Energy, added sugar, and saturated fat contributions of taxed beverages and foods in Mexico

Carolina Batis, PhD,[1] Lilia S Pedraza,MSc,[2] Tania G Sánchez-Pimienta, MSc,[3]
Tania C Aburto, MSc,[2] Juan A Rivera-Dommarco,PhD.[3]

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Abstract

Objective. To estimate the dietary contribution of taxed beverages and foods. **Materials and methods.** Using 24-hour diet recall data from the Ensanut 2012 (n=10 096), we estimated the contribution of the items which were taxed in 2014 to the total energy, added sugar, and saturated fat intakes in the entire sample and by sociodemographic characteristics. **Results.** The contributions for energy, added sugar, and saturated fat were found to be 5.5, 38.1, and 0.4%, respectively, for the taxed beverages, and 14.4, 23.8, and 21.4%, respectively, for the taxed foods. Children and adolescents (*vs.* adults), medium and high socioeconomic status (*vs.* low), urban area (*vs.* rural), and North and Center region (*vs.* South) had higher energy contribution of taxed beverages and foods. The energy contribution was similar between males and females. **Conclusions.** These taxes covered an important proportion of Mexicans' diet and therefore have the potential to improve it meaningfully.

Keywords: taxes; energy; nutritive sweeteners; saturated fatty acids; Mexico

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Contribución de energía, azúcar añadido y grasa saturada de las bebidas y alimentos con impuesto en México.
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Resumen

Objetivo. Estimar la contribución dietética de las bebidas y alimentos con impuesto. **Material y métodos.** Con el recordatorio de 24-horas de la Ensanut 2012 (n=10 096), estimamos la contribución de los productos con impuesto en 2014 al consumo total de energía, azúcar añadido y grasa saturada en toda la muestra y por sociodemográficos. **Resultados.** La contribución de energía, azúcar añadido y grasa saturada fue 5.5, 38.1 y 0.4%, respectivamente, para bebidas con impuesto y 14.4, 23.8 y 21.4%, respectivamente, para alimentos con impuesto. Los niños y adolescentes (*vs.* adultos), nivel socioeconómico medio y alto (*vs.* bajo), área urbana (*vs.* rural), y región Norte y Centro (*vs.* Sur) tuvieron una contribución de energía mayor de bebidas y alimentos con impuesto. La contribución fue similar entre hombres y mujeres. **Conclusión.** Estos impuestos cubren una proporción importante de la dieta mexicana y por lo tanto tienen el potencial de mejorarla de manera relevante.

Palabras clave: impuestos; energía; edulcorantes nutritivos; ácidos grasos saturados; México

(1) Cátedra Conacyt, Centro de Investigación en Nutrición y Salud, Instituto Nacional de Salud Pública. Cuernavaca, Morelos, México.
(2) Department of Nutrition, Gillings School of Global Public Health, University of North Carolina. Chapel Hill, NC, USA.
(3) Centro de Investigación en Nutrición y Salud, Instituto Nacional de Salud Pública. Cuernavaca, Morelos, México.

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Corresponding author: PhD. Juan A Rivera-Dommarco. Av. Universidad 655, col. Santa María Ahuacatitlán. 62100, Cuernavaca, Morelos, Mexico.
E-mail:jrivera@insp.mx

Owing to the high prevalence in Mexico of overweight or obese people, as well as people with diabetes,[1-3] the Mexican government levied a new tax from January 2014 on sugar-sweetened beverages (SSBs) and nonessential energy-dense foods.[4] The SSBs tax is $1 Mexican peso/liter (~10% of the total price), and applies to all non-dairy, non-alcoholic beverages (including beverage concentrates and powders) with added sugar. The nonessential energy-dense food tax is 8% and applicable to foods such as chips and snacks, candies and sweets, chocolate, pudding, peanut and hazelnut butters, ice cream and ice pops, and cereal-based products with added sugar. To be taxed, products must have an energy density of ≥275 kcal/100 g.[5]

Analyses of household purchases found that after the tax was introduced, purchase of SSBs decreased 6% in 2014[6] and 9.7% in 2015[7] and purchase of nonessential energy-dense foods decreased 5%[8] in 2014 and 7% in 2015.[9] To better understand the impact of these results, it is necessary to know the energy and nutrient contribution of the taxable items to the Mexican diet. We, therefore, aimed to estimate the energy, added sugar, and saturated fat contributions of these taxed items. For this purpose, we used 24-h diet recall data from the Mexican National Survey of Health and Nutrition (Ensanut) 2012.

