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Supplement—The Dietary Intake and Eating Habits of the Mexican Population: Results from the National Health and Nutrition Survey 2012

Usual Intake of Added Sugars and Saturated Fats Is High while Dietary Fiber Is Low in the Mexican Population[1–4]

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Abstract

Background: The Mexican National Health and Nutrition Survey (ENSANUT) was carried out in 2012. Information from the survey is used to design and evaluate food and nutrition policies in Mexico.

Objective: The objective of this study was to estimate the usual intake of energy and macronutrients in the Mexican population by using the ENSANUT 2012.

Methods: Twenty-four-hour recall interviews were administered to a nationally representative subsample of 10,096 individuals aged ≥1 y from the ENSANUT 2012. Usual intake distributions and the prevalence of inadequate intakes were estimated by using the Iowa State University method. Student's *t* tests and tests on the equality of proportions were used to compare usual intakes and prevalence of inadequacy across socioeconomic status, area (rural or urban), and region of residence (North, Center, or South).

Results: Energy and macronutrient intakes and indicators of dietary adequacy are presented for children (ages 1–4 y and 5–11 y), adolescents (12–19 y), and adults (≥20 y). At the national level, the estimated mean fiber intake was below the Adequate Intake for all population subgroups, suggesting inadequacies. The estimated proportion with a usual added sugars intake of >10% of total energy intake was >64% in all age groups. The proportion with a usual saturated fat intake of >10% of total energy intake was estimated to be >78% in children, >66% in adolescents, and >50% in adults. Overall, fiber intake was lower and intakes of saturated fat and added sugars were higher in urban compared with rural areas, in the North compared with South regions, and among those with high compared with low socioeconomic status ($P < 0.05$).

Conclusions: Fiber intake is lower and added sugar and saturated fat intakes are higher than recommended for >50% of the Mexican population aged ≥1 y. These results highlight the importance of improving the diets of the overall population to reduce the risk of noncommunicable chronic diseases. *J Nutr* 2016;146(Suppl):1856S–65S.

Keywords: diet methodology, usual intake, energy, macronutrients, Mexican population

Introduction

Individual-level measurements of energy and nutrient consumption in population subgroups are useful to evaluate intake, assess the risk of malnutrition, and estimate usual intake distributions to compare population subgroups. This information can then be used to track progress toward achieving health and nutritional objectives, to develop dietary guidelines, to uncover possible associations between diet and health in the population, and to design food, nutrition, and public health programs and policies (1–4). In Mexico, earlier National Surveys carried out in 1999

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[4] Supplemental Figure 1 and Supplemental Tables 1–4 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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and 2006 have, for example, contributed to uncovering a growing polarization in food and nutrient intake among individuals from different socioeconomic strata and regions of the country (5–8). This has enabled policy makers to better target nutritional programs to address the needs of specific populations in whom nutritional deficiencies and excesses exist. An example of such programs is Oportunidades, recently renamed Prospera, which has nutrition as one of its components for improving human development and well-being among needy Mexicans (9).

One instrument to collect food intake at the individual level is the 24-h recall, which attempts to capture the quantity of all foods, beverages, and other components of the diet consumed during the previous 24 h. Even though the instrument measures daily intake of a sample of participants, of interest is the distribution of usual or habitual intakes of foods and nutrients in the population, the variance of which reflects only the variability in intakes between individuals. Repeated 24-h recall interviews on ≥2 nonconsecutive days in at least a subsample of respondents permits the estimation of intraindividual variance in intake, which, in turn, permits adjustment of the distribution of daily intakes by removing the contribution of intraindividual variance. When the 24-h recall interview is administered in a linear fashion (i.e., asking the participant about the type and amount of foods in the order that they were consumed), underreporting of energy and perhaps other nutrients is typically observed. This was a limitation of the intake data collected in the National Nutrition Survey from 1999 (5).

An alternative method to the traditional 24-h recall is the 24-h recall automated multiple-pass method (24HR)[7], developed by the USDA. This method is based on cognitive principles related to how individuals report daily food intake (3, 10, 11). To minimize underreporting, the 24HR approach was used in the National Health and Nutrition Survey (ENSANUT) 2012. This is the first time that this method has been used in national surveys in Mexico.

The objectives of this article are to present the distributions of usual intake of energy and macronutrients and to estimate the adequacy of intake relative to recommendations in a representative sample of the Mexican population, by age group and sex. An additional objective is to describe in some detail the dietary data collection methodology and analyses of ENSANUT 2012 used for the first time in Mexico.

Methods

Design and study population

The ENSANUT 2012 is a probabilistic national survey representative of the Mexican population at the national, regional, and state levels and for urban and rural areas in Mexico. The survey was carried out between October 2011 and May 2012 (12). Health and general nutrition information was obtained from 96,031 people from 50,528 randomly selected households. Detailed dietary information was collected with the 24HR from a random subsample (n = 10,886; ~11% of ENSANUT participants) representative of the national, regional, and urban/rural population. A second 24HR interview was conducted in a random subsample of ~9% of the 10,886 participants (n = 981) to estimate the day-to-day variance component in energy and macronutrient intake, as explained later in this article. The 10,886 respondents were separated into population subgroups, defined as follows: preschool-aged children (ages 1–4 y), school-aged children (ages 5–11 y), adolescents (ages 12–19 y), and adults (age ≥20 y). Because the full ENSANUT 2012 is not a self-weighting sample, a survey weight was calculated for each survey participant. The initial weights were computed by using the age and sex distribution in the 2010 Census of the Mexican population (13) as the reference, because several health conditions depend on these variables. The final weights account for the complex survey design as well as for survey nonresponse and were used throughout the analyses that are presented in this article (14). Therefore, the results we present below are generalizable to the noninstitutionalized Mexican population aged ≥1 y, who are not pregnant, lactating, or breastfeeding.

Persons aged ≥15 y were asked about their intakes. The person in charge of food preparation and distribution in the household was asked about ingredients and recipes of foods prepared at home and also provided information on the intakes of children <15 y old.

The first and second 24HR interviews were administered on a randomly selected day of the week in order to obtain measurements on both weekdays and weekend days. The repeated measurements were obtained on nonconsecutive days to avoid correlation in nutrient intake on consecutive days (15). The mean ± SD number of days between the first and second 24HR interviews was 2.4 ± 1.2 d.

Informed consent was obtained for each eligible person aged ≥18 y and from the father, mother, or guardian of participants <18 y old. Informed assent was collected in children and adolescents aged 5–17 y. The survey protocol was approved by the Ethics Committee of the National Institute of Public Health [Instituto Nacional de Salud Publica (INSP)].

Description of the 24HR

The 24HR developed by the USDA was adapted to the Mexican context. In addition, the method was complemented with information on portions of food consumed, characteristics of purchased foods (raw or processed, packaged or unpackaged, frozen or not frozen), and whether foods were prepared at home or bought in a food stand, supermarket, local restaurant, or restaurant chain.

