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# Breakfast Dietary Patterns among Mexican Children Are Related to Total-Day Diet Quality[1–3]

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## Abstract

**Background:** Mexico has experienced shifts in food availability and consumption patterns over the past few decades from traditional diets to those containing more high–energy density foods, resulting in the development of unhealthful dietary patterns among children and adults. However, to our knowledge it is not known whether breakfast consumption patterns contribute to the overall daily diet of Mexican children.

**Objective:** We examined total-day diet among breakfast consumers compared with breakfast skippers, identified and investigated breakfast dietary patterns in relation to energy and nutrient intakes at breakfast and across the day, and examined these patterns in relation to sociodemographic characteristics.

**Methods:** With the use of nationally representative dietary data (one 24-h recall) from the 2012 Mexican National Health and Nutrition Survey, 3760 children aged 4–13 y were categorized into mutually exclusive breakfast patterns with the use of cluster analysis. The association between breakfast patterns and breakfast skippers with dietary intake at breakfast and for the total day was investigated with the use of multivariate linear regression.

**Results:** Most children (83%) consumed breakfast. Six breakfast dietary patterns were identified (milk and sweetened breads, tortillas and beans, sweetened beverages, sandwiches and quesadillas, eggs, and cereal and milk) and reflected both traditional and more Westernized dietary patterns. Sugar-sweetened beverages were consumed across all patterns. Compared with all breakfast dietary patterns, breakfast skippers had the lowest intake of several nutrients of public health concern. Nutrients to limit that were high at breakfast tended to be high for the total day and vice versa for nutrients to encourage.

**Conclusions:** There was not a single pattern that complied perfectly with the Mexican School Breakfast Guidelines, but changes such as increasing dietary fiber by encouraging more whole grains, fruits, vegetables, and beans and reducing sodium and sugar-sweetened beverages could support compliance with these targets and improve overall diet quality. *J Nutr* 2017;147:404–12.

**Keywords:** dietary patterns, energy intake, child diet, nutrition transition, Mexico, breakfast

## Introduction

Mexico has experienced shifts in food availability and consumption patterns over the last few decades from traditional diets to those containing more high–energy density foods (high in added sugars and saturated fats) (1–3), resulting in the development of unhealthful dietary patterns among children and adults across all eating occasions (4–7), often referred to as the nutrition transition (2). However, to our knowledge, it is not known whether shifts in breakfast consumption patterns have occurred and how these patterns contribute to the overall daily diet of Mexican children. In addition, it is also known that energy consumption is too high (3) and that >33% of children are overweight or obese (8). Breakfast consumption and quality could represent an area for improvement in the diets of Mexican children.

Breakfast consumption compared with breakfast skipping has been associated with a more balanced energy intake distribution during the day (9–11), improved micronutrient

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[3] Supplemental Tables 1 and 2 are available from the ''Online Supporting Material'' link in the online posting of the article and from the same link in the online table of contents at http://jn.nutrition.org.

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intakes (9, 12, 13), and improved diet quality (14) in children. Most studies that have examined different types of breakfast among children have focused on ready-to-eat (RTE)[7] cereal consumers compared with "other" breakfast consumers or breakfast skippers. Among US children aged 9–13 y, RTE cereal consumers and breakfast skippers had a lower total daily energy intake than those consuming other breakfast types, but RTE cereal consumers had the highest mean adequacy ratio for many nutrients compared with skippers, who had the lowest (13). Similar findings were reported for Mexican-American children aged 6–18 y (15). Among Canadian children and adolescents aged 4–18 y, RTE cereal consumers had similar fiber, fat, and micronutrient intakes to non-RTE cereal consumers for all meals except breakfast but had higher fiber, lower fat, and higher micronutrient intakes for the total day highlighting the impact of breakfast choice (12). However, by focusing only on RTE cereals, the differences present within other (non-RTE cereal) breakfasts or how they affect daily nutrient intake or overall diet quality cannot be determined. Considering that foods are consumed together and not just in isolation and that RTE cereals represent only one food that is consumed for breakfast, examining the variety of dietary patterns would reveal a broader picture of food and nutrient consumption. To our knowledge, it is also not known how the daily diet quality of these other breakfasts compares to breakfast skippers. Breakfast skippers may have different overall eating patterns throughout the day than breakfast consumers.

Previous research in Mexico has indicated that 19–21% of school-aged children skip breakfast (16, 17), but to our knowledge neither dietary patterns at breakfast nor their relation to energy and nutrient intake during the total day has been explored. Thus, we *1*) examined the role of breakfast consumers compared with skippers on total-day diet quality, *2*) identified and investigated breakfast dietary patterns in relation to energy and nutrient intakes at breakfast and across the day in relation to the Mexican School Breakfast Guidelines, and *3*) examined these patterns in relation to sociodemographic characteristics among Mexican children aged 4–13 y with the use of nationally representative dietary data from 2012.

## Methods

*Study population.* This study used data from ENSANUT (National Health and Nutrition Survey) 2012, a cross-sectional, multistage, stratified, cluster-sampled representative survey conducted by Mexico's National Institute of Public Health between October 2011 and May 2012. ENSANUT 2012 surveyed 50,528 households with a response rate of 87% (8, 18). Among 3979 children aged 4–13 y, 175 were missing weight status and 47 had values for energy intake flagged as outliers (3 children were excluded for both reasons), leaving 3760 children with complete information on diet and covariates of interest. Written informed consent was obtained from the father, the mother, or the tutor of respondents <18 y. Verbal consent was given by children and adolescents aged 5–17 y. The survey protocol was approved by the National Institute of Public Health Ethics Committee.

*Dietary assessment.* The primarily caregiver (usually the mother) reported the type and amount of foods and beverages consumed by the child while at home. In addition, children reported what they consumed away from home (i.e., while at school). A single 24-h recall administered with the use of the USDA's automated 5-step multiple-pass method (19–21) adapted to the Mexican context (3, 7) was used. This adaptation included translations into Spanish as well as modifications to reflect the unique characteristics of food intake in Mexico [e.g., characteristics of purchased foods (raw or processed, packaged or unpackaged, frozen or not frozen), location of intake, and portion sizes]. Interviewers used tools such as photos of commonly consumed foods, a food scale, measuring cup, and serving spoon to help estimate portion sizes. The weight or volume of foods, dishes, and beverages consumed were imputed with the use of the mean value for the respondent's age group, area, and region of residence and meal time when the weight or the volume were not reported by the respondent. For children aged 4–13 y, 2% of the values were imputed. Whole foods were reported as consumed (i.e., bananas, yogurt), and mixed dishes were reported as a single item and then disaggregated into component ingredients to estimate nutrient composition with the use of either a standard recipe (when the food was consumed away from home or the specific proportion of ingredients was partially or wholly unknown) or a consumer recipe (when ingredients were known).

