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Changes in food purchases after Chile's polices on food labeling, marketing, and sales in schools: a before and after study

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Abstract

Background: In 2016, Chile implemented a unique law mandating front-of-package warning labels, restricting marketing, and banning school sales for products high in calories, sodium, sugar, or saturated fat.

Methods: This pre-post study used longitudinal data on food and beverage purchases from 2,381 Chilean households from January 2015–December 2017. Purchases were categorized as "high-in" if they exceeded nutrient thresholds (ie, were subject to policy restrictions). Using fixed-effects models, we examined mean nutrient content of purchases in the post-policy period compared to a counterfactual based on pre-policy trends.

Findings: Compared to the counterfactual, overall calories purchased declined 16·4 kcal/capita/day (95% CI –27·3, –5·6; p=0·0031) or 4%. Overall sugar declined 11·5 kcal/capita/day (–14.6, –8·4; p<0·0001) or 10%, and saturated fat declined 2·2 kcal/capita/day (–3·8, –0·5; p=0·0097) or 4%. Sodium content of overall purchases declined 27·7 mg/capita/day (–46·3, –9·1; p=0·0035) or 5%. Declines from "high-in" purchases drove these results with some offset

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Data availability: Data are from Kantar WorldPanel Chile (http://kantarworldpanel.com/cl). The authors are not legally permitted to share the data used for this study, but interested parties may contact Kantar WorldPanel representative Maria Paz Roman to inquire about accessing this proprietary data (mariapaz.roman@kantar.worldpanel.com). No accession number is needed when requesting data. Additional data come from Euromonitor (http://www.portal.euromonitor.com), which can be accessed only by subscribers; however, many universities and other institutions worldwide have access. The pre-specified analysis plan for data is available at Open Science Framework: https://osf.io/mj8az/.

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by increases in "not-high-in" nutrient purchases. Among high-in purchases, relative to the counterfactual there were notable declines of 24% in calories purchased (–49·4 kcal/capita/day, 95% CI –55·1, –43·7; p<0·0001), 37% in sodium purchased (–96·6 mg/capita/day, 95% CI –105·3, –87·8; p<0·0001), and 27% in sugar purchased (–20·7 kcal/capita/day, 95% CI –23·4, –18·1; p<0·0001).

Interpretation: Chile's Phase 1 policies were associated with reduced high-in purchases, leading to declines in purchased nutrients of concern. Greater changes might reasonably be anticipated following implementation of Phases 2 and 3.

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Introduction

Globally, governments are implementing policies to change the food environment as a strategy to reduce excess consumption of unhealthy packaged foods, improve diets, and prevent increases in obesity prevalence and non-communicable disease. Three important and increasingly common policy strategies recommended by the World Health Organization are front-of-package labels on unhealthy foods and beverages; restrictions on marketing these foods to children; and restricting the sales of these products in schools.[1–3]

However, evidence of these policies' impact is nascent, in part because mandatory implementation of these policies by federal governments is very new, so evaluations are sparse. For example, in 2016 Chile was the first country to implement a mandatory, national front-of-package nutrient warning label policy. Other countries have followed with similar labeling laws, but evaluation data is not yet available. Similarly, although it is well established that food marketing to children leads to increased preferences for and intake of unhealthy foods,[4] little is known about whether mandatory restrictions on food marketing to children can reduce this impact, as most evidence stems from voluntary industry initiatives with little impact and few countries have rigorous national policies.[5] Finally, while the literature shows that school food environment policies can improve dietary intake,[6] data on the impact of national bans on school sales of unhealthy foods is also sparse.

In addition, despite growing consensus that multiple policy actions are critical for improving diets and promoting health, most countries have implemented only one policy at a time —with a particular focus on sugar-sweetened beverage taxes—so there is currently little understanding about the joint impact of marketing, labeling, and school food policies implemented together.

The Chilean law of Food Labeling and Advertising, implemented in three progressively strict phases beginning in 2016, offers a unique opportunity to examine the joint effect of these policies, as it includes not only the first mandatory warning label law, but also imposes comprehensive marketing restrictions and prohibits sales and promotion in schools for all foods and beverages high in added sugar, sodium, saturated fat, or calories. The Chilean law also provides an opportunity to understand the policies' potential impact on nutritional disparities in food purchases. In particular, the front-of-package warning label law aims to make it easier to identify products high in nutrients of concern, which may have greater impact among consumers with lower health and nutrition literacy who are less likely to use or understand the complex back-of-package nutrition label information.[7]

This study aims to examine changes in the calorie, sugar, sodium, and saturated fat content of food and beverage purchases after first phase implementation of the Chilean policies.

Methods

This study is exempt from review by the University of North Carolina, Chapel Hill Institutional Review Board (IRB) as it uses secondary, de-identified data. It was reviewed and approved by the University of Chile IRB.

Participants

This study uses longitudinal data on household food and beverage purchases from January 1, 2015 to December 31, 2017 from Kantar WorldPanel Chile, an open cohort consumer panel study of households located in cities (population >20,000).[8,9] Compared to the overall Chilean population, the Kantar sample is similarly geographically distributed, but with larger households and a higher proportion of households with tertiary education (supplementary table 1).

