ($P < 0.05$).

Conclusion: Higher-SES groups from urban areas had greater purchases and intakes of less-healthy foods and healthy beverages. Lower-SES households had greater purchases of less-healthy beverages, but also had the largest reduction in these purchases from 2012 to 2014, which could be associated with the beverage tax implemented in Mexico in 2014. *J Nutr* 2018;148:109–116.

Keywords: food purchases, food intake, healthy and less-healthy foods, socioeconomic disparities, Mexican population

Introduction

Mexico's population has one of the world's highest prevalence of overweight or obesity, with 76% and 69% of women and men overweight or obese, respectively (1). This is linked with a growing retail food sector and increased marketing of energy-dense foods that are high in added sugar, sodium, and saturated fat. For example, the consumption of caloric beverages doubled

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Supplemental Tables 1–5 are available from the "Supplementary Data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/jn/.
Abbreviations used: CPS, Consumer Panel Survey; ENSANUT, National Health and Nutrition Survey (Encuesta Nacional de Nutrición y Salud); INEGI, National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía); SES, socioeconomic status; SSB, sugar-sweetened beverage.

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in all age groups during the period from 1999 to 2006 (2–4). Research from the national diet survey in 2012 found that >50% of the population consumed added sugars above the level recommended by the WHO (5). Further, the contribution of sugar-sweetened beverages (SSBs) and foods high in saturated fat or added sugars to the total energy intake was 9.8% and 16.1%, respectively, in all age groups (6).

Very little research in Mexico has been undertaken to understand how the socioeconomic status (SES) is related to different components of the diet. According to the WHO, a healthy diet is one that helps protect against all forms of malnutrition, as well as noncommunicable diseases. A healthy diet includes fruits, vegetables, legumes, nuts, and whole grains, whereas the intake of foods with high contents of fats, sugar, or sodium should be limited (7). In other low- and middle-income countries, the evidence to date shows that people with low SES tend to follow a less-healthy diet (8). This result is in line with the concept of nutrition transition, which is linked to a country's economic development and characterized by a shift from traditional fiber- and grains-rich diets to fat- and sugar-rich diets (9–11). The shift generally affects high-SES individuals first, but it may be reversed with the progression of the nutrition transition (12–14). In Mexico, most research on the SES-diet relation has been about specific nutrients or food groups (5, 6, 15–17). A gap remains in understanding how SES is associated with foods and beverages classified as "healthy" and "less healthy," according to whether or not they are part of a healthy diet. This is particularly important because Mexico has instituted 2 taxes on highly processed, energy-dense, nutritionally deficient foods—known as nonessential foods (18)—and SSBs which may modify the link between SES and diet, especially given previous work showing that low-SES groups are more responsive to such taxes (19, 20).

We hypothesized that higher-SES groups have healthier diets, reflected by differences in food and beverage purchases and intakes. To address this hypothesis, we examined the association between SES and diet using 2 quite different sets of data—one focused only on information of purchased packaged foods and beverages collected from households across time and the other on cross-sectional information of total intake of foods and beverages in individuals. All types of taxed foods and beverages are packaged; therefore, trend analysis of purchasing data can be useful to understand SES patterns for packaged foods and beverages. The latter analysis is particularly important, as the period captures food purchases before and after Mexico's 2014 taxes on SSBs and nonessential foods. However, the diet of individuals consists of packaged and unpackaged foods, which requires 24-h recall data, such as the 2012 National Dietary Survey.

Methods

Study design and population

Nielsen Mexico Consumer Panel Survey 2012–2014. The Nielsen Mexico Consumer Panel Survey dataset (CPS data) contains repeated measurements of household food purchases, representative of urban areas with >50,000 inhabitants, which represents 75% of food and beverage expenditures in 2014 (21). An interviewer visits the participating household every 2 wk and scans all the products the household bought. The interviewer also does a pantry check, picks up food packaging from a special garbage bag, and reviews receipts. In addition, the people in the household are asked to keep a diary of their purchases, which can include purchases from places where it is unlikely that receipts can be provided. The study uses data aggregated at the monthly level and includes food and beverage purchases from January 2012 to December 2014. Purchases of tortillas (corn- or wheat-based staple food), tortilla chips, chocolate, and bread from a bakery were excluded from the present analyses because the information was not available for the entire follow-up period or all of the cities under study. Therefore, the analytic sample size included 5813 households in 2012, 5775 in 2013, and 5657 in 2014. Purchasing information for the entire period under study was obtained from 5240 unique households.

