

Appendix: Nutritional composition and purchasing patterns of supermarket prepared foods over time (Petimar et al.)

1. Filling in missing nutrient information in the sales dataset. After linking the sales and nutrition datasets on product UPC, we had matches for 81.4% of sold items (by quantity sold). We filled in the missing data using 2 main procedures:

1a. Filling in missing data on nutrients-per-serving and servings-per-container. We took several steps to find missing data on nutrients-per-serving and servings-per-container data, both of which were necessary to calculate total nutrients in a purchased product (e.g., total calories = calories-per-serving X servings-per-container). We prioritized obtaining calorie-per-serving information, but also obtained data on other nutrients-per-serving when possible. These steps were:

1. We imputed missing data using nutrients-per-serving or servings-per-container data from the same UPC in a different 6-month wave, if available. For example, if a UPC was missing nutrition data from the Guiding Stars dataset covering January-June 2016, but that same UPC had non-missing data for the dataset covering July-December 2016, we imputed data from the wave with non-missing data.
2. We assumed that all items classified as “unsweetened drinks” had 0 calories.
3. We made a list of the 500 highest-selling UPCs that were still missing calorie-per-serving or servings-per-container information after going through steps 1 and 2 above, and imputed missing data for these items by doing the following (in order):
 - a. We determined serving size information using product descriptions when available. For example, we assumed that a product with a description of “6 English muffins” had 6 servings-per-container.
 - b. We collected nutrition data from the item’s web page on the supermarket chain’s website. That is, we searched for the product using the product description as provided in the sales data on the chain’s website. If the product’s Nutrition Facts Label was provided on the website, we used that nutrition information to fill in the missing data.
 - c. We imputed nutrition data for similar foods listed in the Food and Nutrient Database for Dietary Studies (FNDDS) ¹. For example, we were missing nutrition data for a UPC with the product description “chocolate cupcake.” We searched for this phrase in the FNDDS and imputed nutrition data for an entry called “regular chocolate cupcake.”
 - d. We imputed nutrition data from similar products sold in the chain with complete nutrition data. For example, we were missing nutrition data for a UPC with the product description “strawberries.” We found another UPC in our dataset with the description of “organic strawberries” with non-missing data, and used this UPC for the imputation.

After going through these processes, we multiplied nutrients-per-serving by servings-per-container for all items that were non-missing for both of these. We then had complete calorie data on 91.2% of sold items and complete data on other nutrients for 88.6% of sold items.

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1b. Imputing total nutrients purchased for products missing nutrients-per-serving and/or servings-per-container information. For the items that were still missing nutrients-per-serving or servings-per-container data after step 1a above, we used a regression-based imputation procedure to obtain total nutrients purchased. For each nutrient, we regressed the total amount of each nutrient on date, price, quantity, prepared status, food group, and whether Supplemental Nutrition Assistance Program (SNAP) benefits were used to pay for the transaction. We used the resulting beta coefficients to calculate predicted total nutrients for items that had missing values (i.e., we used the linear combination of covariates to calculate predicted total nutrients). We set any imputed values less than 0 equal to 0, and we winsorized any values above the 99th percentile to be equal to the 99th percentile to reduce the effect of potential outliers.

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Appendix Table 1. Definitions of prepared and packaged foods

Category	Description
Prepared foods	<p>Foods made away from home that are ready-to-eat and usually consumed on site or soon after purchasing. Can be purchased from restaurants (e.g., entrees, appetizers, desserts) and supermarkets (e.g., entrees sold at the hot bar, fresh baked goods).</p> <p>Retailers in the U.S. with 20 or more locations are required to post information about the calorie content of prepared foods (e.g., via calorie labels on menu boards or in display cases); however, prepared foods do not typically display other nutrition information.</p>
Packaged foods	<p>Prepackaged foods not prepared on site. May or may not be ready-to-eat and may or may not be consumed soon after purchasing. Retailers are required to display full nutrition information (e.g., calories, saturated fat, sodium, protein) for packaged foods via the Nutrition Facts Label.</p>