This is an unbalanced panel of 2,381 households with a median follow-up of 35 months, providing 67,890 household-month observations. Data on each packaged product[8] purchased includes volume (ml) or weight (g), barcode, price per unit, retail outlet, brand, package size, and date.

The dataset also contains self-reported household information including size, composition (age and gender of each member), assets (number of rooms, bathrooms and cars), geographic region, age of the main shopper, head of household's education level, and socio-economic status (as defined by the market and public opinion research association Asociación de Investigadores de Mercado y Opinión Pública de Chile and calculated based on household assets, household head's education, and access to goods and services). Two households had missing demographics data and were excluded from the study.

The Chilean regulation

The Chilean Law of Food Labeling and Advertising requires packaged foods and beverages containing added sugar, sodium, or saturated fat and exceeding set thresholds for these nutrients or for overall calorie content to carry front-of-package warning labels—black octagon(s) with the words "high in" sugar, sodium, saturated fat, and/or calories, whichever applies. These products are also subject to child-directed marketing restrictions and banned from sale or promotion in schools and nurseries. To accommodate the food industry's request for flexibility in implementation, the policy was designed for phased implementation with increasingly restrictive nutrient thresholds implemented in June of 2016 (Phase 1), 2018 (Phase 2) and 2019 (Phase 3) (supplementary table 2).[10]

Nutritional data and categorization by food group and regulation status

Nutrition facts panel (NFP) data from packages were linked to household purchases at the product level using barcode, brand name, and product description.[8,11–13] We linked pre-policy purchases to NFP data collected in 2015 and 2016, and post-policy purchases to data collected in 2017. Nutritionists reviewed each product for nutritional accuracy and categorized it as “high-in” if it contained added sugar, sodium, or saturated fat and exceeded Phase 1 nutrient or calorie thresholds, and thus was subject to the labeling, marketing, and school regulations.[10] Foods and beverages were grouped based on nutritional profile and typical patterns of consumption (supplementary table 3).

Some groups were excluded from analysis due to absent or inconsistent data collected by Kantar (energy drinks, salty snacks, candy) or insufficient NFP (loose-leaf teas and packaged tea bags). Purchases of loose produce or in bulk (eg, bread by the piece or grains purchased by weight) were also excluded because volume or weight was unavailable. However, compared to national sales data, the Kantar dataset had high representation of top brands and was similar in the contribution of most food groups to total sales (supplementary tables 4 and 5).

Outcomes

All data were aggregated at the monthly level and analyzed for calories (kcal), sugar (kcal), saturated fat (kcal), and sodium (mg) purchased per capita per day. We considered overall calories per capita per day for combined food and beverage purchases the main outcome for the policy’s potential effect on obesity prevention. We also examined calories and nutrients purchased from “high-in” foods and beverages separately from “not-high-in” foods and beverages, as well as by food and beverage subgroup.

Covariates

Covariates included the age of household’s main shopper (continuous), household composition (a set of continuous variables, each with the number of people in the following age categories: children 0–1y, children 2–5y, children 6–13y, adolescents 14–18y by gender, female adults >18y, and male adults >18y), and monthly regional unemployment rate.[14] As a proxy for socioeconomic status (SES), we included head of household’s educational level (less than high school, high school, or more than high school) as well as household assets (created using a factor analysis including number of bedrooms, number of bathrooms, and number of cars; categorized as tertiles; and specified in the model as a set of indicator variables), consistent with our previous evaluation of the Chilean law.[8] Finally, we included calendar month indicator variables to adjust for seasonality and a continuous month variable (1–36) to account for any linear time trend.

Statistical analyses

We conducted all statistical analyses using Stata 16 (College Station, TX, USA). The pre-specified analysis plan was registered with Open Science Framework (https://osf.io/mj8az/) after data was collected but prior to analysis. Changes to pre-specified main analyses and rationale for these changes are documented in (supplementary table 6).

Unadjusted analyses: Descriptive statistics

We examined household socio-demographic characteristics in 2015, 2016, and 2017. We compared unadjusted mean nutrients and calories of purchases as well as proportions of consumers for “high-in” and “not-high-in” products and by food and beverage subcategory in the pre- and post-policy periods, using OLS to obtain cluster-robust standard errors.

Adjusted analyses: Fixed-effects models

Consistent with our previous evaluation,[8] we included 18 months of data before and after policy implementation in order to have balanced pre- and post-policy periods while maximizing available data. We defined the pre-policy period as January 1, 2015 to June 30, 2016 and the post-policy period as July 1, 2016 to December 31, 2017.

For our main analyses, we used a pre-post modeling approach to examine changes in nutrient contents of overall food purchases before and after the policy was implemented. We used a fixed-effects linear regression model with a binary variable for the policy period and its interaction with a linear time trend. We compared purchases in the post-policy period to a counterfactual, or what purchases would have been expected in the post-policy period based on pre-policy trends.[11,12,15,16]

To test whether policy-related changes in purchases varied by SES, we added an interaction of education or assets with every variable. The variable of interest was the triple interaction of SES with the policy period and time trend. We also compared the difference between the post-policy predicted and counterfactual means across levels of education and assets.

All adjusted analyses used standard errors clustered at the household level and controlled for the aforementioned covariates.