We analyzed energy, sugar and fat as these are the key nutrients that have been considered in other policies as well (labeling, marketing, and food availability in schools). We analyzed added sugar instead of total sugar, and saturated fat instead of total fat because of the recommendation to limit the intake of these nutrients in specific.[10] Sodium is another key nutrient that is targeted by several policies and recommendations. However, given the difficulty in estimating total sodium intake from 24-h recall data we did not analyze it.

Materials and methods

Ensanut 2012 was a cross-sectional, multistage, probabilistic survey representative of the Mexican population.[11] It was carried out between October 2011 and May 2012. Informed consent was obtained from each participant or from the participant's parent/guardian. The Ethics Committee of the Mexican National Institute of Public Health reviewed and approved the survey protocol. Data on dietary intake were collected via 24-h diet recall in a random subsample (~11%) of Ensanut 2012 respondents. We included non-pregnant, non-lactating females and all males ≥1 y old, and excluded 125 participants with extreme energy intake (outside ±3 standard deviation of the log of the energy intake/energy requirements ratio). Our analytical sample was 10 096 subjects [2 113 preschool-aged children (1-4 y); 2 753 school-aged children (5-11 y); 2 056 adolescents (12-19 y); and 3 174 adults (≥20 y)]. This sample had specific weights to assure the representativeness of the Mexican population.

Trained interviewers conducted 24-h diet recall in person using a multiple five-pass probing method.[12,13] The interviewers recorded the types and amounts of all food items the participants had consumed in the preceding 24-h period. Respondents, most prominently those <15 y, were assisted by the person who cooked and prepared their meals in the household.

Based on tax law,[5] updated resolutions,[14-16] and personal communications with the Secretariat of Finance and Public Credit's personnel to clarify remaining questions, we identified the items reported in the 24-h diet recall that were taxed. For many industrialized juices, the description in the food composition table was not detailed enough for us to identify whether they were taxable (e.g., some brands have added sugars and others do not, and the description was only "orange juice, industrialized" without brand specification). In those cases, classification was defined based on the most common ingredients for individual juice flavors according to a detailed brand-product-level list from The Nielsen Company's Mexico Consumer Panel Services, the dataset previously used for tax-related evaluations.[6,8] We classified items in taxed beverages and taxed foods and in subcategories of each group.

The food composition table compiled to analyze Ensanut's 24-h diet recall does not include added sugar; this nutrient was estimated as described by Sánchez-Pimienta and colleagues.[17] Briefly, for all foods without sugar or where all sugar is intrinsic (fruits, unprocessed cereals, legumes, etc.) their added sugar value was zero; for foods where all sugar is added (sodas, confectionary, sweeteners, processed meats, and cereals, etc.) their added sugar value is equal to their total sugar. For all other foods that have a mix of intrinsic or added sugar a portion of the total sugar was considered as added; this portion was estimated based on lactose content, or based on similar foods that do not have added sugars (e.g., comparing the sugar content of 100% juice *vs.* industrialized juice).

We included the following sociodemographic characteristics: age group, gender, socioeconomic status (SES), urban/rural area, and geographic region. SES categories were based on tertiles of an index estimated with principal component analysis that included household characteristics and goods. Rural areas were defined as populations with <2 500 inhabitants. The regions included the following states, Center: Aguascalientes, Colima, Estado de Mexico, Guanajuato, Jalisco, México City, Michoacán, Morelos, Nayarit, Querétaro, San Luis

Potosí, Sinaloa, Zacatecas; North: Baja California, Baja California Sur, Coahuila, Chihuahua, Durango, Nuevo León, Sonora, Tamaulipas; and South: Campeche, Chiapas, Guerrero, Hidalgo, Oaxaca, Puebla, Quintana Roo, Tabasco, Tlaxcala, Veracruz, Yucatán.

