

Affordability of sugar-sweetened beverages and nonessential energy-dense foods after taxation, Mexico, 2010–2022

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ABSTRACT

Objectives. This study had two objectives: first, to estimate trends in affordability of sugar-sweetened beverages and nonessential energy-dense foods from 2010 to 2022 in Mexico, both nationally and by household income level. The second was to simulate the effects of different tax increases for these foods and beverages to observe how much their affordability would change compared with the current scenario.

Methods. We used the 2010 to 2022 rounds of the Mexican National Survey of Household Income and Expenditures. The affordability ratio was estimated as the proportion of monthly income required to purchase 16 L of sugar-sweetened beverages and 2.8 kg of nonessential energy-dense foods, amounts that reflect median monthly consumption per household. Trends in the affordability ratio and its components (e.g. income and costs) are reported. Additionally, different tax increases were simulated for 2014–2022.

Results. Nationally and among low-income households, the affordability of these foods and beverages did not show significant changes before and after the implementation of the taxes on these introduced in 2014. The simulation scenarios showed that a tax of 3 pesos/L for sugar-sweetened beverages and 32% for nonessential energy-dense foods would be effective in reducing affordability at all income levels.

Conclusions. Current taxes are not high enough to significantly reduce the affordability of these foods and beverages. For low-income households, increases in income were greater than the increases in prices, thus sugar-sweetened beverages and nonessential energy-dense foods did not become less affordable, even after taxes were introduced in 2014. Tax rates would need to increase significantly to reduce affordability, and they should be adjusted for economic growth to compensate for increases in household income.

Keywords

Affordability; sugar-sweetened beverages; food, processed; taxes; income; Mexico.

The consumption of sugar-sweetened beverages (SSB) and nonessential energy-dense food (NEDF) has increased worldwide during the past three decades (1, 2). SSB are the primary contributors of added sugars to the diet (3), and excessive consumption of SSB has been associated with increased risks of developing obesity, diabetes, cardiovascular diseases and some cancers (4, 5). Consumption of NEDF represents a health

risk associated with a high degree of food processing, which regularly involves the addition of refined flours, sugars, sweeteners, saturated fats or sodium (6, 7) and tends to replace basic foods in the diet (e.g. fruits, vegetables, legumes and whole grains) (8).

Mexico is an upper-middle-income country and is among the 15 largest economies in the world (9). However, it is

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also one of the most unequal countries in the Region of the Americas, with 36% of its population living in poverty (10). The country has a high and growing burden of noncommunicable diseases. Between 2006 and 2022, the prevalence of diabetes increased from 14.4% to 18.3% (11), and since 2000 the prevalence of hypertension has remained close to 30% (12). Worldwide, a suboptimal diet is associated with 34% of deaths from diabetes and 49% of deaths from cardiovascular diseases (13). Despite interventions implemented to reduce the consumption of ultraprocessed food – such as taxes, front-of-pack labeling, marketing and school regulations – Mexico is the largest consumer of these products in Latin America: in 2019, the average consumption of salty snacks was 90 g per capita per week and soft drinks was 1.9 L per capita per week (14). Taxing SSB and NEDF is an effective policy to reduce the consumption of these products by increasing their prices (15). The evidence about the health impacts of taxes on unhealthy foods and beverages is mixed. Systematic reviews of modeling studies suggest that health benefits are associated with taxes, including decreases in the prevalence of obesity and mortality associated with cardiovascular disease and cancer (16, 17), and benefits are greater among low-income groups (18). Another review of the impact of taxes on beverages found mixed evidence for taxes implemented in the United States of America, but there have not been studies evaluating the effects of recently implemented taxes because they have not been in effect for long enough (19). Similarly, another review failed to find any studies evaluating the impact of taxes on health outcomes (20).

Evaluating the long-term health effects of taxation of unhealthy foods in low- and middle-income countries is challenging because measuring significant health impacts requires accurate outcome measurements and robust study designs. Also, a single policy, particularly a low tax rate, is unlikely to yield observable health effects in the short or medium term. In January 2014, Mexico implemented a tax on nonalcoholic SSB of 1 Mexican peso per liter, which excluded 100% natural juices and artificially sweetened beverages (21). In 2024, the tax reached 1.5 pesos/L because it was adjusted for inflation (22). Along with implementing the SSB tax in January 2014, the Mexican Congress proposed and passed a tax on high-calorie food. An 8% tax on NEDF was introduced for products containing at least 275 kilocalories per 100 g, including snacks, sweet bread, chocolates, candies, puddings, cookies, pastries and ice cream (21).

The effectiveness of a tax on unhealthy foods and beverages can be analyzed through an affordability ratio – that is, how much a product costs as a proportion of income (23). A product is less affordable as the ratio increases because the cost represents a higher proportion of income. Measures of affordability vary based on the objective of a study and the methods used to measure costs and income. Studies often use gross domestic product per capita in purchasing power parity (PPP) to compare affordability across countries, and a measure of costs in PPP based on the price of a standard brand or presentation (often reflecting the most widely consumed products) in each country (24, 25). Studies estimating affordability within a country use different measures for the denominator, often either wages (24) or household income (26). For the cost of a product, studies rely on measures of prices in the country. Prices can be derived from surveys reporting the quantity

purchased and expenditures (27) or from price data collected in stores (24).