Sensitivity analyses

We examined the robustness of the results on overall calories to variations in the model specification (eg, inclusion of covariates) and underlying data (eg, linking of purchases to NFP) (appendix 1).

Role of the funding source

Study funders had no role in study design, data collection and analysis, interpretation, writing and preparation of the manuscript, or in the decision to submit the paper for publication. MB, LST, and MAC had access to the underlying data; all authors accept responsibility to submit for publication.

Results

Unadjusted pre- vs. post-policy means

Sample demographic characteristics can be found in table 1. Prior to the law’s introduction, there was a slight downward time trend for overall, high-in, and not-high-in food and beverage purchases (p=0.0061 for the pre-regulation linear time trend) (supplementary figure 1). Although the percentage of households who bought any high-in product or who bought high-in food remained nearly 100% after the law, the percentage of households who bought high-in beverages dropped 13 percentage points (94% to 81%; p<0·001) (supplementary table 7).

Unadjusted pre- vs. post-policy consumers of food and beverage groups

We found few differences in the proportion of consumers of specific food groups pre- vs. post-implementation, overall (differences all <4 percentage points, supplementary table 8). However, we found some differences by high-in status. Compared to the pre-policy period, largest decreases in high-in purchases were for industrialized fruit and vegetable juices (–47%), dairy-based beverages and substitutes (–31%), condiments and sauces (–33%), meat, poultry, and meat substitutes (–11%), breakfast cereals (–11%), and sweets- and non-grain-based desserts (–8%) (p<0·0001 for all). The proportion of consumers of not-high-in products from these food groups increased, typically by a similar or lesser magnitude.

Total food and beverage purchases

Compared to the counterfactual, overall calories purchased declined by 16·4 kcal/capita/day (95% CI –27·3, –5·6; p=0·0031) or 4% (figure 1; supplementary table 9). Overall purchased sugar declined by 11·5 kcal/capita/day (–14·6, –8·4; p<0·0001) or 10%, and saturated fat declined by 2·2 kcal/capita/day (–3·8, –0·5; p=0·0097) or 4%. Sodium content of overall purchases declined by 27·7 mg/capita/day (–46·3, –9·1; p=0·0035) or 5%.

These results were driven largely by declines in high-in food and beverage purchases. Relative to the counterfactual, high-in calories purchased declined by 49·4 kcal/capita/day (–55·1, –43·7; p<0·0001) or 24%, while calories from sugar in high-in purchases declined by 20·7 kcal/capita/day (–23·4, –18·1; p<0·0001) or 27%, and calories from saturated fat declined by 6·2 kcal/capita/day (–7·5, –4·8; p<0·0001) or 16%. Purchases of high-in sodium declined by 96·6 mg/capita/day (–105·3, –87·8; p<0·0001), or 37% relative to the counterfactual.

In contrast, purchases of calories, sugar, saturated fat, and sodium from not-high-in foods and beverages increased, though not enough to offset the declines from high-in products. For example, not-high-in calories purchased increased by 33·0 kcal/capita/day (25·8, 40·2; p<0·0001), or 13% relative to the counterfactual.

Food Purchases

Food-specific results aligned with those from combined foods and beverages, with statistically significant declines in purchased sugar, sodium, and saturated fat. However, calories from food purchases alone, did not decline significantly (figure 2).

Calories from high-in food purchases decreased by 33·1 kcal/capita/day (–37·7, –28·6, p<0·0001), or 21% relative to the counterfactual. Declines in sodium from high-in foods were also large at –89·4 mg/capita/day (–97·9, –80·9, p<0·0001), or –36% relative to the counterfactual. Sugar from high-in food purchases declined by 6·7 kcal/capita/day (–7·8, –5·7; p<0·0001), or 23% relative to the counterfactual, as did saturated fat (–5·4 kcal/capita/

day; –6·7, –4·1; p<0·0001; or 14% relative to the counterfactual). As with total purchases, these declines among high-in food purchases were partially offset by not-high-in purchases.

Beverage Purchases

Overall, beverage purchases had statistically significant declines in calories, sugar, saturated fat, and sodium (figure 3). We found a 10·0 kcal/capita/day decline from all beverage purchases (–13·4, –6·6; p<0·0001), or 10% relative to the counterfactual, and a 9·1 kcal/capita/day decline in sugar (–11·5, –6·6; p<0·0001), or 13%, relative to the counterfactual. Absolute changes in saturated fat and sodium were small (<1 kcal/capita/day and <5 mg/capita/day, respectively), though they represented 6% and 5% reductions relative to their respective counterfactuals.

As with food purchases, the sizeable declines in beverage calories and sugar were driven by reduced high-in beverage purchases. For example, high-in beverage purchases declined by 16·3 kcal/capita/day (–18·7, –13·9; p<0·0001), or 31% relative to the counterfactual. High-in beverage purchases from sugar declined by 14·0 kcal/capita/day (–16·2, –11·8; p<0·0001), or 29% relative to the counterfactual. As with foods, these declines were partially offset by increases in not-high-in beverage purchases.

SES subpopulations: Education and assets

We found no statistically significant interactions between the time trend, the post-policy period, and education or assets for overall or high-in calories purchased, and most pairwise comparisons were statistically non-significant (table 2). However, the pattern of results suggest that highest-educated households showed larger declines in both overall and high-in calories purchased. There was a statistically significant interaction for not-high-in foods wherein the lowest-educated households showed the largest increases in not-high-in calories purchased.