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Appendix Table 2. Food category descriptions and examples (more details in Grummon et al.²)

Category	Description	Examples
Bakery items	Baked goods including muffins, pastries, bagels, biscuits, cookies, cakes, sweet breads, cupcakes, and rolls	<ul style="list-style-type: none"> • Supermarket prepared: bulk bakery items including muffins, donuts, cookies, rolls, bagels, etc.; cakes from the fresh bakery section • Supermarket packaged: pre-packaged donuts, cookies, cakes, biscuit doughs, sweet breads, rolls, etc. • Restaurant prepared: muffins, donuts, cookies, bagels, biscuits, sweet breads, cakes, cupcakes, rolls, etc. from restaurants
Entrees and sides	Main course items or side dishes/appetizers	<ul style="list-style-type: none"> • Supermarket prepared: rotisserie chicken, sushi, ready-to-eat sandwiches, chicken wings, pizza, fresh soups, fresh salads, potato salad, etc. • Supermarket packaged: meal kits, frozen dinners, soup mixes, boxed macaroni and cheese, frozen pizzas, instant mashed potatoes, instant rice mixes, etc. • Restaurant prepared: entrees (e.g., stir fry, pasta, chicken, fish, hamburgers), salads, soups, sandwiches, pizza, sides (e.g., mashed potatoes, French fries, vegetables)
Deli items	Sliced meats and cheeses	<ul style="list-style-type: none"> • Supermarket prepared: freshly sliced meats (turkey, ham, salami, etc.), sausages, and cheeses (American cheese, Swiss, cheddar, etc.) from the deli counter • Supermarket packaged: pre-packaged, sliced meats and cheeses not sold at the deli counter • Restaurant prepared: cheese, sliced meats (e.g., turkey, salami), sausages from restaurants

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Appendix Table 3. Characteristics of NHANES participants who consumed restaurant foods compared to the full NHANES sample.

Characteristic	Consumed restaurant foods (n=2,701)	Full NHANES sample (n=19,225)
Age		
5 or younger	3%	7%
6 to 11	5%	8%
12 to 17	8%	8%
18 to 29	23%	16%
30 to 44	23%	19%
45 to 59	21%	20%
60 and older	17%	21%
Gender		
Male	51%	49%
Female	49%	51%
Race/ethnicity		
Mexican American	9%	11%
Other Hispanic	7%	7%
Non-Hispanic White	62%	60%
Non-Hispanic Black	13%	12%
Other race/ethnicity, including multi-racial	9%	10%
Education (among those ≥20 years)		
Less than 9th grade	2%	5%
9th-11th grade	6%	8%
HS/GED	23%	24%
Some college/AA	35%	32%
College or more	34%	31%
Income to poverty ratio		
<1	13%	16%

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1 to <2	19%	22%
2 to <3	16%	16%
3 to <5	22%	22%
5 or more	29%	24%

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Appendix Table 4. Nutrient profile (median [interquartile range] or %) of prepared and packaged foods in supermarkets and restaurants, person-level NHANES analysis

