

Increased Snacking and Eating Occasions Are Associated with Higher Energy Intake among Mexican Children Aged 2–13 Years^{1–3}

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Abstract

Background: Little is known about the dietary behaviors of Mexican children with regard to frequency, amount, and quality of foods consumed at eating occasions and their impact on total daily energy intake.

Objectives: The objectives were to 1) describe foods consumed across eating occasions and 2) examine whether the number or type of total eating occasions was associated with increased total daily energy intake and differed between 2- to 5-y-old and 6- to 13-y-old Mexican children.

Methods: A nationally representative sample of 5031 children from the 2012 ENSANUT (Encuesta Nacional de Salud y Nutrición) was used to examine the percentage of meals and snacks consumed, mean energy intake from meals and snacks, and the top food groups contributing to meals and snacks. Multivariate linear regression was used to examine the association between meals, snacks, and total eating occasions with daily energy intake for 2- to 5-y-old and 6- to 13-y-old children.

Results: Eating patterns were similar across age groups (per capita mean intake of 3 meals and 1.4–1.6 snacks/d). Each additional snack was associated with greater increases in mean daily energy for older children (+191–289 kcal/d; $P < 0.01$) relative to younger children (+102–130 kcal/d; $P < 0.01$). Likewise, each additional eating occasion was associated with greater increases in mean daily energy for older children (+323 kcal/d; $P < 0.01$) relative to younger children (+166–261 kcal/d; $P < 0.01$). In both younger and older children, snacking was prevalent (75% and 68%, respectively). Top food contributors to snacks included fruit, salty snacks, candy, sweetened breads, and cookies. Among older children, whole milk as a snack was partially replaced with soda and sweetened fruit drinks.

Conclusion: Snacks represent an area for potential improvement in the diets of Mexican children, especially among those aged 6 to 13 y, for whom each additional snack or eating occasion was linked to even greater increases in total daily energy intake. *J Nutr* 2015;145:2570–7.

Keywords: snacks, sugar-sweetened beverages, energy intake, dietary behavior, child diets, preschooler diets, Latin America

Introduction

Public health experts increasingly seek to understand dietary determinants of excess energy intake and obesity in Mexican children. In addition to high-caloric foods and beverages (1),

snacking has become a predominant way of eating among Mexican children, similar to increases in snacking across the globe (2–4). One recent article showed that snacking increased from 1999 to 2012, with 79% of 2- to 18-y-old children consuming snacks (5). In northwestern Mexico, >86% of fifth-graders consumed at least 1 sweet snack and 85% consumed at least 1 high-fat snack (6) weekly. Other work found that feeding high-fat snacks and sweetened beverages starts early in life (<6 mo of age), with >60% of 12- to 24-mo-olds consuming high-fat snacks and sweetened drinks at least once per week (7).

This trend toward increased snacking is potentially problematic. Whereas snacking and increased meal frequency have been linked to increased energy intake in US children and adults (8–10), the literature on eating frequency and weight is mixed: some studies found no link between meal patterns, snacking, and

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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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overweight status (11–13), whereas others found that increased snacking was positively associated with overweight (14, 15). There are several possible explanations for these conflicting findings: although increases in both the energy density of snacks and increased portion sizes of snacks may contribute to excess energy intake (16, 17), other work (primarily in adults) is suggestive but inconclusive that frequent eating throughout the day can help with appetite control and promote energy regulation (18, 19). One recent study in British and American adults found that ≥ 6 eating occasions was associated with lower total energy, lower mean BMI, and a higher nutrient-rich foods index (20).

Thus, one major question is whether eating occasions (meals compared with snacks) are linked to shifts in total daily energy and the quality of foods consumed. Yet, virtually no work has examined the link between snacking or other eating occasions and total daily energy intake in a representative sample of Mexican school-aged children. The one study to examine associations between meal frequency and energy was a small study ($n = 45$) conducted in a geographically limited region of rural Mexico in the early 1990s, which found that among children < 5 y old, increased eating frequency was associated with increased energy intake (21). Of particular interest are evening snacks, because these have been linked to increased energy intake (22–24) and overweight in adults, as well as a fourth meal called *almuerzo*, which is consumed in the late morning before lunch and represents a potentially major unexplored contributor to Mexican diets.

Finally, understanding differences between preschoolers (children aged 2–5 y) and older children (ages 6–13 y) is important, considering that although younger children's intake at individual eating occasions tends to be more variable, their daily energy intake tends to be less variable (25), indicating better energy self-regulation (26, 27). Conversely, older children's food intake may be driven less by hunger and satiety and more influenced by social and environmental cues, such as portion size or eating patterns (26, 28). Older children also have increased autonomy in choosing, purchasing, and consuming foods, especially outside the home (29).