In terms of affordability, the effectiveness of SSB taxes has varied between countries. In India and Paraguay, a reduction in the affordability of SSB was observed after taxes on these beverages were implemented (25, 27). In Chile, the SSB tax implemented in 2014 was effective in reducing the affordability of these beverages (24). In 2015, Mexico was ranked second in the Americas in having the most affordable SSB, after only the United States (26). Despite this, efforts to reduce the affordability of SSB have been effective; a study showed that among 15 Latin American countries, Mexico was the only one that had significant reductions in SSB affordability (measured as nominal wage divided by SSB price) between 2007 and 2016, with an average annual reduction in affordability of -1.07% ($P < 0.05$), which may be attributed to the tax, but this effect was not explored (27). However, the study had only few observations after 2014, making it difficult to establish a long-term association (27). In countries such as Colombia, Costa Rica, Ecuador and Peru, the affordability of SSB has increased despite the implementation of taxes (27).

To our knowledge, no study has evaluated the association between changes in the long-term affordability of SSB and NEDF after implementation of taxes and none has looked at differences by household income level, which is relevant given the high income inequalities in the country. For this study, the affordability ratio was estimated as the proportion of household income required to purchase a specific amount of a product. As the numerator is the cost and the denominator is household income, SSB and NEDF are less affordable when the ratio is higher, and vice versa. This study had two objectives. First, the study sought to estimate trends in the affordability of SSB and NEDF from 2010 to 2022, both nationally and by household income level. The second objective was to simulate the effects of different tax increases on SSB and NEDF to determine how much affordability would decrease compared with the current tax scenarios from 2014. Our estimates rely on a representative survey of Mexican households conducted between 2010 and 2022.

METHODS

Data sources

The 2010 to 2022 rounds of the Mexican National Survey of Household Income and Expenditures were used (28). The National Survey is cross-sectional, with a probabilistic two-stage stratified design, conducted every 2 years and is representative at the national level and for urban and rural areas. The National Survey is designed to collect detailed and homogeneous information about household income and expenditures across rounds. The National Survey collects information about weekly food and beverage purchases (i.e. the quantity purchased and amount spent) as reported by the household member responsible for all purchases and by other members for individual purchases. Sociodemographic and occupational variables are also included in the National Survey (28).

Income

All household members report their monthly income from work, rents, transfers (i.e. income from retirement, insurance

compensation, scholarships or transfers from social programs) and any other source of income. The National Survey estimates quarterly household income by adding income from all members of the household.

Food and beverage purchases

The National Survey collects information about food and beverage purchases using a self-reported instrument designed to gather information about food purchases daily for 7 consecutive days. Field workers train the household member responsible for purchasing food and beverages about how to complete the instrument. Nonmonetary expenses, such as food and beverages obtained as gifts or from subsidies or domestic production are included, based on calculations made by interviewers using market prices (28).

The National Survey contains 247 categories for food, beverage and tobacco purchases. Categories can be assigned to a single food for the goods consumed most often or to a group of similar foods that are consumed less often. For this study, we included SSB and NEDF. The SSB group includes ready-to-drink juices, soft drinks, energy drinks and flavored waters sweetened with sugar. The NEDF group includes snacks, sweet bread, chocolates, candies, custards, jellies, jams, processed fruit sweets, packaged cookies, pastries and ice cream.

Affordability

Affordability was estimated by calculating the ratio of household income required to purchase a specific amount of a product (29, 30). For all periods, the numerator for the affordability ratio was 16 L of SSB and 2.8 kg of NEDF, which are the median monthly amounts purchased per household based on the National Survey during the period before the taxes were introduced, 2010–2012. Medians were used to determine the distributions of the quantities of SSB and NEDF purchased because these amounts are not normally distributed. The analyses were conducted on households with SSB or NEDF purchases greater than zero.

Quarterly median household income and weekly purchases were converted to monthly figures. SSB and NEDF prices were derived by dividing the amount spent on these by the quantity purchased (liters for SSB and kilograms for NEDF). We multiplied the derived prices by 16 for SSB and 2.8 for NEDF to get the cost to purchase 16 L of SSB and 2.8 kg of NEDF. We then estimated weighted costs to purchase SSB or NEDF by multiplying the proportion of weekly expenditures for each product in the SSB or NEDF group by the cost of purchasing SSB or NEDF. Purchase costs and monthly income were reported in constant 2022 Mexican pesos, based on the national consumer price index (31). We then converted purchase costs to PPP in international dollars for 2022. The weighted cost to purchase SSB or NEDF is represented as:

$$PC_j = \sum_{i=1}^n PC_{ij} * w_{ij}$$

where PC_j is the weighted cost to purchase SSB or NEDF, PC_{ij} is the cost to purchase each product within each group (i.e. SSB or NEDF) and w_{ij} is the proportion of each product within each group (i.e. SSB or NEDF).

Descriptive analysis and simulations

First, we described the proportion of households that purchased SSB and NEDF (i.e. those with purchases greater than zero), the median monthly income per household, the median cost of purchasing each product (i.e. 16 L for SSB and 2.8 kg for NEDF) and the affordability ratios for SSB and NEDF in the 2010–2022 rounds of the Mexican National Survey.