A socioeconomic index was provided by Nielsen Mexico and constructed using indicators of household assets (number of rooms, type of unit, number of bathrooms, showers, stoves, light bulbs, and automobiles) and educational attainment of the head of household. Using this index, SES was classified into 3 levels: low, medium, and high. Additional covariates include age and sex of each household member, as well as household size (number of persons in the household), which were used to create household composition variables: number of infants (0–1 y), preschool-age boys and girls (2–4 y), school-age boys and girls (5–11 y), female and male adolescents (12–19 y), and adult men and women (≥20 y). Further, geographical regions were classified as North, Monterrey (Nuevo León), Central, Guadalajara (Jalisco), South, and Mexico City.[1]

To control for changes in the socioeconomic environment over time, unemployment rate by year and state was obtained from the National Institute of Statistics and Geography [INEGI, (Instituto Nacional de Estadística y Geografía)] (22), while the rate of minimum wage by geographic area was from the National Commission of Minimum Wages (23). We estimated the total purchases per capita daily (milliliters per day for beverages; grams per day for foods) through dividing the total purchases per year by 365 d and total number of individuals in household.

Dietary intake data: National Health and Nutrition Survey 2012. The National Health and Nutrition Survey [ENSANUT (Encuesta Nacional de Nutrición y Salud)] is a probabilistic cross-sectional survey representative at the national, regional, and state level and for the urban and rural population in Mexico, carried out between October 2011 and May 2012. Information about health and nutrition was obtained from 96,031 people from 50,528 randomly selected households, through questionnaires and anthropometric measurements (24). Dietary collection and assessment have been described elsewhere, but in brief, dietary information was collected in a random subsample (1 individual randomly selected per household, $n = 10{,}886$), which is representative of the national, regional (North, Central, and South), and urban and rural population (5). The 24-h dietary recall developed by the USDA (automated 5-step multiple-pass method) was used and adapted to the Mexican context (25, 26). Persons ≥15 y of age were asked about their own intake. Moreover, persons in charge of food preparation and distribution in the household were asked about ingredients and recipes of foods prepared at home, and they provided information about the intake of children <15 y of age. Children <15 y of age provided information about food consumed at school or while away from a caregiver. Energy and nutrient intake were calculated using the food composition database compiled by the National Institute of Public Health. This compilation database is based on 14 different sources, mainly the tables of nutritive value of most consumed foods in Mexico (27), the tables of fatty acids composition of common foods in the Mexican diet (28), the USDA National Nutrient Database for Standard Reference (29), and the USDA Food and Nutrient Database for Dietary Studies (30). Informed consent was obtained for each eligible person aged ≥18 y, as well as from the father, the mother, or the guardian of participants aged <18 y. Informed assent was collected in children and adolescents from ages 5 to 17 y. The survey protocol was approved by the Ethics Committee of the National Institute of Public Health.

[1] Urban cities from states by region: North: Baja California, Chihuahua, Coahuila, Durango, Sinaloa, Sonora, Tamaulipas, and Zacatecas. Monterrey: Nuevo León. Central: Aguascalientes, Colima, Estado de México, Guanajuato, Hidalgo, Michoacán, Querétaro, San Luis Potosí, and Tlaxcala. Guadalajara: Jalisco. South: Campeche, Chiapas, Guerrero, Morelos, Oaxaca, Puebla, Tabasco, Veracruz, and Yucatán.

Exclusion criteria for the present analysis included the following: infants <2 y of age (n = 949); infants ≥2 y of age with partial breastfeeding (n = 107); pregnant or nursing women (n = 154); and persons with implausible weight or height (n = 4). The eligible sample included 9672 individuals of the total 10,886 with diet information. The ratio of daily energy intake to the estimated energy requirement was calculated for each person and each day and transformed to the logarithmic scale to remove outliers <−3 SDs and >3 SDs for each age group as previously described (5). Therefore, 9642 individuals were still included in the analytic sample. A large number of sociodemographic variables were captured by the ENSANUT 2012; for the present study, we considered age, sex, area, region of residence, and SES. Age was categorized as follows: preschoolers 2–4 y; school age 5–11 y; adolescents 12–19 y; and adults ≥20 y. In ENSANUT 2012, locations with <2500 inhabitants were classified as rural, and those with ≥2500 inhabitants were classified as urban. Regions were defined as North, Central, and South.[2]

A socioeconomic index was constructed using factor analysis, where factor scores were estimated using a principal components approach, applied to household characteristics and assets (31). The index score was computed for each respondent and respondents were then classified into 3 categories (low, medium, and high) using tertiles of the distribution of the socioeconomic index scores as cut-off points (range of scores by SES: low, −6.0 to <−0.6; medium, −0.6 to <0.9; high, 0.9 to 4.7).