The objectives of this study were first to describe energy intake and top foods consumed across eating occasions in a nationally representative sample of 2- to 13-y-old Mexican children and explore sociodemographic correlates. Second, we examined whether consuming during key eating occasions (snacks, *almuerzo*) or increased total eating occasions were associated with increased total daily energy intake and whether this differed between 2- to 5-y-old and 6- to 13-y-old children.

Methods

Study population. This study used data from the Encuesta Nacional de Salud y Nutrición (ENSANUT) 2012 (Mexican National Health and Nutrition Survey), a cross-sectional, multistage, stratified, and cluster-sampled representative survey conducted by Mexico's Instituto Nacional de Salud Pública (National Institute of Public Health) between October 2011 and May 2012. The survey methodology has been described elsewhere, but, in brief, ENSANUT 2012 surveyed 50,528 households with a response rate of 87% (30, 31).

Dietary assessment. Dietary intake data were collected on a random subsample across all ages ($n = 9937$) by using a single 24-h recall administered via the automated 5-step multiple-pass method, which has been adapted to the Mexican context and found to better estimate energy intake than the traditional 24-h recall (32). For children aged between 2 and 13 y, the primary household meal preparer reported intake, with the

children providing confirmation of foods consumed while not in the presence of the primary meal preparer (i.e., while at school). Participants reported the type and amount of foods and beverages consumed over the past 24 h and detailed information about food characteristics, including place of consumption (home, restaurant, school), and method of preparation (i.e., raw, processed, packaged, frozen, etc.). Interviewers used tools to aid in portion-size estimation, including photos of commonly consumed foods, a food scale, measuring cup, and serving spoon. Grams or milliliters of foods/dishes/beverages consumed were imputed by age group, area and region of residence, and eating occasion when the weight or volume was not reported by the participant.

Whole foods were reported as consumed (i.e., banana, yogurt) and mixed dishes were reported as a single item and then disaggregated into component ingredients by using 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). The food groups used in this study were based on the food groups used in the Feeding Infants and Toddlers Study (33). Two trained Mexican dietary research specialists modified existing groups and created additional groups to reflect foods consumed by children in Mexico, such as the addition of tortillas (Supplemental Table 1). Our study used the most recent food-composition table, which was based on a combination of pre-existing Mexican food-composition tables (67% of foods) (32) and the food-composition tables from the USDA's Food and Nutrient Database for Dietary Studies (33% of foods) (34).

Participants were asked to report the eating occasion and name of the eating occasion in which they consumed each food or dish. Specifically, participants could report that an item was consumed at 1 of 4 customary mealtimes, including breakfast (first meal of the day), lunch (often the main meal, consumed between noon and midafternoon), dinner (evening meal), and *almuerzo*, which is a meal that occurs after breakfast (typically late morning or noon), or as a snack. Snacks were defined as any food or beverage contributing > 0 kcal that was consumed between the customary mealtimes, including the following: before-breakfast snack, morning snack, afternoon snack, and evening snack (after dinner). Eating occasions were coded as unique eating occasions if they occurred > 60 min after the most recent eating occasion. On the basis of the questionnaire design, participants could report up to 4 snacks for the morning and afternoon snacks, but only 1 snack before breakfast or after dinner. Water was not coded as a meal or snack, because water is essential for physiologic function and should be consumed ad libitum (35).

The International Obesity Task Force cutoffs were used to classify overweight and obesity using BMI by age and sex (36, 37). This method extrapolates to childhood the BMI (in kg/m^2) in young adulthood of ≥ 25 for overweight and ≥ 30 for obesity, thereby creating cutoffs at every age by sex.

Statistical analysis. Statistical analysis was conducted by using Stata, version 13 (Stata Corporation). First, we examined the differences in the percentage of consumers and mean per capita consumption of eating occasions by key demographic characteristics using chi-square tests and t tests, respectively, with significance defined at $P < 0.05$. We also descriptively examined per capita energy intake across eating occasions and total daily energy intake by age group, as well as by consumer. We then examined the top 5 food groups consumed at each eating occasion as well as their mean energy contribution to that eating occasion and to total daily energy intake. Finally, using multivariate linear regression, we examined the association between the consumption of key eating occasions [breakfast, *almuerzo* (or late-morning meal), morning/afternoon/evening snack], total snacks, and total eating occasions and total daily energy intake, adjusted for key sociodemographic factors, including age (continuous), sex, weight status (normal weight compared with overweight/obesity), urbanicity (rural compared with urban), and tertiles of socioeconomic status (SES; according to household assets). Analyses were stratified by age group (2–5 compared with 6–13 y) and conducted by using survey commands and adjusted to be nationally representative. For the multivariate analysis, we used margins commands to predict mean energy intake for each level of consumption status of each key eating occasion, adjusted for the aforementioned variables. Significance for multivariate analyses was defined at $P < 0.01$.