Diet information was obtained via 5 iterative steps that complement each other to capture the food intake of the interviewees more accurately as follows:

1. Participants were asked to report all of the foods and beverages (including drinking water) consumed the previous day, from the moment when they woke up until they went to sleep. In this first pass, respondents were allowed to remember their intake in an unstructured manner, disregarding the order in which foods were consumed or time of consumption. In the case of persons with special working schedules, particularly those working at night (e.g., physicians, nurses, taxi drivers, guards) or infants, the reporting period started at midnight of the previous day and ended at midnight of the day when the 24HR interview information was collected. This first step produced a preliminary list of foods and beverages consumed by the participant.
2. In the second pass, the preliminary list was augmented by adding foods that are often overlooked. The interviewer went back to the beginning of the preliminary food list and helped the participant remember foods frequently omitted, by means of a predetermined food list.
3. The goal of the third pass was to augment the food list by the use of time cues. In this step, the interviewer revisited the food list in order to obtain the time when each food was consumed with the purpose of arranging them in chronologic order, which facilitates identifying the context (at home, at a table, watching television, driving, walking) in which each consumption occurred. This step allowed grouping foods by mealtime and helped to identify other foods forgotten in the previous steps.
4. Registering in detail of amounts and characteristics of foods consumed, as follows: *1*) if the food was prepared or consumed as a single food or if foods were combined in a dish or recipe; *2*) if the food was a dish for which the interviewee could describe the ingredients of the recipe or only name the dish or recipe; *3*) if a food or beverage was consumed; *4*) the characteristics of the foods, when they were prepared without mixing with other foods,

[7] Abbreviations used: AI, Adequate Intake; EER, estimated energy requirement; ENSANUT, National Health and Nutrition Survey; INSP, National Institute of Public Health (Instituto Nacional de Salud Publica); IOM, Institute of Medicine; 24HR, 24-h recall automated multiple-pass method.

or of the specific ingredients if they were part of a recipe; *5*) the amount of foods consumed as ingredients of a recipe or consumed alone, expressed in household measures or food weights; *6*) if the food weight reported was net or gross; *7*) food preparation method (raw; cooked: steamed, roasted, fried, grilled, or baked); *8*) total amount of the foods or dishes served; *9*) amounts of foods and dishes that were not consumed; *10*) form of processed foods purchased (frozen and/or packaged or bulk).

5. The fifth pass was a final review. In this step, a review of the final list was carried out to obtain additional information or details that might have been forgotten at each mealtime, or for correcting any specific information that had been improperly reported.

24HR software

The 24HR software (24-h recall multiple pass method, version 1.0, 2012; INSP) was developed and tested specifically by an INSP team for its use in the ENSANUT 2012.

Training for and quality control of the 24HR interview

The description of the training and field logistics has been published elsewhere (14), so we provide a brief summary below. To be eligible to participate in the survey as an interviewer, applicants had to meet 3 minimum requirements: *1*) have previous experience working with surveys, *2*) demonstrate competency expressing amounts in fractions, and *3*) have basic cooking knowledge. All interviewers participated in an extensive 4-wk training session in which they learned the correct implementation of each step of the questionnaire, including the appropriate interview technique, and other relevant techniques and procedures to collect dietary information. Interview staff were monitored throughout the training and fieldwork periods to ensure the quality of the information they were collecting.

For example, during fieldwork, a supervisor was in charge of a maximum of 4 interviewers. Supervisors reviewed and verified incomplete interviews and revisited a random sample of 20% of the completed interviews. If the supervisor detected errors or omissions in the collection of the 24HR interview, the interviewers had to repeat the interview.

Selection criteria

Exclusion criteria for the present analyses included the following: infants <1 y (n = 411), infants >1 y old with partial breastfeeding (n = 107), pregnant or nursing women (n = 154), and persons with implausible weight and/or height (n = 4). The eligible sample included 10,210 individuals of the total 10,886 with diet information.

Data editing and processing

In the first stage, the foods reported by a participant were reviewed and information including coding, quantity reported, recipe ingredients, and context in which the meal or feeding episode took place was scrutinized for consistency as described below. All inconsistencies were corrected if possible. In the second stage, energy and nutrient intakes were reviewed to identify implausible values. Each of the review stages was divided into 2 phases. The process is detailed below.

Stage 1. In this stage, inconsistencies due to incorrect coding of the food, quantities, recipe ingredients, and feeding context were corrected. The following comparisons about context were helpful to identify inconsistencies: *1*) consumption place and activity during food consumption; *2*) age, consumption place, and activity during food consumption; *3*) mealtime and consumption place; and *4*) mealtime and activity during food consumption. Food consumption data were examined to identify the correct coding for measurement units of foods. The consistency between foods and their measurement units was explored for specific foods.

The second step in the first stage of the data editing and processing included 2 systematic imputation processes. The first imputation process permitted filling in data gaps whenever *1*) the weight or the volume of the prepared food had not been reported by the participant, *2*) there was no information on amounts for the household measures, or *3*) the units reported for a specific food were incorrect (e.g., liters for meat), the mean consumption of the food in grams or milliliters, according to age group, area, region of residence, and mealtime was used instead of the incomplete or incorrect record. The second imputation step allowed us to address outliers and consisted in substituting mean consumption by mealtime, food group, and age group when the reported amount was >4 SDs from the mean. The reference distributions of food consumption were obtained by food type, food code, region, mealtime, area of residence (rural or urban), and age group. When participants provided incomplete recipes for a mixed dish, we instead used a standard recipe for that dish. After the first stage of the data editing and processing, energy and nutrient intakes were calculated by using the food-composition database compiled by the INSP (16).

Stage 2. In the first data editing and processing phase, the estimated energy requirement (EER) was calculated for each person and each interview day by using the equations for maintenance of body weight from the Institute of Medicine (IOM) (17). The EER is calculated by using weight, height, age, and physical activity information for each individual. Data collected in the National Nutrition Survey from 1999 were used to select appropriate physical activity factors by age group. We assumed low physical activity levels for preschool-aged children, schoolchildren, and males (adolescents and adults), whereas for females (adolescents and adults) we assumed a sedentary level (18). The IOM physical activity level values that corresponded to those assumptions are as follows: boys aged 3–18 y (nonobese and obese = 1.13 and 1.12, respectively), girls aged 3–18 y (nonobese and obese = 1.16 and 1.18, respectively), men aged ≥19 y (nonobese and obese = 1.11 and 1.12, respectively), and women aged ≥19 y (nonobese and obese = 1.0). Physical activity level values are not required to estimate EER in children aged <3 y (17). The ratio of daily energy intake to EER was calculated for each person and each day and transformed to the logarithmic scale to remove outliers below −3 SDs and above +3 SDs for each age group (19). After the first data editing and processing phase, 10,096 individuals were still included in the analytic sample.

In the second phase of data editing and processing, implausible, usually high, intakes of micronutrients were identified. Excessive micronutrient intakes were defined as those that exceeded 1.5 times the 99th percentile of the observed intake distribution of the nutrient in the corresponding sex and age group. Intakes above this upper limit were substituted by a random value generated from a uniform distribution in the interval with lower bound equal to the 95th percentile of observed intake and an upper bound equal to 1.5 times the 99th percentile.

Study variables

Dietary variables. We estimated usual intake distributions for total energy, protein, carbohydrates, fiber, and fat. In addition, intakes of complex and simple carbohydrates, added sugars, animal and plant protein, and polyunsaturated, monounsaturated, and saturated fat were analyzed. Added sugar, complex and simple carbohydrate, and animal and plant protein intakes were estimated for each ingredient in the recipe for mixed dishes. If the respondent did not know the ingredients or amounts used in a recipe, nutrient contents were estimated by using standard recipes. A carbohydrate was classified as complex when it contained >10% of fiber.