In contrast, the pattern of results suggest that compared to households with higher assets, households with lower assets had larger decreases in calories purchased overall and from high-in products, relative to their respective counterfactuals, and they had smaller increases in calories purchased from not-high-in foods.

Sensitivity Analyses

Overall, our findings were robust (appendix 1), although some there were some differences in estimates and precision by model specification, by NFP linkage, and by time window included.

Discussion

Following implementation of the first phase of Chile's Law of Food Labeling and Advertising, we found significant decreases in overall purchases of calories (–16·4 kcal/capita/day), calories from sugar (–11·5 kcal/capita/day), calories from saturated fat (–2·2 kcal/capita/day), and sodium (–27.7 mg/capita/day), compared to the counterfactual. These declines were largely driven by reductions in high-in food and beverage purchases, with partial compensation from increases in not-high-in purchases.

This study builds on previous evaluations of the Chilean Law, which found that the law improved the nutritional content of the food supply,[17] reduced unhealthy food marketing to children,[18,19] reduced availability of unhealthy foods in schools[20] and helped people better identify unhealthy products and discourage their consumption.[21] Although we were not able to disentangle the effects of the labeling, marketing, and school components of the law in this study, the body of evaluation results shows how each aspect of the law contributed to changes in the food environment and behavior. We believe these results emphasize the need to implement multi-component policies. Also, these results reflect only changes after Phase 1 of implementation. We anticipate larger changes after implementation of Phases 2 and 3, with their increasingly strict nutrient thresholds plus an expansion of the marketing regulation to prohibit all television advertising for high-in products from 6am to 10pm.[22]

Our findings are consistent with a recently published analysis of purchases data from Walmart-Chile by Barahona et al, which found an overall decrease in sugar and calorie purchases of 7–9% among Walmart customers over two years after the policy was implemented.[23] Results were also consistent with a recent meta-analysis of warning label experiments,[24] which included one study in Canada which examined "high-in" warnings similar to the Chilean warning[25] that found that very similar decreases in overall calories, sugar, and sodium purchased. The consistency of these findings across study designs and populations provides support for the effect of these policies on food purchases.

These results also highlight the importance of policies that apply to both beverages and foods. Although Chile is one of the world's top consumers of sugar-sweetened-beverages,[26] beverages comprise only ≈10% of daily calorie intake.[27] Indeed, post-implementation calories purchased from high-in foods showed greater absolute decreases than high-in beverages, compared to their counterfactuals (–33·1 kcal/capita/day and –16·3 kcal/capita/day, respectively). We also found differential changes in nutrients purchased from foods vs. beverages, with larger absolute reductions in sugar coming from beverages, while foods had larger absolute reductions in sodium and saturated fat. Importantly, results for foods may be underestimated given our inability to include all packaged foods (eg, salty snacks; candy) due to the absence of consistently collected data on this category in Kantar. Regardless, these results highlight the need to focus policies on all foods and beverages, not just beverages.

Declines in high-in purchases were partially offset by increases in not-high in purchases. Among foods, this shift resulted in a statistically non-significant change in overall calories purchased. This result is comparable to those of Barahona et al,[23] who also found a pattern of consumers shifting from high-in to not-high in purchases. There was also little net change in purchases from specific food groups, suggesting that consumers shifted (either by choice or due to reformulation) from high-in to not-high-in products within a category rather than changing the type of food or drink they purchased.

Regarding differences by SES, we found complex results. Although statistical tests were largely non-significant for education, the pattern observed suggested that highest-educated households reduced overall and high-in calories more than low-educated households. This result may be driven by greater high-in purchases from high-educated households prior to the law's implementation (supplementary table 10) and is consistent with sugar-sweetened beverage tax evaluations that found greater impact among those who buy more.[28,29] This pattern also aligns with previous literature suggesting differential response to nutrition information by educational status.[30] In contrast, we found that lowest-asset households had larger declines in overall and high-in calories purchased than did high-asset households, but smaller increases in not-high-in calories. This is interesting because households with lower household assets purchased fewer calories in the pre-policy period (supplementary table 10). More research will be needed to understand the drivers of this potential differential effect (eg, if prices of high-in products changed), and should also consider using additional SES measures such as household income.

More research will be needed to understand how industry responded to the law, including changes in price, product reformulation, and food marketing, as well as to monitor potential unintended consequences such as increases in the consumption of non-caloric sweetener.

Limitations

This study's main limitation is the use of observational data to examine changes in purchase trends, precluding assessment of causality. In addition, we were unable to disentangle the effects of multiple policy components (ie, labeling, marketing, and school-based restrictions). A second major limitation is that household food purchases do not represent all foods and beverages that Chileans purchase or consume, including categories that likely contain large amounts of high-in foods, such as those eaten away from home or bulk purchases (including unpackaged bread—a top sodium contributor in Chile). As mentioned, we were also limited by missing Kantar data for sales of high-in product categories of energy drinks, salty snacks, chocolate, and candy. If changes in omitted foods follow the pattern observed in the categories we examined here, we might expect even greater changes. Capturing intake from a range of sources to evaluate dietary changes will also be essential for assessing the law's potential impact on health.

