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Nutritional Composition and Purchasing Patterns of Supermarket Prepared Foods Over Time

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Abstract

Introduction: Prepared (ready-to-eat) foods are sold in >90% of U.S. supermarkets, but little is known about their nutritional quality. This study examined trends in purchases of supermarket prepared foods and compared their nutritional profile to that of supermarket packaged foods and restaurant foods.

Methods: Nutrition data were obtained on prepared foods sold from 2015–2019 in 2 supermarket chains (~1,200 stores). One chain (193 stores) provided transaction-level sales data from 2015–2017. Analyses (conducted in 2021–2022) examined trends in the number of different prepared foods offered by the chains, and trends in purchases of calories, total sugar, saturated fat, and sodium from prepared foods. Calorie and nutrient densities (i.e., per 100g of food) and prevalence of being "high in" calories or nutrients (based on Chilean standards) were analyzed among supermarket prepared foods, supermarket packaged foods, and restaurant foods consumed in the National Health and Nutrition Examination Surveys 2015–2018.

Results: The number of different prepared foods offered at the supermarket chains increased from 1,930 in 2015 to 4,113 in 2019. Calories-per-transaction purchased from supermarket prepared foods increased by 1.0 calorie/month (95% CI=0.8, 1.1), a ~3% annual increase, with similar trends for other nutrients. At supermarkets, >90% of prepared bakery and deli items and

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CREDIT STATEMENT

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61% of prepared entrees/sides were high in calories or another nutrient of concern, similar to supermarket packaged foods and restaurant foods.

Conclusions: Supply of and demand for supermarket prepared foods have grown substantially over time. These trends are concerning given these foods' overall poor nutritional quality.

INTRODUCTION

Poor nutrition is a leading modifiable cause of death in the U.S.[1] "Prepared foods" are an important contributor to the U.S. diet, comprising one-third of daily calorie intake.[2] Prepared foods are ready-to-eat foods that are made away from home and are usually eaten on site or soon after purchasing.[3] Sales of prepared foods have increased over the last several decades and now comprise the majority of food sales in the U.S.[2] Prepared foods are a public health concern because compared to homemade foods, they are typically higher in calories, saturated fat, and sodium; contain fewer fruits and vegetables; and are served in larger portions.[2,4]

Although restaurants are the primary source of prepared foods in the U.S. (e.g., entrees, sides, desserts), nearly all U.S. supermarkets also sell prepared foods, including bulk bakery items, sandwiches, deli items, sushi, and pizza.[5] According to food industry reports, supermarket prepared foods are already a multi-billion dollar market, with rapid growth expected over the next several years.[6–9] Supermarket prepared foods often mimic restaurant foods,[10,11] which is concerning given the overall low nutritional quality of restaurant foods.[12–14] However, limited research has examined supermarket prepared foods. One study from 2011–2012 found that most supermarkets offered prepared foods,[5] but examined only a small number of food categories (pizza, tacos, salads, and burgers/hotdogs) and did not report on sales or nutritional quality of these foods. To determine the importance of targeting supermarket prepared foods in future interventions, research characterizing the availability, sales, and nutritional profile of the full range of supermarket prepared foods is needed.

To address these gaps, this study had the following objectives: (1) examine changes in the availability of prepared foods at 2 large supermarket chains over time; (2) analyze time trends in sales of calories and nutrients of interest (saturated fat, sugar, and sodium) from prepared foods purchased in one of the supermarket chains; and (3) compare the nutritional profile (i.e., calorie and nutrient densities) of supermarket prepared foods with that of supermarket packaged foods and restaurant foods.

METHODS

Prepared Food Availability

To determine the availability of prepared foods over time, this study examined the number of different prepared foods sold by 2 supermarket chains from 2015–2019. The chains comprised ~1,200 stores in the Northeastern, Mid-Atlantic, and Southeastern U.S. The chains are traditional supermarkets (not specialty or discount stores) located in rural, suburban, and urban areas that are demographically similar to the U.S. overall.[15] The chains participate in Guiding Stars, a shelf-tag nutrition labeling program.[16,17]