Sociodemographic variables. A large number of sociodemographic variables were captured by the ENSANUT 2012; here, we consider age in years, sex, region and area of residence, and socioeconomic status. We defined 3 geographic regions in Mexico: North, Center, and South. Locations with <2500 inhabitants were classified as rural, and those with ≥2500 inhabitants were classified as urban. A socioeconomic index was constructed by using factor analysis (where factor scores were estimated by using a principal components approach) applied to household characteristics and assets (20). The index was computed for each respondent, and respondents were then classified into 3 categories (low, medium, and high) by using tertiles of the distribution of the index as cutoff points.

Statistical analysis

Summaries of sociodemographic characteristics (sex, area and region of residence, and socioeconomic status) were obtained taking into account the design effect and sample weights. Calculations for summary statistics were carried out by using "survey" commands in Stata 12.1 (Stata Statistical Software, release 12.1; StataCorp). We estimated the usual intake distributions of each nutrient in the population subgroups of interest using the Iowa State University method (21), which is a commonly used and widely accepted method (22, 23), and implemented it using the PC-Side program version 1.0 (Iowa State University). The Iowa State University method has been discussed elsewhere (e.g., references 17, 21, and 22). Briefly, the Iowa State University method estimates distributions of usual nutrient intake by removing the effect of the day-to-day (intraperson) variability in intake from daily intakes. To do so, it uses information provided by ≥2 independent 24HR interviews obtained on at least a subsample of respondents. A good feature of the method is that it permits incorporation of the study design to generate nationally representative results. Using the estimated usual intake distributions and the DRIs for fiber, carbohydrates, protein, and fat, we assessed the prevalence of inadequate intakes in the population subgroups defined in ENSANUT (17). Student's t tests and tests on equality of proportions were used to compare attributes of usual intake distributions and the prevalence of inadequacy, respectively, across socioeconomic levels, areas, and regions. A significance level of 0.05 was used to declare differences to be significant. The Bonferroni correction was used to adjust for multiple comparisons (24).

Energy adequacy was assessed by comparing individual intake to the person's EER. The EER for each person was calculated by using the equations proposed by the IOM (17).

For total protein intake, we estimated the prevalence of inadequacy in each subpopulation as the proportion of persons with usual intake below the Estimated Average Requirement. For carbohydrates and total fat, we estimated the prevalence of inadequacy in each group as the proportion of persons with usual intakes outside of the corresponding Acceptable Macronutrient Distribution Range (17).

One challenge we encountered is that age groups for which the IOM-defined DRIs and the age groups in ENSANUT do not match. To use the IOM references, we rescaled intakes as needed (**Supplemental Figure 1**). Adequate Intake (AI), established by the IOM, was used to assess total fiber intake, except for men aged 14 to 50 y, for whom we adopted the reference value proposed by the World Cancer Research Foundation (25). Following WHO recommendations (26), we computed the prevalences of excessive added sugar and saturated fat intake as the proportion of persons in a group with >10% of energy consumption derived from those 2 dietary components.

Results

The main characteristics of the study population are shown in **Table 1**. Approximately half of the respondents were female, a high percentage lived in urban areas (73%), and the age distribution in the sample was similar to that in the entire ENSANUT 2012 sample and in the 2010 Census of the Mexican Population (the closest to 2012) (13). We observed a slight overrepresentation of adults and school-aged children and a slight underrepresentation of adolescents. Approximately half of the survey participants lived in the Center region, which is also consistent with the 2010 Census results. All results presented in this article were obtained by using individual-level survey weights.

In **Tables 2–5**, we present the means ± SEMs of the estimated usual intake distributions for total energy, protein, carbohydrate, fiber, and fat, as well as for added sugars and saturated fat. In addition, we also show mean energy intake in EER units and the prevalence of excessive consumption of added sugars and saturated fat in each population subgroup. Usual intakes of protein from different sources (animal and plant), carbohydrates (complex and simple), and fat (polyunsaturated and monounsaturated) are presented in **Supplemental Tables 1–4**. The prevalence of inadequate protein intake in population subgroups as well as the prevalence of inadequate total carbohydrate and fat intakes are presented in Supplemental Tables 1–4.

TABLE 1 Sociodemographic characteristics of the Mexican population[1]

	Unweighted, n	Weighted (in millions),[2] n	Weighted, %
Sex			
Male	4899	55.1	49.5
Female	5197	56.2	50.5
Age group			
Children (1–4 y)	2113	8.4	7.6
School-aged children (5–11 y)	2753	17.9	16.1
Adolescents (12–19 y)	2056	16.1	14.5
Adults (≥20 y)	3174	68.8	61.8
Area[3]			
Urban	6312	81.3	73.0
Rural	3784	30.0	27.0
Region			
North	2402	22.0	19.8
Center	4186	54.1	48.6
South	3508	35.2	31.6
Socioeconomic status[4]			
Low	3679	33.8	30.4
Medium	3544	35.7	32.0
High	2873	41.8	37.6
Total	10,096	111.3	100

[1] Data are from the National Health and Nutrition Survey (ENSANUT) 2012 (14).
[2] Survey commands (StataCorp) were used to account for survey design and weighting to generate nationally representative results.
[3] Locations with <2500 inhabitants were classified as rural; those with ≥2500 inhabitants were classified as urban.
[4] Tertiles were based on the distribution of a socioeconomic index constructed using factor analysis (ranges: low, −6.0 to −0.7; medium, −0.6 to 0.8; high, 0.9 to 4.7).

Children aged 1–4 y

The usual energy intake in children aged 1–4 y was higher in urban than in rural areas, in the North than in the Center and South, and among those with high and medium socioeconomic status than among those with low socioeconomic status ($P < 0.05$). The mean consumption of energy among preschoolers was 20% higher than required, according to the equations proposed by the IOM. The surplus of energy intake was higher in urban than in rural areas, in the North than in the Center and South, and among children with high compared with medium and low socioeconomic status ($P < 0.05$). The mean intake of fiber in children aged 1–4 y was below the AI, whereas the percentage with intakes of added sugars and saturated fat above the limit recommended by the WHO was >60%. Fiber intake was lower and excessive intake of added sugars and saturated fat was higher in urban than in rural areas, in the North than in the Center and South, and among children with low and medium compared with high socioeconomic status ($P < 0.05$) (Table 2).

School-aged children (ages 5–11 y)

Boys. For boys aged 5–11 y, mean energy intake was higher in the North and Center than in the South and among those with medium than among those with low and high socioeconomic status ($P < 0.05$). The usual intake of all nutrients, except for carbohydrates (total, complex, and simple), fiber, and plant protein, were lower among boys with low than with medium and high socioeconomic status ($P < 0.05$). Usual animal protein and saturated fat intakes were higher in boys living in urban areas than in rural areas, whereas usual fiber intake was higher in rural areas than in urban areas ($P < 0.05$; Table 3, Supplemental Table 2). The mean intake of energy in boys was

TABLE 2 Mean usual intakes of energy and other macronutrients, fiber as a percentage of the AI, and prevalence of inadequate or excessive intakes of sugar and saturated fat in preschool-aged children (1–4 y old)[1]