Food groups. We created groups named "healthy" and "less healthy" based on the latest scientific evidence and dietary guidelines (32–41) to classify food and beverages from both CPS data and ENSANUT. Fruit and vegetables, legumes, corn tortillas (staple food), and whole-grain cereals are important sources of fiber and essential nutrients (vitamins and minerals) that are associated with a decreased risk of several noncommunicable diseases, including type 2 diabetes, cardiovascular diseases, and different forms of cancer (32, 33, 36). Even though it is uncertain whether all corn tortillas are whole grain, we considered all of them as such if they met the 10:1 carbohydrate-to-fiber ratio. On average, corn tortillas has a 1.4 g of fiber for every 10 g of carbohydrates (29). This criterion was developed by the American Heart Association 2020 Strategic Impact Goals Committee for identifying whole grain foods, and it seems to be the best indicator to identify more healthful whole-grain products (with more fiber, less sugars and sodium, and less likely to contain *trans* fats, without energy expenses) (38, 40). Further, fruit and vegetables; plain water; and unsweetened, artificially sweetened, and low-fat foods and beverages might help with weight loss or control (32, 34). Thus, these types of foods and beverages were classified as healthy. On the other hand, we classified as less-healthy foods and beverages with high energy, saturated fat, added sugars, or sodium content and foods low in fiber or essential nutrients because they are the leading risk factors of morbidity for obesity and noncommunicable diseases (35, 37, 39, 41) (**Supplemental Tables 1 and 2**). We additionally created a healthy food group without corn tortillas and a less-healthy food group without wheat tortillas, tortilla chips, chocolate, and bread from a bakery to make comparable analyses between CPS data and ENSANUT.

Statistical analysis

All analyses were conducted in Stata 14 (StataCorp, Stata Statistical Software, Release 14, 2015). Nielsen is not responsible for and had no role in preparing the analysis reported herein. Mean percentages with corresponding standard errors were obtained for household characteristics (SES, number of persons in households—overall, children, and adults—and region of residence) and individual characteristics (SES, sex, age group, and region and area of residence) derived from CPS and ENSANUT data, respectively, considering the design effects and sample weights. Multivariate linear regression models were conducted to predict mean per capita daily purchases and intakes for each of the 4 food groups created (less-healthy and healthy food and beverages), with dummy variables for the SES group. Outcome variables were transformed by taking the natural logarithm, owing to skewed data. We back-transformed the logged outcomes into grams and milliliters daily per capita to allow for interpretability. Daily per capita purchases were adjusted for household composition, region of residence, rate of minimum wage, and unemployment rate, and the cluster at the household level was considered. In addition, the interaction between SES and year of purchases was included to model changes in purchasing by SES over time. Daily per capita intakes in urban and rural areas were adjusted for age, sex, and area and region of residence. Survey commands were used to account for survey design and weighting to generate nationally representative results. t Tests were used to compare daily per capita purchases and intakes of healthy and less-healthy foods and beverages across SES groups, as well as daily per capita purchases of healthy and less-healthy foods and beverages by SES over time. Statistical significance was achieved at a P-value of 0.05, Bonferroni-adjusted for multiple comparisons.

Results

In CPS data, just over half of households were classified with medium SES. Further, about 42% and 45% of households were composed of 4–5 family members and 2–3 children, respectively. Trends were similar across 2012–2014 (**Supplemental Table 3**). The Mexican population studied as part of the ENSANUT 2012 consisted of a higher proportion of individuals classified with high SES than with medium or low SES, living in the Central region than in the North and South, and living in urban than in rural areas (**Supplemental Table 4**).

In CPS data, daily per capita purchases of healthy foods were on average 54% and 142% higher in households with high SES than in those with medium and low SES, respectively, in all years under study (2012–2014) ($P < 0.05$), and a reduction of 10% and 4% in healthy food purchases was observed in 2014 compared with 2013 in the low- and medium-SES groups, respectively (**Figure 1**; $P < 0.05$). Likewise, SES was positively associated with daily per capita purchases of less-healthy foods during the 3 y under study ($P < 0.05$). The daily per capita purchases of less-healthy foods were on average 33% and 55% higher in households with high SES than in those with medium and low SES, respectively. Further, all 3 SES categories had a reduction of less-healthy food purchases from 2013 to 2014, but the reduction was higher in households with low SES than in households with medium and high SES ($P < 0.05$). On the other hand, in ENSANUT, daily per capita intakes of healthy foods in urban areas (excluding corn tortillas) was 11% and 4% higher in the highest and lowest SES group, respectively, compared with households with medium SES, whereas a positive association was observed between SES and less-healthy foods (excluding wheat tortillas, tortilla chips, chocolate, and bread from a bakery) (**Figure 2**; $P < 0.05$). The daily per capita intakes of less-healthy foods were 15% and 136% higher in individuals with high SES than in individuals with medium and low SES, respectively ($P < 0.05$).