Data for this objective came from Guiding Stars, which tracked nutrition information for all foods sold in the 2 chains from July 2015–January 2019 (n=94,718 unique items) to implement their labeling system.[16–18] Guiding Stars provided updated databases in 6-month intervals. Non-food items (n=1,405) were excluded. Guiding Stars provided products' Universal Product Code (UPC), product description, serving size, servings-per-container, nutritional content per serving, and whether products were subject to U.S. calorie labeling requirements for prepared foods.[3] *Prepared foods* were identified based on this calorie labeling indicator; prepared status and nutrition information were confirmed through an extensive data review process that used product websites and guidance from Guiding Stars personnel (see Grummon et al.[15]). All other foods were classified as *packaged foods* (i.e., prepackaged foods not prepared on site). Foods were further classified into 3 categories: (1) bakery items (e.g., muffins), (2) entrees/sides (e.g., pizza), and (3) deli meats and cheeses (e.g., sliced turkey). Categorization drew on a previously developed food grouping system[19,20] and is described elsewhere.[15] Appendix Tables 1–2 provide additional details on food categorization.

Prepared food availability was determined by calculating the number of different prepared foods (i.e., UPCs) sold at the 2 supermarket chains and the proportion of total foods sold that were prepared foods. These outcomes were calculated in 6-month intervals to provide information on availability over time.

Trends in Prepared Food Sales

To analyze time trends in sales of prepared foods, transaction-level purchasing data were obtained from 1 of the 2 supermarket chains (comprising 193 stores in Maine, Massachusetts, New Hampshire, New York, and Vermont) from April 1, 2015–March 31, 2017. The data included information on items' UPC, product description, date of purchase, price, and quantity purchased. Sales from 175 stores that were continuously open throughout the study period were included. Analyses excluded 497,914,097 non-food items (15.3% of purchased items) and 246,191,725 items (7.6%) that were missing a product description and could not be identified, yielding an analytic sample of 2,501,428,658 items purchased across 273,106,246 transactions.

Nutrition information was obtained for each item purchased by linking the sales data to the Guiding Stars database on UPC at each 6-month interval for which Guiding Stars data were provided. Items sold at the hot bar were excluded because transaction information did not specify which items were selected. Initial linking of the sales data to the Guiding Stars data yielded complete nutrition data for 81.4% of purchased items. After completing several steps to fill in the missing data, 91.2% of purchased items had complete calorie data and 88.6% had complete data for other nutrients. Values for the remaining missing data were imputed to avoid detecting trends that were solely due to missingness (Appendix provides details).

Prepared foods were identified using information in the Guiding Stars database and classified as bakery items, entrees/sides, and deli items (as for objective 1). Outcome measures were sales of calories and unhealthy nutrients (i.e., sugar, saturated fat, and sodium) from prepared foods, derived by multiplying nutrients-per-serving by servings-per-container in each product. Mean calories- and nutrients-per-transaction were calculated by

summing calories or nutrients purchased across all prepared foods in a 4-week period and dividing by the number of transactions in that 4-week period. Purchases were aggregated to 4-week periods (hereafter "month") to reduce the influence of short-term fluctuations in purchases. The percent of total purchases of each nutrient that came from prepared foods was also calculated.

Monthly time trends in mean calories- and nutrients-per-transaction purchased from prepared foods were estimated using generalized estimating equations, regressing the outcome of interest on month. Observations were weighted by the total number of transactions in each store (to reflect between-store differences in sales) and clustered at the store-level. Models were estimated with robust SEs. Monthly trends in percent of total calories and nutrients purchased from prepared foods were estimated similarly. Analyses were conducted overall, by food category, and by poverty status of supermarkets' census tracts (> versus ≤median poverty level [9.8%], from the 2015–2019 American Community Survey[21]) to examine trends by neighborhood SES.

Nutritional Profiles of Supermarket Prepared Foods, Supermarket Packaged Foods, and Restaurant Foods

This study additionally compared the nutritional profile of supermarket prepared foods to that of similar supermarket packaged foods and restaurant prepared foods. Data on the nutritional profile of supermarket foods came from Guiding Stars (described above) for the chain with sales data available. Data on restaurant foods came from the National Health and Nutrition Examination Surveys (NHANES), a nationally representative survey of the civilian, non-institutionalized U.S. population. This study examined foods consumed in NHANES rather than a restaurant foods database (e.g., MenuStat) to reflect the frequency with which different restaurant foods are consumed. Data were obtained from the 2015–2016 and 2017–2018 NHANES cycles (n=19,225) to mirror the periods covered by the supermarket data. This study analyzed the first day of dietary recalls collected by NHANES, consistent with recommendations for estimating mean usual intake.[22] Dietary intake data included information on the types, amounts, and sources (e.g., restaurant vs store) of foods consumed. Participants reporting consumption of restaurant foods (n=2,701) were demographically similar to NHANES participants overall (Appendix Table 3).

