RESEARCH LETTER

ONLINE FIRST

Fattening Fasting: Hungry Grocery Shoppers Buy More Calories, Not More Food

Fasting, intended or unintended, is a common phenomenon.[1] It can be self-imposed in the case of extreme dieting, religious fasts, and chaotic work schedules.[2,3] It can be medically imposed in the case of fasting before blood draws or surgery.[4] In extreme cases, it can be caused by external circumstances, such as food shortages, natural disasters, or poverty.[5]

Food deprivation has been shown to alter the quantity of food people buy or consume.[6,7] However, little attention has been given to how fasting affects the composition of people's food choices. Do people just buy more when food deprived, or do they specifically increase purchases of high-calorie, relative to low-calorie, foods?

See Editor's Note

There is some reason to suspect that shifts in purchase following food deprivation would indeed focus on increases in high-calorie foods. Fasting has been shown to increase brain reactivity to particular types of food over others.[8] Fasting participants showed increased activation in brain areas associated with reward, including the ventral striatum, amygdala, anterior insula, and medial and lateral orbiofrontal cortex, in response to high-calorie, vs low-calorie, foods.[9]

If reactivity to high-calorie foods is increased following fasting, it may well be that people would also choose more of those foods relative to low-calorie foods. Indeed, recent research has demonstrated a shift toward more high-calorie options following 18-hour fasts.[1] Such fasts might be a rarity in daily life, but short periods of deprivation—such as skipping a meal—are fairly common. If shifts toward a higher-calorie shopping basket occur even with short-term deprivation, this would increase the importance of such findings for a wide number of groups ranging from meal-skipping dieters to overworked medical residents. We sought to determine whether short-term food deprivation leads to an increase in high-calorie relative to low-calorie choices.

Methods. A laboratory study and a field study were conducted. In the laboratory study, 68 paid participants (age range, 18-62 years; 71% were female) were asked to avoid eating for 5 hours prior to the study. The institutional review board–approved study was conducted in the afternoon hours (12-5 PM) of 2 weekdays, involving groups of 6 to 12 participants. In a random half of the sessions, participants were given a plate of Wheat Thins (Nabisco) and instructed to eat enough to no longer feel hungry (satiety condition). In the other half of the sessions, participants were not given such foods (hunger condition). Participants were then asked to shop in a simulated online grocery store that offered a mix of lower-calorie foods (fruits, vegetables, chicken breasts) and higher-calorie (candy, salty snacks, red meat) foods with each high-calorie item paralleled by a lower-calorie alternative. Products were displayed without prices.

A follow-up field study was conducted in a grocery store where we tracked people's purchases at different times of the day (N = 82 participants) when an earlier study had indicated they were most likely to be full (1:00-4:00 PM) or hungry (4:00-7:00 PM). Purchases were categorized as low-calorie and high-calorie. We then calculated number of low-calorie options relative to high-calorie options across these hungry and full time slots.

Results. As **Table 1** indicates, hungry laboratory participants chose a higher number of higher-calorie products [$t_{66} = 2.02$; $P = .05$], but there were no differences between conditions in the number of lower-calorie choices ($P > .50$) and the total number of food items they selected was similar ($P = .10$). This same trend was found across individual product categories (**Table 2**).

Field study shoppers completing the study at higher hunger hours (4:00-7:00 PM) bought less low-calorie food relative to high-calorie food options compared with those completing the study at lower-hunger, after-lunch hours (1:00-4:00 PM). The ratio of low-calorie to high-calorie foods purchased was lower after 4:00 PM (2.48) than between 1:00 PM and 4:00 PM (3.96). Differences were sig-

Table 1. Choices for Hungry vs Sated Participants

	Mean (SD), No.	
Choice	Hungry	Sated
Food choices, total	13.90 (4.62)	11.72 (5.62)
Low-calorie choices	8.24 (2.77)	7.76 (7.77)
High-calorie choices	5.72 (3.49)	3.95 (3.47)
Low-calorie food by category		
Snacks	2.84 (0.99)	2.44 (1.05)
Dairy	1.40 (1.11)	1.56 (1.36)
Grocery	2.80 (1.61)	2.81 (1.89)
Meat	1.20 (0.71)	0.95 (0.95)
High-calorie food by category		
Snacks	1.24 (0.97)	0.91 (0.89)
Dairy	1.60 (1.32)	1.11 (1.35)
Grocery	1.60 (1.66)	1.09 (1.92)
Meat	1.28 (0.79)	0.84 (0.87)

Table 2. Purchase of Less Healthy Items in Late Evening Relative to Afternoon

	Shopping Time			
Choice	1:00-4:00 PM	4:00-7:00 PM	Difference	*P* Value
Ratio of low- to high-calorie food	3.96 (3.89)	2.48 (2.77)	$F_{1,43} = 5.52$	.02
Low-calorie food	11.2 (11.77)	8.21 (7.41)	$F_{1,55} = 4.26$	.04
High-calorie food	3.69 (3.31)	3.81 (4.44)	$F_{1,55} = 0.24$	.62

nificant at the $P = .02$ level, controlling for BMI: $F_{1,43} = 5.52$. This difference emanated mostly from a decrease in healthy items for afternoon hours: from 11.2 in the early afternoon to 8.21 in the evening: $F_{1,55} = 4.26$; $P = .04$. In other words, people who shopped at hours when they were more likely to be hungry tended to buy less low-calorie foods proportionate to overall purchases.

Discussion. Even short-term food deprivation can lead to a shift in choices such that people choose less low-calorie, and relatively more high-calorie, food options. Given the prevalence of short-term food deprivation, this has important health implications. It suggests that people should be more careful about their choices when food-deprived and possibly avoid choice situations when hungry by making choices while in less hungry states (eg, by eating an appetizer before shopping).

In conclusion, even short-term fasts can lead people to make more unhealthy food choices, picking a lower quantity of high-calorie, relative to low-calorie, foods.

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