This study used the most recent food composition table that was based on a combination of pre-existing Mexican food composition tables (67% of foods) (3) and the food composition tables from the 2011–2012 USDA Food and Nutrient Database for Dietary Studies and USDA National Nutrient Database for Standard Reference, release 26 (33% of foods) (22, 23). Added sugar values were obtained through linkages to the 2007–2012 Food Patterns Equivalents Database (for Food and Nutrient Database for Dietary Studies links) and Food Patterns Equivalents Ingredient Database (for National Database for Standard Reference, release 26 links). Teaspoon equivalents in the Food Patterns Equivalents Database were converted to grams with the use of the ratio 4.2 g/teaspoon. We examined macronutrients as well as other nutrients that have been targeted in the Mexican School Breakfast Guidelines (24) and frequently by international dietary guidelines, such as total energy, total sugars, added sugars, fiber, and sodium, as well as key micronutrients required for healthy childhood development.

*Food groups.* The food groups used in this study were based on the food groups previously used in the US Feeding Infants and Toddlers Study (25, 26). Two trained Mexican dietary research specialists and a nutrition scientist at Nestlé adapted these food groups and created additional groups to reflect foods commonly consumed by children in Mexico, such as tortillas (27). To achieve a smaller set of meaningful food groups to use for clustering, food groups consumed at breakfast were then aggregated based on the type of food or beverage and percentage consuming, yielding 21 mutually exclusive food groups (**Supplemental Table 1**). The cereal food group included food codes for RTE cereals (with milk, yogurt, and/or fruit) or cooked cereals (such as oatmeal with milk). Because the proportions of cereal and milk were not provided, we could not disaggregate these mixtures into individual foods and include milk in the distinct food group. RTE cereal was retained as a separate food group when reported alone.

*Covariate assessment.* ENSANUT 2012 included 3 phases of data collection: identifying and selecting households, administering household and individual questionnaires, and collecting nutrition-related information with the use of 24-h recall, anthropometrics, and blood samples. Information about income, demographics, and socioeconomic characteristics were ascertained with the use of questionnaires. Socioeconomic status (SES) was calculated based on an inventory of household assets (28). Therefore, sociodemographic information was collected in the second phase. Height was measured with the use of stadiometers with 1-mm precision and body weight with 100-g precision (29, 30). Measurements were taken by trained personnel with the use of standard procedures (31, 32). Normal weight or underweight compared with overweight and obesity was classified with the use of International Obesity Task Force cutoffs (33, 34). These cutoffs were chosen because they correspond to adult BMI cutoffs. Stunting was classified with the use of the WHO height-for-age $z$ score of $<-2$ (35, 36). The primary caregiver's education was classified as less than elementary, elementary to secondary, or more than high school.

[7] Abbreviations used: ENSANUT, National Health and Nutrition Survey; IOM, Institute of Medicine; RTE, ready to eat; SES, socioeconomic status; SSB, sugar-sweetened beverage.

Respondents were asked to report the name of the eating occasion in which they consumed each food or dish. Options for meal names included *desayuno* (breakfast); *comida* (lunch), which is typically the main meal consumed between noon and midafternoon and usually outside of school); *cena* (dinner); and *almuerzo* (technically translated as lunch in English but in Mexico refers to a meal that occurs typically in late morning or around noon but before the main meal and often occurs while at school). Snacking occasions were identified by respondents and were categorized as any food or beverage contributing >0 kcal that was consumed between the customary mealtimes. Water was not coded as a meal or snack (37). Children were classified as breakfast skippers if they did not report consuming any foods or beverages at breakfast. The intake for the rest of the day was defined as total day's intake minus intake at breakfast.

*Dietary patterns: cluster development.* Cluster analysis is a common method for describing patterns of food intake (38). Children were categorized into mutually exclusive clusters with the use of the 21 breakfast food groups (Supplemental Table 1). Cluster analysis was considered only for children who consumed breakfast, because only breakfast consumers could consume different combinations of food groups at breakfast. Breakfast skippers were in a distinct group that was not included in the cluster analysis but was included in multivariate analyses. To look at the relative proportions of foods consumed as a marker of dietary quality and to avoid getting clusters driven by high compared with low energy intakes, we included food group variables as a percentage of energy consumed at breakfast. SAS version 9.4 (SAS Institute) was used to conduct 100 iterations of cluster procedures to randomly generate initial group centers and to identify the center that produced the largest $r^2$ value, maximizing the inter- to intracluster variability. These initial group centers were then used as the seed values for nonhierarchical clustering with the use of the *cluster kmeans* command in Stata version 14 (StataCorp) to generate a fixed number of cluster solutions. To identify the optimal number of cluster solutions, we examined the Calinski-Harabasz value for each number of cluster solutions, which indicates intra-cluster homogeneity and inter-cluster heterogeneity (39), and compared each cluster solution to the previous, less complex cluster solution. If the more complex cluster solution generated meaningful subgroups, this solution was chosen as long as the Calinksi-Harabasz value was comparable. To maintain within-cluster reliability, a cluster could contain ≥4% of the sample (40). Breakfast clusters were first examined by the 4–8- and 9–13-y age groups. Because they yielded similar clusters, the combined age category of 4–13 y was used instead. The cluster analysis revealed that a 6-cluster solution was optimal. Patterns of foods consumed at breakfast were named after their defining characteristic: milk and sweetened breads, tortillas and beans, sweetened beverages, sandwiches and quesadillas, eggs, and cereal and milk.