Results

Sociodemographic characteristics and associations with eating and snacking occasions. Our analytic sample comprised 5093 children, 47% of whom were girls. A total of 16% were overweight and 7% were obese. Most (61%) children lived in urban areas of Mexico.

Younger children had slightly more total eating occasions than did older children due to increased snacking (Table 1; $P < 0.05$), in particular in the afternoon and evening. On average, younger children consumed 3 meals and 1.6 snacks (resulting in 4.6 total eating occasions/d), whereas older children consumed 3 meals and 1.2 snacks (resulting in 4.2 total eating occasions/d).

We observed regional and socioeconomic variations in eating occasions. The percentage of consumers of *almuerzo* was higher in rural than in urban areas (55% compared with 40%) and in south and central Mexico (49% in both regions) compared with northern Mexico and Mexico City (40% and 32%, respectively) ($P < 0.05$). On the other hand, children in urban areas as well as in northern Mexico and Mexico City were more likely to consume snacks, including afternoon and evening snacks. Children from families with higher SES were also more likely to consume snacks than children from families in the lowest tertile of SES (75% compared with 64% for highest compared with lowest tertiles, respectively; $P < 0.05$). There were no significant differences in the number of eating occasions between overweight/obese children and normal-weight children ($P = 0.16$) or by sex ($P = 0.22$).

Mean energy intakes across eating and snacking occasions. The relative contribution of meals and snacks remained fairly consistent between 2- to 5-y-old children and 6- to 13-y-old

children (Figure 1), although older children had higher absolute energy intake at each meal and snack as well as higher total daily energy. Although *almuerzo* contributed only 11% and 13% of per capita daily energy for younger and older children, respectively, among those who consumed *almuerzo*, it contributed 25% and 28% of daily energy for younger and older children (Supplemental Table 2). Total snacks contributed 19% and 16% of per capita total daily energy for younger and older children, respectively, primarily in the form of morning snacks (8% of per capita daily energy) and afternoon snacks (8–9% of per capita daily energy). The per capita contribution of energy from evening snacks was small (1–2%), but among those who consumed evening snacks, it represented 12% of total daily energy intake for both age groups.

Top foods consumed across snacking occasions. For 2- to 5-y-old children, top sources of foods and beverages consumed as snacks were consistent across snacking occasions. Top snacks included fruit, candy, salty snacks, cookies, sweetened breads (i.e., bread or bakery products that have been sweetened, also known as “pan dulce”), and dairy (whole milk, yogurt, lactose-free milk, and fortified milk) (Table 2). The evening snack, in particular, comprised mostly milk-based beverages and some candy and sweetened breads. For 6- to 13-y-old children, top snack foods included fruit, salty snacks, candy, cookies, and sweetened breads. However, at morning snack, carbonated soda partially replaced whole milk as the caloric beverage of choice. For evening snacks, sweetened tea and coffee were the biggest contributors to energy intake, followed by fruit, salty snacks, whole milk, and candy.

For both age groups, *almuerzo* was characterized predominantly by sandwiches and other sandwich-type products and

TABLE 1 Sociodemographic associations with percentage of consumers for eating occasions and mean per capita number of eating occasions among children aged 2–13 y participating in the Mexican National Health and Nutrition Survey (ENSANUT), 2012¹

