Do People Make Up for a Missed Meal with High-Calorie, Less Healthful Meals?

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Overview: Skipping meals may lower your diet quality

It is generally recommended that individuals refrain from skipping meals as this may result in an increase in energy intake at succeeding meals. In fact, some scholars have shown that individuals' attention to food changes depending on whether the individual is hungry or satiated. Moreover, other studies have found that the longer an individual went between meals, the more calories they consume at the next meal, and the lower the quality of that meal. These findings suggest that the healthfulness of food choices may be significantly influenced by the individual's state of food deprivation.

What did we do?

We use the dietary intake data from five rounds of the National Health and Examination Survey (NHANES), covering 2007-16, to examine whether individuals who skip breakfast consume a less nutritious and higher calorie lunch.

Data: The dietary intake component of NHANES

NHANES is a nationally representative survey of the U.S. population that includes a dietary intake component that collects two non-consecutive days of food intake via recall. During the dietary interview, the participant states what they ate, the time of day they started, and what they considered that occasion to be (e.g., breakfast, snack). We classify each meal as either a breakfast, lunch, dinner, or snack according to the respondent's definition of the eating occasion. Meals are classified as FAFH if the majority of calories in that meal, excluding beverages, came from fast-food or table-service restaurants, cafeterias, or taverns.

On average, 21 percent of all the eating occasions are reported to be breakfast, 20 percent are lunch, 23 percent are dinner, and 36 percent are snacks. Each breakfast has on average 383 calories, while an average lunch has 594 calories and dinner has 711 calories. On average, 15 percent of Americans skip breakfast, 16 percent skip lunch, and 7 percent skip dinner.

Meal	Percent	Calories	Percent who skip
Breakfast	21.1	383.0	15.0
Lunch	20.3	594.3	16.0
Dinner	22.8	711.0	6.8

Estimation Strategy: Individual Fixed Effects Model

Exploiting the fact that we have two distinct days of dietary intake for the same individual, we estimate the relationship between our outcomes (nutritional quality and energy intake at lunch) and skipping breakfast using an individual fixed effects model (FE). We specify the lunch outcome (y_{id}) as follows:

$$y_{id} = \alpha_0 + \alpha_1 \text{Breakfast}_{id} + \alpha_2 Z_{id} + \beta_i + \epsilon_{id}$$

Where y_{id} is equal to the nutritional quality or the total calories consumed at lunch, excluding drinks, on day $d = 1, 2$, by individual i; $Breakfast_{id}$ is a dummy variable equal to 1 if individual i ate breakfast on day d, and zero otherwise; Z_{id} is a vector of day specific variables for individual i (i.e., day of week, total meals consumed in the day, etc), β_i is the unobserved time-invariant individual effect, and ϵ_{ie} is the individual, event-specific error term.

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Measuring Nutritional Quality: Guiding Stars Program

We assess nutritional quality according to the Guiding Stars Program (GSP) formula, which evaluates the nutrient content of foods as compared to the recommendations in the *Dietary Guidelines for Americans* (DGA). The GSP formula assigns a score to each item that reflects its healthfulness based on the information on the Nutrition Facts Panel and the ingredients list. The formula assigns credit points for nutrients that are encouraged by the DGAs, such as vitamins and minerals, whole grains, and dietary fiber, and assigns debits point for nutrients that should be consumed less according to the DGAs, such as sodium and added sugars.

Final GSP scores in our data range from -21 (least healthful) to +7 (most healthful). A score above zero indicates that the positive nutrient contribution outweighs the negative nutrient contribution. After rating each food item consumed at lunch, we calculate the overall nutritional quality score using three different approaches: simple mean; weighting each item by its share of total grams; and weighting each item by its share of total calories.