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)	370.8 (321.5, 433.3)
Sugar density (g/100g)	24.8 (21.2, 32.5)	34.5 (20.5, 41.9)	21.1 (6.9, 32.2)
Saturated fat density (g/100g)	4.7 (3.5, 9.4)	5.8 (2.9, 9.3)	5.1 (3.0, 8.1)
Sodium density (mg/100g)	318.6 (309.7, 411.8)	357.1 (300.0, 482.1)	353.4 (310.0, 507.8)
High in calories (>300kcal/100g)	79%	90%	81%
High in sugar (>15g/100g)	85%	80%	62%
High in saturated fat (>5g/100g)	84%	74%	51%
High in sodium (>500mg/100g)	8%	23%	26%
High in any nutrient ^c	97%	94%	91%
Entrees/sides			
Calorie density (kcal/100g)	141.7 (100.0, 143.4)	238.1 (152.9, 328.9)	235.6 (179.8, 281.9)
Sugar density (g/100g)	0.1 (0.0, 2.0)	2.1 (0.6, 4.4)	2.9 (1.8, 4.2)
Saturated fat density (g/100g)	3.3 (0.6, 3.4)	1.8 (0.0, 3.5)	3.5 (2.2, 5.0)
Sodium density (mg/100g)	511.1 (191.2, 2965.2)	526.7 (350.0, 814.3)	508.1 (400.4, 618.9)
High in calories (>300kcal/100g)	4%	30%	22%
High in sugar (>15g/100g)	0%	1%	5%
High in saturated fat (>5g/100g)	53%	31%	27%
High in sodium (>500mg/100g)	56%	54%	50%
High in any nutrient ^c	61%	64%	63%
Deli items			
Calorie density (kcal/100g)	333.3 (125.0, 388.0)	357.1 (300.0, 392.9)	325.7 (325.0, 325.7)
Sugar density (g/100g)	0.0 (0.0, 2.4)	0.0 (0.0, 0.0)	1.1 (1.1, 1.1)
Saturated fat density (g/100g)	10.7 (1.8, 17.9)	16.7 (10.7, 20.0)	8.8 (8.8, 10.2)
Sodium density (mg/100g)	928.6 (642.9, 1392.9)	803.6 (642.9, 1238.1)	814.3 (814.3, 815.0)
High in calories (>300kcal/100g)	54%	75%	87%

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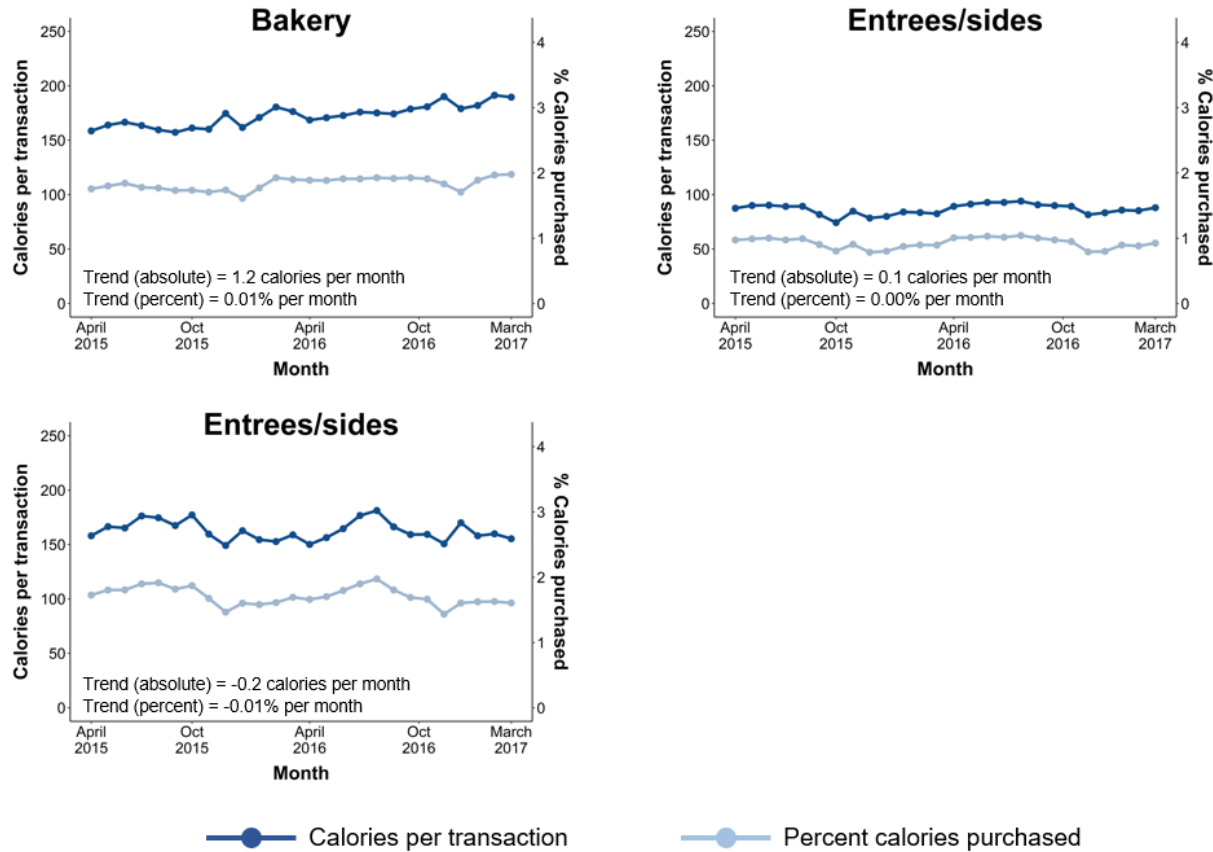
High in sugar (>15g/100g)	0%	0%	0%
High in saturated fat (>5g/100g)	62%	94%	94%
High in sodium (>500mg/100g)	83%	94%	100%
High in any nutrient ^c	92%	99%	100%