Characteristic	n	Consumers, %							Number of eating occasions per capita ³			
		Breakfast	<i>Almuerzo</i> ²	Lunch	Dinner	Any snack	Morning snack	Afternoon snack	Evening snack	Total meals	Total snacks	Total eating occasions
Age												
2–5 y (ref)	2039	86	44	92	82	75	48	55	16	3.0 ± 0.02	1.6 ± 0.05	4.6 ± 0.05
6–13 y	2992	83*	45	91	82	68*	41*	45*	8*	3.0 ± 0.02	1.2 ± 0.03*	4.2 ± 0.04*
Sex												
Male (ref)	2564	84	45	90	82	68	43	46	11	3.0 ± 0.02	1.3 ± 0.04	4.3 ± 0.04
Female	2467	84	44	92*	83	72	44	50	10	3.0 ± 0.02	1.3 ± 0.03	4.3 ± 0.04
Region												
South (ref)	1795	86	49	88	79	63	42	42	7	3.0 ± 0.03	1.2 ± 0.05	4.2 ± 0.05
Central	1847	81*	49	94*	82	69	42	48	10	3.1 ± 0.03	1.2 ± 0.04	4.3 ± 0.05
North	1148	79*	40*	91	87*	77*	46	56*	14*	3.0 ± 0.03	1.4 ± 0.04*	4.4 ± 0.04*
Mexico City	241	93*	32*	93*	82	78*	47	53*	14	3.0 ± 0.06	1.5 ± 0.10*	4.5 ± 0.12
Urbanicity												
Rural (ref)	1952	79	55	88	78	64	39	44	8	3.0 ± 0.02	1.2 ± 0.05	4.2 ± 0.05
Urban	3079	86*	40*	92*	84*	73*	45*	50*	11*	3.0 ± 0.02	1.3 ± 0.03*	4.4 ± 0.04*
Weight status												
Normal weight (ref)	3644	84	45	91	83	70	43	49	11	3.0 ± 0.02	1.3 ± 0.03	4.3 ± 0.04
Overweight/obese	1133	84	45	90	81	71	44	45	8	3.0 ± 0.03	1.2 ± 0.05	4.2 ± 0.05
Socioeconomic status												
Lowest tertile (ref)	1886	83	48	90	78	64	40	44	10	3.0 ± 0.02	1.2 ± 0.04	4.2 ± 0.05
Middle tertile	1785	83	43	90	83	71*	45	49*	11	3.0 ± 0.03	1.3 ± 0.04*	4.3 ± 0.05
Highest tertile	1360	87	42	93	86*	75*	46	52*	10	3.1 ± 0.03*	1.4 ± 0.05*	4.5 ± 0.06*

¹ n = 5093. *Different from referent group, $P < 0.05$ (chi-square test for percentage of consumers and t test for mean number of eating occasions). ENSANUT, Encuesta Nacional de Salud y Nutrición; ref, referent.

² *Almuerzo* is a late-morning meal in Mexico.

³ Values are means ± SEs.

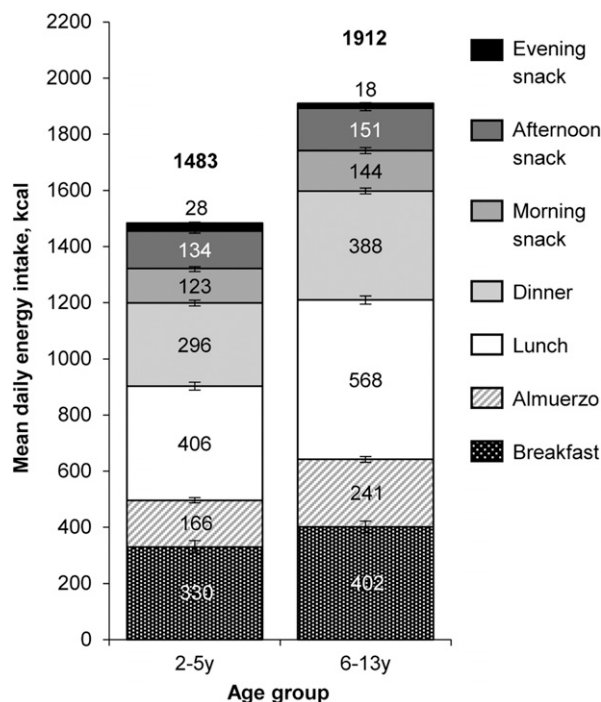


FIGURE 1 Mean energy intake by eating occasion for 2- to 5-y-olds ($n = 2039$) and 6- to 13-y-olds ($n = 2992$) in the 2012 ENSANUT (Encuesta Nacional de Salud y Nutrición).

tortillas (which together comprised 25% and 36% of mean per capita energy intake for 2- to 5- and 6- to 13-y-olds, respectively), followed by eggs and egg dishes, soups and stews (2–5 y), meat tacos (6–13 y), and legumes (both age groups). Food groups at lunch were similar, although soda was a top contributor of energy for older children but not younger children. At breakfast, whole milk, sweetened breads, and ready-to-eat cereal were top contributors for both age groups, whereas cookies and egg dishes were top contributors of energy for 2- to 5-y-olds and sandwiches and tortillas were top contributors for 6- to 13-y-olds.