*Statistical analysis.* Differences in the likelihood of being in a breakfast dietary pattern or a breakfast skipper by key demographic characteristics were examined first with the use of chi-square tests, with statistical significance defined as $P < 0.007$ (0.05/7 for Bonferroni correction) (**Table 1**). Next, with the use of multivariate linear regression, the following associations were investigated: breakfast dietary patterns in relation to energy and nutrient intake at breakfast and breakfast dietary patterns and skippers in relation to total daily intake. In the nutrient intake at breakfast models, the tortillas and beans pattern was the reference group (**Table 2**), whereas in the total daily nutrition models breakfast skippers were the reference group (**Table 3**). The outcomes of the analysis included intakes of energy (kilocalories per day), carbohydrates, protein, total fat, fiber, total and added sugars, and key micronutrients at breakfast and for the entire day. All analyses included each breakfast dietary pattern and were adjusted for key sociodemographic factors, including age, sex, weight status, place and region of residence, and SES. Mean per capita and consumer energy intake at breakfast from food groups was descriptively examined (Supplemental Table 1). Analyses were conducted with the use of survey commands and adjusted to be nationally representative. Stata's margins command was used to predict the adjusted mean nutrient outcome for each dietary pattern or breakfast skipper, and the outcome was adjusted for the aforementioned variables.

## Results

The study population included 3760 children aged 4–13 y (Table 1): 26% were overweight or obese, 61% lived in urban areas, and 37% were beneficiaries of assistance programs. A total of 68% of the primary caregivers were not employed, and 89% had achieved an elementary or secondary education. Most children consumed breakfast (83%). Compared with breakfast consumers, a higher percentage of breakfast skippers lived in rural areas in the North and Central regions of Mexico, were in the lower and middle tertiles of SES, and had a primary caregiver with less than a secondary education (Table 1). A substantially larger number of breakfast skippers ate *almuerzo* (89%) than breakfast consumers (41%) (results not shown). Similar percentages of breakfast consumers and breakfast skippers consumed a snack before breakfast (7% compared with 9%) and a snack before lunch (38% compared with 36%), respectively. Children in the milk and sweetened breads pattern had a higher number of eating occasions than those in the tortillas and beans breakfast dietary pattern (Table 1).

Foods and beverages consumed at breakfast were grouped into 21 distinct food groups (Supplemental Table 1). Among breakfast consumers, the most-frequently reported food groups consumed at breakfast were sugar-sweetened beverages (SSBs) (41%), followed by milk (32%), tortillas (19%), and sweetened breads (19%). Other popular breakfast food groups included eggs and egg dishes (consumed by 16%), sandwiches and quesadillas (14%), cereals (10%), and dried beans and peas (9%). Corn mixed dishes (such as tacos, tamales, and enchiladas) and protein mixed dishes (such as chicken stew) were consumed by ~7% and ~5% of children, respectively.

The food groups that characterized the 6 breakfast dietary patterns are shown in **Figure 1**. The milk and sweetened breads pattern was the most commonly consumed dietary pattern (38% of children). This pattern was based on the consumption of milk, sweetened breads, corn mixed dishes, and cookies. The tortillas and beans breakfast pattern (consumed by 12% of children) was based on the intake of tortillas, beans, eggs, and SSBs. The sweetened beverages breakfast pattern (10% of children) was characterized by the intake of SSBs and sweetened breads. The sandwiches and quesadillas breakfast pattern (9% of children) was distinguished by intakes of sandwiches and quesadillas, SSBs, and milk. The eggs breakfast pattern (8% of children) was characterized by the intake of eggs, tortillas, milk, and SSBs. Finally, the cereal and milk dietary pattern (6% of children) was almost exclusively composed of different types of RTE cereals or oatmeal with milk.

SSBs were consumed across all patterns. However, the types of SSBs were numerous and differed by breakfast dietary pattern (**Supplemental Table 2**). For example, in the tortillas and beans breakfast dietary pattern, the SSBs that contributed the most to energy intake were sweetened tea and coffee followed by water- and milk-based *atoles* [hot masa (cornmeal) beverages with sugar and flavored with chocolate, vanilla, or cinnamon), whereas in the sandwiches and quesadillas breakfast dietary pattern, fruit-flavored drinks and milkshakes, smoothies, and *licuados* (blended beverages similar to smoothies made with milk, fruits, powdered chocolate, sugar, ice, and sometimes amaranth, granola, nuts, or eggs) were more common. The second similarity was milk consumption, which was present in all 6 breakfast dietary patterns.

Sociodemographic characteristics differed by breakfast dietary pattern (Table 1). For example, the milk and sweetened breads and eggs breakfast dietary patterns had the highest

**TABLE 1** Sociodemographic characteristics by breakfast dietary patterns of Mexican children aged 4–13 y from ENSANUT 2012 ($n$ = 3760)[1]