We estimated the unadjusted relative changes from each previous round for household monthly income, cost per 16 L or 2.8 kg and affordability from 2010 to 2022. We then estimated affordability trends for SSB and NEDF at the national level and by income tertile for the same period.

Generalized linear models were used to estimate differences in income, the cost to purchase SSB and NEDF, and affordability ratios both before and after tax implementation. Values were considered statistically significant when $P < 0.05$.

Finally, different tax increase scenarios were simulated to observe how affordability would change if household incomes did not change. Since the design of the taxes is different (i.e. SSB is a volumetric tax and the NEDF is ad valorem), we modeled three different scenarios separately for SSB and NEDF. For SSB, we simulated increases of 2, 3 and 4 pesos/L. For NEDF, we simulated increases of 16%, 24% and 32%. Prices associated with these tax increases were derived using price compositions (Supplementary Tables 1 and 2, available at <https://journal.paho.org/en/media/156>). These prices were used to estimate the affordability ratio under each tax scenario. All analyses considered the complex design of the survey using the survey prefix command *svy* of the Stata 15.0 statistical package (StataCorp., College Station, TX, USA).

RESULTS

Supplementary Table 1 (<https://journal.paho.org/en/media/156>) shows the median household income, the cost to purchase each product and the affordability ratios from 2010 to 2022 for SSB and NEDF. During this period, the proportion of households purchasing SSB dropped from 65.7% to 63.9% and for NEDF, from 61.3% to 58.0%. In households that purchased SSB, median incomes increased from 1 559.66 international dollars at PPP/month to 1 745.03/month (equivalent to an 11% increase), and among households that purchased NEDF, incomes rose from 1 488.68 international dollars at PPP/month to 1 626.16/month (equivalent to an 8% increase). From 2010 to 2022, the cost to purchase 16 L of SSB and 2.8 kg of NEDF increased 12% and 20%, respectively. From 2010 to 2014, the affordability ratio for SSB increased from 1.49% to 1.65%, therefore, SSB became less affordable. From 2016 to 2022, the affordability ratio decreased, so SSB became more affordable, except for 2020. The affordability ratio for NEDF increased from 1.44% in 2010 to 1.65% in 2022 – NEDF became less affordable – with 2020 being the year with the highest affordability ratio.

Figure 1 shows relative changes from each previous round for median household income, price per 16 L or 2.8 kg and the affordability ratio for SSB (panel a) and NEDF (panel b). For SSB, although the cost to purchase 16 L increased over time (except for 2018), changes in income were larger. SSB became less affordable – that is, the costs to purchase SSB divided by household income increased – in 2012 and 2020 in parallel with reductions in income of 4.9% and 4.4%, respectively. In 2016

TABLE 1. Household income, price and affordability ratio of sugar-sweetened beverages and nonessential energy-dense foods, before and after the 2014 implementation of consumption taxes, by household income level, Mexico, 2010–2022

Income, price and affordability	Before implementation of taxes (pre-2014)	After implementation of taxes (post-2014)	Difference ^d
Monthly income spent on SSB purchases ^a			
Nationally	1 518.23	1 615.96	97.73
Low-income household	691.44	748.04	56.60***
Middle-income household	1 411.29	1 501.26	89.97***
High-income household	3 070.75	3 075.68	4.93
Cost to purchase 16 L of SSB ^{a,b}			
Nationally	23.52	25.43	1.90***
Low-income household	23.74	25.40	1.66***
Middle-income household	22.81	24.91	2.11***
High-income household	23.96	26.10	2.14***
SSB affordability ratio (%) ^c			
Nationally	1.56%	1.61%	0.05%
Low-income household	3.64%	3.70%	0.06%
Middle-income household	1.64%	1.70%	0.05%***
High-income household	0.77%	0.84%	0.07%***
Monthly income spent on NEDF purchases ^a			
Nationally	1 453.65	1 506.68	53.03
Low-income households	665.05	723.30	58.25***
Middle-income households	1 411.41	1 488.01	76.60***
High-income households	3 050.76	3 081.70	30.94
Cost to purchase 2.8 kg of NEDF ^{a,b}			
Nationally	22.22	23.70	1.48***
Low-income households	19.28	20.38	1.10***
Middle-income households	22.59	23.66	1.07***
High-income households	24.60	27.31	2.71***
NEDF affordability ratio (%) ^c			
Nationally	1.48%	1.54%	0.06%
Low-income households	3.09%	2.99%	-0.10%
Middle-income households	1.57%	1.58%	0.01%**
High-income households	0.75%	0.82%	0.07%*

NEDF: nonessential energy-dense foods; SSB: sugar-sweetened beverages; *: $P < 0.05$; **: $P < 0.01$; ***: $P < 0.001$.
^a Calculated using international dollars at purchasing power parity.

^b The cost to purchase SSB or NEDF stratified by household income represents differences in prices associated with the store where households purchase these products or price differences depending on product brand or package size.

^c The affordability ratio was calculated as the proportion of monthly income required to purchase 16 L of SSB or 2.8 kg of NEDF.

^d Differences are estimated from a generalized linear model.