	National	Area		Region			Socioeconomic status[2]		
		Urban	Rural	North	Center	South	Low	Medium	High
Unweighted, *n*	2113	1296	817	491	879	743	791	784	538
Weighted (in millions),[3] *n*	8.4	6.1	2.4	1.7	4.0	2.7	2.7	3.0	2.7
Energy, kcal/d	1380 ± 9.5	1400 ± 11.8*	1330 ± 14.6	1530 ± 22.2[a]	1340 ± 13.1[b]	1340 ± 16.2[b]	1280 ± 14.3[b]	1400 ± 15.6[a]	1450 ± 18.9[a]
Intakes									
Total protein, g/d	48 ± 0.3	49 ± 0.4*	44 ± 0.5	52 ± 0.7[a]	48 ± 0.5[b]	45 ± 0.5[b]	43 ± 0.5[b]	48 ± 0.5[a,b]	51 ± 0.6[a]
Total carbohydrates, g/d	187 ± 1.4	186 ± 1.8	188 ± 2.1	204 ± 3.4[a]	182 ± 2[b]	183 ± 2.3[b]	182 ± 2.3[b]	185 ± 2.3[a,b]	193 ± 2.6[a]
Fiber, g/d	13 ± 0.2	13 ± 0.2*	14 ± 0.3	14 ± 0.4	13 ± 0.2	14 ± 0.3	13 ± 0.3	13 ± 0.3	13 ± 0.3
Added sugars, g/d	40 ± 0.5	41 ± 0.6*	36 ± 0.8	46 ± 1.1[a]	39 ± 0.7[b]	38 ± 0.7[b]	36 ± 0.6[c]	40 ± 0.8[b]	43 ± 0.9[a]
Total fat, g/d	49 ± 0.4	50 ± 0.5*	47 ± 0.7	57 ± 0.8[a]	50 ± 0.6[b]	50 ± 0.7[b]	45 ± 0.5[c]	54 ± 0.7[b]	56 ± 0.8[a]
Saturated fat, g/d	20 ± 0.2	21 ± 0.2*	19 ± 0.2	23 ± 0.3[a]	21 ± 0.2[b]	21 ± 0.3[b]	18 ± 0.2[c]	23 ± 0.3[b]	24 ± 0.3[a]
Energy, % of EER	120 ± 0.8	121 ± 1	117 ± 1.2	131 ± 1.8[a]	117 ± 1.2[b]	117 ± 1.3[b]	115 ± 1.3[b]	119 ± 1.3[b]	126 ± 1.5[a]
Lower fiber intake[4,5] (less than the AI), %	87 ± 2.5	89 ± 3*	82 ± 4.8	84 ± 5	89 ± 3.6	87 ± 4.4	85 ± 3.9	88 ± 4.6	88 ± 5.1
High intake[4,6] (more than the WHO recommendation), %									
Added sugars	60 ± 2.3	62 ± 3.3*	54 ± 2.4	66 ± 12.2	63 ± 6.3	65 ± 6.2	60 ± 5.5[b]	65 ± 7.8[b]	69 ± 13.5[a]
Saturated fat	92 ± 8.9	97 ± 8.4*	76 ± 11.9	90 ± 19[a]	83 ± 15.9[b]	87 ± 16.9[a,b]	77 ± 11.4[c]	85 ± 15.8[b]	93 ± 24.3[a]

[1] Values are means or mean percentages ± SEMs unless otherwise indicated. Data are from the National Health and Nutrition Survey (ENSANUT) 2012 (14). Multiple comparisons with the use of Student's *t* or proportion tests were conducted accordingly with the use of Bonferroni adjustment. Labeled means in a row without a common superscript letter differ between regions of residence and between tertiles of socioeconomic status, $P < 0.05$. *Different from rural, $P < 0.05$. AI, Adequate Intake; EER, estimated energy requirement.

[2] Tertiles are based on the distribution of a socioeconomic index constructed using factor analysis (ranges: low, −6.0 to −0.7; medium, −0.6 to 0.8; high, 0.9 to 4.7).

[3] Survey commands (StataCorp) were used to account for survey design and weighting to generate nationally representative results.

[4] Values are percentages ± SEEs.

[5] AI as established by the Institute of Medicine (17).

[6] An excessive intake of added sugars and saturated fat was defined as a usual intake >10% of the total energy intake, according to WHO recommendations (26).

10% higher than the calories they required; the difference between intake and requirement was lower in urban than in rural areas and in those with high and medium than in those with low socioeconomic status ($P < 0.05$). The mean fiber intake in school-aged boys was below the AI at the national level. Almost 60% (58% ± 2.4%) of school-aged boys consumed an excess of added sugars and 79% ± 7.7% had intakes of saturated fat above the recommendations. The percentage of boys with excessive intakes of added sugars and saturated fat was higher in urban than in rural areas, in the North than in the Center and South regions, and among those with high and medium than among those with low socioeconomic status ($P < 0.05$) (Table 3).

Girls. The findings for school-aged girls were very similar to those for school-aged boys. Energy intake by area was similar to that of boys and preschoolers. Energy intake was higher among girls with high than among those with medium and low socioeconomic status ($P < 0.05$). For the other nutrients, the differences between areas, regions, and socioeconomic strata mirrored those observed for boys in the same age group. As for boys, mean fiber intake among girls was below the AI in all regions, areas, and socioeconomic tertiles; and the percentage of girls with added sugar and saturated fat intakes above the recommended level was high (>65%) (Table 3, Supplemental Table 2).

Adolescents (ages 12–19 y)

Males. As was the case for school-aged children, adolescent males living in the North had higher energy intakes than adolescent males in the Center or South ($P < 0.05$). The mean energy intake of adolescent males was ∼95% of the EER; therefore, on average, adolescent males consumed just below the requirement. As in all other population subgroups, mean fiber intake was below the AI, which suggests that the prevalence of inadequate fiber intake is high. The percentages of males with added sugar and saturated fat intakes above the recommended limits were 71% ± 7.7% and 67% ± 2.5%, respectively. The percentage of adolescent males with intakes of added sugars and saturated fat above the recommended limit was higher in urban than in rural areas and in the North than in the South ($P < 0.05$) (Table 4).

Females. The usual mean energy intake of adolescent females was higher in urban than in rural areas and in those with medium than in those with low or high socioeconomic status ($P < 0.05$). Unlike adolescent males, adolescent females had a mean energy intake that was slightly higher (7%), on average, than the mean EER. The mean fiber intake in adolescent females was below the AI; therefore, for this group, it is not possible to conclude that the intake of fiber is adequate. The percentages of adolescent females with added sugar and saturated fat intakes above the recommended limit were 85% ± 14.7% and 82% ± 15.7%, respectively. Differences in the percentage of adolescent females with an excessive intake of added sugars and saturated fat across areas and regions were similar to those observed in adolescent males (Table 4).

Adults (age ≥20 y)

Men. For men, the differences in the usual intakes of energy and macronutrients across areas, regions, and socioeconomic strata were similar to those we have already described for preschoolers, school-aged children, and adolescents. The mean energy intake in men was ∼90% of the mean requirement, suggesting that men in this age group expend more energy than they consume, on average. The mismatch between consumption and expenditure was lower in the South region of Mexico than in the North and Center regions and among men with medium

TABLE 3 Mean usual intakes of energy and other macronutrients, fiber as a percentage of the AI, and prevalence of inadequate or excessive intakes of sugar and saturated fat in school-aged children (5–11 y old)[1]