^aThe supermarket sample included 281 prepared bakery items, 2205 packaged bakery items, 470 prepared entrees/sides, 3401 packaged entrees/sides, 159 prepared deli items, and 1343 packaged deli items sold at one of the supermarket chains between April 1, 2015 and March 31, 2017.

^bThe NHANES sample included 537 participants who consumed bakery items; 3515 who consumed entrees/sides; and 78 who consumed deli items from restaurants in survey cycles 2015–2016 or 2017–2018.

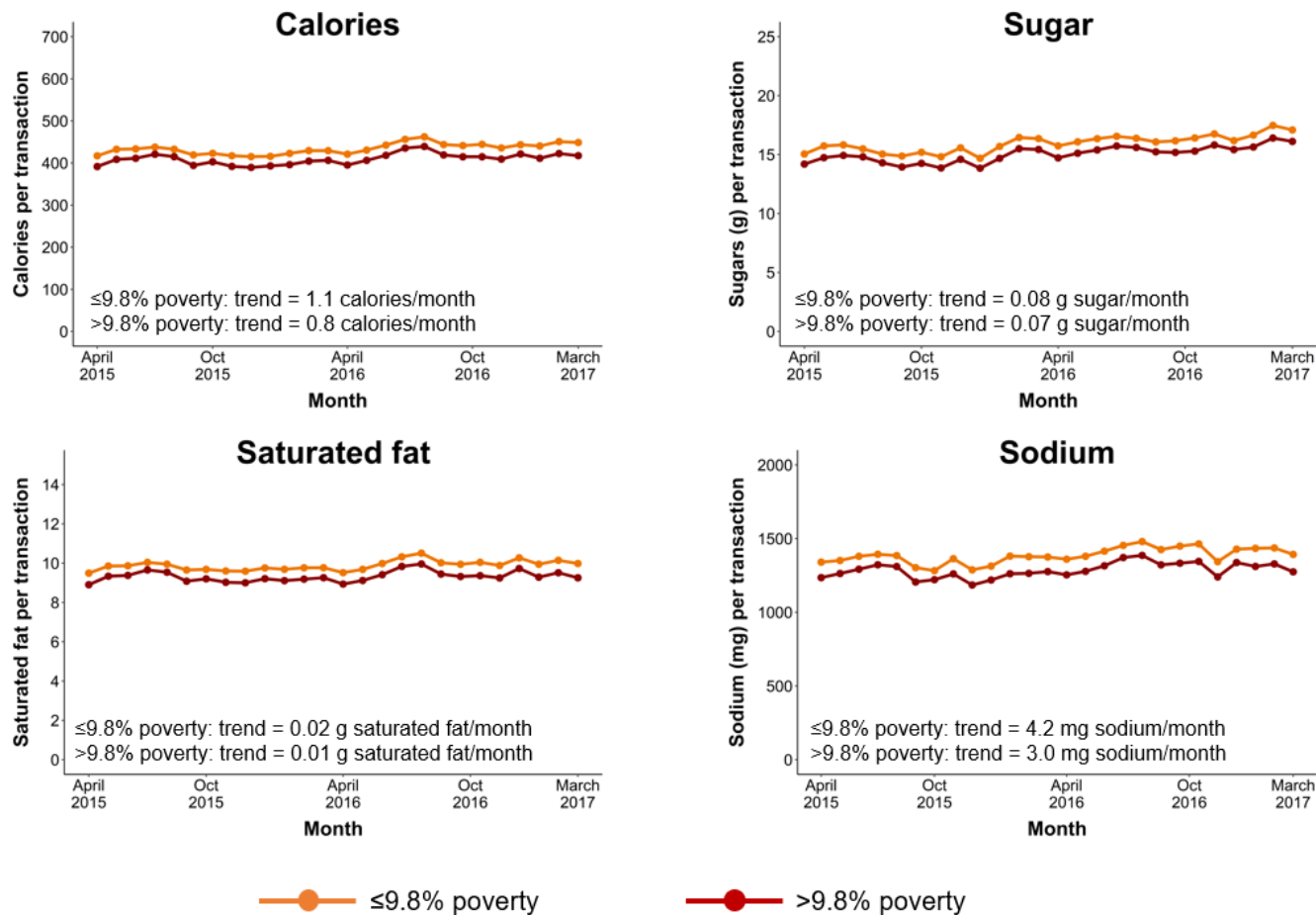
^cPercent of foods that were high in calories, sugar, saturated fat, and/or sodium