Like any observational study, our results varied depending on the model used and underlying data. For example, results may have been underestimated given that we only had data for 18 months prior to implementation. In fact, we estimated a slight downward trend in high-in purchases in the pre-policy period, which does not reflect the longer-term increase in unhealthy food intake that occurred for at least a decade prior. In addition, there was some variability in estimated differences between observed and counterfactual depending on the model specification and a slight increase in the estimated effect for beverages compared to our previous paper (≈3 calories), though all models consistently found statistically significant declines in overall calories and high-in calories, with an increase in not-high-in calories.

Conclusion

After Phase 1 of the Chilean Law of Food Labeling and Advertising was implemented in 2016, we observed important declines in "high-in" packaged food and beverage purchases that resulted in small but significant declines in purchased calories, sodium, saturated fat, and sugars. More research is needed to understand the law's overall impact after full implementation in 2019.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Research in context

Evidence before this study

To prevent further increases in nutrition-related, non-communicable diseases, Chile was the first country to implement a set of mutually reinforcing policies mandating front-of-package warning labels, restrictions on marketing to children, and banning in-school sales of packaged foods and beverages high in calories and added sugar, sodium, and saturated fat. While previous data showed a decline in calories from beverage purchases after the law was implemented, it is important to understand changes in calories or nutrients from *total* purchases—that is, foods and beverages combined—to understand the potential impact on health.

Added value of this study

This study finds important reductions in calories, sugar, sodium, and saturated fat from unhealthy "high-in" food and beverage purchases following implementation of the Chilean set of laws, which were partially offset by an increase in not-high-in purchases. These changes led to declines in overall purchases of calories and nutrients of concern.

Implications of all the available evidence

These findings emphasize the potential for greater public health impact from multi-component food policies as well as the importance of including full food supply approaches that apply to both beverages and foods. More research will be needed to understand how declines in purchased calories and nutrients of concern translate into changes in diet and health in the long-term.