In CPS data, there was a positive association between SES and daily per capita purchases of healthy beverages during the 3 y under study (**Figure 3**; $P < 0.05$). The daily per capita purchases of these type of beverages were on average 19% and 56% higher in households with high SES than in households with medium and low SES, respectively, from 2012 to 2014. An increase of healthy beverage purchases was observed in all 3 SES groups from 2012 to 2013, and a decrease in the lowest SES from 2013 to 2014 ($P < 0.05$). In 2014, daily per capita

[2] States by region: North: Baja California, Chihuahua, Coahuila, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas, and Zacatecas. Central: Aguascalientes, Colima, Estado de México, Guanajuato, Hidalgo, Jalisco, Michoacán, Querétaro, and San Luis Potosí, Tlaxcala. South: Campeche, Chiapas, Guerrero, Morelos, Oaxaca, Puebla, Tabasco, Veracruz, and Yucatán.

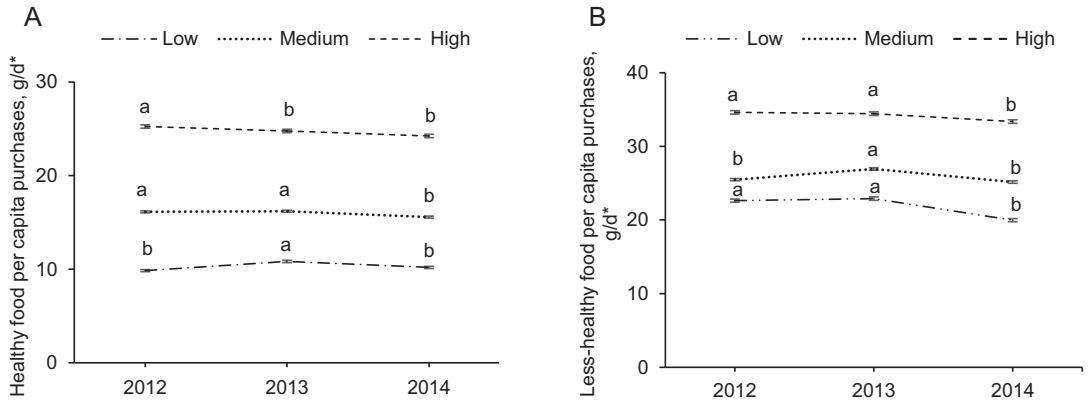

FIGURE 1 Daily per capita purchases of healthy (A) and less-healthy (B) foods in urban Mexican households, according to SES, 2012–2014. Values are means ± SEs. $n = 959$ in the low-, $n = 3133$ in the medium-, and $n = 1721$ in the high-SES group in 2012; $n = 1094$ in the low-, $n = 2872$ in the medium-, and $n = 1809$ in the high-SES group in 2013; and $n = 1087$ in the low-, $n = 2815$ in the medium-, and $n = 1755$ in the high-SES group in 2014. Results are derived from the authors' own analyses and calculations based on data from Nielsen (The Nielsen Company, 2016) through its Mexico Consumer Panel Service for the food and beverage categories from January 2012 to December 2014. Nielsen is not responsible for and had no role in preparing the results reported herein. SES classification is based on the socioeconomic index provided by Nielsen. Multivariate linear regression models were used to predict per capita daily purchases of healthy and less-healthy foods according to SES and year of purchases, adjusting for household composition, region of residence, rate of minimum wage, unemployment rate, and cluster at the household level. Within the SES group, labeled means without a common letter differ among years, $P < 0.05$, with the use of Bonferroni adjustment. *SES differences in purchases of healthy and less-healthy foods were found at each time point, $P < 0.05$, with the use of Bonferroni adjustment. SES, socioeconomic status.

purchases of healthy beverages were 22% and 65% higher in households with high SES than in households with medium and low SES. SES was inversely associated with daily per capita purchases of less-healthy beverages in 2012, but not in 2013 or 2014. In 2012, the daily per capita purchasing of less-healthy beverages was 2% and 27% higher in households with low SES than in households with medium and high SES, respectively. Further, reductions in purchases of less-healthy beverages were observed in all 3 SES groups from 2012 to 2014, but the reductions were higher in low-SES groups than in medium- and high-SES groups ($P < 0.05$). In 2013, the daily per capita purchases of less-healthy beverages were not statistically different between households with low and medium SES. In 2014, the daily per capita purchases of less-healthy beverages were 6% and 23% higher in households with medium SES than in those with low and high SES, respectively ($P < 0.05$). The results from ENSANUT in urban areas show that SES was positively associated with daily per capita intakes of healthy beverages (**Figure 4**; $P < 0.05$). The daily per capita intake was 33% and 43% higher in high-SES households than in medium- and low-SES households, respectively. The daily per capita intakes of less-healthy beverages were 10% and 9% higher in medium and high-SES than in low-SES households, respectively ($P < 0.05$).