Source: Table prepared by the authors based on data from the Mexican National Survey of Household Income and Expenditures 2010–2022.

and 2022, the SSB affordability ratio decreased – SSB became more affordable – mostly explained by increases in household incomes of 8.6% and 10.1%, respectively, as the costs of SSB changed less. For NEDF, increases in the affordability ratio were observed in 2012 (9.6%), driven by increases in costs of 5.3% and reductions in income of -4.7%; similarly, in 2020 there was a larger increase in costs of 7.1% and a reduction in income of -3.4%.

Figure 2 shows the affordability of SSB and NEDF by tertiles of median household income. In panel (a), SSB are more affordable for high-income households compared with middle- and low-income households. After the taxes were implemented in 2014, the affordability ratio decreased for low- and middle-income households (panel b). In contrast, for high-income households, the affordability ratio remained similar across the rounds of the National Survey. Similar to SSB, NEDF are less affordable for low- and middle-income households compared with high-income households. For both products, a reduction in the affordability ratio was observed in 2016, but they became slightly more affordable thereafter, except for SSB in 2022. Panels (c) and (d) show trends in the affordability ratio by place of residence (i.e. urban versus rural). For SSB, the affordability ratio was greatest in 2014 and subsequently declined in urban and rural areas. For NEDF, the affordability ratio was greatest in 2014 but these goods subsequently became less affordable in rural areas.

Table 1 shows differences in household income, the cost to purchase SSB and NEDF and the affordability ratio of these products both before and after implementation of the taxes. After the SSB tax was implemented, there was a significant increase in the SSB affordability ratio for middle-income households (from 1.64% to 1.70%) and high-income households (from 0.77% to 0.84%). Affordability for low-income households did not show significant changes, despite increases in the cost of the product, as monthly income increased more. Similar to SSB, we see small but significant increases in the NEDF affordability ratio in the pre- and post-tax comparisons for middle-income (positive difference of 0.01%) and high-income households (positive difference of 0.07%).

Supplementary Tables 2 and 3 (available at <https://journal.paho.org/en/media/156>) show the prices used for the simulations for each tax scenario for SSB and NEDF. The price per liter for SSB under the current scenario (1 peso/L) is 1.57 international dollars at PPP, but with increases of 2, 3 and 4 pesos/L, the price increases to 1.69, 1.82 and 1.96 international dollars at PPP, respectively. For NEDF the price per kilogram under the current scenario (8% tax) is 8.46 international dollars at PPP, but with increases of 16%, 24% and 32%, the price increases to 9.09, 9.72 and 10.35 international dollars at PPP, respectively.

Figure 3 shows trends in the affordability ratio for current taxes and under various simulations of tax increases. For both products, under the current tax scenario (i.e. 1 peso/L for SSB and 8% for NEDF) affordability is similar to that observed in 2012 (a pre-tax year). For SSB, scenarios that increase the tax to 2 pesos/L and 3 pesos/L would cause SSB to be less affordable than in 2012. For NEDF, the tax scenarios equivalent to 24% and 32% increases would cause NEDF to be less affordable than in 2012.

Supplementary Figure 1 (available at <https://journal.paho.org/en/media/156>) shows how affordability changes under the three different tax increase scenarios for SSB, nationally

and by income level. For low- and middle-income households, SSB became slightly more affordable in 2014, but the affordability ratio decreased below 2012 levels thereafter. A 2 peso/L tax would make SSB less affordable, but the magnitude of change would be larger with a tax of 3 pesos/L or 4 pesos/L. The affordability ratio for high-income households under the current tax is above 2012 levels.

Supplementary Figure 2 shows changes in NEDF affordability under the three tax simulation scenarios. For low-income households a 32% tax would reduce affordability to below 2012 levels for all years of the National Survey. For all tax scenarios, affordability among high-income households was above 2012 levels.

Supplementary Table 4 shows the median affordability ratio with 95% confidence intervals for increases in SSB and NEDF taxes. Under the current scenario, the years in which SSB are less affordable are 2014 and 2020; when the affordability ratio is compared with 2010, there was an increase of 9% in 2014 and 10.7% in 2020. For the 2, 3 and 4 pesos/L scenarios, SSB become less affordable as taxes increase the cost to purchase SSB in relation to income – that is, the affordability ratios are higher. Under the current tax scenario, for middle-income households SSB were more affordable in 2022, with an affordability ratio of 1.58% compared with 1.68% in 2012. However, for this income group, in the 4 pesos/L tax scenario SSB become less affordable in 2022, with an affordability ratio of 2.15%. For low-income households, NEDF were more affordable in 2022, with an affordability ratio of 3.06%, lower than that in 2012 at 3.29%, while in the simulation scenarios of 24% and 32% tax increases, NEDF would be more affordable in 2012 than in 2022.

Differences in the affordability of SSB and NEDF between the pre- and post-2014 tax periods in the six simulation scenarios are shown in Table 2. Increases in prices associated with higher taxes make SSB and NEDF significantly less affordable at all income levels, except for NEDF for low-income households in the 16% tax scenario.