For the entire sample, we estimated the mean intake of energy, added sugar, and saturated fat (kcal) from the total diet and from the taxed beverages, taxed foods, and subcategories of each. Then, based on these mean intakes, we calculated the percentage of contribution to total energy, added sugar, and saturated fat intake (% kcal) from the taxed items. Energy intake estimations were also calculated for taxed beverages and taxed foods by sociodemographic characteristics. In all analyses, we accounted for the complex sample design of Ensanut.

Results

The general characteristics of the sample are shown in table I; the majority of the Mexican population lived in urban areas (73%) and in the Central region (49%).

In the entire sample (table II), taxed beverages had a mean contribution of 5.5% for energy, 38.1% for added sugar, and 0.4% for saturated fat. Industrialized carbonated beverages were the top contributor for energy and added sugar among the different categories of taxed beverages. Taxed foods had a mean contribution of 14.4% for energy, 23.8% for added sugar, and 21.4% for saturated fat; bakery-made sweet bread was the top contributor for energy and saturated fat.

Taxed beverages had a mean energy contribution of ~4% among preschool- and school-aged children, 6.6% among adolescents, and 5.6% among adults (table III). Taxed foods had a mean energy contribution of ~20% among preschool- and school-aged children, 17.9% among adolescents, and 11.9% among adults. Taxed beverages and foods combined had a mean energy contribution that was similar between males and females (20.0 *vs*. 19.8%); it was lower among those with low SES compared to medium and high SES (16.7 *vs*. ~21%); it was lower in rural compared to urban areas (16.8 *vs*. 21.0%); and it was lower in the South compared to the North and Center (17.9 *vs*. ~21%). The energy contribution of taxed beverages reached 7.2% in the North.

Table I
Sociodemographic characteristics of the Mexican population. México, October 2011 to May 2012

	Value
Sample size, n	10 096
Age group, %	
Preschool-aged children (1-4 y)	7.6 ± 0.3
School-aged children (5-11 y)	16.1 ± 0.5
Adolescents (12-19 y)	14.5 ± 0.4
Adults (≥20 y)	61.8 ± 0.7
Gender, %	
Male	49.5 ± 0.9
Female	50.5 ± 0.9
Socioeconomic status, %	
Low	30.4 ± 0.9
Medium	32.0 ± 0.9
High	37.6 ± 1.0
Area, %	
Urban	73.0 ± 0.7
Rural	27.0 ± 0.7
Geographic region, %	
North	19.8 ± 0.6
Center	48.6 ± 0.9
South	31.6 ± 0.8

Discussion

Our analysis revealed that the energy contribution in the Mexican diet in 2012, before the tax was introduced, was 5.5 and 14.4%, respectively, for the beverages and foods that were later-on taxed. Together, the subject items of both taxes accounted for 19.9% of total energy, 61.8% of added sugar, and 21.8% of saturated fat intakes. Industrialized carbonated beverages were the top energy and added sugar contributor among taxed beverages and bakery-made sweet bread was top for energy and saturated fat among taxed foods. Adolescents had the highest consumption proportion of the taxed beverages and children (1-11 y) were highest for the taxed foods. Low SES, rural areas, and South region had a lower consumption proportion of taxed foods and beverages combined.

It is important to consider that the tax does not cover all SSBs that Mexicans consume. A previous analysis of Ensanut 2012 found that energy contribution of all SSBs, not only including industrialized ones but also homemade coffee or tea with sugar and *aguas frescas* (sweetened and blended multi-ingredient beverages), was 9.8% kcal.[18] Fortunately, the tax covers industrialized carbonated beverages, which are the most widely consumed SSBs,[19] and those with the highest added sugar content,[17] in Mexico.