| Sociodemographic characteristics | Breakfast skippers | | Breakfast dietary patterns | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $n$ | Values | $n$ | Sweetened beverages[2] | Sandwiches and quesadillas | Eggs | Tortillas and beans | Cereal and milk | Milk and sweetened breads |
| Total, $n$ (%) | 652 (17) | | 3108 (83) | 365 (10) | 332 (9) | 292 (8) | 450 (12) | 243 (6) | 1426 (38) |
| Age, y | | | | | | | | | |
| 4–8 (reference) | 335 | 14 ± 1.1 | 1747 | 8.4 ± 0.90 | 8.8 ± 0.90 | 9.1 ± 1.0 | 8.0 ± 0.80 | 8.1 ± 0.90 | 43 ± 1.7 |
| 9–13 | 317 | 18 ± 1.4 | 1361 | 10 ± 1.1 | 8.9 ± 1.1 | 5.4 ± 0.80* | 13 ± 1.1* | 5.9 ± 1.0 | 39 ± 2.0 |
| Sex | | | | | | | | | |
| Male (reference) | 349 | 17 ± 1.3 | 1530 | 8.7 ± 1.0 | 9.3 ± 1.0 | 7.1 ± 0.90 | 9.9 ± 0.90 | 7.6 ± 1.0 | 41 ± 1.8 |
| Female | 303 | 15 ± 1.2 | 1578 | 9.8 ± 1.0 | 8.5 ± 0.90 | 7.2 ± 0.80 | 11 ± 1.0 | 6.2 ± 0.90 | 42 ± 1.8 |
| Region | | | | | | | | | |
| North | 179 | 21 ± 1.7* | 651 | 5.6 ± 1.0 | 8.0 ± 1.2 | 17 ± 1.9* | 11 ± 1.3* | 7.1 ± 1.0 | 31 ± 2.3* |
| Central | 291 | 20 ± 1.6* | 1086 | 9.3 ± 1.1 | 9.6 ± 1.3 | 5.9 ± 0.90 | 8.5 ± 1.2* | 6.5 ± 0.90* | 40 ± 2.4* |
| Mexico City (reference) | 16 | 7.1 ± 2.2 | 166 | 10 ± 2.5 | 7.6 ± 2.2 | 5.7 ± 2.3 | 1.4 ± 0.80 | 14 ± 3.1 | 54 ± 4.9 |
| South | 166 | 14 ± 1.6 | 1205 | 11 ± 1.1 | 9.3 ± 1.1 | 4.1 ± 0.8 | 17 ± 1.4 | 3.8* ± 0.70 | 41 ± 1.8 |
| Urbanicity | | | | | | | | | |
| Rural | 291 | 21 ± 1.8* | 1179 | 12 ± 1.2 | 5.7 ± 0.90* | 4.6 ± 0.80* | 17 ± 1.4* | 4.2 ± 0.70* | 35 ± 2.0* |
| Urban (reference) | 361 | 14 ± 1.0 | 1929 | 8.1 ± 0.80 | 10 ± 0.90 | 8.2 ± 0.80 | 7.8 ± 0.80 | 8.1 ± 0.90 | 44 ± 1.7 |
| Body weight | | | | | | | | | |
| Underweight or normal weight (reference) | 488 | 16 ± 1.0 | 2295 | 9.8 ± 0.80 | 8.3 ± 0.80 | 7.3 ± 0.70 | 11 ± 0.90 | 7.1 ± 0.70 | 40 ± 1.5 |
| Overweight or obese | 164 | 16 ± 1.7 | 813 | 7.8 ± 1.2 | 10 ± 1.3 | 6.9 ± 1.4 | 8.7 ± 1.1 | 6.4 ± 1.5 | 44 ± 2.5 |
| Stunting | | | | | | | | | |
| No (reference) | 55 | 16 ± 0.91 | 221 | 9.1 ± 0.70 | 9 ± 0.72 | 7.5 ± 0.69* | 10 ± 0.71 | 7.1 ± 0.73 | 42 ± 1.4 |
| Yes | 597 | 22 ± 3.9 | 2887 | 10 ± 2.9 | 7.4 ± 2.7 | 3.3 ± 1.0 | 15 ± 2.7 | 4.5 ± 2.0 | 38 ± 4.6 |
| Socioeconomic status tertile | | | | | | | | | |
| Lowest | 261 | 18 ± 1.7 | 1133 | 9.9 ± 1.1 | 6.2 ± 0.90* | 4.6 ± 0.70 | 18 ± 1.4* | 3.8 ± 0.90* | 40 ± 2.0 |
| Middle | 243 | 17 ± 1.5 | 1106 | 9.8 ± 1.2 | 7.8 ± 1.0* | 9.2 ± 1.3 | 8.4 ± 1.0 | 6.4 ± 0.90* | 41 ± 2.1 |
| Highest (reference) | 148 | 13 ± 1.4 | 869 | 7.8 ± 1.3 | 13 ± 1.6 | 7.5 ± 1.1 | 5.7 ± 1.0 | 11 ± 1.5 | 43 ± 2.4 |
| Dietary recall on weekday | | | | | | | | | |
| Yes (reference) | 472 | 16 ± 1.1 | 2301 | 9.4 ± 0.80 | 9.7 ± 0.80 | 6.7 ± 0.70 | 9.7 ± 0.80 | 7.3 ± 0.80 | 41 ± 1.6 |
| No | 180 | 16 ± 1.7 | 807 | 8.9 ± 1.2 | 6.4 ± 1.2 | 8.6 ± 1.6 | 13 ± 1.6 | 5.8 ± 1.2 | 41 ± 2.7 |
| Child beneficiary of assistance program | | | | | | | | | |
| Food | 34 | 21 ± 4.5 | 144 | 8.4 ± 2.7 | 12 ± 4.8 | 2.3 ± 0.90* | 4.1 ± 1.4* | 9.9 ± 3.4 | 43 ± 6.2 |
| Money | 165 | 17 ± 2.0 | 762 | 11 ± 1.4 | 4.4 ± 0.90* | 7.0 ± 1.2 | 15* ± 1.7 | 6.2 ± 1.5 | 39 ± 2.5 |
| Medical | 46 | 19 ± 3.6 | 185 | 5.7 ± 1.90 | 7.4 ± 2.8 | 2.3 ± 0.70* | 23 ± 3.8* | 1.7 ± 0.70* | 41 ± 5.0 |
| None (reference) | 378 | 15 ± 1.0 | 1899 | 8.2 ± 0.80 | 10 ± 0.90 | 8.3 ± 0.90 | 8.5 ± 0.80 | 7.7 ± 0.80 | 42 ± 1.6 |
| Education of primary caregiver | | | | | | | | | |
| <Elementary | 39 | 21 ± 4.0* | 150 | 11 ± 3.1 | 5.5 ± 2.2* | 1.1 ± 0.50* | 22 ± 4.0* | 7.6 ± 3.8 | 32 ± 4.8 |
| Elementary to secondary | 569 | 16 ± 1.0* | 2648 | 8.7 ± 0.70 | 8.6 ± 0.80 | 7.3 ± 0.70 | 11 ± 0.80* | 6.9 ± 0.80 | 42 ± 1.4 |
| >High school (reference) | 15 | 7.2 ± 2.3 | 192 | 6.3 ± 2.4 | 18 ± 3.9 | 12 ± 2.6 | 2.5 ± 1.3 | 9.6 ± 2.8 | 45 ± 4.8 |
| Primary caregiver employed | | | | | | | | | |
| Yes | 189 | 15 ± 1.5 | 953 | 6.4 ± 0.90* | 9.9 ± 1.2 | 8.7 ± 1.3 | 8.3 ± 1.1 | 9.7 ± 1.7 | 42 ± 2.5 |
| No (reference) | 434 | 17 ± 1.1 | 2037 | 9.9 ± 0.90 | 8.5 ± 0.90 | 6.5 ± 0.70 | 12 ± 0.90 | 5.7 ± 0.70 | 41 ± 1.6 |
| Eating occasions | | | | | | | | | |
| Meals | 652 | 2.5 ± 0.040** | 3108 | 3.2 ± 0.040** | 3.0 ± 0.040** | 2.9 ± 0.050 | 2.8 ± 0.040 | 3.3 ± 0.060** | 3.3 ± 0.030** |
| Snacking occasions | 652 | 1.5 ± 0.070 | 3108 | 1.6 ± 0.090 | 1.7 ± 0.11 | 1.6 ± 0.10 | 1.6 ± 0.10 | 1.5 ± 0.14 | 1.6 ± 0.050 |
| Meals + snacking occasions | 652 | 4.1 ± 0.080** | 3108 | 4.8 ± 0.10 | 4.7 ± 0.12 | 4.5 ± 0.11 | 4.4 ± 0.10 | 4.8 ± 0.14 | 4.8 ± 0.050** |