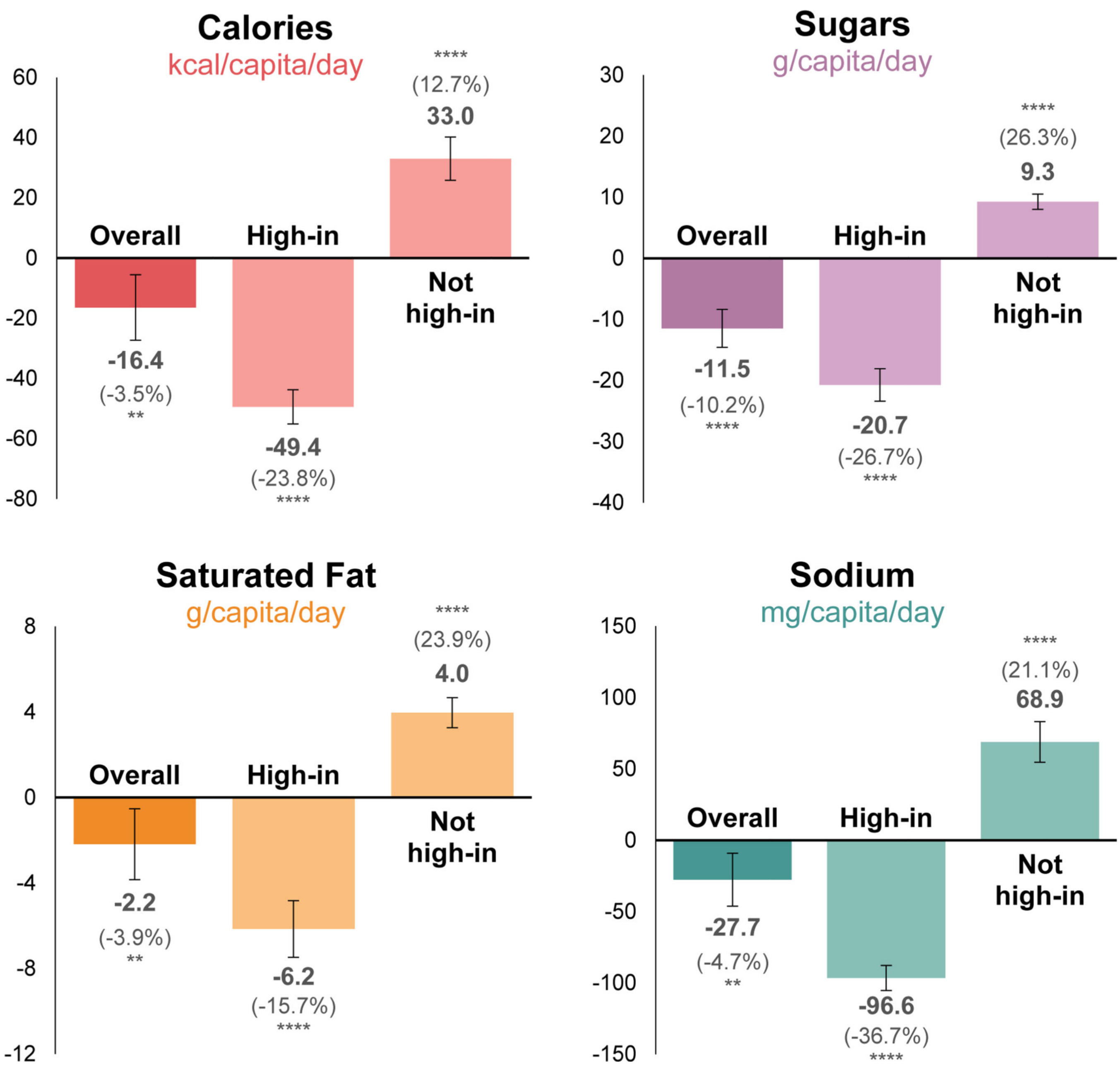

Figure 1. Mean differences in nutrient content between estimated adjusted post-policy purchases and estimated adjusted counterfactual post-policy total food and beverage purchases,[1] overall and by high-in status[2]

[1] Estimates derived from fixed effects models comparing post-policy nutrient content of purchases to counterfactual post-policy nutrient content of purchases based on pre-policy trends. Purchase data provided by Kantar WorldPanel Chile.

[2] High-in status: High-in foods and beverages were those subject to the marketing, labeling, and school foods policies of the Chilean Law of Food Labeling and Advertising due containing added sugars, saturated fats, or salt and exceeding nutrient or energy thresholds; not high-in foods and beverages did not exceed nutrient thresholds and were not subject to the policies; overall estimates include High-in and Not high-in product purchases.

* p<0.05, ** p<0.01, *** p<0.001, *** p<0.0001 for the difference between post-policy nutrient content of purchases compared to the counterfactual post-policy nutrient content of purchases

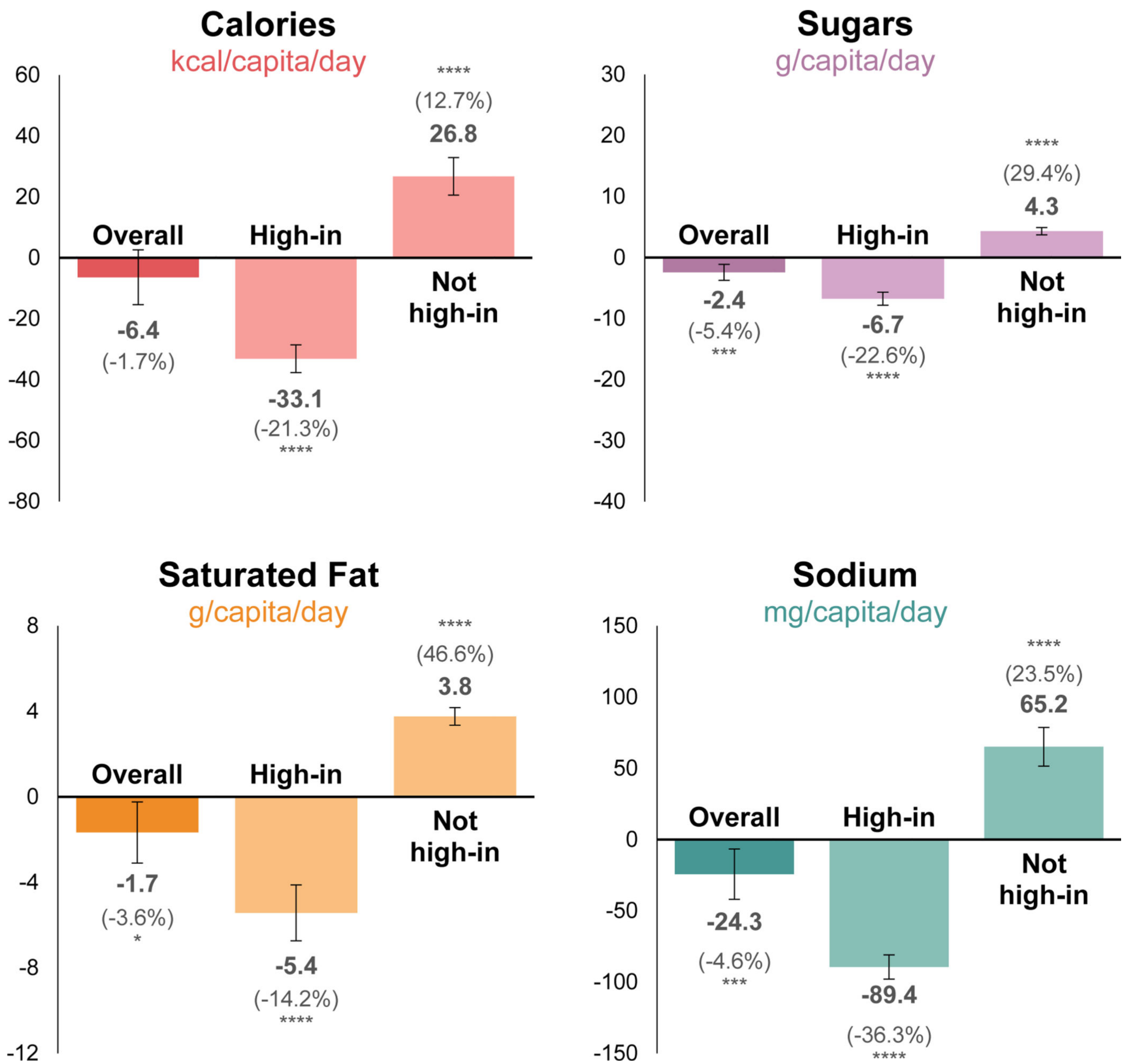

Figure 2. Mean differences in nutrient content between estimated adjusted post-policy purchases and estimated adjusted counterfactual post-policy food purchases,[1] overall and by high-in status[2]

[1] Estimates derived from fixed effects models comparing post-policy nutrient content of purchases to counterfactual post-policy nutrient content of purchases based on pre-policy trends. Purchase data provided by Kantar WorldPanel Chile.