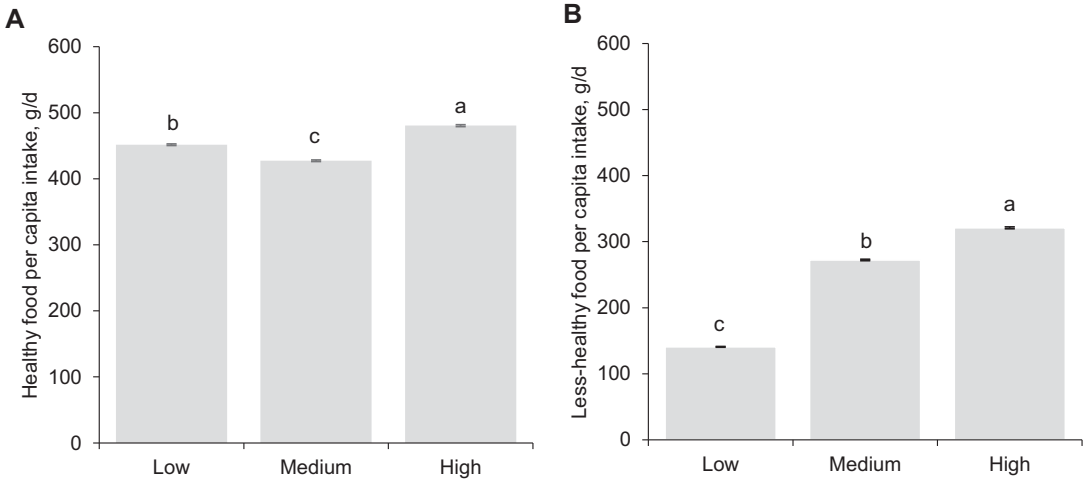

FIGURE 2 Daily per capita intakes of healthy (A) and less-healthy foods (B) in the urban Mexican population, categorized according to SES, 2012. Values are means ± SEs. $n = 3502$ in the low-, $n = 3367$ in the medium-, and $n = 2773$ in the high-SES group. Results are derived from the Mexican National Health and Nutrition Survey 2012 (24). Corn tortillas, tortillas, tortilla chips, chocolate, and bread from a bakery were excluded from the healthy and less-healthy food groups. Tertiles of SES are based on the distribution of the socioeconomic index scores computed as part of the Mexican National Health and Nutrition Survey 2012 (range of scores by SES: low, −6.0 to <−0.6; medium, −0.6 to <0.9; high, 0.9 to 4.7) (31). Multivariate linear regression models were used to predict per capita daily intakes of healthy and less-healthy foods according to SES, adjusting for age (categorical), sex, area, and region of residence. Labeled means without a common letter differ among categories of SES, $P < 0.05$, with the use of Bonferroni adjustment. SES, socioeconomic status.