DISCUSSION

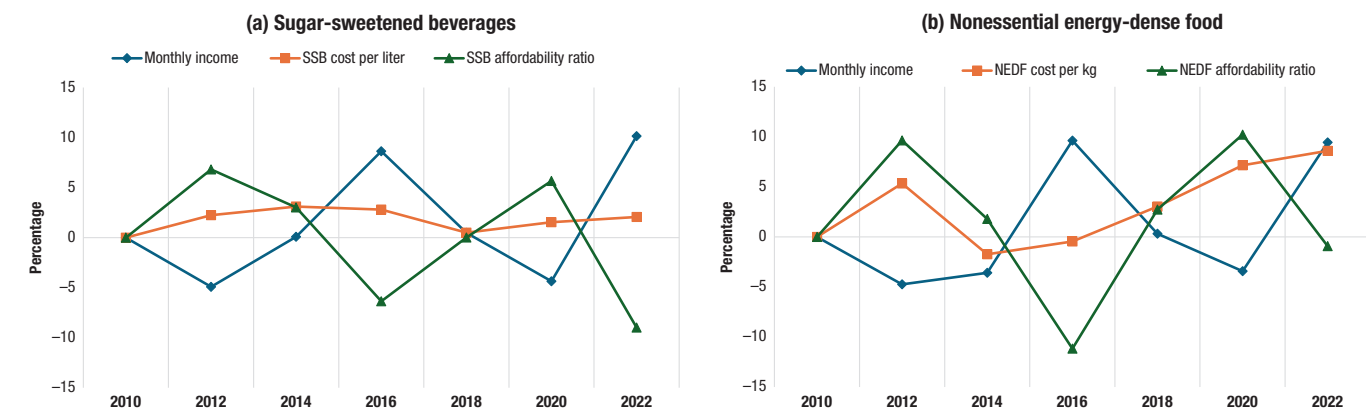
This study describes trends in the affordability of SSB and NEFD as a proportion of household income and the cost to purchase 16 L of SSB and 2.8 kg of NEDF in a representative sample of Mexican households between 2010 and 2022, a period that allowed changes to be observed before and after implementation of taxes on these goods. Heterogeneity in changes in affordability was explored by household income level and place of residence (i.e. rural versus urban areas). Different scenarios of tax increases were simulated to determine how affordability would change for both products.

The affordability of SSB and NEDF changes due to two factors: changes in prices or changes in income (25, 32). This study showed that in Mexico, changes in the affordability of SSB were associated mainly with increases in income. In 2016 and 2022, SSB became more affordable as household incomes increased. A study conducted by Paraje and Pincheira showed that of 15 Latin American countries, Mexico was the only one that had reduced the affordability of SSB, with an average annual reduction rate of –1.07% between 2007 and 2016 (27). Similarly, this study’s results showed that in 2012, 2014 and 2020, SSB and NEDF became less affordable. However, comparisons between

TABLE 2. Changes in the affordability ratio (%) of sugar-sweetened beverages and nonessential energy-dense foods before and after the 2014 implementation of consumption taxes, by household income level and simulated tax scenario, Mexico, 2010–2022

Tax scenario	Changes in affordability ratio ^a		
	Before implementation of taxes (pre-2014)	After implementation of taxes (post-2014)	Difference ^b
Sugar-sweetened beverages			
2 pesos/L			
Nationally	1.56%	1.61%	0.05%***
Low-income households	3.64%	4.05%	0.41%***
Middle-income households	1.64%	1.87%	0.23%***
High-income households	0.77%	0.92%	0.16%***
3 pesos/L			
Nationally	1.56%	1.93%	0.38%***
Low-income households	3.64%	4.40%	0.76%***
Middle-income households	1.64%	2.05%	0.41%***
High-income households	0.77%	1.01%	0.24%***
4 pesos/L			
Nationally	1.56%	2.09%	0.54%***
Low-income households	3.64%	4.76%	1.11%***
Middle-income households	1.64%	2.22%	0.58%***
High-income households	0.77%	1.10%	0.33%***
Nonessential energy-dense foods			
16% tax			
Nationally	1.48%	1.66%	0.18%***
Low-income households	3.09%	3.21%	0.12%
Middle-income households	1.57%	1.70%	0.13%***
High-income households	0.75%	0.88%	0.13%***
24% tax			
Nationally	1.48%	1.77%	0.29%***
Low-income households	3.09%	3.43%	0.34%***
Middle-income households	1.57%	1.82%	0.25%***
High-income households	0.75%	0.94%	0.19%***
32% tax			
Nationally	1.48%	1.88%	0.40%***
Low-income households	3.09%	3.65%	0.56%***
Middle-income households	1.57%	1.94%	0.36%***
High-income households	0.75%	1.00%	0.25%***

NEDF: nonessential energy-dense foods; SSB: sugar-sweetened beverages; *: $P < 0.05$; **: $P < 0.01$; ***: $P < 0.001$.
^a The affordability ratio was calculated as the proportion of monthly income required to purchase 16 L of SSB or 2.8 kg of NEDF.
^b Differences are estimated from a generalized linear model.
Source: Table prepared by the authors based on data from the Mexican National Survey of Household Income and Expenditures 2010–2022.

FIGURE 1. Relative change in price, income and affordability ratios (%) of sugar-sweetened beverages and nonessential energy-dense foods, Mexico 2010–2022^a

NEDF: nonessential energy-dense foods; SSB: sugar-sweetened beverages.