Figure 1: Distribution of Guiding Stars scores among food items consumed at lunch
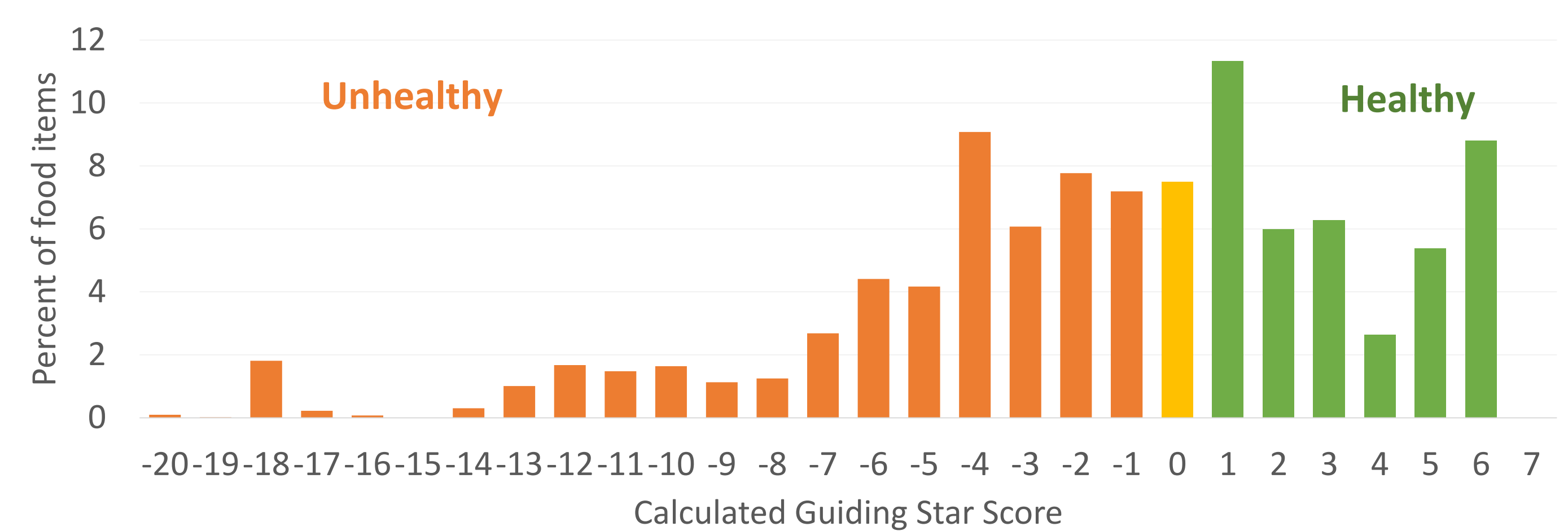
What did we find?

After controlling for the number of snacks, the time between the last meal and lunch, whether lunch was consumed at home or away from home, calories from beverages, and whether it was a weekend, we find that people who eat breakfast consume 32.2 (6 percent) fewer calories at lunch (column 1). If occurring daily, this decrease in calories results in a reduction of 964.5 calories per month. We also find that those who eat breakfast have a lunch that is between 0.24 and 0.33 points more healthful (increases of between 17.5 and 24.3 percent), depending on how the healthfulness score is constructed.

Dependent variable (y_{id})	(1) Calories at lunch	(2) None	(3) Grams	(4) Calories
		GSP score for lunch food items (Weighted by...)		
Breakfast	-32.15*	0.33**	0.28*	0.24*
	(18.32)	(0.16)	(0.16)	(0.13)
# of snacks before lunch	10.96*	0.1	0.1	0.1
	(5.78)	(0.05)	(0.05)	(0.04)
y_{id} from drinks at lunch	0.15***	0.03***	0.03***	0.02***
	(0.04)	0.0	(0.01)	(0.01)
Time since last meal	0.14***	0.0	0.0	0.0
	(0.04)	0.00	0.00	0.00
Lunch FAH	-92.16***	0.13**	0.0	0.12**
	(7.30)	(0.06)	(0.06)	(0.05)
Weekend	56.68***	-0.20***	-0.16***	-0.08*
	(6.30)	(0.06)	(0.05)	(0.05)
Constant	525.37***	-1.82***	-1.45***	-1.62***
	(23.67)	(0.20)	(0.20)	(0.16)
Mean	527.40	-1.38	-1.15	-1.37

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Next steps

We will expand the analysis to study how dinner intake is affected when skipping either breakfast, lunch, or both earlier meals, and explore whether effects vary by income and other demographic characteristics. We also plan to investigate how skipping meals affects children's overall diet.