

Bad Popcorn in Big Buckets: Portion Size Can Influence Intake as Much as Taste

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ABSTRACT

Objective: It is often believed that people overeat the foods they like. We investigated whether environmental cues such as packaging and container size are so powerful that they can increase our intake of foods that are less palatable.

Design, Setting, and Participants: In a 2 × 2 between-subjects design, 158 moviegoers in Philadelphia (57.6% male; 28.7 years) were randomly given a medium (120 g) or a large (240 g) container of free popcorn that was either fresh or stale (14 days old). Following the movie, consumption measures were taken, along with measures of perceived taste.

Outcome Measures and Results: Moviegoers who were given fresh popcorn ate 45.3% more popcorn when it was given to them in large containers. This container-size influence is so powerful that even when the popcorn was disliked, people still ate 33.6% more popcorn when eating from a large container than from a medium-size container.

Conclusions and Implications: Even when foods are not palatable, large packages and containers can lead to overeating. The silver lining of these findings may be that portion size can also be used to increase the consumption of less preferred healthful foods, such as raw vegetables.

KEY WORDS: environmental cues, portion size, intake, palatability, serving size, freshness, stale popcorn

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INTRODUCTION

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People tend to believe that how much they eat is largely based on the taste of food, and research in physiology and sensory studies often reports positive correlations between food palatability and consumption volume.¹ Interestingly, this correlation has been shown only in the absence of competing environmental influences. On a day-to-day basis, a wide range of competing environmental influences—such as serving sizes, distractions, and the presence of others—may increase food intake independent of its palatability.² As a result, the taste or quality of a food—within a reasonable range—might have less to do with how much we eat than the environmental factors around us.

Consider the basic impact of environmental cues, such as package and portion sizes.^{3,4} For both adults⁵ and children,⁶ the doubling of a size of a container has generally translated into a 18% to 25% increase in consumption for many meal-related foods (such as spaghetti) and a 30% to 45% increase in many snack-related foods.⁷ These large packages and portions may increase consumption partly because they suggest larger consumption norms, that is, they implicitly suggest what might be construed as a “normal” or “appropriate” amount to consume. For instance, adults at a Super Bowl party served themselves 53% more Chex-mix when presented with 4-liter serving bowls instead of 2-liter serving bowls. The reason? The bigger bowls subtly suggested it was “normal” to take more.⁸

Many people do not carefully monitor how much they eat, and they can be influenced by consumption norms suggested by larger packages and portions.² Without knowing how much is appropriate to eat or how much one has eaten, the amount of food left in a container can provide a biasing consumption norm. Over-reliance on such cues may, in turn, influence how much food people consume in distracting or engaging situations. People who were served soup from “bottomless,” refillable soup bowls ate 73% more soup than those eating from conventional bowls, but they did not rate themselves any more full.⁹

There are emerging indications that distracting or engaging situations may foster a context in which people can be influenced by container size and portion size even when the food does not taste good.^{10,11} Unfortunately, these indications are not conclusive because such studies do not manipulate food palatability; instead, they ask participants only to

rate the taste of a generally favorable food (such as chocolate candies or lasagna).

If, however, it can be shown that environmental cues such as package size or portion size can influence the consumption of less palatable foods, there are immediate implications for nutrition education and consumer welfare.¹² For instance, such a finding would provide an important warning that portion size can ubiquitously cause us to overeat even when we are served less preferred foods. It could also suggest a means by which to encourage the consumption of more healthful foods (such as raw vegetables) that might not be preferred as much as sweet or salty snacks or high-fat side dishes.

Past research in this area by Wansink and Park has not been conclusive because it did not objectively manipulate the palatability of food.¹⁰ The study described in this article directly manipulates the palatability of popcorn (fresh versus stale) and then presents it to moviegoers in either medium- or large-size containers. Although people tend to believe that how much they eat is largely based on the taste of food, this study investigated whether this was true or whether environmental factors could instead influence a food's intake independent of its palatability.

METHOD

This study investigated moviegoers who had independently elected to see 1 of 4 showings (2 consecutive shows on 2 consecutive evenings) of the film *Stargate* at a second-run theater in a northern Philadelphia suburb. On purchasing their ticket, all of the 177 adult moviegoers were asked if they would consent to answer a few questions related to the "theater and its concessions" following the movie. One hundred fifty-eight people (89.3% of the original 177 moviegoers approached) between the ages of 18 and 66 years agreed to be involved in the study (57.6% male; 28.7 years). Consistent with the standard policy of the Human Subjects Committee of the Institutional Review Board, questions related to ethnicity, height, weight, or income were not asked to maintain greater confidence of anonymity.