Supermarket foods were classified as *prepared foods* or *packaged foods* as described above and elsewhere.[15] Supermarket foods were additionally categorized as bakery items, entrees/sides, or deli items, as above. Foods consumed by NHANES participants were classified as *restaurant foods* if they were obtained from any restaurant (full-service or quick service), including: restaurants with wait staff; fast food or pizza restaurants; bars, taverns, or lounges; or other types of restaurants. Restaurant foods were classified as bakery items, entrees/sides, or deli items using food codes and combination food types (Appendix Table 2).

Outcome measures were calorie density (calories per 100g of food, calculated as [calories-per-serving/serving size in grams]*100), sugar density (grams per 100g), saturated fat density (grams per 100g), and sodium density (milligrams per 100g) from each source (i.e., supermarket prepared foods, similar supermarket packaged foods, and restaurant foods).

These density measures allowed for assessment of nutritional composition independent of product size. For supermarket prepared and packaged foods, densities were calculated by dividing nutrients-per-serving by serving size (grams) for the 88.6% of items with complete data before imputation (n=277 prepared bakery UPCs, 456 prepared entrees/sides, 159 prepared deli, 2,220 packaged bakery, 3,389 packaged entrees/sides, and 1,337 packaged deli). For restaurant foods, densities were calculated by dividing nutrients consumed by the amount of food (grams) for each item consumed on the dietary recall day (1,249 bakery items; 25,704 entrees/sides; 163 deli items). Supermarket and restaurant foods were classified as "high in" calories (>300kcal/100g food), sugar (>15g/100g food), saturated fat (>5g/100g food) and sodium (>500mg/100g food), based on 2018 thresholds of the Chilean Law of Food Labeling and Advertising.[23]

Statistical Analysis

To characterize the nutritional profiles of supermarket prepared foods, supermarket packaged foods, and restaurant foods, the median and IQR of nutrient densities were calculated, as was the percent of foods that were "high in" each nutrient. Analyses of supermarket foods were weighted by the total number of servings sold of each UPC to reflect customer demand. Primary analyses of restaurant foods included all prepared foods consumed as separate observations without applying survey weights, which gave more weight to more commonly consumed foods but did not reflect NHANES's complex sampling design. Sensitivity analyses calculated nutrient outcomes among participants, then estimated survey-adjusted outcomes among consumers of restaurant foods after applying sampling weights. All nutrient density analyses were stratified by food category. The nutritional profile of supermarket prepared foods was examined over time by plotting the percent of items that were high in calories and each nutrient of interest at each 6-month interval with Guiding Stars data.

Analyses were conducted in 2021–2022 using SAS version 9.4 (Cary, NC) and Stata MP version 17. This study was approved by the Harvard Pilgrim Health Care IRB.

RESULTS

The number of different prepared foods offered (i.e., available for purchase) at the supermarkets more than doubled from 1,930 foods in July 2015 to 4,113 in January 2019, though the rate of growth slowed in later years (Figure 1). The percent of different food offerings that were prepared foods also approximately doubled, from 3.1% of all food items in 2015 to 6.4% in 2019.

There were small increases in nutrients-per-transaction purchased from supermarket prepared foods from April 2015–March 2017 (Figure 2). In April 2015, transactions included a mean (SD) of 404.2 calories (68.2), 14.6g sugar (2.7), 9.2g saturated fat (1.7), and 1,287.2mg sodium (236.0) purchased from prepared foods. Over the following 2 years, there was a monthly increase of 1.0 calories (95% CI=0.8, 1.1), 0.08g sugar (95% CI=0.07, 0.08), 0.01g saturated fat (95% CI=0.01, 0.02), and 3.6mg sodium (95% CI=3.0, 4.1) purchased per transaction from prepared foods. The percent of total nutrients (i.e., from all items sold)

that were purchased from prepared foods was stable over time except for a small decrease in percent of saturated fat from prepared foods (trend= −0.02%/month, 95% CI= −0.02, −0.02).