Table II
Mean total intake and contribution of taxed food groups for energy, added sugar, and saturated fat among the Mexican population (≥1 y excluding pregnant and lactating women) (n=10 096). México, October 2011 to May 2012

	Energy		*Added sugar*		*Saturated fat*	
	kcal/per capita	*% kcal*	*kcal/per capita*	*% kcal*	*kcal/per capita*	*% kcal*
Total intake	1 923.9 ± 18.9		237.7 ± 3.9		221.4 ± 3.2	
All taxed beverages and foods	383.0 ± 7.1	19.9	147.0 ± 3.3	61.8	48.2 ± 1.2	21.8
All taxed beverages	105.1 ± 2.7	5.5	90.4 ± 2.6	38.1	0.8 ± 0.1	0.4
Industrialized carbonated beverages*	77.2 ± 2.5	4.0	77.1 ± 2.5	32.5	0.0 ± 0.0	0.0
Industrialized non-carbonated beverages‡	27.9 ± 1.3	1.5	13.3 ± 0.8	5.6	0.8 ± 0.1	0.4
All taxed foods	277.9 ± 6.3	14.4	56.5 ± 2.1	23.8	47.4 ± 1.2	21.4
Salty snacks§	48.7 ± 2.8	2.5	0.7 ± 0.1	0.3	9.5 ± 0.6	4.3
Packaged cereal-based sweets#	81.7 ± 4.1	4.2	19.1 ± 1.0	8.0	11.8 ± 0.7	5.3
Bakery-made sweet bread&	99.1 ± 3.8	5.2	11.4 ± 0.4	4.8	20.5 ± 0.8	9.2
Non-cereal-based sweets≠	31.1 ± 2.7	1.6	20.6 ± 1.8	8.7	5.3 ± 0.4	2.4
Ready-to-eat cereal∞	17.3 ± 1.0	0.9	4.8 ± 0.3	2.0	0.4 ± 0.0	0.2

* Cola and non-cola sodas
‡ Nectars, sports drinks, industrialized tea/coffee, flavored waters, energy drinks, flavored yogurt drinks, and powders to prepare flavored waters
§ Processed peanuts and seeds, potato chips, corn chips, flour chips, fried pork skin, and popcorn
\# Packaged pastries, sweet bread, cakes, cookies, and cereal bars
& Unpackaged sweet bread
≠ Chocolate, candies, ice cream, sorbet, spreads, and jellies
∞ Breakfast cereals

Also of note, sweet bread made in small-scale businesses* is exempted from paying the tax; therefore, the total contribution of taxed bakery-made sweet bread presented is an over estimation. Unfortunately, data is not available to estimate the proportion of sweet bread made in small-businesses.

The largest difference that we found in the energy contribution of taxed items between sociodemographic characteristics was for taxed foods when comparing different age groups. The energy contribution was eight to five percentage points larger among children and adolescents compared to adults. This age difference might reflect that younger age groups have an enhanced food preference for this type of sweet and savory snacks, that marketing is targeted towards this age group, and/or that the availability of these foods is high at the schools and their surroundings.

We also found that the energy contribution of both taxed beverages and foods was lower for the low SES, rural areas and South region. However, the differences comparing to higher SES, urban areas and North and Center region were of only two to four percentage points. Meaning that the intake in these disadvantaged populations is also considerable, even if it is slightly lower. These results are worrisome, considering that Colchero and colleagues reported that the price of taxed beverages and foods increased less in rural areas,[20] and hence the effect of the tax on consumption in rural areas could be attenuated as has been already identified in the case of taxed beverages.[21]

The limitations of this study are those related to the measurement error expected in self-reported dietary data,[22] as well as limitations in the of foods and beverages available in the food composition table that hinders exact classification of items as taxed or untaxed. Moreover, the content of added sugar was not available in the food

* The law definition of small-scale businesses has changed from year to year (annual income of <$2 million pesos in 2014, <$100 000 pesos in 2015, and <$300 000 pesos in 2016). The exemption is for both producers and retailers. However, even when a small retailer such as a "corner store" is exempt from the tax, the items sold in this store could have a higher price because the tax was already paid by the producer. Likewise, the exemption applies to all taxed beverages and foods (not only sweet bread); but it might affect particularly bakery-made sweet bread, which among all taxed beverages and foods is the main item generally producible in small-scale businesses.