[1] All values are means ± SEs unless otherwise noted. *Different from the reference in that column for demographic variables: $P < 0.007$ (Bonferroni correction of 0.05/7). **Different from tortillas and beans (reference) in that row: $P < 0.0083$ (Bonferroni correction of 0.05/6). ENSANUT, National Health and Nutrition Survey.
[2] Includes sweetened tea, coffee, and other sweetened beverages but excludes 100% juice.

percentage of children from North Mexico compared with other breakfast dietary patterns. The highest percentage of children in the cereal and milk and in the milk and sweetened breads breakfast dietary patterns were from Mexico City. The milk and sweetened breads breakfast dietary pattern was popular in both rural (35%) and urban areas (44%). Another common pattern in rural areas was the tortillas and beans breakfast dietary pattern (17%), and in urban areas the sandwiches and

**TABLE 2** Association between breakfast dietary patterns and energy and nutrient intakes at breakfast among Mexican children aged 4–13 y from ENSANUT 2012 ($n$ = 3108)[1]

| | Breakfast dietary patterns | | | | | |
|---|---|---|---|---|---|---|
| | Sweetened beverages | Sandwiches and quesadillas | Eggs | Tortillas and beans (reference) | Cereal and milk | Milk and sweetened breads |
| *n* | 365 | 332 | 292 | 450 | 243 | 1426 |
| Energy, kcal | 315 ± 18* | 626 ± 26 | 479 ± 27* | 580 ± 27 | 369 ± 18* | 421 ± 12* |
| Protein, g | 10 ± 0.80* | 25 ± 1.2 | 23 ± 1.1 | 23 ± 1.1 | 12 ± 0.60* | 14 ± 0.50* |
| Total fat, g | 9.0 ± 0.70* | 27 ± 1.3* | 23 ± 1.5* | 16 ± 1.0 | 9.3 ± 0.50* | 15 ± 0.50 |
| Carbohydrates, g | 48 ± 3.0* | 73 ± 3.0* | 45 ± 4.0* | 89 ± 4.0 | 63 ± 3.0* | 59 ± 2.0* |
| Fiber, g | 2.2 ± 0.27* | 5.0 ± 0.28* | 4.4 ± 0.48* | 12 ± 0.83 | 3.6 ± 0.35* | 3.2 ± 0.18* |
| Total sugars, g | 27 ± 1.6* | 27 ± 1.7* | 16 ± 1.3 | 17 ± 1.3 | 29 ± 1.7* | 28 ± 0.90* |
| Added sugars, g | 18 ± 1.3* | 15 ± 1.2* | 9.0 ± 1.1 | 9.0 ± 0.90 | 15 ± 1.3* | 16 ± 0.80* |
| Vitamin C, mg/d | 8.0 ± 2.1 | 23 ± 3.0 | 8.0 ± 1.3 | 16 ± 3.7 | 17 ± 2.0 | 12 ± 1.9 |
| Thiamin, mg/d | 0.30 ± 0.03* | 0.70 ± 0.08* | 0.30 ± 0.02* | 0.40 ± 0.03 | 0.90 ± 0.05* | 0.30 ± 0.01 |
| Riboflavin, mg/d | 0.40 ± 0.03 | 0.60 ± 0.03* | 0.70 ± 0.03* | 0.40 ± 0.02 | 1.2 ± 0.06* | 0.50 ± 0.01 |
| Niacin, mg/d | 2.0 ± 0.30* | 6.0 ± 0.30* | 2.0 ± 0.20* | 4.0 ± 0.30 | 11 ± 0.60* | 3.0 ± 0.10* |
| Vitamin B-6, mg/d | 0.20 ± 0.03* | 0.40 ± 0.03* | 0.40 ± 0.03* | 0.60 ± 0.04 | 1.3 ± 0.13* | 0.30 ± 0.02* |
| Folate, μg DFEs/d | 30.0 ± 2.0* | 65.0 ± 4.6* | 77.0 ± 7.0 | 105 ± 13 | 33.0 ± 3.0* | 40.0 ± 2.0* |
| Vitamin B-12, μg/d | 0.80 ± 0.080 | 1.5 ± 0.10* | 1.2 ± 0.07 | 0.90 ± 0.09 | 4.1 ± 0.26* | 1.0 ± 0.04 |
| Calcium, mg/d | 197 ± 18* | 427 ± 28* | 225 ± 15 | 267 ± 13 | 309 ± 18 | 266 ± 8.0 |
| Vitamin D, μg/d | 1.5 ± 0.13 | 1.6 ± 0.12 | 2.9 ± 0.17* | 1.5 ± 0.15 | 4.5 ± 0.19* | 1.8 ± 0.07 |
| Iron, mg/d | 2.0 ± 0.27* | 4.8 ± 0.48 | 3.2 ± 0.22 | 3.9 ± 0.21 | 11.3 ± 0.75* | 2.7 ± 0.13* |
| Zinc, mg/d | 1.3 ± 0.11* | 3.4 ± 0.18 | 2.7 ± 0.16* | 3.6 ± 0.16 | 4.0 ± 0.47 | 1.9 ± 0.07* |
| Sodium, mg/d | 348 ± 32* | 1035 ± 57* | 946 ± 63 | 760 ± 55 | 422 ± 27* | 464 ± 22* |
| Potassium, mg/d | 368 ± 26* | 601 ± 34* | 576 ± 36* | 789 ± 62 | 507 ± 27* | 494 ± 19* |

[1] All values are means ± SEs. Numbers represent predicted means with all covariates at their sample mean controlling for child age (continuous), sex, weight status (normal weight or underweight compared with overweight and obesity), residence (rural compared with urban), region (North, South, Central, and Mexico City), and socioeconomic status (tertiles). *Different from tortillas and beans (reference): $P < 0.01$ (Bonferroni correction of 0.05/5). DFE, dietary folate equivalent; ENSANUT, National Health and Nutrition Survey.

quesadillas breakfast dietary pattern was the second most common (10%). Children in the lowest SES tertile were predominantly in the milk and sweetened breads breakfast dietary pattern (40%) and in the tortillas and beans breakfast dietary pattern (18%) compared with other breakfast dietary patterns. The percentage of children in the cereal and milk breakfast dietary pattern was higher with increasing SES, whereas the percentage of children in the tortillas and beans breakfast dietary pattern was highest in the low SES tertile.