		Area		Region			Socioeconomic status[2]		
	National	Urban	Rural	North	Center	South	Low	Medium	High
Boys									
Unweighted, *n*	1405	856	549	322	547	536	551	472	382
Weighted (in millions),[3] *n*	9.1	6.3	2.8	1.7	4.2	3.2	3.2	3.0	2.8
Energy, kcal/d	1910 ± 13.1	1910 ± 12.9	1910 ± 27.1	1960 ± 29.5[a]	1940 ± 21.6[a]	1830 ± 18.5[b]	1870 ± 20.5[b]	1980 ± 23.2[a]	1870 ± 23.3[b]
Intakes									
Total protein, g/d	63 ± 0.4	64 ± 0.5	61 ± 1	64 ± 0.9[a]	65 ± 0.6[a]	60 ± 0.5[b]	61 ± 0.6[b]	65 ± 0.7[a]	63 ± 0.7[a]
Total carbohydrates, g/d	259 ± 1.8	252 ± 2.6*	273 ± 3	254 ± 4.1	259 ± 3	260 ± 2.8	271 ± 3.1[a]	255 ± 3[b]	248 ± 3.4[b]
Fiber, g/d	21 ± 0.2	19 ± 0.2*	24 ± 0.4	18 ± 0.4[b]	21 ± 0.3[a]	22 ± 0.3[a]	24 ± 0.4[a]	19 ± 0.3[b]	19 ± 0.3[b]
Added sugars, g/d	55 ± 0.9	57 ± 1.2	51 ± 1.1	65 ± 2.1[a]	53 ± 1.3[b]	53 ± 1.4[b]	49 ± 1.3[c]	55 ± 1.5[b]	61 ± 1.7[a]
Total fat, g/d	68 ± 0.6	70 ± 0.8	69 ± 1.3	79 ± 1.3[a]	76 ± 1[a]	65 ± 0.8[b]	65 ± 0.9[c]	81 ± 1.1[a]	72 ± 1[b]
Saturated fat, g/d	26 ± 0.2	27 ± 0.2*	24 ± 0.5	30 ± 0.5[a]	29 ± 0.4[a,b]	24 ± 0.3[b]	23 ± 0.4[c]	31 ± 0.4[a]	29 ± 0.4[b]
Energy, % of EER	110 ± 0.7	108 ± 0.8*	114 ± 1.5	110 ± 1.6	109 ± 1.2	108 ± 1.1	112 ± 1.2[a]	111 ± 1.2[a]	103 ± 1.4[b]
Lower fiber intake[4,5] (less than the AI), %	85 ± 7.9	90 ± 9.1*	71 ± 9.1	90 ± 15.9[a]	86 ± 15.5[b]	82 ± 10.5[b]	70 ± 8.6[b]	91 ± 15[a]	9.3 ± 10.7[a]
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	58 ± 2.4	62 ± 3.8*	51 ± 3.6	67 ± 8.1[a]	54 ± 3.2[b]	55 ± 2.8[b]	47 ± 2.7[b]	54 ± 3.2[a]	69 ± 6.6[a]
Saturated fat	79 ± 7.7	88 ± 11*	53 ± 3.3	86 ± 19.4[a]	66 ± 9.4[b]	69 ± 6.3[b]	58 ± 4.7[b]	70 ± 10.2[a]	84 ± 10.5[a]
Girls									
Unweighted, *n*	1348	836	512	280	593	475	502	492	354
Weighted (in millions),[3] *n*	8.9	6.4	2.4	1.5	4.3	3.0	3.1	3.2	2.5
Energy, kcal/d	1770 ± 13.1	1800 ± 15.2*	1694 ± 22	1800 ± 31.5	1770 ± 18.5	1750 ± 22.1	1720 ± 22.6[b]	1760 ± 19.2[b]	1846.8 ± 26.6[a]
Intakes									
Total protein, g/d	60 ± 0.5	62 ± 0.5*	55 ± 0.8	59 ± 1.1	61 ± 0.8[d]	58 ± 0.8	57 ± 0.8[b]	59 ± 0.7[b]	63 ± 1[a]
Total carbohydrates, g/d	241 ± 1.3	241 ± 1.9	241 ± 2.7	241 ± 3.2	239 ± 1.8	243 ± 2.3	243 ± 2.3	239 ± 2.1	241 ± 2.6
Fiber, g/d	20 ± 0.2	19 ± 0.2*	21 ± 0.2	17 ± 0.4[c]	19 ± 0.3[b]	20 ± 0.3[a]	21 ± 0.3[a]	19 ± 0.3[b]	18 ± 0.4[b]
Added sugars, g/d	52 ± 0.5	55 ± 0.7*	44 ± 0.8	58 ± 1.4[a]	55 ± 0.9[a]	45 ± 0.9[b]	43 ± 0.8[b]	53 ± 0.9[a]	62 ± 1.3[a]
Total fat, g/d	64 ± 0.7	66 ± 0.8*	60 ± 1.2	71 ± 1.7[a]	67 ± 1[b]	64 ± 1.2[b]	60 ± 1.2[c]	67 ± 1.1[b]	74 ± 1.5[a]
Saturated fat, g/d	25 ± 0.3	27 ± 0.2*	21 ± 0.5	28 ± 0.6[a]	27 ± 0.4[a]	24 ± 0.4[b]	23 ± 0.4[c]	26 ± 0.4[b]	30 ± 0.5[a]
Energy, % of EER	110 ± 0.8	110 ± 1	107 ± 1.4	111 ± 1.8	109 ± 1.1	111 ± 1.3	110 ± 1.4	19 ± 0.3	111 ± 1.5
Lower fiber intake[4,5] (less than the AI), %	83 ± 7.8	86 ± 9.5*	80 ± 22.7	89 ± 16.8[a]	84 ± 8.6[a]	80 ± 16.5[b]	75 ± 8.6[b]	88 ± 17.6[a]	89 ± 19.6[a]
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	66 ± 5.7	74 ± 12*	51 ± 3.5	75 ± 15.8[a]	71 ± 12.6[a]	52 ± 3.4[b]	47 ± 3.7[c]	69 ± 9.4[b]	79 ± 13.4[a]
Saturated fat	85 ± 12	90 ± 12.2*	50 ± 3.2	92 ± 21.6[a]	85 ± 22.1[b]	64 ± 8.4[c]	63 ± 10.7[c]	82 ± 18[b]	92 ± 14.4[a]

[1] Values are means or mean percentages ± SEMs unless otherwise indicated. Data are from the National Health and Nutrition Survey (ENSANUT) 2012 (14). Multiple comparisons with the use of Student's *t* or proportion tests were conducted accordingly with the use of Bonferroni adjustment. Labeled means in a row without a common superscript letter differ between regions of residence and between tertiles of socioeconomic status, $P < 0.05$. *Different from rural, $P < 0.05$. AI, Adequate Intake; EER, estimated energy requirement.

[2] Tertiles are based on the distribution of a socioeconomic index constructed using factor analysis (ranges: low, −5.7 to −0.7; medium, −0.6 to 0.8; high, 0.9 to 3.9).

[3] Survey commands (StataCorp) were used to account for survey design and weighting to generate nationally representative results.

[4] Values are percentages ± SEEs.

[5] AI as established by the Institute of Medicine (17).

[6] An excessive intake of added sugars and saturated fat was defined as a usual intake >10% of the total energy intake, according to WHO recommendations (26).

compared with low and high socioeconomic status ($P < 0.05$). As in all other groups, mean fiber intake was below the AI for fiber, whereas the percentages of men with usual intakes of added sugars and saturated fat exceeding recommendations were 64% ± 2.9% and 54% ± 2.6%, respectively. The prevalence of excessive added sugar and saturated fat consumption was higher in urban than in rural areas, in the North than in the South, and among those with high than among those with low socioeconomic status ($P < 0.05$) (Table 5).