Increases in purchases of calories from prepared foods were driven by prepared bakery items (1.2 calories/month, 95% CI=1.1, 1.2). Conversely, trends were negative for purchases of prepared deli items (−0.2 calories/month, 95% CI= −0.3, −0.2) and flat for prepared entrees/sides (0.1 calories/month, 95% CI= 0.0, 0.1) (Appendix Figure 1). The results were similar by poverty level of supermarkets' census tracts (Appendix Figure 2).

Supermarket prepared foods had generally high calorie and nutrient densities in all food categories (Table 1). The proportion of prepared foods high in ≥1 nutritional outcome was 97% for bakery items, 61% for entrees/sides, and 92% for deli items. The proportion of prepared foods for sale that were high in calories or other nutrients was generally constant over time (Appendix Figure 3). Supermarket packaged foods followed an overall similar pattern to supermarket prepared foods, with some exceptions (e.g., 94% of purchased packaged deli items were high in saturated fat versus only 62% for prepared foods). Restaurant foods consumed by NHANES participants were similarly high in calories and unhealthy nutrients (Table 1). For example, like supermarket prepared foods, the majority of restaurant bakery items, entrees/sides, and deli items were high in ≥1 nutritional outcome (90%, 59%, and 100%, respectively). These results were very similar when examining person-level outcomes (Appendix Table 4).

DISCUSSION

This study of prepared foods sold across 2 large U.S. supermarket chains found substantial increases in prepared foods available for sale over time, coupled with small increases in calories and nutrients purchased from these foods. Prepared foods purchased from supermarkets had generally unhealthy nutritional profiles, with 61% of prepared entrees and >90% of prepared bakery and deli items high in calories or at least 1 nutrient of concern. The nutritional profile of supermarket prepared foods was similar to that of comparable packaged items sold in supermarkets and restaurant foods consumed by a nationally representative sample.

The large increase in the number of prepared foods offered by the supermarket chains from 2015–2019 suggests increasing retailer investment in prepared foods, a trend also documented in industry publications.[24,25] There were also small increases in nutrients purchased from prepared foods from 2015–2017: calories purchased from prepared foods increased on average by 1.0 calories/month, a ~3% annual increase, driven by prepared bakery items (1.2-calorie/month increase, ~9% annually). Although this is among the first studies to examine purchases of supermarket prepared foods, prior studies have documented increasing sales of similar packaged foods.[26,27] Notably, the percent of total calories and nutrients purchased from prepared foods did not change over time, suggesting that customers did not substitute prepared foods for packaged foods but instead may have increased overall food purchases during the study period. The addition of supermarket prepared foods to customers' baskets could have negative health implications given their overall low nutritional quality.

Prior studies have documented that both restaurant foods[12–14,28,29] and ready-to-heat/ready-to-eat supermarket packaged foods[26,30–38] are typically high in calories, saturated fat, sodium, and/or sugar. This study finds a comparably unhealthy nutritional profile of supermarket prepared foods. Although median nutrient densities varied between bakery items, entrees, and deli items, the majority were high in calories or at least 1 nutrient of concern (sugar, saturated fat, sodium). Overconsumption of these nutrients has been linked to chronic disease risk and mortality.[39–42] The overall similar nutritional quality of supermarket prepared foods to restaurant foods observed in this study may contradict customers' perceptions that supermarkets are healthy retail establishments.[43,44] These results also have implications for research studies on the neighborhood food environment, which typically consider supermarkets healthy and restaurants unhealthy.[45] This study demonstrates that supermarkets' prepared food options are generally as unhealthy as restaurant foods, indicating that greater nuance is needed when determining supermarkets' contributions to the neighborhood food environments.

Together, this study's findings underscore the importance of designing policy and behavioral interventions to encourage healthier prepared food choices in supermarkets. One possible strategy is labeling requirements. For example, the Affordable Care Act mandates calorie labeling of prepared foods in large U.S. retailers as a strategy for encouraging healthy prepared food choice and spurring product reformulation.[3] Implementation of these labels was associated with small declines in prepared food purchases from restaurants[46–49] and supermarkets,[50] as well as the introduction of lower-calorie prepared bakery options in supermarkets.[15] Calorie labels might therefore mitigate the increase in calories purchased from prepared foods observed in the present study, which examined sales prior to labeling. Other countries mandate nutrient warning labels,[23] which have been found to reduce availability[51,52] and purchases[53,54] of unhealthy packaged foods in supermarkets; these labels could potentially also be applied to supermarket prepared foods. Another way to improve prepared food selection could be through choice architecture interventions, which target product placement and promotion (e.g., making healthy items most visible to customers). These interventions can lead to healthier food choices for both packaged[55] and prepared foods.[56]