Table III

Mean total energy intake and contribution of taxed food groups to energy intake among the Mexican population, by sociodemographic characteristics. México, October 2011 to May 2012

	Sample size	Total intake	All taxed beverages and foods		All taxed beverages		All taxed foods	
	n	kcal/per capita	kcal/per capita	% kcal	kcal/per capita	% kcal	kcal/per capita	% kcal
Age group, %								
Preschool-aged children (1-4 y)	2 113	1 355.3 ± 20.8	328.4 ± 10.1	24.2	57.8 ± 2.8	4.3	270.6 ± 9.4	20.0
School-aged children (5-11 y)	2 753	1 807.8 ± 23.0	432.8 ± 11.4	23.9	75.9 ± 3.0	4.2	356.9 ± 11.4	19.7
Adolescents (12-19 y)	2 056	2 106.4 ± 34.1	515.3 ± 17.6	24.5	138.2 ± 6.0	6.6	377.1 ± 14.8	17.9
Adults (≥20 y)	3 174	1 981.1 ± 28.3	345.7 ± 10.2	17.4	110.8 ± 4.1	5.6	234.9 ± 9.0	11.9
Gender, %								
Male	4 899	2 134.8 ± 30.3	426.2 ± 12.4	20.0	124.9 ± 4.3	5.9	301.3 ± 11.5	14.1
Female	5 197	1 717.2 ± 20.2	340.6 ± 7.0	19.8	85.8 ± 3.4	5.0	254.8 ± 6.2	14.8
Socioeconomic status, %								
Low	3 679	1 871.4 ± 31.6	312.2 ± 9.8	16.7	85.1 ± 4.2	4.5	227.1 ± 8.6	12.1
Medium	3 544	1 935.5 ± 30.1	408.2 ± 11.4	21.1	116.5 ± 5.1	6.0	291.7 ± 9.3	15.1
High	2 873	1 956.6 ± 33.7	418.7 ± 13.7	21.4	111.7 ± 4.8	5.7	307.1 ± 12.7	15.7
Area, %								
Urban	6 312	1 941.8 ± 23.5	408.1 ± 8.8	21.0	114.6 ± 3.4	5.9	293.5 ± 7.9	15.1
Rural	3 784	1 875.5 ± 28.8	315.0 ± 10.3	16.8	79.6 ± 3.8	4.2	235.4 ± 9.6	12.6
Geographic region, %								
North	2 402	1 995.2 ± 36.1	433.3 ± 14.9	21.7	142.8 ± 6.0	7.2	290.5 ± 12.1	14.6
Center	4 186	1 906.6 ± 31.4	389.7 ± 11.3	20.4	102.2 ± 4.2	5.4	287.4 ± 10.4	15.1
South	3 508	1 906.0 ± 26.8	341.2 ± 10.3	17.9	86.0 ± 4.1	4.5	255.2 ± 9.4	13.4

composition table; hence, our estimation is only an approximation. Another limitation is that the survey was conducted between October 2011 and May 2012, hence we did not capture the intake during all the seasons. This limitation is particularly important for taxed beverages, as previous analyses have found that their consumption increases during the summer.[6] Despite these limitations, the 24-hour recall data from Ensanut 2012 is the best source of dietary information available representative of the Mexican population. Ensanut 2012 also has a Food Frequency Questionnaire,[23] but 24-hours recalls are considered more valid.[24]

In sum, the taxes introduced in 2014 targeted items that account for a considerable portion of Mexicans' energy, added sugar and saturated fat intake (20, 62, and 22% respectively). Therefore, these taxes have the potential to beneficially influence the quality of the Mexican population's diet. For example, the 7.6% reduction in taxed beverages that was previously reported in 2014 and 2015[6,7] could be translated to a decrease of eight kcal/day of total energy and seven kcal/day of added sugar; whereas the 5.1% reduction in taxed foods that was previously reported in 2014[8] could be translated into a decrease of 14 kcal/day of total energy intake, three kcal/day of added sugar, and two kcal/day of saturated fat. All the above assuming there are no substitutions. Although these effects might seem small, the taxes are only 8-10%, and simulation studies have found that these changes can substantially decrease morbidity and mortality from diabetes and cardiovascular disease in Mexico.[25] Additionally, it should also be considered that the effect of the tax is larger in some groups of the population, such as low SES.[6-8]

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