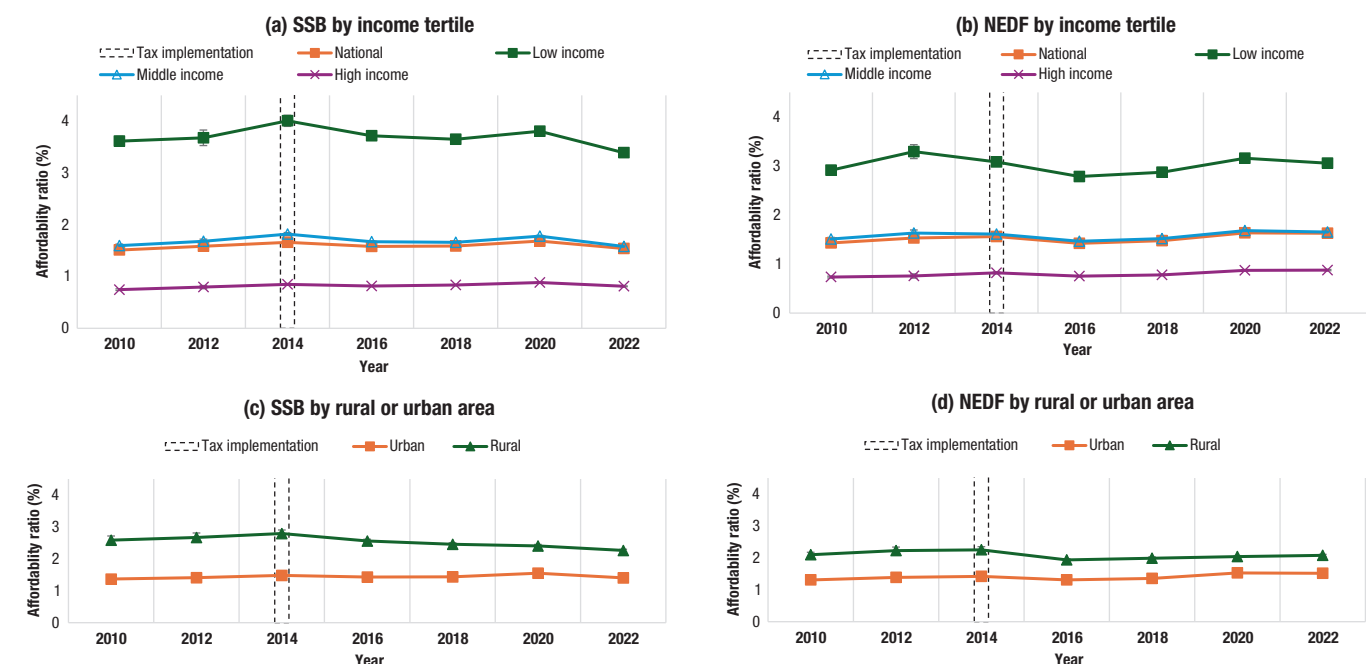
^a The affordability ratio was estimated as the proportion of monthly income required to purchase 16 L of SSB or 2.8 kg of NEDF. Positive values indicate that there was an increase in the affordability ratio, so the product becomes less affordable.

Source: Figure prepared by the authors based on data from the Mexican National Survey of Household Income and Expenditures 2010–2022.

pre-2014 (before taxes) and post-2014 data did not show significant changes.

Although the affordability ratios for SSB and NEDF significantly increased after tax implementation (from 1.56% to 1.61% for SSB and from 1.48% to 1.54% for NEDF), these changes were small and not significant for low-income households because despite increases in prices for SSB and NEDF associated with the taxes, increases in household income were larger. Between 2018 and 2024, the government introduced policies to reduce income inequalities, such as increasing the

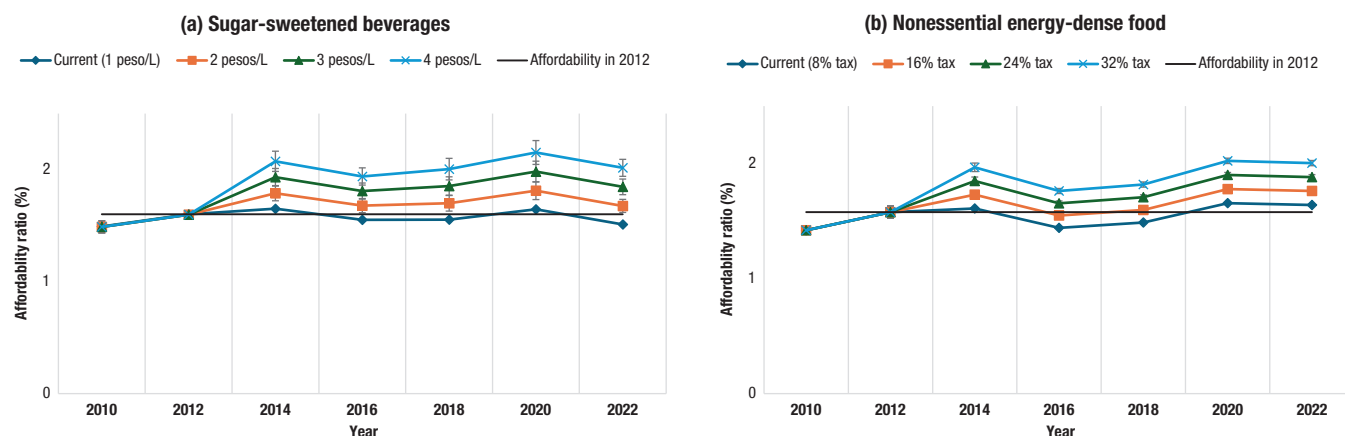
minimum wage and implementing several social programs, mainly providing school scholarships and unconditional cash transfers for vulnerable populations. As a result, lower-income households have increased their purchasing power. In 2019, the government increased the minimum wage (by 100% in municipalities close to the northern border and 16% in the rest of the country), mainly benefiting lower-income households (33). Although in terms of social development the results were positive, increasing the purchasing power of low-income households attenuated the effects of the SSB and NEDF taxes