Limitations

Limitations of this study included that data were not available on consumption of supermarket prepared foods or on the number of people who intended to share each item. This made it difficult to contextualize the absolute amount of nutrients purchased and to examine how people consume these foods as part of their overall diet, including potential replacement of homemade or restaurant meals. Furthermore, the data did not contain information on customer demographic characteristics, precluding investigation among populations that may have different purchasing patterns, such as households with lower-income or who shop online.[19,57,58] Third, data on calories and nutrients purchased from items at the supermarket hot bar were unavailable. The estimated trends of purchases from and nutritional profile of entrees/sides could be incorrect if either the popularity of hot bar items or their nutrient content changed over time. Fourth, because the purchasing data were limited to a Northeast supermarket chain, the observed trends in nutrient purchases

over time and nutritional composition of supermarket prepared foods may not generalize to other regions. The chain also participates in Guiding Stars and may be more health-focused than non-participating chains. Future studies using data from other regions of the U.S. and from other supermarkets (including those not participating in nutrition labeling programs) could address these limitations. Finally, nutrient profile analyses compared foods purchased from supermarkets in the Northeast to foods consumed by a nationally representative sample; given these differences, comparisons should be interpreted with caution.

CONCLUSIONS

This study found a substantial increase in supermarket prepared food offerings over time coupled with small increases in unhealthy nutrients purchases from supermarket prepared foods. Supermarket prepared foods had generally poor nutritional quality, with a similar profile to restaurant foods. Interventions that encourage healthy prepared food choice in supermarkets are warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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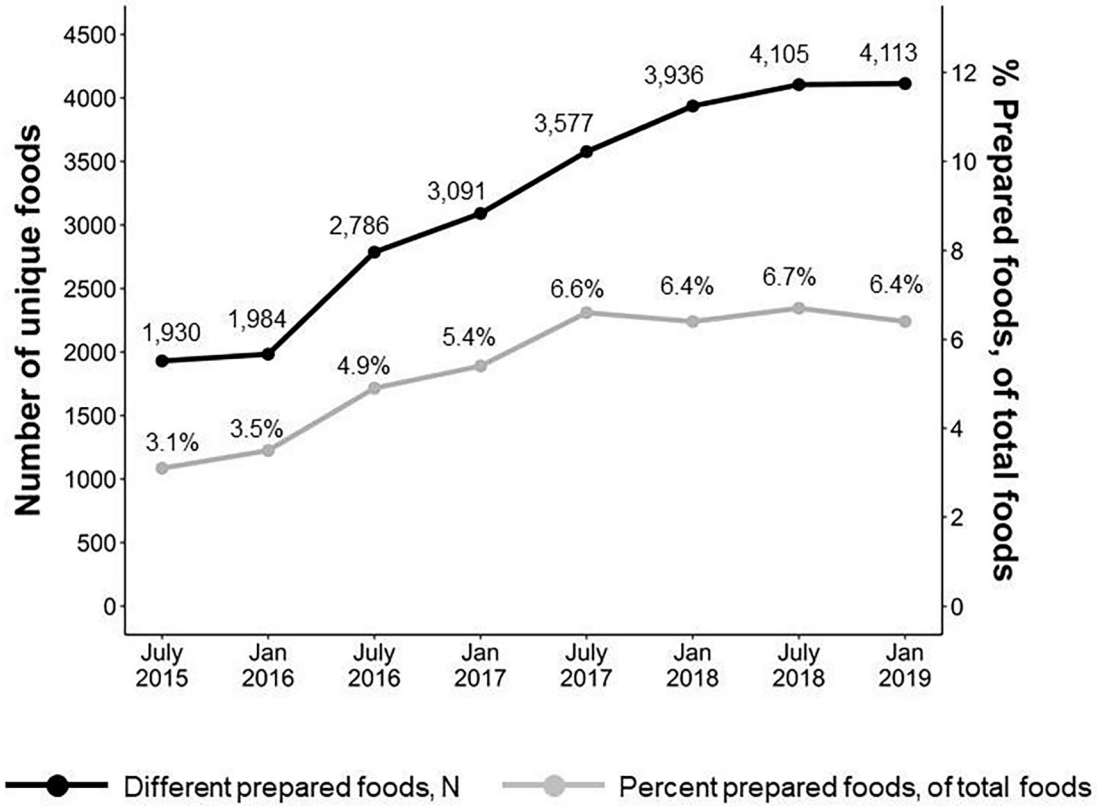

Figure 1.