Because of their participation in the study, moviegoers were then told that they would be given free popcorn and a drink. The study employed a 2 × 2 between-subjects design wherein each individual was randomly given a medium (120 g) or a large (240 g) container of popcorn that was either fresh or stale (14 days old). Each bucket of popcorn was

preweighed prior to being distributed, and the weight had been unobtrusively marked on the bottom of the bucket. The generous size of the buckets ensured that the popcorn would not be completely consumed and that there would be no artificial ceiling to how much people could consume.¹⁰

The random assignment of the moviegoers to the 4 conditions enabled equivalent comparisons to be made. As Table 1 indicates, the moviegoers in each randomized subsample were similar in terms of their age (28.9, 30.4, 29.0, and 27.2 years of age; $F_{3,154} = 0.45, P > .20$) and in terms of their gender mix (57%, 60%, 62%, and 54% male; $\chi^2 = 0.522, P > .20$).

Following each 119-minute movie session, the popcorn containers were collected. The weight of each person's remaining popcorn was subtracted from the initial weight to assess how much had been eaten. Subsequent inspections of the theater revealed no notable spillage.

All moviegoers also completed a questionnaire that asked whether they agreed or disagreed with the statements "This popcorn tasted good" and "This popcorn was of high quality." They indicated their agreement on a 9-point scale (1 = "strongly disagree" and 9 = "strongly agree"). Consistent with the recommended process-tracing efforts in food intake research,¹³ moviegoers were also asked to write down their description of the taste of the popcorn and to indicate whether they thought they ate more or less because they were given a large or a small bucket. Each questionnaire was given a unique identification code that matched the subject's popcorn container. As they left the theater and turned in their questionnaire, subjects were given a written debriefing along with a free movie pass.

RESULTS

The results in Table 2 indicate that moviegoers ate an average of 45.3% more popcorn from a large container than from a medium container when the popcorn was fresh (85.6 vs 58.9 g; $F_{1,76} = 38.6, P < .01$). The key focus of this study, however, was whether container sizes influenced consumption when the popcorn was unfavorable. In this case, 73 of 86 moviegoers who were given stale popcorn described the popcorn with negatively valenced remarks, such as "stale," "soggy," or "terrible." In spite of these negative reactions toward this stale, 14-day-old popcorn, the Figure illustrates that moviegoers who had been given large containers ate 33.6% more than those given the medium-size containers

Table 1. Random Assignment of Moviegoers Showed No Age or Gender Differences (Means ± Standard Deviations)

	Medium Container (120 g)		Large Container (240 g)		Statistical Test
	Fresh Popcorn (n = 38)	Stale Popcorn (n = 39)	Fresh Popcorn (n = 40)	Stale Popcorn (n = 40)	
Age	28.9 ± 11.7	30.4 ± 13.1	29.0 ± 11.7	27.2 ± 10.9	$F_{3,154} = 0.465 (P > .20)$
Gender, % male	57	60	62	54	$\chi^2 = 0.522 (P > .20)$

Table 2. Larger Containers Influence Consumption Volume of Both Fresh and Stale Popcorn (Means \pm Standard Deviations)

	Medium Container (120 g) n = 77		Large Container (240 g) n = 80		F Values (df = 154)	Statistical Significance of Container Size, Freshness, and Their Combined Impact	
	Fresh Popcorn	Stale Popcorn	Fresh Popcorn	Stale Popcorn		Container Size	Container Size \times Freshness
Popcorn eaten, g	58.9 \pm 16.7	38.0 \pm 16.1	85.6 \pm 19.8	50.8 \pm 14.1	52.4**	101.8**	7.4**
"This popcorn tasted good" [†]	7.7 \pm 1.4	3.9 \pm 2.4	6.8 \pm 1.5	2.2 \pm 1.7	19.5**	201.1**	2.5**
"This popcorn was of high quality" [†]	7.3 \pm 2.1	3.1 \pm 1.5	6.8 \pm 1.9	2.1 \pm 2.1	5.6*	194.0**	0.4

[†]Means were measured on a 9-point scale (1 = strongly disagree; 9 = strongly agree).

* $P < .05$; ** $P < .01$.