FIGURE 2. Trends in the affordability ratio (%) of sugar-sweetened beverages and nonessential energy-dense foods, by income tertile and urban versus rural area, Mexico 2010–2022^a

NEDF: nonessential energy-dense foods; SSB: sugar-sweetened beverages.

^a The affordability ratio was estimated as the proportion of monthly income required to purchase 16 L of SSB or 2.8 kg of NEDF. Positive values indicate that there was an increase in the affordability ratio, so the product becomes less affordable.

Source: Figure prepared by the authors based on data from the Mexican National Survey of Household Income and Expenditures 2010–2022.

FIGURE 3. Trends in the affordability ratio of sugar-sweetened beverages and nonessential energy-dense foods as proportion of household income, for current taxes and simulations of increases in taxes for these products, Mexico, 2010–2022^a

NEDF: nonessential energy-dense foods; SSB: sugar-sweetened beverages.

^a The affordability ratio was estimated as the proportion of monthly income required to purchase 16 L of SSB or 2.8 kg of NEDF. Positive values indicate that there was an increase in the affordability ratio, so the product becomes less affordable.

Source: Figure prepared by the authors based on data from the Mexican National Survey of Household Income and Expenditures 2010–2022.

on their affordability, as shown in this study. In addition, the SSB tax in Mexico is smaller than those implemented in other Latin American and Caribbean countries, as it represents only 6.6% of the final price compared with SSB taxes in countries such as Belize, Chile and Ecuador, where tax shares range from 12.7% to 22.4% (34).

As shown in this study, the current taxes have a limited ability to reduce the affordability of SSB and NEDF. Thus, we simulated tax rate increases for SSB and NEDF to see how the affordability ratios would change. Both nationally and among low- and middle-income households, SSB would have been less affordable if the tax was 3 or 4 pesos/L, as the cost to purchase SSB would increase: if there are no changes to income, the affordability ratio increases. For NEDF, a 16%, 24% and a 32% tax would increase affordability nationally and among middle-income households. For low-income households, a 24% and 32% tax would increase the affordability of NEDF. Although tax rate increases can reduce the affordability of SSB and NEDF, substitutions associated with price increases could attenuate the impact of redesigning a consumption tax. However, as the SSB tax covers most beverages with added sugar, the evidence from the tax implemented in Mexico shows consumers substitute untaxed beverages, particularly bottled water, which is a positive effect (35). For NEDF, a recent study showed that the consumption of taxed foods decreased, but there was an increase in the contribution of untaxed whole grains, processed meats, sugar and desserts to the diet (36).

As in the study by Cuadrado et al. in 2020, we estimated weighted prices (24). Cuadrado et al. used price data from products collected in stores and provided detailed information about the type of beverage (i.e. brand and package size), whereas in our study, prices were derived from the quantity purchased without including detailed information about the product. Although prices in the study by Cuadrado et al. may have more variability, the robustness of the studies is similar because both studies estimated the weighted average or median prices.

This study has some limitations. First, prices were derived from the quantity purchased and expenditures, and this may have led to recall bias. However, because we estimated the average cost to purchase a specific amount of SSB and NEDF

for the complete sample of the National Survey – that is, the calculation was the same for all households – recall biases do not affect our results. Another limitation is that we cannot separate beverages with artificial sweeteners as the survey groups them together with SSB. However, in Mexico beverages with artificial sweeteners represent a very low percentage (in 2022 less than 4% of total beverages excluding water) (37), therefore this potential bias should not affect our estimates. Finally, the tax simulation scenarios do not consider possible responses by industry to the increase in the price of unhealthy products.

Despite these limitations, our study relies on a nationally representative survey and the period considered allowed us to observe changes in affordability for 8 years after the implementation of the SSB and NEDF taxes. The tax simulation analyses show which levels of taxes are required for SSB and NEDF to become significantly less affordable.

Conclusions

During 2010–2022, the affordability of SSB and NEDF did not change significantly, suggesting that current taxes are not high enough to reduce the affordability of both products. For low-income households, affordability did not change significantly because increases in income were larger than the increases in prices. Thus, these taxes should increase and need to be adjusted to account for economic growth and compensate for increases in household income.