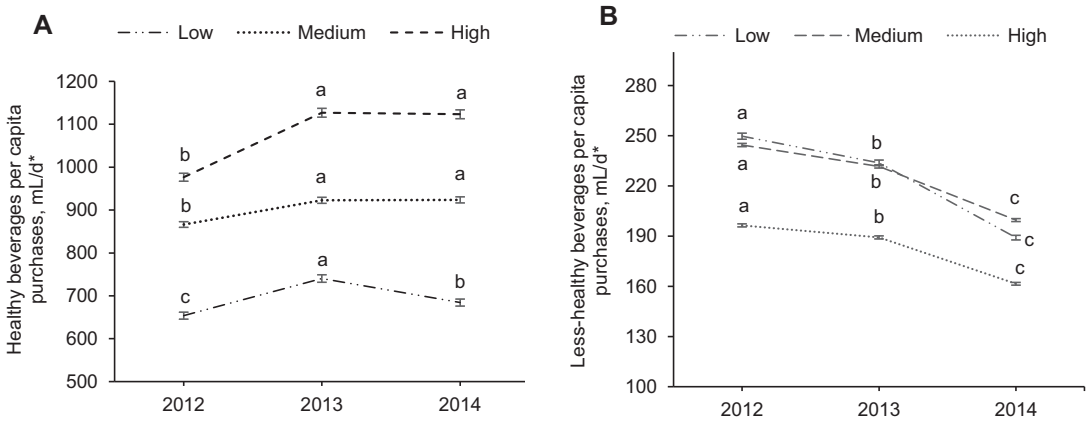

FIGURE 3 Daily per capita purchases of healthy (A) and less-healthy (B) beverages in urban Mexican households, according to SES, 2012–2014. Values are means ± SEs. $n = 959$ in the low-, $n = 3133$ in the medium-, and $n = 1721$ in the high-SES group in 2012; $n = 1094$ in the low-, $n = 2872$ in the medium-, and $n = 1809$ in the high-SES group in 2013; $n = 1087$ in the low-, $n = 2815$ in the medium-, and $n = 1755$ in the high-SES group in 2014. Results are derived from the authors' own analyses and calculations based on data from Nielsen through its Mexico Consumer Panel Service for the food and beverage categories from January 2012 to December 2014 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. SES classification is based on the socioeconomic index provided by Nielsen. Multivariate linear regression models were used to predict per capita daily purchases of healthy and less-healthy beverages based on SES and year of purchases, adjusting for household composition, region of residence, rate of minimum wage, unemployment rate, and cluster at the household level. Within the SES groups, labeled means without a common letter differ among years, $P < 0.05$, with the use of Bonferroni adjustment. *SES differences in purchases of healthy and less-healthy beverages were found at each time point, $P < 0.05$, with the use of Bonferroni adjustment, except for the comparison of per capita daily purchases of less-healthy beverages between low- and medium-SES groups in 2013 ($P = 0.27$). SES, socioeconomic status.

The following results are part of the ENSANUT data only, where information of daily per capita intake in individuals from urban and rural areas is available, unlike CPS data. Daily per capita intakes of healthy foods in urban areas (including corn tortillas) was 12% higher in low-SES households than in medium- and high-SES households, whereas a positive association was observed between SES and less-healthy foods (including wheat tortillas, tortilla chips, chocolate, and bread from a bakery) (Table 1; $P < 0.05$). The daily per capita intake of less-healthy foods in urban areas was 12% and 99% higher in high- than in medium- and low-SES groups, respectively. In rural areas, SES had an inverse and a positive association with daily per capita intakes of healthy and less-healthy foods, respectively ($P < 0.05$). The daily per capita intake of healthy foods in rural areas was 3% and 16% higher in low-SES individuals than in medium- and high-SES individuals, respectively, whereas the daily per capita intake of less-healthy foods was 27% and 148% higher in individuals with high SES than in those with medium and low SES, respectively. SES was positively associated with daily per capita intakes of healthy beverages in rural areas, whereas less-healthy beverages were higher in the lowest- and highest-SES groups than in the medium-SES groups in this area ($P < 0.05$). The daily per capita intake of healthy beverages in rural areas was 57% and 81% higher in individuals

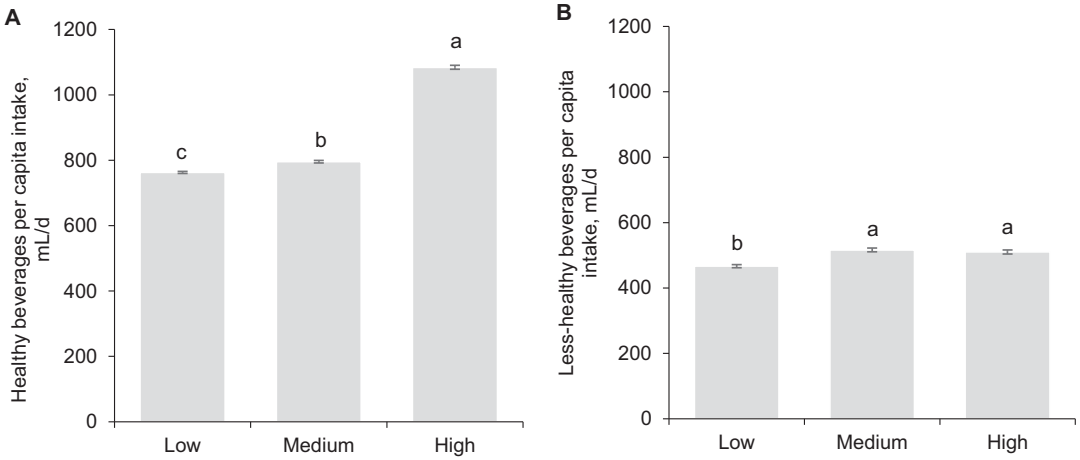

FIGURE 4 Daily per capita intakes of healthy and less-healthy beverages in the Mexican population from urban areas, categorized by SES. Results are derived from the Mexican National Health and Nutrition Survey 2012 (24). Values are means ± SEs. $n = 3502$ in the low-, $n = 3367$ in the medium-, and $n = 2773$ in the high-SES group. Tertiles of SES are based on the distribution of the socioeconomic index scores computed as part of the Mexican National Health and Nutrition Survey 2012 (range of scores by SES: low, −6.0 to <−0.6; medium, −0.6 to <0.9; high, 0.9 to 4.7) (31). Multivariate linear regression models were used to predict per capita daily intakes of healthy and less-healthy beverages according to SES, adjusting for age (categorical), sex, area, and region of residence. Labeled means without a common letter differ among categories of SES, $P < 0.05$, with the use of Bonferroni adjustment. SES, socioeconomic status.