Women. The differences in usual intakes of energy and macronutrients by area, region, and socioeconomic status were similar to those already described for all age and sex groups. The mean energy intake in women was almost identical to the mean energy requirement in the group. Energy intake was higher in urban than in rural areas and among women with high than among those with medium and low socioeconomic status ($P < 0.05$). The mean usual fiber intake was below the AI, and the prevalence of excessive intake of added sugars and saturated fat was similar to that in men (Table 5).

Discussion

Results of the analyses of macronutrient intake by the Mexican population indicate that >50% of individuals in all population subgroups have excessive intakes of added sugars and saturated fats and are also likely to have inadequate intakes of fiber relative to WHO and World Cancer Research Foundation recommendations. These results are alarming, because high intakes of added sugars and saturated fat and low intakes of fiber are

TABLE 4 Mean usual intakes of energy and other macronutrients, fiber as a percentage of the AI, and prevalence of inadequate or excessive intakes of sugar and saturated fat in adolescents (12–19 y old)[1]

	National	Area		Region			Socioeconomic status[2]		
		Urban	Rural	North	Center	South	Low	Medium	High
Males									
Unweighted, *n*	1025	655	370	252	441	332	333	357	335
Weighted (in millions),[3] *n*	8.4	6.0	2.4	1.6	4.2	2.6	2.3	2.7	3.3
Energy, kcal/d	2360 ± 22	2350 ± 25	2400 ± 40.8	2570 ± 49.9[a]	2310 ± 33.3[b]	2300 ± 34[b]	2300 ± 37.4[b]	2430 ± 37[a]	2330 ± 37.2[a,b]
Intakes									
Total protein, g/d	78 ± 0.9	77 ± 1.2*	81 ± 1.5	83 ± 2.3[a]	75 ± 1.3[b]	79 ± 1.4[a,b]	78 ± 1.6[a,b]	81 ± 1.7[a]	77 ± 1.3[b]
Total carbohydrates, g/d	312 ± 3	306 ± 3.7*	326 ± 4.8	323 ± 6.7[a]	301 ± 4.4[b]	321 ± 5.1[a]	324 ± 5.5[a]	323 ± 4.6[a]	293 ± 5.1[b]
Fiber, g/d	24 ± 0.3	22 ± 0.3*	28 ± 0.6	21 ± 0.5[c]	22 ± 0.4[b]	29 ± 0.5[a]	28 ± 0.6[a]	26 ± 0.5[b]	20 ± 0.4[c]
Added sugars, g/d	72 ± 1	73 ± 1.2*	69 ± 1.8	83 ± 2.4[a]	69 ± 1.4[b]	70 ± 1.7[b]	62 ± 1.5[b]	77 ± 1.8[a]	74 ± 1.8[a]
Total fat, g/d	84 ± 1.1	87 ± 1.3	83 ± 1.8	103 ± 2.5[a]	89 ± 1.6[b]	82 ± 1.7[c]	81 ± 2[c]	90 ± 1.8[b]	96 ± 1.9[a]
Saturated fat, g/d	31 ± 0.5	33 ± 0.6*	29 ± 0.7	40 ± 1.1[a]	34 ± 0.7[b]	28 ± 0.7[c]	28 ± 0.8[c]	33 ± 0.7[b]	38 ± 0.8[a]
Energy, % of EER	95 ± 1	93 ± 1.1*	100 ± 1.8	101 ± 2.3[a]	91 ± 1.4[b]	95 ± 1.6[b]	95 ± 1.7[a]	99 ± 1.8[a]	91 ± 1.7[b]
Lower fiber intake[4,5] (less than the AI), %	82 ± 6.2	91 ± 33.6*	66 ± 3.7	91 ± 10.3[a]	86 ± 28.1[a]	67 ± 5.7[b]	67 ± 8.5[b]	77 ± 7.3[a]	93 ± 6.6[a]
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	71 ± 7.7	77 ± 16.5*	61 ± 5.9	76 ± 16.6[a]	68 ± 11.5[b]	66 ± 9[b]	59 ± 7.4[b]	74 ± 10.1[a]	72 ± 17.8[a]
Saturated fat	67 ± 2.5	78 ± 6.5*	45 ± 2.6	74 ± 8.2[a]	69 ± 5.5[a]	66 ± 5.5[b]	60 ± 3.6	73 ± 5.5	73 ± 12.7
Females									
Unweighted, *n*	1031	654	377	269	432	330	321	374	336
Weighted (in millions),[3] *n*	7.7	5.5	2.3	1.6	3.7	2.5	2.2	2.4	3.1
Energy, kcal/d	1900 ± 16.4	1870 ± 19.9*	1950 ± 22.7	1940 ± 35.7	1890 ± 24.5	1880 ± 30.4	1900 ± 30.5[b]	1990 ± 29.8[a]	1800 ± 27.2[c]
Intakes									
Total protein, g/d	61 ± 0.6	60 ± 0.7*	67 ± 1.1	59 ± 1.3	61 ± 0.9	59 ± 0.9	62 ± 1.1[a]	61 ± 0.9[a]	58 ± 1[b]
Total carbohydrates, g/d	260 ± 1.6	249 ± 1.8*	285 ± 2.8	254 ± 3.2[b]	256 ± 2.5[b]	267 ± 3[a]	269 ± 2.9[a]	274 ± 3[a]	240 ± 2.5[b]
Fiber, g/d	21 ± 0.2	19 ± 0.2*	26 ± 0.5	18 ± 0.4[c]	21 ± 0.4[b]	23 ± 0.4[a]	24 ± 0.4[a]	22 ± 0.4[a]	18 ± 0.3[b]
Added sugars, g/d	64 ± 0.6	68 ± 0.8*	53 ± 1.1	74 ± 2[a]	64 ± 1.3[b]	58 ± 1.5[c]	52 ± 1.4[b]	67 ± 1.3[a,b]	70 ± 1.7[a]
Total fat, g/d	68 ± 0.9	69 ± 1.1	69 ± 1.4	80 ± 2[a]	72 ± 1.2[b]	67 ± 1.6[c]	69 ± 1.6[b]	76 ± 1.5[a]	71 ± 1.4[b]
Saturated fat, g/d	25 ± 0.3	27 ± 0.4a	25 ± 0.4	30 ± 0.8[a]	28 ± 0.5[a]	24 ± 0.6[b]	23 ± 0.6[b]	29 ± 0.6[a]	28 ± 0.6[a]
Energy, % of EER	107 ± 0.8	103 ± 0.8*	116 ± 1.8	106 ± 1.6[a,b]	105 ± 1.2[b]	110 ± 1.5[a]	112 ± 1.4[a]	112 ± 1.5[a]	97 ± 1.2[b]
Lower fiber intake[4,5] (less than the AI), %	77 ± 7.9	87 ± 13.1*	54 ± 3.3	88 ± 67.6[a]	77 ± 15.5[b]	90 ± 8.6[a]	64 ± 10.9[c]	75 ± 15.3[b]	89 ± 20.2[a]
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	85 ± 14.7	89 ± 15.6*	69 ± 31.9	87 ± 12.9[a]	79 ± 17.7[b]	71 ± 12.9[c]	60 ± 8.5[b]	81 ± 13.7[a,b]	86 ± 15.5[a]
Saturated fat	82 ± 15.7	81 ± 9.2*	37 ± 7.4	97 ± 14.1[a]	94 ± 29.3[a]	84 ± 23.8[b]	74 ± 24.2[b]	95 ± 30.9[a,b]	98 ± 13.4[a]

[1] Values are means or mean percentages ± SEMs unless otherwise indicated. Data are from the National Health and Nutrition Survey (ENSANUT) 2012 (14). Multiple comparisons with the use of Student's *t* or proportion tests were conducted accordingly with the use of Bonferroni adjustment. Labeled means in a row without a common superscript letter differ between regions of residence and between tertiles of socioeconomic status, $P < 0.05$. *Different from rural, $P < 0.05$. AI, Adequate Intake; EER, Estimated Energy Requirement.