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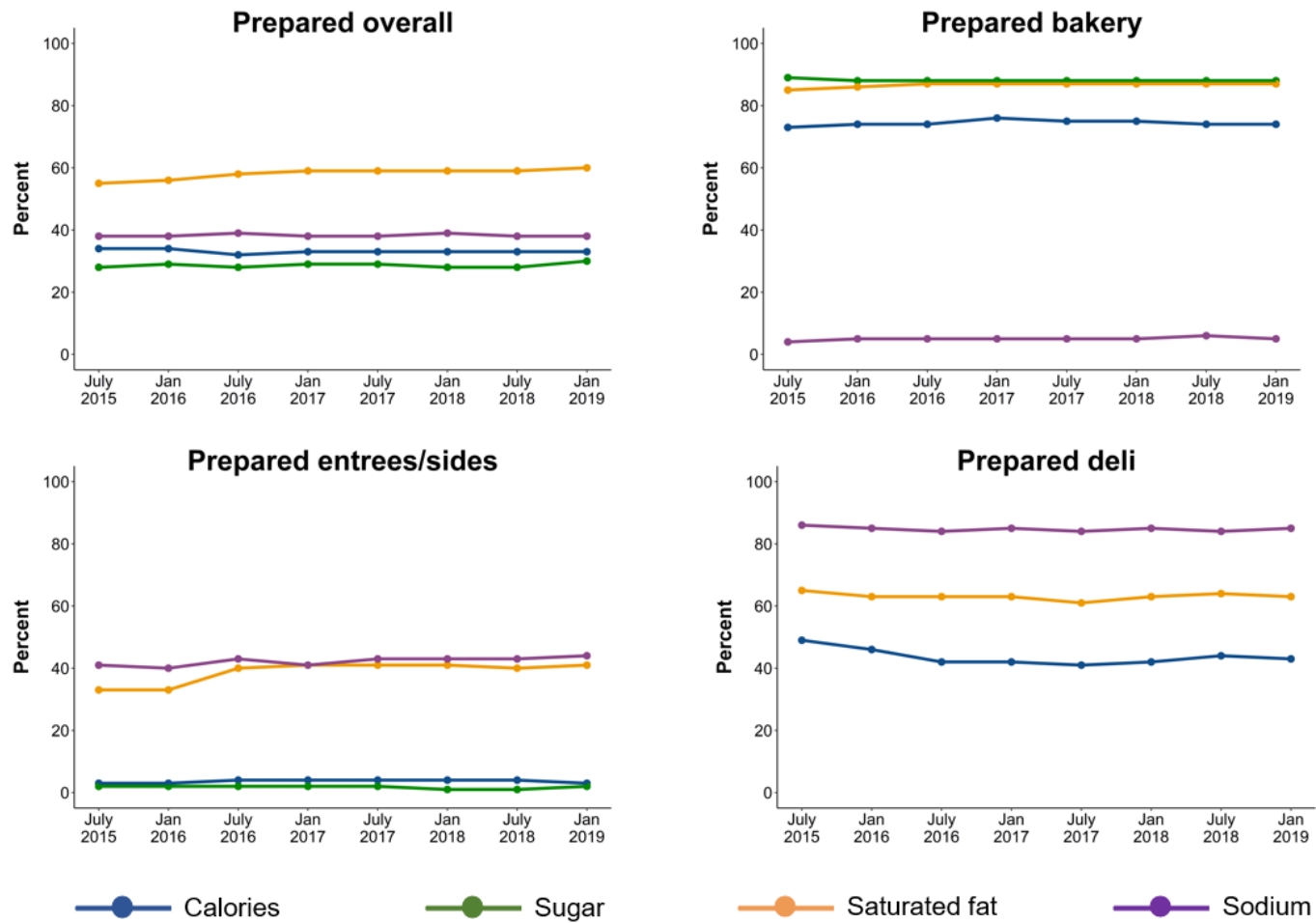
Appendix Figure 1. Trends in purchased calorie content from supermarket prepared foods by food category. The graph shows the mean calories-per-transaction (dark blue) and mean percent of calories purchased (light blue) from prepared foods by prepared food category across all supermarkets over time. Trends represent the change in mean calories-per-transaction per month from generalized estimating equations (bakery: trend=1.2 [95% CI: 1.1, 1.2]; entrees/sides: 0.1 [0.0, 0.1]; deli: -0.2 [-0.3, -0.2]), as well as change in percent of calories-per-transaction per month that came from prepared foods (bakery: trend=0.01% [95% CI: 0.01, 0.01]; entrees/sides: 0.00% [0.00, 0.00]; deli: -0.01% [-0.01, -0.01]).