Compared with all breakfast dietary patterns, breakfast skippers had the lowest mean total daily energy, protein, fat, carbohydrate, and total and added sugar intake (Table 3) after adjusting for key sociodemographic factors. In addition, breakfast skippers had the lowest daily intakes of B vitamins (riboflavin, niacin, vitamin B-6, folate, and vitamin B-12), calcium, vitamin D, iron, zinc, sodium, and potassium (Table 3).

Adjusted mean energy and nutrient intakes at breakfast and for the total day were examined across the 6 patterns. The percentage contribution of breakfast to daily energy intake ranged from 19% for the sweetened beverages to 32% for the tortillas and beans breakfast dietary pattern. The dietary patterns with the highest mean energy intake at breakfast were sandwiches and quesadillas (626 kcal) and tortillas and beans (580 kcal) (Table 2). Those who consumed sandwiches and quesadillas also had the highest daily energy intake (2007 kcal) compared with all breakfast dietary patterns. The lowest intakes at breakfast and for the total day were the sweetened beverages breakfast dietary pattern (315 kcal at breakfast and 1668 kcal for the total day). Compared with all breakfast dietary patterns, children in the tortillas and beans breakfast dietary pattern had the lowest energy intake during the rest of the day (1205 kcal), whereas children in the cereal and milk breakfast dietary pattern had the highest energy intake during the rest of the day (1481 kcal), followed by the milk and sweetened breads breakfast dietary pattern (1445 kcal), indicating an adaptation based on what is first eaten.

Relative to all other breakfast dietary patterns, children in the sandwiches and quesadillas and egg dietary patterns had the highest mean intake of total fat and sodium at breakfast and for the total day (Tables 2 and 3). The sweetened beverages and milk and sweetened breads dietary patterns (together accounting for 50% of the children) had the highest intakes of added sugars and lowest intakes of fiber, iron, zinc, and potassium at breakfast (Table 2) compared with all breakfast dietary patterns. On the other hand, the tortillas and beans and eggs patterns had the lowest intakes of total and added sugars at breakfast and for the total day. The tortillas and beans pattern had 2–6 times higher mean fiber intake and 1.4–3.5 times higher mean folate intake at breakfast than the other 5 breakfast dietary patterns; the total daily intake of fiber and folate was also highest in this pattern. Across all breakfast dietary patterns, children in the cereal and milk breakfast dietary pattern had the highest intakes of B vitamins (except folate), vitamin D, zinc, and iron at breakfast and for the total day. The sandwiches and quesadillas pattern had the highest intakes of calcium (427 mg) and vitamin C (23 mg) at breakfast and for the entire day (1014 and 92 mg, respectively) relative to all other breakfast dietary patterns. Children in this pattern consumed the greatest amount of fruits and 100% juices at breakfast (Figure 1). Children in the sweetened beverages pattern had the lowest intakes of B vitamins, calcium, and vitamin D at breakfast and for the entire day compared with children in the other breakfast dietary patterns.

**TABLE 3** Association between breakfast dietary patterns and energy and nutrient intakes during the total day among Mexican children aged 4–13 y from ENSANUT 2012 ($n$ = 3760)[1]

| | Breakfast dietary patterns | | | | | | |
|---|---|---|---|---|---|---|---|
| | Breakfast skippers (reference) | Sweetened beverages | Sandwiches and quesadillas | Eggs | Tortillas and beans | Cereal and milk | Milk and sweetened breads |
| $n$ | 652 | 365 | 332 | 292 | 450 | 243 | 1426 |
| Energy, kcal | 1600 ± 56 | 1668 ± 60 | 2007 ± 59* | 1823 ± 68* | 1785 ± 53 | 1850 ± 102 | 1866 ± 36* |
| Protein, g | 61 ± 2.6 | 65 ± 4.2 | 80 ± 3.1* | 80 ± 4.7* | 70 ± 2.6 | 67 ± 3.3 | 72 ± 1.9* |
| Total fat, g | 56 ± 2.6 | 60 ± 3.2 | 77 ± 3.1* | 72 ± 3.6* | 55 ± 2.3 | 63 ± 4.6 | 67 ± 2.1* |
| Carbohydrates, g | 221 ± 8.0 | 225 ± 7.0 | 256 ± 8.0* | 221 ± 9.0 | 262 ± 8.0* | 264 ± 15 | 252 ± 5.0* |
| Fiber, g | 21 ± 1.1 | 20 ± 1.1 | 22 ± 0.91 | 20 ± 1.0 | 29 ± 1.3* | 23 ± 1.3 | 21 ± 0.53 |
| Total sugars, g | 77 ± 3.7 | 88 ± 4.5 | 99 ± 4.1* | 81 ± 4.9 | 77 ± 3.6 | 99 ± 5.5* | 99 ± 2.5* |
| Added sugars, g | 47 ± 2.2 | 56 ± 3.3 | 57 ± 3.6 | 47 ± 4.5 | 46 ± 2.6 | 60 ± 4.1* | 59 ± 1.8* |
| Vitamin C, mg/d | 69 ± 7.1 | 64 ± 5.9 | 92 ± 9.6 | 66 ± 6.5 | 71 ± 8.0 | 73 ± 7.1 | 86 ± 7.0 |
| Thiamin, mg/d | 1.3 ± 0.14 | 1.3 ± 0.12 | 1.9 ± 0.16 | 1.3 ± 0.06 | 1.4 ± 0.08 | 2.2 ± 0.21* | 1.5 ± 0.05 |
| Riboflavin, mg/d | 1.2 ± 0.05 | 1.4 ± 0.07* | 1.8 ± 0.08* | 1.9 ± 0.12* | 1.4 ± 0.06 | 2.3 ± 0.09* | 1.7 ± 0.04* |
| Niacin, mg/d | 15 ± 0.80 | 17 ± 1.1 | 19 ± 1.0* | 19 ± 1.50 | 17 ± 0.80 | 25 ± 1.1* | 18 ± 0.60* |
| Vitamin B-6, mg/d | 1.6 ± 0.07 | 1.7 ± 0.10 | 1.8 ± 0.10 | 2.0 ± 0.16 | 1.9 ± 0.09 | 2.8 ± 0.16* | 1.9 ± 0.06 |
| Folate, μg DFEs/d | 189 ± 11 | 194 ± 10 | 230 ± 11* | 228 ± 14 | 253 ± 16* | 216 ± 18 | 222 ± 7.0 |
| Vitamin B-12, μg/d | 2.9 ± 0.34 | 3.1 ± 0.24 | 4.2 ± 0.27* | 4.5 ± 0.57 | 3.0 ± 0.28 | 6.6 ± 0.35* | 3.8 ± 0.17 |
| Calcium, mg/d | 616 ± 22 | 727 ± 28* | 1014 ± 53* | 765 ± 36* | 727 ± 27* | 858 ± 43* | 849 ± 18* |
| Vitamin D, μg/d | 3.2 ± 0.20 | 4.2 ± 0.42 | 5.1 ± 0.45* | 6.5 ± 0.54* | 4.2 ± 0.75 | 7.5 ± 0.37* | 5.0 ± 0.22* |
| Iron, mg/d | 12 ± 0.98 | 12 ± 0.81 | 15 ± 1.1 | 14 ± 0.80 | 13 ± 0.63 | 24 ± 1.6* | 14 ± 0.43 |
| Zinc, mg/d | 8.6 ± 0.39 | 8.9 ± 0.49 | 11 ± 0.39* | 10 ± 0.58 | 9.7 ± 0.32 | 12 ± 0.82* | 10 ± 0.27* |
| Sodium, mg/d | 2306 ± 102 | 2493 ± 130 | 3165 ± 124* | 3007 ± 182* | 2444 ± 105 | 2538 ± 124 | 2761 ± 96* |
| Potassium, mg/d | 1991 ± 79 | 2103 ± 96 | 2420 ± 97* | 2366 ± 114* | 2328 ± 98* | 2358 ± 112 | 2396 ± 63* |