Increasing availability of prepared foods over time.

Notes: The graph shows the number of different prepared foods (black) and percent of total different foods that are prepared foods (grey) offered in supermarkets over time.

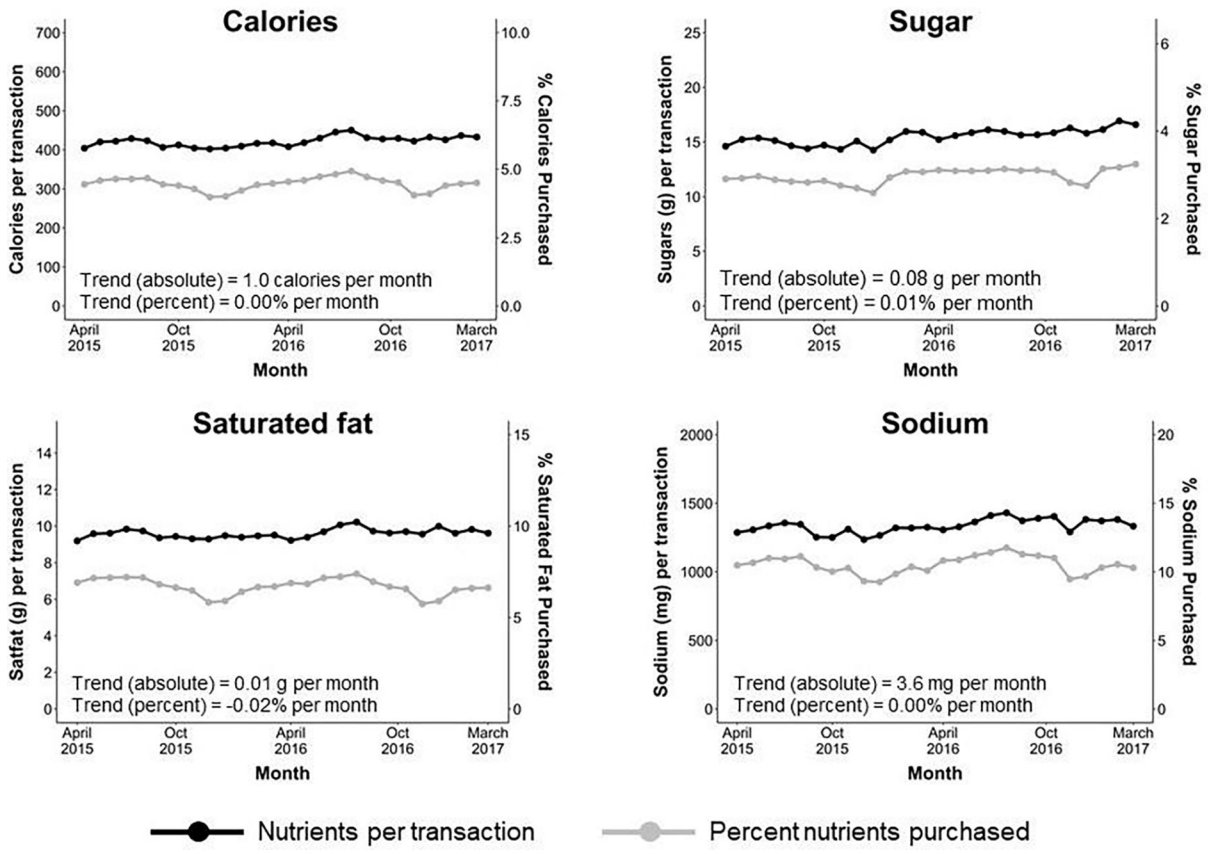

Figure 2.

Trends in purchased nutrient content from supermarket prepared foods.