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Appendix Figure 2. Trends in purchased nutrient content from supermarket prepared foods by poverty status of supermarket census tracts. The graph shows the mean nutrients-per-transaction from prepared foods across supermarkets in census tracts below the median for poverty level (≤9.8% poverty, orange) and above the median (>9.8% poverty, red). Trends represent the change in mean nutrients-per-transaction per month from generalized estimating equations (calories, ≤9.8% poverty: trend=1.1 [95% CI: 0.9, 1.3]; calories, >9.8% poverty: 0.8 [0.6, 1.1]; sugars, ≤9.8% poverty: 0.08 [0.07, 0.09]; sugars, >9.8% poverty: 0.07 [0.07, 0.08]; saturated fat, ≤9.8% poverty: 0.02 [0.01, 0.02]; saturated fat, >9.8% poverty: 0.01 [0.01, 0.02]; sodium, ≤9.8% poverty: 4.2 [3.4, 5.0]; sodium, >9.8% poverty: 3.0 [2.2, 3.7]).

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Appendix Figure 3. Percent of prepared foods available that were high in calories or nutrients of concern over time. The graph shows the percent of prepared foods for sale that were high in calories (blue), sugar (green), saturated fat (orange), and sodium (purple) in each 6-month interval overall and by food group.

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References

1. U.S. Department of Agriculture, Agricultural Research Service. USDA Food and Nutrient Database for Dietary Studies 2017-2018. Published online 2020.
<http://www.ars.usda.gov/nea/bhnrc/fsrg>
2. Grummon AH, Petimar J, Zhang F, et al. Calorie Labeling and Product Reformulation: A Longitudinal Analysis of Supermarket-Prepared Foods. *Am J Prev Med.* 2021;61(3):377-385.
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