[2] Tertiles are based on the distribution of a socioeconomic index constructed using factor analysis (ranges: low, −5.7 to −0.7; medium, −0.6 to 0.8; high, 0.9 to 3.9).

[3] Survey commands (StataCorp) were used to account for survey design and weighting to generate nationally representative results.

[4] Values are percentages ± SEEs.

[5] AI as established by the Institute of Medicine (17).

[6] An excessive intake of added sugars and saturated fat was defined as usual intake >10% of the total energy intake, according to WHO recommendations (26).

risk factors for obesity and for a number of noncommunicable chronic diseases (27–29). Results derived from randomized clinical trials and epidemiologic studies showed that individuals who consume higher amounts of added sugars, especially sugar-sweetened beverages, have a higher risk of obesity (30–32), type 2 diabetes (30, 33, 34), dyslipidemias (35, 36), hypertension (37, 38), and cardiovascular diseases (34, 36). Likewise, findings derived from randomized trials suggest a small but potentially important reduction in cardiovascular disease when saturated fat intake is reduced (39), whereas epidemiologic and clinical studies also showed that dietary fiber is inversely related to obesity (40, 41), type 2 diabetes (42, 43), and cancer and cardiovascular disease (44, 45). The fact that inadequate intakes of these nutrients occur in all age groups, including preschool- and school-aged children and adolescents, indicates early exposure to these risk factors for obesity and noncommunicable chronic diseases. We observed higher usual intakes of added sugars and saturated fat above recommendations in individuals living in urban compared with rural areas, in the North compared with the South region of Mexico, and in among those with high compared with low socioeconomic status. These trends can be explained in part by differences in dietary patterns and in the type of food consumed. The contribution to total energy intake of high saturated fat or added sugar products (i.e., savory snacks, desserts, confectionery, cookies, cakes, sweet bread, and caloric sweeteners) is higher in those with high socioeconomic status than in the other tertiles. Similarly, the contribution of meat and animal products as well as of sugar-sweetened beverages is higher in the North relative to other regions and in urban compared with rural areas (46).

TABLE 5 Mean usual intakes of energy and other macronutrients, fiber as a percent of the AI, and prevalence of inadequate or excessive intakes of sugar and saturated fat in adults (≥20 y old)[1]

		Area		Region			Socioeconomic status[2]		
	National	Urban	Rural	North	Center	South	Low	Medium	High
Men									
Unweighted, *n*	1375	853	522	377	552	446	525	456	394
Weighted (in millions),[3] *n*	33.4	24.3	9.1	7.0	16.2	10.1	10.6	10.4	12.5
Energy, kcal/d	2030 ± 14.4	2310 ± 19.1*	2180 ± 26	2360 ± 29.9^{a}	2220 ± 22.3^{b}	2290 ± 22.4^{a}	2200 ± 23.2^{b}	2340 ± 24.8^{a}	2270 ± 26.1^{a,b}
Intakes									
Total protein, g/d	75 ± 0.5	75 ± 0.7	75 ± 1.1	76 ± 1	74 ± 0.9	76 ± 0.9	74 ± 0.9	77 ± 0.9g	74 ± 1
Total carbohydrates, g/d	303 ± 1.7	305 ± 2.4*	316 ± 4	297 ± 3.3^{b}	299 ± 2.6^{b}	328 ± 3.1^{a}	317 ± 3^{a}	312 ± 3^{a}	297 ± 3^{b}
Fiber, g/d	27 ± 0.3	25 ± 0.2*	31 ± 0.4	23 ± 0.5^{c}	26 ± 0.4^{b}	31 ± 0.5^{a}	31 ± 0.5^{a}	27 ± 0.5^{b}	23 ± 0.4^{c}
Added sugars, g/d	69 ± 0.9	74 ± 1.3*	54 ± 1.1	73 ± 2^{a}	70 ± 1.3^{b}	64 ± 1.7^{c}	60 ± 1.6^{b}	70 ± 1.8^{a}	76 ± 1.9^{a}
Total fat, g/d	68 ± 0.5	78 ± 1*	72 ± 0.9	89 ± 1.1^{a}	82 ± 0.9^{b}	76 ± 0.8^{c}	70 ± 0.8^{b}	87 ± 0.9^{a}	87 ± 1^{a}
Saturated fat, g/d	27 ± 0.2	29 ± 0.3*	24 ± 0.2	33 ± 0.5^{a}	30 ± 0.4^{b}	26 ± 0.4^{c}	23 ± 0.3^{b}	32 ± 0.5^{a}	32 ± 0.4^{a}
Energy, % of EER	90 ± 0.5	91 ± 0.7	91 ± 1.1	91 ± 1.1^{b}	88 ± 0.8^{b}	95 ± 1.6^{a}	90 ± 0.9^{a,b}	93 ± 0.9^{a}	89 ± 1^{b}
Lower fiber intake[4,5] (less than the AI), %	65 ± 5.7	82 ± 16.9*	53 ± 5.9	79 ± 13.5^{a}	70 ± 17.5^{b}	67 ± 5.7^{c}	46 ± 4^{c}	66 ± 8^{b}	78 ± 20.2^{a}
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	64 ± 2.9	72 ± 5.2*	47 ± 3.7	67 ± 5.6^{a}	68 ± 5.2^{a}	57 ± 3.9^{b}	57 ± 3.8^{b}	61 ± 4.3^{b}	75 ± 6.1^{a}
Saturated fat	54 ± 2.6	61 ± 4.5*	32 ± 4.6	82 ± 12.6^{a}	81 ± 11.3^{a}	66 ± 5.5^{b}	65 ± 9.3^{b}	72 ± 10.4^{a}	88 ± 11.3^{a}
Women									
Unweighted, *n*	1799	1,162	637	411	742	646	656	609	534
Weighted (in millions),[3] *n*	35.4	26.8	8.7	6.9	17.5	11.0	9.8	10.8	14.9
Energy, kcal/d	1778 ± 11.1	1804 ± 12.8*	1698 ± 21.4	1759 ± 21.7	1784 ± 16.9	1770 ± 18.7	1736 ± 17.4^{b}	1732 ± 18.1^{b}	1841 ± 21.4^{a}
Intakes									
Total protein, g/d	62 ± 0.4	64 ± 0.5*	57 ± 0.6	57 ± 0.8^{c}	65 ± 0.7^{a}	60 ± 0.6^{b}	57 ± 0.6^{c}	59 ± 0.7^{b}	67 ± 0.9^{a}
Total carbohydrates, g/d	245 ± 1.4	245 ± 1.6	245 ± 2.9	234 ± 2.9^{b}	250 ± 2.2^{a}	243 ± 2.3^{a}	257 ± 2.5^{a}	240 ± 2.3^{b}	241 ± 2.5^{b}
Fiber, g/d	22 ± 0.2	21 ± 0.2*	24 ± 0.4	19 ± 0.4^{b}	22 ± 0.3^{a}	23 ± 0.3^{a}	24 ± 0.4^{a}	21 ± 0.3^{b}	21 ± 0.4^{b}
Added sugars, g/d	52 ± 0.6	56 ± 0.6*	42 ± 1.1	63 ± 1.5^{a}	52 ± 1^{b}	46 ± 0.9^{c}	45 ± 1^{b}	56 ± 2.3^{a}	54 ± 1.1^{a}
Total fat, g/d	59 ± 0.5	66 ± 0.7*	56 ± 0.8	67 ± 1.2^{a}	62 ± 0.8^{b}	62 ± 0.9^{b}	57 ± 0.8^{b}	61 ± 0.8^{a}	69 ± 1.1^{a}
Saturated fat, g/d	22 ± 0.2	23 ± 0.2*	19 ± 0.2	26 ± 0.3^{a}	23 ± 0.2^{b}	21 ± 0.2^{c}	19 ± 0.2^{c}	23 ± 0.2^{b}	26 ± 0.3^{a}
Energy, % of EER	99 ± 0.6	100 ± 0.6	98 ± 1.1	96 ± 1.1^{b}	99 ± 0.9^{c}	102 ± 1^{a}	101 ± 0.9^{a}	97 ± 0.9^{b}	100 ± 1.1^{a,b}
Lower fiber intake[4,5] (less than the AI), %	65 ± 3.1	69 ± 5.2*	56 ± 2.8	64 ± 6.8^{a}	47 ± 2.7^{b}	43 ± 3.4^{b}	40 ± 3.7^{b}	54 ± 2.9^{a}	54 ± 3.6^{a}
High intake[4,6] (more than the WHO recommendations), %									
Added sugars	64 ± 4.8	78 ± 14.4*	47 ± 3.7	76 ± 20.6^{a}	61 ± 5.4^{b}	52 ± 2.7^{c}	47 ± 3.3^{b}	67 ± 6.3^{a}	65 ± 7.9^{a}
Saturated fat	59 ± 3.2	70 ± 9.4*	32 ± 13.4	85 ± 25.4^{a}	71 ± 11.5^{b}	60 ± 4.4^{c}	56 ± 4.9^{b}	76 ± 13.4^{a}	76 ± 13.7^{a}