TABLE 1 Per capita daily intakes of healthy and less-healthy foods and beverages in the Mexican population from urban and rural areas: ENSANUT 2012[1]

	SES[2]		
	Low	Medium	High
Urban areas[3]			
n	1409	2245	2383
Foods, g/d			
Healthy	654 ± 2.4[a]	582 ± 2.2[b]	585 ± 2.4[b]
Less healthy	169 ± 0.6[c]	300 ± 1.1[b]	337 ± 1.4[a]
Beverages, mL/d			
Healthy	753 ± 3.2[c]	807 ± 4[b]	1070 ± 6.1[a]
Less healthy	471 ± 4.8[b]	522 ± 5.8[a]	488 ± 5.8[b]
Rural areas[4]			
n	2093	1122	390
Foods, g/d			
Healthy	654 ± 2.8[a]	636 ± 2.9[b]	565 ± 2.8[c]
Less healthy	164 ± 0.9[c]	328 ± 1.9[b]	407 ± 2.6[a]
Beverages, mL/d			
Healthy	646 ± 1.6[c]	746 ± 1.9[b]	1170 ± 3.3[a]
Less healthy	466 ± 4.3[a]	387 ± 3.9[b]	552 ± 6.1[a]

[1]Values are means ± SEs. Results are derived from the National Health and Nutrition Survey 2012 (24). Multivariate linear regression models were used to predict daily per capita intakes of healthy and less-healthy foods and beverages according to SES and adjusting for age (categorical), sex, and region of residence. Labeled means without a common superscript letter differ among categories of SES, $P < 0.05$, with the use of Bonferroni adjustment. ENSANUT, National Health and Nutrition Survey; SES, socioeconomic status.

[2]Tertiles are based on socioeconomic index scores computed as part of the Mexican National Health and Nutrition Survey 2012 (range of scores by SES: low, −6.0 to <−0.6; medium, −0.6 to <0.9; high, 0.9 to 4.7) (31).

[3]≥2500 inhabitants.

[4]<2500 inhabitants.

classified with high SES than in those with medium and low SES, respectively. The daily per capita intake of less-healthy beverages in rural areas was 20% and 43% higher in individuals with low and high SES, respectively, than in those with medium SES. Similar results were observed for daily per capita energy intake (**Supplemental Table 5**).

Discussion

To our knowledge, this study is the first to explore the purchase and intake of foods and beverages of varying healthfulness by SES in the urban Mexican population.

Although higher-SES households and higher-SES individuals in urban areas purchased and consumed more healthy foods than did their lower-SES counterparts, they also had increased purchases and consumption of less-healthy foods. Moreover, in the purchases data, we found that these trends remained consistent over time. Our results are mixed in comparison with findings in other low- and middle-income countries, where high SES is associated with overall healthier dietary patterns (8, 42, 43). These findings could be because in the transitioning economies, such as Mexico, the Westernization of diet can be an opportunity for higher intake of healthy and diverse foods but also an occasion for higher intake of low-priced, highly energy-dense foods, such as pastries, baked goods, confectionary, and salty snacks (8). Further, the report by the Global Panel on Agriculture and Food System for Nutrition indicates that as countries get wealthier, consumption increases of not only defined "healthy" foods but also, even more strongly, foods associated with low-quality diets (44). In transition countries, these changes in food consumption generally affect high-SES individuals (13), as observed in our results.

Compared with higher-SES households, lower-SES households had greater purchases of less-healthy beverages in 2012. The above-mentioned result is consistent with that has been observed in the highest-income countries, including the United States and several European countries, where the highest intake of SSBs is observed in lower-SES groups (45–47), whereas in low- and middle-income countries, such as India, Brazil, and Sri Lanka, the greatest intakes of SSBs are observed in populations with higher SES (48–50). Such results in less-healthy beverages purchasing may imply that low-SES groups had access to less-healthy beverages more easily than healthy beverages because of differences in availability and prices. Although bottled water is cheaper than bottled soda, bottled water remains relatively expensive compared with tap water when it is available. As a result, low-income households may be more inclined to choose bottled soda over bottled water when choosing a bottled beverage, perhaps because of preferences for sweetness or because of preferences to get more calories per dollar (51, 52).

Less-healthy beverage intake was not different between higher- and lower-SES individuals in 2012. A potential explanation for this inconsistency is that different information is collected in purchases and intake data. The purchases database is comprised of selected categories of packaged beverages. In contrast, the ENSANUT data include detailed information of beverages consumed, including homemade and out-of-home beverages. A previous study shows that caloric soda, caloric coffee or tea (with sugar), and *aguas frescas* (traditional Mexican beverages usually prepared with water, fruit, and sugar) were the top 3 major beverage contributors to the total energy intake per capita in the Mexican population (4). Therefore, a higher consumption of caloric coffee or tea and/or *aguas frescas* among higher-SES individuals could explain the similar consumption of less-healthy beverages across SES groups.