Notes: The graph shows the mean calories- and nutrients-per-transaction (black) and mean percent of calories and nutrients purchased (grey) from prepared foods across all supermarkets over time. Trends represent the absolute change in mean calories- and nutrients-per-transaction per month from generalized estimating equations (calories: trend=1.0 [95% CI=0.8, 1.1]; sugars: 0.08 [95% CI=0.07, 0.08]; saturated fat: 0.01 [95% CI=0.01, 0.02]; sodium: 3.6 [95% CI=3.0, 4.1]), as well as change in percent of calories- and nutrients-per-transaction per month that came from prepared foods (calories: trend=0.00% [95% CI=0.00, 0.00]; sugars: 0.01% [95% CI=0.00, 0.01]; saturated fat: −0.02% [95% CI= −0.02, −0.02]; sodium: 0.00% [95% CI=0.00, 0.01]).

Table 1.

Nutrient Profile (Median [IQR] or %) of Prepared and Packaged Foods in Supermarkets and Restaurants

Outcome	Supermarkets[a]		NHANES restaurants[b]
	Prepared foods	Packaged foods	
Bakery items			
Calorie density (kcal/100g)	366.3 (322.2, 398.2)	421.1 (372.1, 470.6)	375.0 (330.9, 428.2)
Sugar density (g/100g)	24.8 (21.2, 32.5)	34.5 (20.5, 41.9)	22.8 (7.2, 32.9)
Saturated fat density (g/100g)	4.7 (3.5, 9.4)	5.8 (2.9, 9.3)	5.9 (3.0, 9.5)
Sodium density (mg/100g)	318.6 (309.7, 411.8)	357.1 (300.0, 482.1)	347.6 (304.4, 511.6)
High in calories (>300kcal/100g)	79%	90%	82%
High in sugar (>15g/100g)	85%	80%	65%
High in saturated fat (>5g/100g)	84%	74%	57%
High in sodium (>500mg/100g)	8%	23%	26%
High in any nutrient[c]	97%	94%	90%
Entrees/sides			
Calorie density (kcal/100g)	141.7 (100.0, 143.4)	238.1 (152.9, 328.9)	219.3 (102.2, 293.0)
Sugar density (g/100g)	0.1 (0.0, 2.0)	2.1 (0.6, 4.4)	2.0 (0.4, 3.8)
Saturated fat density (g/100g)	3.3 (0.6, 3.4)	1.8 (0.0, 3.5)	2.3 (0.3, 4.7)
Sodium density (mg/100g)	511.1 (191.2, 2965.2)	526.7 (350.0, 814.3)	451.2 (243.0, 665.1)
High in calories (>300kcal/100g)	4%	30%	23%
High in sugar (>15g/100g)	0%	1%	7%
High in saturated fat (>5g/100g)	53%	31%	23%
High in sodium (>500mg/100g)	56%	54%	46%
High in any nutrient[c]	61%	64%	59%
Deli items			
Calorie density (kcal/100g)	333.3 (125.0, 388.0)	357.1 (300.0, 392.9)	325.7 (325.0, 327.5)
Sugar density (g/100g)	0.0 (0.0, 2.4)	0.0 (0.0, 0.0)	1.1 (1.0, 1.1)
Saturated fat density (g/100g)	10.7 (1.8, 17.9)	16.7 (10.7, 20.0)	8.8 (8.8, 11.3)
Sodium density (mg/100g)	928.6 (642.9, 1392.9)	803.6 (642.9, 1238.1)	814.3 (811.4, 821.4)
High in calories (>300kcal/100g)	54%	75%	87%
High in sugar (>15g/100g)	0%	0%	0%
High in saturated fat (>5g/100g)	62%	94%	94%
High in sodium (>500mg/100g)	83%	94%	98%
High in any nutrient[c]	92%	99%	100%

[a]The supermarket sample included 277 prepared bakery items, 2,200 packaged bakery items, 456 prepared entrees and sides, 3,389 packaged entrees and sides, 159 prepared deli items, and 1,337 packaged deli items sold at 1 of supermarket chains between April 1, 2015 and March 31, 2017.

[b]The NHANES sample included 1,249 bakery items, 25,704 entrees and sides, and 163 deli items from restaurants consumed by NHANES participants in survey cycles 2015–2016 or 2017–2018.

[c]Percent of foods that were high in calories, sugar, saturated fat, and/or sodium.

NHANES, National Health and Nutrition Examination Survey.