[1] Values are means ± SEs. Numbers represent predicted means with all covariates at their sample mean controlling for child age (continuous), sex, weight status (normal weight or underweight compared with overweight and obesity), residence (rural compared with urban), region (North, South, Central, and Mexico City), and socioeconomic status (tertiles). *Different from breakfast skippers (reference): $P < 0.0083$ (Bonferroni correction of 0.05/6). DFE, dietary folate equivalent; ENSANUT, National Health and Nutrition Survey.

## Discussion

A total of 83% of Mexican children aged 4–13 y consumed breakfast in this study. Among these children, 6 breakfast dietary patterns reflecting both traditional (such as tortillas and beans and eggs) and Westernized (such as cereal and milk) dietary patterns were identified. Traditional patterns were more commonly consumed in the South and North of the country than in other regions, whereas Westernized patterns were more prevalent in Mexico City and among children with a high SES. SSBs were consumed in all patterns. The nutrient intake at breakfast associated with each pattern also seemed to be associated with daily intakes for certain nutrients.

Breakfast skippers had lower daily energy and nutrient intakes (B vitamins, calcium, vitamin D, iron, zinc, and potassium) than breakfast consumers, a finding consistent with other studies (12, 13, 15, 41). However, although 17% of children skipped breakfast, most did consume a morning meal when considering both breakfast and *almuerzo*. Despite this, the nutrient intake for the total day among breakfast skippers was considerably less than that for breakfast consumers, indicating that the *almuerzo* did not compensate fully for missing breakfast.

Consistent with previous studies of dietary patterns in Mexico (4–6), breakfast dietary patterns differed by geographical location and SES. These results were indicative of the nutrition transition of higher SES in urban areas. Children in rural areas (and those with a lower SES) were more likely to be breakfast skippers and have a higher prevalence of the traditional tortillas and beans pattern than their urban counterparts. However, rural children were less likely to be in the cereal and milk group or the milk and sweetened breads group than urban children.

There were striking differences in the prevalence of recipients of food-assistance programs (including school breakfast, lunch, and *almuerzo* programs as well as other supplementary food programs) by breakfast pattern: whereas ~43% of children in the milk and sweetened breads pattern and 21% of breakfast skippers were recipients of food assistance, only 4% of children in the tortillas and beans pattern were recipients. More research is required to understand whether these breakfast consumption habits reflect the foods provided in these assistance programs or simply differences in dietary preferences or food accessibility across SES groups.

The contribution of breakfast to daily energy intake exceeded the Mexican School Breakfast Guidelines of 25% ± 5% energy intake from breakfast for the tortillas and beans and the sandwiches and quesadillas breakfast dietary patterns (24). Children in the sweetened beverages breakfast dietary pattern did not consume enough protein relative to these recommendations (15 g). Mean added sugar intake in all patterns exceeded the Mexican School Breakfast Guidelines recommendation of <5 g of added sugars at breakfast by 1.8–3.6-fold. Similarly, mean sodium intakes in all patterns (except the sweetened beverages pattern) exceeded the School Breakfast Guidelines recommended intake of <360 g at breakfast (29) by 1.2–2.9 times. Compared with the recommendation of 5.4 g at breakfast, fiber intake was insufficient in all patterns but tortillas and beans. Although children in this pattern exceeded energy intake recommendations at breakfast, they had the lowest energy intake during the rest of the day among all breakfast consumers, which could be caused by the higher feeling of satiety from fiber (42). Future longitudinal research will be required to understand whether