[2] High-in status: High-in foods were those subject to the marketing, labeling, and school foods policies of the Chilean Law of Food Labeling and Advertising due containing added sugars, saturated fats, or salt and exceeding nutrient or energy thresholds; not high-in foods did not exceed nutrient thresholds and were not subject to the policies; overall estimates include High-in and Not high-in product purchases.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, *** $p<0.0001$ for the difference between post-policy nutrient content of purchases compared to the counterfactual post-policy nutrient content of purchases

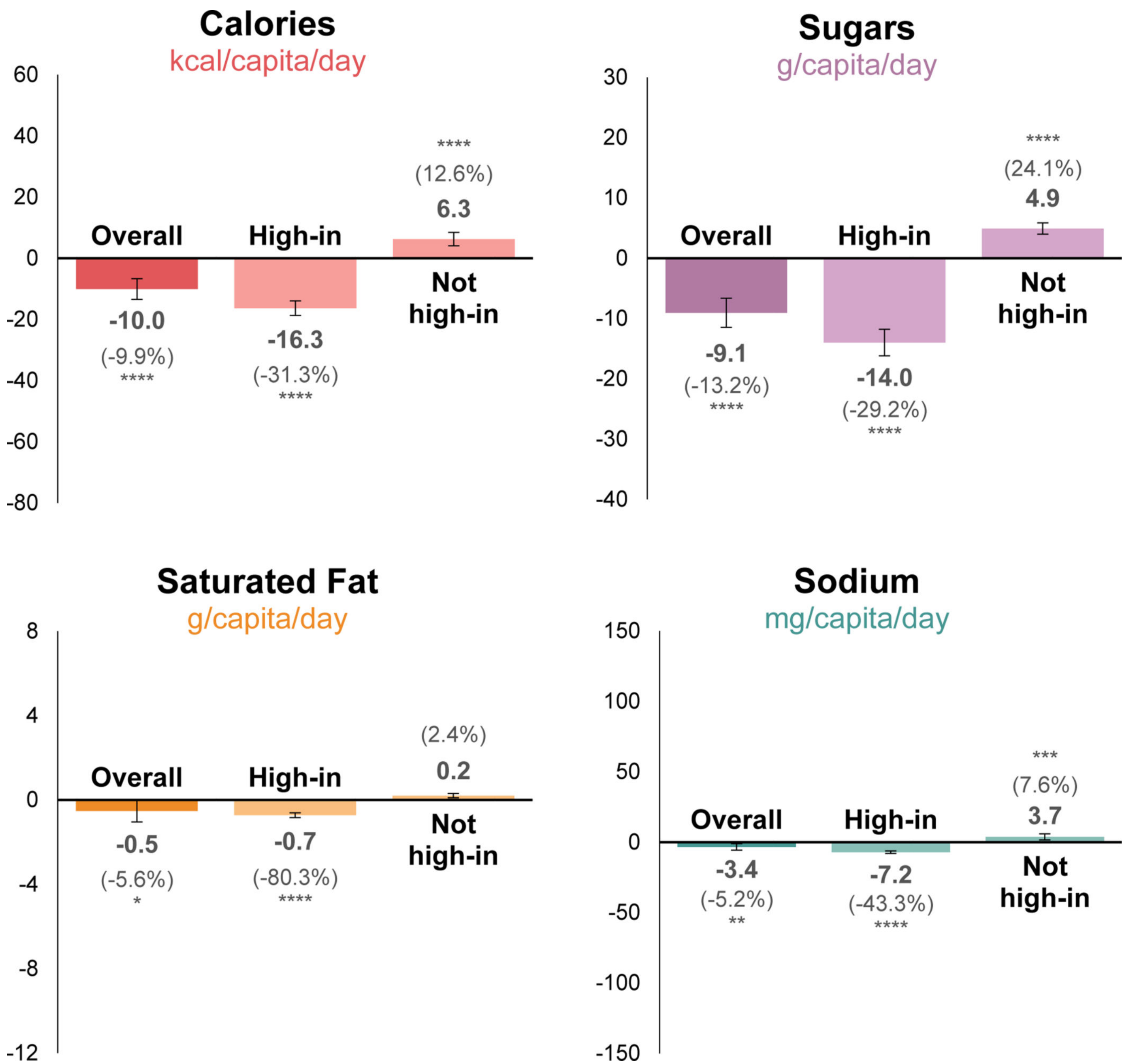

Figure 3. Mean differences in nutrient content between estimated adjusted post-policy purchases and estimated adjusted counterfactual post-policy beverage purchases,[1] overall and by high-in status[2]

[1] Estimates derived from fixed effects models comparing post-policy nutrient content of purchases to counterfactual post-policy nutrient content of purchases based on pre-policy trends. Purchase data provided by Kantar WorldPanel Chile.