(50.8 vs 38.0 g; $F_{1,77} = 8.73$, $P < .01$). Container size increased consumption for both the fresh and the stale popcorn (45.3% and 33.6%, respectively); however, the relative increase in consumption was greater for the fresh popcorn than for the stale popcorn ($F_{1,154} = 7.42$, $P < .01$).

Do we overeat the foods we like, or do we overeat the food we have? In this distracting theater environment, 41.6% of the amount of the popcorn that each person ate could be simply attributed to the size of the container and the popcorn's freshness, not to the actual perceived taste or quality of the popcorn. Table 3 shows that when a regression of container size and freshness was conducted against consumption volume, ratings of taste and quality had no incremental impact on how much was eaten. That is, a regression of container size and freshness on consumption volume accounted for 41.6% of the variance in how much was eaten. Importantly, when perceptions of taste and quality were added to the regression, they did not account for any additional variation in how much was consumed (R^2 from 0.416 to 0.423; $F_{1,154} = 0.487$; $P > .20$). Together these findings indicate that perceived taste and quality had little to do with how much popcorn was eaten compared to the size of the container and its freshness.

CONCLUSIONS

Research in both physiology and sensory studies has underscored the importance of palatability on food intake and consumption. In contrast, our findings show that environmental cues, such as container size or portion size, can influence the consumption of even unpalatable foods. This is the first study to show evidence of this powerful effect even after having directly altered the palatability of a food.

Although a food's palatability is correlated with consumption in controlled laboratory conditions, environmental cues can dramatically influence consumption of even less palatable foods in day-to-day situations. This is consistent with the notion that the size of a serving provides a suggested "consumption norm" of how much is appropriate to consume.^{2,9} In the absence of other cues as to how much is

appropriate to eat, the size of a container can bias one's intake in a distracting environment, such as a theater.

Portion size increases consumption regardless of a food's favorability. Although container or package size can be used to downwardly adjust portion size and consumption, it can also be used to increase consumption among populations (children and the elderly) for which healthful yet possibly less palatable foods (such as fruits and vegetables) are important for continued health.² Although a small bowl of raw carrots might make a good afternoon snack, a large bowl might be even better. These basic findings suggest 3 conclusions for nutrition educators.¹⁴

1. Be aware that portion size and package shapes can affect consumption of tasty foods, as well as ones that are not as tasty. Even if a person does not particularly care for a food, "grazing" from a large bowl will cause him or her to eat more.
2. It may be possible to increase the consumption of less preferred healthful foods, particularly among populations of children and the elderly, by serving them in larger bowls.¹² One rule of thumb is that the portion size of a food should vary with the healthfulness of that food.⁸

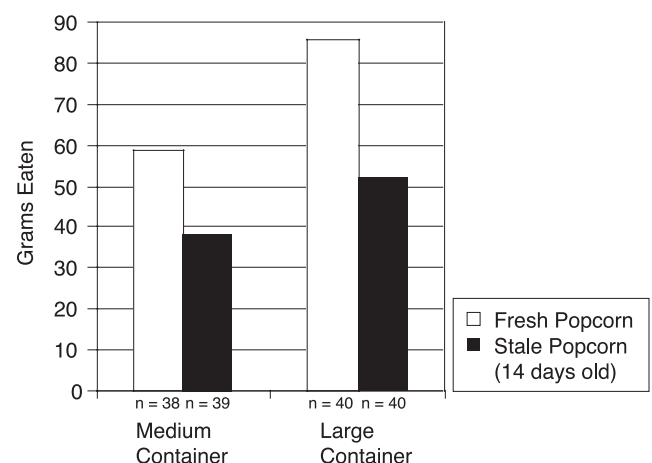


Figure. Larger containers influence consumption of both palatable and unpalatable food.

Table 3. Ratings of Taste and Quality Cannot Account for Consumption Volume

Model (n = 158)	Container Size	Freshness of Popcorn	Taste Ratings of Popcorn	Quality Ratings of Popcorn	R ²
Full model	0.374** (5.59)	-0.698** (6.13)	0.118 (1.16)	-0.054 (0.55)	.423
Container and freshness only	0.407** (6.53)	-0.573** (9.20)416
Taste and quality only	0.083 (0.82)	0.252* (2.49)	.098

Standardized beta weights with *t* values in parentheses.

P* < .05; *P* < .01.

3. Larger bowls of carrot sticks or other raw vegetables or fruits might encourage greater consumption in distracting environments, such as while watching television or snacking at a party.²

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