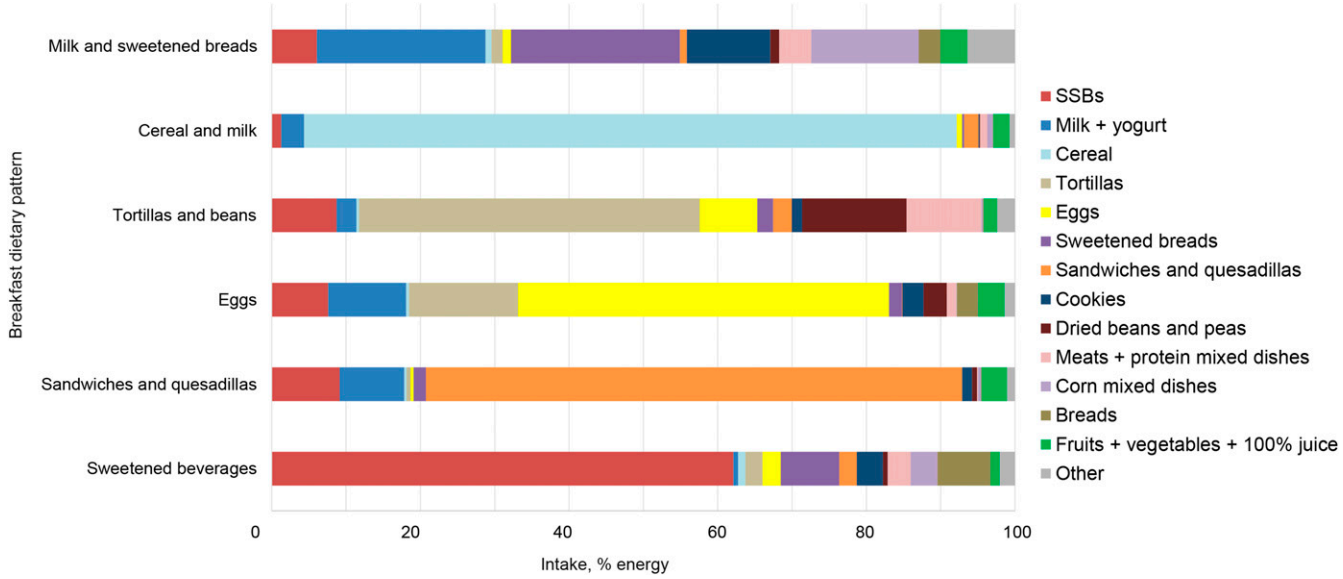


**FIGURE 1** Food groups' energy contribution to breakfast dietary patterns among Mexican children aged 4–13 y from ENSANUT 2012, $n$ = 3760. Sweetened beverages: $n$ = 365; sandwiches and quesadillas: $n$ = 332; eggs: $n$ = 292; tortillas and beans: $n$ = 450; cereal and milk: $n$ = 243; milk and sweetened breads: $n$ = 1426. Values are percentages of energy intake. For illustration purposes, some of the less-frequently reported food groups were combined as follows: milk and yogurt, meats and protein mixed dishes, fruits and vegetables, and 100% juice. ''Other'' includes grains, pasta, and rice; pastries, candy, and desserts; cheese, sauces, and other toppings; and salty snack food groups. ENSANUT, National Health and Nutrition Survey; SSB, sugar-sweetened beverage.

this tortillas and beans breakfast dietary pattern leads to sustained lower total daily energy intakes and whether this translates into overweight and obesity prevention in children.

Total daily intake was affected by breakfast consumption. Nutrients to limit (such as sodium and added sugars) that were high at breakfast tended to be high for the total day and vice versa for nutrients to encourage, highlighting the potential impact of breakfast on total diet quality. Mean total daily sodium intake among children in most dietary patterns was above the IOM upper daily limit of 1900 mg/d for children aged 4–8 y and 2200 mg/d for those aged 9–13 y (43). Conversely, comparing all breakfast dietary patterns, the ones with the lowest added sugar intake at breakfast and for the total day were the tortillas and beans and eggs patterns. This could reflect inherent dietary preferences (i.e., those who ate sweets at breakfast ate more sweets throughout the day). Daily fiber intake among children was lower than the IOM's adequate fiber intakes in all except the tortillas and beans pattern (44). Children in the cereal and milk pattern had the highest intakes of B vitamins (except folate), iron, zinc, and vitamin D both at breakfast and for the total day, likely because of breakfast cereal fortification. Mean daily intakes of calcium, vitamin D, and potassium were below the IOM adequate intakes in nearly all dietary patterns (43, 45), consistent with other findings on the prevalence of nutrient inadequacies in Mexican children (3, 46–48).

This study indicates that breakfast can influence the daily consumption of key nutrients of public health concern in Mexican children. We found low consumption of all types of milk, fruits, and 100% fruit juice, which suggests the need to encourage low-energy nutrient-dense foods at breakfast (skimmed or semiskimmed milk and fruits, but a limited amount of sweetened milks, 100% fruit juice, and SSBs) to improve compliance with the Beverage Consumption Recommendations for the Mexican Population (49), the Mexican School Breakfast Guidelines (24), and the Mexican Healthy Eating Plate (50). Children and parents could be educated on nutrient-dense breakfast food choices and simple dietary changes to customarily consumed foods.

The study's main limitation is the use of only one 24-h recall in calculating nutrient intakes because repeated 24-h recalls are typically required to determine long-term intake. However, recommended intakes were examined in relation to mean intakes calculated with one 24-h recall, which do not differ significantly from mean intakes calculated from the usual intake (51). Also, as with all dietary intake assessments, this study was prone to measurement errors. In addition, although this was a cross-sectional study and we could not assess whether eating certain foods was causally linked to consuming other foods later in the day, we could see that those who were more likely to eat certain types of foods at breakfast were also more likely to consume a similar nutrient profile of foods during their other eating occasions. For example, those consuming low amounts of protein at breakfast (those in the sweetened beverages dietary pattern) also had the lowest protein intake during the rest of the day. Strengths of the study include the use of nationally representative data, the large sample size, and the use of the 24-h recall method to estimate the intake of specific foods and their quantities. We were also able to compare the dietary contributions across the patterns and identify more or less healthful aspects of each pattern.

In conclusion, a variety of breakfast dietary patterns were identified, reflecting both traditional and more Westernized dietary patterns. Nutrient intakes associated with these breakfast patterns seemed to be related to daily nutrient intakes. There was not a single pattern that complied perfectly with the Mexican Breakfast School Guidelines, but changes such as increasing dietary fiber by encouraging more whole grains, fruits, vegetables, and beans and reducing sodium and added sugars (especially SSBs) could support compliance with these targets. A few of the patterns, such as the sweetened beverages pattern, might be affected by the recent tax on SSBs and

nonessential energy-dense foods (52, 53). Further investigation of the impact of the tax will not be possible until data from ENSANUT 2016 are available. Breakfast skippers had the lowest intakes of several nutrients of public health concern and of energy and added sugars. These results illustrate that there is still room for improving the breakfast habits of Mexican children and that small dietary changes at breakfast are likely to improve daily nutrient intakes for several nutrients.


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