Eating occasions with total daily energy intake. For older children, the consumption of *almuerzo* was associated with a 193-kcal/d increase in mean daily energy ($P < 0.05$), but this was not the case in younger children ($P = 0.97$) (Table 3). Morning, afternoon, and evening snacks were associated with increased daily energy for both younger and older children (+144, +197, and +140 kcal/d, respectively, for younger children and +240, +353, and +432 kcal/d, respectively, for older children; $P < 0.01$ for comparison of snack consumers with nonconsumers within age group). Each additional snack was associated with greater increases in mean daily energy for older children (+191–289 kcal/d per additional snack) relative to younger children (+102–130 kcal/d per additional snack) ($P < 0.01$ for each additional snack within age group). Likewise, each additional eating occasion was associated with greater increases in mean daily energy for older children (+323 kcal/d for each additional eating occasion) relative to younger children (+166–261 kcal/d for each additional eating occasion) ($P < 0.01$ for each additional eating occasion within age group).

Discussion

In this study, we found consistent eating patterns between 2- to 5- and 6- to 13-y-old children, primarily encompassing 3 meals/d,

with 75% and 68% of younger and older children consuming snacks, respectively, and a mean per capita snack consumption of 1.2–1.6 snacks/d. The mean number of snacks and percentage of consumers of snacks were slightly lower than recent estimates by Duffey et al. (5), who found that 79% of 2- to 5-y-old Mexican children were consuming snacks, with a per capita consumption of 2.0 snacks/d, and 76% of 6- to 11-y-olds were consuming snacks, with a per capita consumption of 1.5 snacks/d. This difference is primarily due to Duffey et al.'s classification of *almuerzo* as a snack, whereas we classified *almuerzo* as a meal.

Indeed, the classification of snacks compared with meals poses an important complexity for analyzing eating patterns, because definitions are sometimes but not always based on cultural and social norms about what constitutes a “main eating occasion” (i.e., meal) rather than an eating occasion that is typically smaller and occurs outside of these main eating occasions (i.e., snack) (38, 39). For example, in the Philippines, *merienda* is a commonly consumed fourth meal in the late afternoon, similar to British tea, in which people consume substantial foods such as sandwiches, spaghetti, or fast food (L Adair, University of North Carolina, Chapel Hill, personal communication, 2015) (40). In this study, *almuerzo* was consumed by ~45% of children and, among those who consumed it, contributed ~25% of daily calories, suggesting that this eating occasion is a major contributor to Mexican children's diets, especially among children living in rural areas or in the south. Moreover, those who consumed *almuerzo* consumed the same number of snacks but more total meals relative to nonconsumers (data not shown), suggesting that this meal is an additional eating occasion and not simply a snack replacement. On the other hand, foods consumed at *almuerzo* tended to be more similar to other meals (tortillas, soups, legumes, sandwiches) and less similar to snacks. Future work should examine how the consumption of this late-morning meal affects hunger and satiety and energy regulation across the day in order to understand whether this additional meal is a potential contributor to or potential strategy against excess intake and weight gain. It may also be important for US nutritional surveys such as the NHANES to consider adding a late-morning meal to the meal definitions, to understand how common this behavior is in the United States and to help in understanding its potential implications for weight gain.

Notably, younger and older children had similar eating patterns and percentage of contribution of energy intake across eating occasions, with 81% and 84% of energy coming from meals and 19% and 16% of energy from snacks for younger and older children, respectively. These results were somewhat surprising, because we would have expected some changes in eating frequency as children shift from preschool to elementary school. In addition, some work indicates that older children and adolescents snack more frequently, which is, in turn, associated with increased meal skipping (41). One possibility is that the 4-meal structure, coupled with the increased prevalence of snacking over time, has created a social norm in which eating frequently throughout the day is acceptable across ages. One question for future research is to better understand whether any shifts in eating occasions have occurred alongside other shifts in the eating environment, such as eating in front of the television (42), or shifts in where children are getting snacks (i.e., from school, vending machines, corner stores), because some work suggests that the source of food is linked to increased empty calories in kids (43). In consideration of mounting evidence that family meals

TABLE 2 Per capita percentage of energy contributed from the top 5 food groups by age group at each eating occasion among children aged 2–13 y participating in the Mexican National Health and Nutrition Survey (ENSANUT), 2012¹