[1] Values are means or mean percentages ± SEMs unless otherwise indicated. Data are from the National Health and Nutrition Survey (ENSANUT) 2012 (14). Multiple comparisons with the use of Student's *t* or proportion tests were conducted accordingly with the use of Bonferroni adjustment. Labeled means in a row without a common superscript letter differ between regions of residence and between tertiles of socioeconomic status, $P < 0.05$. *Different from rural, $P < 0.05$. AI, Adequate Intake; EER, Estimated Energy Requirement.

[2] Tertiles are based on the distribution of a socioeconomic index constructed using factor analysis (ranges: low, −6.0 to −0.7; medium, −0.6 to 0.8; high, 0.9 to 4.0).

[3] Survey commands (StataCorp) were used to account for survey design and weighting to generate nationally representative results.

[4] Values are percentages ± SEEs.

[5] AI as established by the Institute of Medicine (17).

[6] An excessive intake of added sugars and saturated fat was defined as a usual intake >10% of the total energy intake, according to WHO recommendations (26).

Results show that the mean usual energy intake for most individuals in all age and sex groups is between 90% and 120% of mean energy requirements. In a population who is maintaining weight, we would expect to find a large proportion of individuals who consume ∼100% of what they require, and in particular, we would expect that the mean energy intake in the group is approximately the same as the mean energy requirement; large differences between mean intake and mean requirement are likely due to under- or overreporting of energy, poorly estimated physical activity levels, increasing or decreasing trends in population weight, or a combination of the these factors. In women, the distribution of usual energy intake in EER units was centered at ∼100%. In the absence of incorrect reporting and assuming that a reasonable physical activity level was assigned to women, energy intake was consistent with the maintenance of body weight. A study to assess the validity of the USDA's automated multiple-pass method, which is very similar to the method we implemented in ENSANUT, compared the energy intake obtained in adults (30–69 y) living in the United States with energy expenditure estimated by using doubly labeled water (10). Results suggested that overall, the 24HR underestimates energy intake by ∼11% (by 10% in men and 12% in women). A similar level of underestimation of energy intake in men (10%) was observed in the present study, but in the case of women, underreporting of energy intake appears to have been negligible. Several studies have documented that overweight and obese adults tend to underreport their food consumption (47–49). In Mexico, analysis of energy and nutrients of the National Nutrition Survey from 1999 in women aged 12–49 y showed that, although all of the women underreported their energy consumption, the degree of underreporting was twice as high in obese women than in nonobese women (5). This could explain the apparent underestimation of the 10% of energy consumed in men, who have a high prevalence of excess body weight (70.4% in men ≥20 y old) (50). However, this effect was not observed in women, even though 74.4% of women aged ≥20 y in Mexico have a BMI (in kg/m^2) >25 (50). It is possible that the physical activity level we assumed for men was too high, in which case energy consumption would appear to be underreported.

We are not aware of any validation studies carried out in children and adolescents; as stated earlier, we found that energy intake exceeded energy requirements in most of these age groups. The highest difference between intake and requirement was observed in children aged 1–4 y. Dietary intake information in this age group was reported by the person in charge of preparing and offering the food to children in this age group, because preschool-aged children cannot estimate portion sizes and have difficulty remembering their food intake on the previous day (51). A systematic review showed that overreporting of food consumption in children is significant when the 24HR is used and when parents report intakes. One of several plausible explanations for this finding is that parents tend to overestimate portion sizes for their young children because portions are so much smaller than for adults (52).

The strengths and limitations of the present study are listed below. The validity of the main results we describe above highlights the importance of using, for the first time to our knowledge in a national survey in Mexico, up-to-date methodology for data collection and for the statistical analysis of the survey data. Neither the 24HR nor adjustment of intra-individual variance had been implemented in earlier surveys in Mexico. All of the statistical analyses incorporated individual survey weights to account for the fact that ENSANUT had a complex multistage design. However, the assumptions about physical activity levels and the likely under- or overreporting of energy intakes in some population subgroups may have introduced some bias in the results. In addition, the generalizability of the results could be somewhat limited by the fact that the ENSANUT collected no information between the months of June and September, when different patterns of energy and nutrient intake are likely.

Although the use of the 24HR and Iowa State University method to collect and analyze food consumption data represents an advance relative to earlier surveys, the change in the methodology makes it difficult to compare results across surveys. Going forward, some of the methods that were developed for and deployed in ENSANUT 2012 will allow the estimation of consumption trends over time. In addition to updated data collection and analysis methods, we also defined a standard protocol for data editing and processing and updated the food-composition table for Mexico. These are structural improvements that will continue to enhance dietary intake data collection and analyses in Mexico.

The main findings are that added sugars and saturated fats are consumed in excessive amounts by more than half of the Mexican population. Fiber intake was low, but in the absence of an Estimated Average Requirement for fiber, it is not possible to estimate the prevalence of inadequacy. These results highlight the importance of improving the diet of the Mexican population to reduce the risk of noncommunicable chronic diseases. Differences by socioeconomic status, area, and region of residence can be partially explained by differences in patterns of food consumption across subpopulations. Energy intake observed in ENSANUT 2012 is higher for all age and sex groups than the intakes reported in the 1999 (5) and 2006 (6–8) ENSANUTs. These differences are likely due to the use of better dietary data collection methods, the data editing and processing based on different criteria, and an updated statistical analysis of the intake data.

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