[2] High-in status: High-in beverages were those subject to the marketing, labeling, and school foods policies of the Chilean Law of Food Labeling and Advertising due containing added sugars, saturated fats, or salt and exceeding nutrient or energy thresholds; not high-in beverages did not exceed nutrient thresholds and were not subject to the policies; overall estimates include High-in and Not high-in product purchases.

[*] p<0.05, ** p<0.01, *** p<0.001, *** p<0.0001 for the difference between post-policy nutrient content of purchases compared to the counterfactual post-policy nutrient content of purchases

Table 1.

Socio-demographic characteristics of the Kantar WorldPanel Chile sample, 2015–2017

	2015		2016		2017	
No. of households	2,099		2,076		2,099	
No. of household-month observations	22,897		22,881		22,112	
Head of household education	**N**	**%**	**N**	**%**	**N**	**%**
<High school	652	31	584	28	575	27
High school	793	38	820	39	815	39
College or greater	654	31	672	32	709	34
Total	2099	100	2076	100	2099	100
Household assets index, tertile (%)	**N**	**%**	**N**	**%**	**N**	**%**
Low	788	38	750	36	781	37
Middle	635	30	648	31	649	31
High	676	32	678	33	669	32
Household composition, by sex and age (mean (SD))						
Children 0–1 year	0·12 (0·35)		0·08 (0·28)		0·03 (0·19)	
Children 2–5 years	0·34 (0·58)		0·33 (0·57)		0·34 (0·58)	
Children 6–13 years	0·53 (0·72)		0·53 (0·71)		0·54 (0·72)	
Children, female, age 14–18 years	0·18 (0·44)		0·17 (0·41)		0·16 (0·39)	
Children, male, age 14–18 years	0·17 (0·41)		0·17 (0·41)		0·18 (0·43)	
Women	1·53 (0·73)		1·55 (0·76)		1·60 (0·80)	
Men	1·21 (0·78)		1·22 (0·81)		1·28 (0·84)	
Monthly regional unemployment rate (mean (SD))	6·3 (1·0)		6·5 (1·2)		6·7 (1·1)	

Table 2.

Mean differences between the estimated adjusted post-policy calories purchased from total foods and beverages and estimated adjusted counterfactual post-policy food purchases by educational level and household assets[1, 2,3]

	Overall				High-In				Not High-In			
	Absolute Difference	**95% CI**	**p-value**	**Relative Difference**	**Absolute Difference**	**95% CI**	**p-value**	**Relative Difference**	**Absolute Difference**	**95% CI**	**p-value**	**Relat Differe**
Education												
<High School	−7·6	−29·3, 14·0	0·49	−1·7%	−46·8	−57·5, −36·1	<0·0001	−23·1%	39·2	24·5, 53·9	<0·0001	15·3%
High School	−13·9	−29·6, 1·8	0·083	−3·1%	−43·2	−51·4, −34·9	<0·0001	−21·8%	29·2	18·9, 39·6	<0·0001	11·7%
College or Greater	−28·1	−47·8, −8.5	0·0050	−5·6%	−59·3	−70·1, −48·4	<0·0001	**−26·5%** [a]	31·1	18·6, 43·6	<0·0001	11·3%
		p for interaction	0·095			**p for interaction**	0·34			**p for interaction**	0·013	
Household Assets												
Low	−22·3	−42·1, −2·5	0·027	−4·7%	−52·4	−62·2, −42·6	<0·0001	−25·2%	30·1	16·7, 43·5	<0·0001	11·3%
Middle	−15·6	−34·0, 2·8	0·097	−3·5%	−49·5	−59·1, −40·0	<0·0001	−24·6%	34·0	21·5, 46·4	<0·0001	14·0%
High	−11·8	−30·3, 6·7	0·21	−2·4%	−46·3	−56·6, −36·0	<0·0001	−21·6%	34·5	22·7, 46·2	<0·0001	12·6%
		p for interaction	0·93			**p for interaction**	0·23			**p for interaction**	0·27	

[1] Estimates derived from fixed effects models comparing post-policy nutrient content of purchases to counterfactual post-policy nutrient content of purchases based on pre-policy trends. Covariates included age of household's main shopper, household head education level, household composition, household assets, and monthly regional unemployment rate, along with indicator variables for calendar months, a linear time trend, an indicator variable for the policy period, and the interaction of time trend, policy period, and household education or assets. Household education was defined as the educational level of the household head. Household assets was created using a factor analysis including a household's number of bedrooms, number of bathrooms, and number of cars; this index was categorized into tertiles and specified as a set of indicator variables in the model. Pairwise comparisons were conducted between each level of education and household assets.

[2] Purchase data provided by Kantar WorldPanel Chile.

[3] p-value for interaction from Wald tests of the equality of the interaction for policy period, linear time trend, and education or assets.

[a] The only statistically significant pairwise comparison was between college and greater and high school education for high-in calories purchased, p=0.02.