Rank	Food groups	Contribution, %	
		To eating occasion	To total daily energy
2- to 5-y-olds			
Breakfast			
1	Whole milk	18.1 ± 1.18	4.3 ± 0.34
2	Sweetened breads	10.3 ± 1.17	3.0 ± 0.31
3	Eggs and egg dishes	9.0 ± 0.74	2.3 ± 0.23
4	Ready-to-eat cereal	8.6 ± 0.98	2.1 ± 0.24
5	Cookies	6.2 ± 0.69	1.7 ± 0.21
<i>Almuerzo</i>			
1	Sandwiches, tortas, filled rolls	13.3 ± 1.81	3.4 ± 0.45
2	Tortillas	11.7 ± 1.04	3.0 ± 0.26
3	Eggs and egg dishes	9.4 ± 1.03	2.1 ± 0.26
4	Soups and stews	5.9 ± 1.12	1.6 ± 0.45
5	Legumes	5.9 ± 0.85	1.5 ± 0.23
Lunch			
1	Tortillas	17.4 ± 0.79	4.8 ± 0.23
2	Soups and stews	11.9 ± 0.77	3.2 ± 0.26
3	Legumes	5.6 ± 0.47	1.6 ± 0.15
4	Poultry	5.2 ± 0.62	1.8 ± 0.29
5	Sandwiches, tortas, filled rolls	4.2 ± 0.71	1.5 ± 0.28
Dinner			
1	Whole milk	15.9 ± 1.04	3.4 ± 0.22
2	Sweetened breads	9.8 ± 1.06	2.7 ± 0.29
3	Ready-to-eat cereal	7.5 ± 0.98	1.4 ± 0.20
4	Sandwiches, tortas, filled rolls	7.2 ± 0.82	2.2 ± 0.29
5	Tortillas	4.9 ± 0.45	1.2 ± 0.13
Morning snack			
1	Fruit, fresh and frozen	18.7 ± 1.68	2.6 ± 0.35
2	Whole milk	13.8 ± 1.44	2.9 ± 0.41
3	Salty snacks	8.0 ± 1.03	1.4 ± 0.20
4	Candy	6.6 ± 1.33	0.5 ± 0.08
5	Baby yogurt	5.2 ± 0.82	0.9 ± 0.14
Afternoon snack			
1	Fruit, fresh and frozen	20.9 ± 1.75	2.2 ± 0.19
2	Candy	15.7 ± 1.50	1.6 ± 0.22
3	Salty snacks	12.3 ± 1.24	2.4 ± 0.24
4	Cookies	6.6 ± 0.98	1.5 ± 0.22
5	Sweetened breads	4.9 ± 0.98	1.4 ± 0.50
Evening snack			
1	Whole milk	46.6 ± 4.46	5.6 ± 0.71
2	Fortified milk	5.2 ± 1.65	0.5 ± 0.19
3	Sweetened breads	4.6 ± 1.53	1.2 ± 0.40
4	Water and milk-based <i>atoles</i>	3.9 ± 2.02	0.6 ± 0.36
5	Candy	3.8 ± 1.66	0.3 ± 0.12
6- to 13-y-olds			
Breakfast			
1	Whole milk	13.0 ± 0.93	2.7 ± 0.19
2	Sweetened breads	12.2 ± 0.91	3.3 ± 0.25
3	Tortillas	8.6 ± 0.56	2.9 ± 0.21
4	Sandwiches, tortas, filled rolls	7.6 ± 0.68	2.4 ± 0.24
5	Ready-to-eat cereal	7.6 ± 0.92	1.5 ± 0.17
<i>Almuerzo</i>			
1	Sandwiches, tortas, filled rolls	19.0 ± 1.35	5.1 ± 0.39
2	Tortillas	16.5 ± 1.12	5.2 ± 0.35

(Continued)