Notably, we also found a reduction in the purchases of less-healthy foods and beverages from 2012 to 2014 for all 3 SES g ups, although these reductions were higher in low-SES households. This change in purchases could be associated to the ad valorem tax of 8% on nonessential foods and the excise tax on SSBs, resulting in an ∼10% price increase based on 2013 prices, instituted by the Mexican congress in January 2014 (18). Further, these results are consistent with those reported by Batis et al. (20) and Colchero et al. (53), who found that purchases of taxed high energy–dense foods and SSBs in households of urban areas decreased during 2014 by an average of 5% and 6%, respectively, but the reduction of these purchases in low-SES households was about 10% and 9%, respectively. If this trend continues, we might expect a reduction in disparities in diet quality by SES in future years. Future research using the 2016 Mexican national survey, which will be available at the end of 2017, will be essential to understanding whether these taxation efforts improved the total diet, which includes away-from-home food intake, and whether these initial higher responses by lower-SES households continue.

Trends in purchasing less-healthy foods and healthy beverages in urban areas were consistent with trends in intakes in both urban and rural areas. These results might suggest that food and beverage purchasing patterns in rural areas could be similar to those observed in households from cities. However, it is necessary to interpret these similarities with caution. While diet intake patterns between urban and rural individuals in 2012

may have been similar, we might expect to see larger differences in food and beverages intakes (and by extension, purchases) between urban and rural areas as urbanization occurs. Future work in the newest ENSANUT survey will be necessary to understand whether the associations between SES, urbanicity, and diet quality are indeed changing over time. Further, it is important to consider that households located in rural and small urban areas represent ~37% of the Mexican population and ~25% of food and beverage expenditure (53). Consequently, food and beverage purchases data do not include information about an important and substantial proportion of the Mexican households that might have different purchasing patterns than those of urban households. One important question for future study will be whether SES disparities are consistent or differ between rural and urban areas.

It is important to acknowledge the differences between CPS and ENSANUT datasets. The CPS purchasing database is useful to analyze food purchasing patterns over time because it contains detailed and very carefully collected information about households' food purchases, as well as sociodemographic variables for a better estimation of purchasing changes. However, purchasing data are only representative of urban households, and, thus, we are unable to generalize as to whether the observed diet-SES associations in food purchases would also hold in rural areas. Further, this database is limited to selected categories of packaged foodstuffs. Given that many of the foods considered most healthful by nutritionists are not packaged (e.g., fruit and vegetables), this limitation is more likely to affect the food group categorized as healthy. Therefore, the greater difference in healthy foods between high- and low-SES groups observed in purchasing than in intake data could indicate that higher-SES households bought more packaged foods classified as healthy. Further, information of out-of-home purchasing is not included in the purchasing database. For instance, Taillie et al. (54) found that 11% and 18% of daily energy intake in Mexican children 2–5 and 6–13 y of age, respectively, was from away-from-home eating. Therefore, it is expected that the percentage of foods consumed or purchased away from home increases with age and according to SES.

One key limitation of the CPS data is its failure to include corn tortillas, a staple part of the Mexican diet. Lack of data on tortillas could influence the SES-healthy food purchasing association, especially if lower-SES households are more likely to maintain a more traditional diet pattern (55). However, the dietary data also have their own limitations. Our analysis is based on a single 24-h dietary recall, which does not allow between- and within-person variability to be distinguished, and therefore usual dietary intake cannot be estimated. Finally, it is important to recognize that different definitions of SES and urban areas are used between CPS and ENSANUT data. However, together, these data provide a comprehensive picture of how food purchases and intake are changing across SES, which provides critical insight for understanding diet-related disparities in Mexico.

This study is the first to our knowledge to analyze the association between diet and SES using both purchases and intake data in the Mexican population. Results show that higher-SES households and higher-SES individuals from urban areas had greater purchases and intake of less-healthy foods and healthy beverages. Further, the trends of higher purchases of these food and beverage categories in higher-SES households did not change over time. Conversely, we observed that lower-SES households had greater purchases of less-healthy beverages in 2012. Notably, we also found a reduction in purchases of less-healthy foods and beverages for all 3 SES groups during the period under study, with the largest changes among low-SES households, which could be associated with the food and beverage tax implemented in Mexico in 2014. However, future analysis of dietary intake data will be needed to understand whether tax-related changes in food and beverage intake extend to the total diet, and how these changes may have differed by SES level.

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