Since affordability is an intermediate step between price increases and reductions in consumption, tax policies designed to address the consumption of unhealthy products should consider this indicator as an indirect measure of effectiveness.

Authors' contributions. AVF, JAQR and MAC conceived the original idea for the study. NASO analyzed the data. MAC guided the data analysis and interpretation of results. MAC, JAQR, AVF and JEMR contributed to the data analyses and interpretation of results. All authors reviewed the paper and approved the final version.

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Asequibilidad de bebidas azucaradas y alimentos no esenciales de alto contenido calórico tras la introducción de impuestos en México en el período 2010-2022

RESUMEN

Objetivos. Este estudio tuvo dos objetivos. En primer lugar, estimar las tendencias en la asequibilidad de las bebidas azucaradas y los alimentos no esenciales de alto contenido calórico del 2010 al 2022 en México, tanto a nivel nacional como según nivel de ingresos de los hogares. En segundo lugar, simular los efectos de diferentes aumentos de los impuestos para estos alimentos y bebidas a fin de observar en cuánto cambiaría su asequibilidad en comparación con la situación actual.

Métodos. Utilizamos las rondas del 2010 al 2022 de la Encuesta Nacional de Ingresos y Gastos de los Hogares de México. La razón de asequibilidad se calculó mediante la proporción de los ingresos mensuales necesaria para comprar 16 litros de bebidas azucaradas y 2,8 kg de alimentos no esenciales de alto contenido calórico, cantidades que corresponden a la mediana del consumo mensual por hogar. Se describen las tendencias de la razón de asequibilidad y sus componentes (p. ej., ingresos y costos). Además, se simuló diferentes aumentos de impuestos para el período 2014-2022.

Resultados. A nivel nacional y en los hogares de ingresos bajos, la asequibilidad de estos alimentos y bebidas no mostró cambios significativos entre antes y después de la aplicación de los impuestos que se les aplicaron en el 2014. Los escenarios de simulación mostraron que un impuesto de 3 pesos/l para las bebidas azucaradas y del 32% para los alimentos no esenciales de alto contenido calórico sería eficaz para reducir la asequibilidad en todos los niveles de ingresos.

Conclusiones. Los impuestos actuales no son lo suficientemente altos como para lograr una reducción significativa de la asequibilidad de estos alimentos y bebidas. Para los hogares de ingresos bajos, los aumentos de los ingresos fueron mayores que los aumentos de los precios, por lo que las bebidas azucaradas y los alimentos no esenciales de alto contenido calórico no se pasaron a ser menos asequibles, ni siquiera después de la introducción de los impuestos en el 2014. Las tasas impositivas tendrían que aumentar de manera significativa para reducir la asequibilidad, y deberían ajustarse en función del crecimiento económico para compensar los aumentos de los ingresos familiares.

Palabras clave Costos y análisis de costo; bebidas azucaradas; alimentos procesados; impuestos; renta; México.

Viabilidade financeira de bebidas açucaradas e alimentos não essenciais com alta densidade energética após tributação, México, 2010–2022

RESUMO

Objetivos. Este estudo teve dois objetivos: primeiro, estimar as tendências da viabilidade financeira de bebidas açucaradas e alimentos não essenciais com alta densidade energética no México entre 2010 e 2022, tanto em âmbito nacional quanto por nível de renda familiar. O segundo foi simular os efeitos de diferentes aumentos nos impostos incidentes sobre esses alimentos e bebidas para observar a variação da sua viabilidade financeira em comparação com o cenário atual.

Métodos. Adotamos as rodadas de 2010 a 2022 da Pesquisa Nacional de Renda e Despesas Familiares do México. O índice de viabilidade financeira foi estimado como a proporção da renda mensal necessária para comprar 16 litros de bebidas açucaradas e 2,8 kg de alimentos não essenciais com alta densidade energética, valores que refletem o consumo mensal mediano por domicílio. São apresentadas as tendências do índice de viabilidade financeira e seus componentes (por exemplo, renda e custos). Além disso, foram simulados diferentes aumentos nos impostos para o período de 2014 a 2022.

Resultados. Em âmbito nacional e entre as famílias de baixa renda, não houve variações significativas na viabilidade financeira dos alimentos e bebidas incluídos no estudo antes e depois da cobrança de impostos sobre esses itens alimentícios, introduzidos em 2014. Os cenários de simulação mostraram que um imposto de 3 pesos/litro sobre bebidas açucaradas e 32% sobre alimentos não essenciais com alta densidade energética reduziria a acessibilidade para todos os níveis de renda.

Conclusões. O patamar atual dos impostos não é suficiente para reduzir consideravelmente a viabilidade financeira desses alimentos e bebidas. Para as famílias de baixa renda, os aumentos de renda foram maiores que os aumentos de preços; portanto, as bebidas açucaradas e os alimentos não essenciais com alta densidade energética não se tornaram menos acessíveis, mesmo após a introdução dos impostos em 2014. As alíquotas dos impostos precisariam sofrer um aumento significativo para reduzir a viabilidade financeira, e devem ser corrigidas pelo crescimento econômico a fim de compensar os aumentos na renda familiar.

Palavras-chave

Custos e análise de custo; bebidas adoçadas com açúcar; alimento processado; impostos; renda; México.