TABLE 2 Continued

Rank	Food groups	Contribution, %	
		To eating occasion	To total daily energy
3	Eggs and egg dishes	5.7 ± 0.63	1.4 ± 0.14
4	Meat tacos	5.5 ± 0.75	1.4 ± 0.22
5	Legumes	4.7 ± 0.62	1.4 ± 0.16
Lunch			
1	Tortillas	24.9 ± 0.83	8.3 ± 0.32
2	Soups and stews	7.8 ± 0.69	2.2 ± 0.18
3	Legumes	6.8 ± 0.55	2.2 ± 0.24
4	Sandwiches, tortas, filled rolls	4.7 ± 0.48	1.8 ± 0.20
5	Carbonated sodas	4.6 ± 0.33	1.5 ± 0.09
Dinner			
1	Sweetened breads	10.9 ± 0.92	2.9 ± 0.24
2	Tortillas	10.0 ± 0.69	2.9 ± 0.20
3	Whole milk	9.1 ± 0.70	1.8 ± 0.14
4	Sandwiches, tortas, filled rolls	7.0 ± 0.61	2.0 ± 0.19
5	Ready-to-eat cereal	6.1 ± 0.68	1.4 ± 0.16
Morning snack			
1	Fruit, fresh and frozen	18.7 ± 1.41	1.9 ± 0.23
2	Salty snacks	16.2 ± 1.50	3.2 ± 0.41
3	Candy	8.4 ± 1.19	0.5 ± 0.08
4	Sandwiches, tortas, filled rolls	7.7 ± 1.60	2.5 ± 0.87
5	Carbonated sodas	4.7 ± 0.94	0.5 ± 0.10
Afternoon snack			
1	Salty snacks	24.3 ± 1.62	4.8 ± 0.43
2	Fruit, fresh and frozen	16.9 ± 1.38	1.6 ± 0.16
3	Candy	13.4 ± 1.28	1.0 ± 0.10
4	Cookies	5.8 ± 0.80	1.5 ± 0.26
5	Sweetened breads	3.2 ± 0.60	0.7 ± 0.15
Evening snack			
1	Sweetened tea and coffee	12.0 ± 4.03	0.4 ± 0.12
2	Fruit, fresh and frozen	11.7 ± 3.4	0.9 ± 0.52
3	Salty snacks	10.4 ± 2.96	1.3 ± 0.32
4	Sweetened breads	10.0 ± 2.72	1.4 ± 0.42
5	Whole milk	8.6 ± 2.15	0.9 ± 0.22

¹ Values are means ± SEs, *n* = 5093. ENSANUT, Encuesta Nacional de Salud y Nutrición.

with appropriate parental modeling are linked to improved intake of fruit, vegetables, and key nutrients such as calcium and iron (44–46), this could be one potential area for future interventions.

One key difference between older and younger children is that younger children were twice as likely to consume an evening snack, which contributed ~12% of daily energy intake, on average, for those who consumed it. Although the consumption of evening snacks could be problematic for some segments of the population given the associations between night eating and increased intake of energy-dense and unhealthy foods, younger children's evening snacks mostly consisted of milk-based beverages, so this snacking occasion may not pose cause for concern in young children.

Among both younger and older children, however, consumption at any particular eating occasion or of additional snacks or number of total eating occasions was positively and significantly associated with increases in total energy. For older children, these results were consistent with a US study, which showed that among children ages 9–11 y each additional reported meal and

TABLE 3 Multivariate associations between eating occasions and total energy intake among children aged 2–13 y participating in the Mexican National Health and Nutrition Survey (ENSANUT), 2012¹

	2- to 5-y-olds		6- to 13-y-olds	
	<i>n</i>	Mean (99% CI)	<i>n</i>	Mean (99% CI)
Breakfast				
Nonconsumer (ref)	313	1646 (1371, 1922)	543	1606 (1448, 1764)
Consumer	1726	1855* (1631, 2079)	2449	1844* (1771, 1917)
Almuerzo				
Nonconsumer (ref)	1124	1838 (1603, 2074)	1554	1718 (1631, 1805)
Consumer	915	1840 (1607, 2073)	1438	1911* (1817, 2006)
Morning snack				
Nonconsumer (ref)	1023	1803 (1580, 2026)	1786	1706 (1626, 1786)
Consumer	1016	1947* (1717, 2186)	1206	1946* (1837, 2054)
Afternoon snack				
Nonconsumer (ref)	943	1754 (1536, 1972)	1629	1647 (1567, 1728)
Consumer	1096	1951* (1690, 2218)	1363	2000* (1900, 2100)
Evening snack				
Nonconsumer (ref)	1715	1858* (1635, 2082)	2774	1769 (1702, 1837)
Consumer	324	1999 (1738, 2259)	218	2201* (1897, 2505)
Total meals				
≤3 (ref)	1608	1770 (1530, 2010)	2362	1708 (1635, 1780)
≥4	431	1958* (1724, 2190)	630	2133* (2008, 2258)
Total snacks				
0 (ref)	500	1750 (1503, 1998)	986	1564 (1475, 1654)
1	582	1880 (1658, 2102)	1038	1779* (1674, 1884)
2	481	1992* (1744, 2239)	641	1970* (1839, 2101)
≥3	476	2094* (1807, 2381)	327	2259* (2033, 2485)
Total eating occasions				
≤3	495	1612 (1362, 1862)	938	1459 (1368, 1549)
4	537	1873* (1643, 2102)	989	1782* (1673, 1891)
≥5	1007	2039* (1803, 2275)	1065	2105* (1996, 2213)

¹ Values are predicted adjusted means (99% CIs) from linear regression models controlling for child age, weight status (normal, overweight/obesity), urbanicity, socioeconomic status, and sex; *n* = 5093. *Different from referent group, *P* < 0.01. ENSANUT, Encuesta Nacional de Salud y Nutrición; ref, referent.

snack was associated with an 18.5% and a 9.4% increase in total energy intake, respectively (8). However, for younger children, these results were slightly surprising, because previous US-based research has shown that preschool children self-regulate energy intake across the day (44), suggesting that additional eating occasions would not necessarily be associated with increases in total daily energy intake. More work, including laboratory-based studies, will be needed to understand how Mexican children compensate for additional snacks or eating occasions (as well as other potentially important dietary behaviors such as portion size or energy density), and how this changes as children age.

Notably, increases in daily energy by eating occasion were greater for older than for younger children. For example, a single snack per day was associated with only a 130-kcal, nonsignificant increase for younger children (*P* = 0.05), but with a 215-kcal increase for older children (*P* < 0.01), relative to non-snack consumers. This difference was exacerbated for top snack consumers: whereas eating ≥3 snacks/d was associated with a 344-kcal increase for younger children relative to non-snack consumers (*P* < 0.01), eating ≥3 snacks/d was associated with a 695-kcal increase for older children (*P* < 0.01). In addition, older children consumed fewer healthy snacks relative to younger children, because salty snacks were more commonly consumed and milk beverages were

replaced, at least in part, by sugar-sweetened beverages including soda, fruit drinks, and sweetened coffee.

The relatively greater increases in daily energy associated with eating occasions for older compared with younger children may be due to older children's overall greater energy intake, such that each additional eating occasion makes a bigger absolute difference in total daily energy for older kids. Sustained over time, if this energy intake is in excess of daily energy requirements, additional snacks could be a potentially major contributor to weight gain as children become adolescents, especially for those consuming less-healthy snacks. On the other hand, this cross-sectional work cannot rule out reverse causality: increased snacking could simply reflect the eating habits of those who eat more in general (38). In the present study, we did not find an association between eating occasion and overweight/obesity. This may be due in part to the cross-sectional design of this study. It is also possible that children who have higher physical activity have more eating occasions and higher total energy intake but lower weight, leading to a lack of an association between eating occasion and overweight and obesity. Due to data limitations on physical activity in this sample, we were unable to examine this. Longitudinal studies in Mexican children are needed to understand how meal and snacking frequency affects energy intake and weight status over time, including whether this association varies by the source and quality of foods consumed.

Foods consumed at snack time appear to be one potential key area for future intervention. Although fruit was the top snack for both older and younger children, other top snacks included salty snacks, candy, sweetened breads, and cookies. Among older children, nonnutritive caloric beverages, including soda and sweetened coffee and tea, were consumed at snacks, although, notably, we also did not capture water intake and so we cannot ascertain the proportion of beverage intake constituted by these beverages. Breakfast was also notably characterized by a number of high-carbohydrate foods such as sweetened breads, ready-to-eat cereal, and among younger children, cookies. These characteristics potentially are cause for concern, because previous work has shown that among Mexican children, a "sweet cereal" (i.e., bread and cookies) and corn dishes dietary pattern (characterized by a high intake of sugary cereals, tortillas, and maize products) and a Western pattern (a high intake of sweetened beverages, fried snacks, industrial snack cakes, and sugary cereals) were associated with overweight and obesity in Mexican children (47). More work will be needed to understand the association between breakfast, key foods consumed at breakfast, and diet quality.

In January 2014, Mexico instituted a 1 peso per liter sales tax on sugar-sweetened beverages together with an 8% ad valorem tax on nonessential foods with an energy density ≥275 kcal/100 g, which is meant to target foods high in added sugars or solid fats. One key question for future research will be how this tax changes the types of foods children consume across all eating occasions, especially snacks.

This work is not without limitations. This study was primarily cross-sectional and thus represents a description of eating occasions and energy intake, rather than seeking to establish a causal link between patterns of eating throughout the day and energy intake. Future studies should look longitudinally to understand how patterns of eating across the day affect total energy and subsequent changes in weight status.

In conclusion, this study describes patterns of snacking and meals among a nationally representative sample of Mexican

children ages 2–5 and 6–13 y old. The pattern of consumption of snacks and meals was consistent across age groups, and for both younger and older children additional eating occasions were linked to increases in total daily energy. Fruit and milk-based beverages were commonly consumed as snacks. However, less-nutrient-dense snacks, such as candy, cookies, sweetened breads, and salty snacks, which were commonly consumed in this sample, represent a key area for improving the diets of Mexican children.

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