RESEARCH LETTER

Super Bowls: Serving Bowl Size and Food Consumption

To the Editor: Obesity has been linked in part to the expanding portion sizes of prepackaged or preserved foods.[1-3] However, adults frequently serve themselves the food they will eat for a meal or snack. We investigated how the size of serving bowls influences how much food a person decides to serve and consume in a natural environment.

Methods. Graduate students were recruited to attend a Super Bowl party at 5:30 PM. On arrival, 40 individuals orally consented to participate in an institutional review board–approved study in which they "may be asked questions about food and commercials in party environments, such as at a Super Bowl party." No reference was made to the hypotheses being examined. Each participant was led in an alternating order to 1 of 2 identical buffet tables on opposite sides of an adjoining room and asked, "Would you care for some snacks before the game?" – had identical amounts of high energy density snacks (assorted roasted nuts and a pretzel/chip variety mix, both approximately 5.26 kcal/g). On one table these snacks were offered in 2 large (4-L capacity) serving bowls. On the second table, an equal quantity of the same 2 snacks was offered in 4 medium (2-L capacity) serving bowls that were otherwise identical to the larger bowls.

Participants served the snack mix to themselves on 10-inch plates using a 1-cup serving scoop. Immediately following their self-serving, a research assistant blinded to the purpose of the study weighed the plate. The participant was then led to a table to watch the game. Beverages were not available until after the food was served. After the last participant had taken a serving, all food was removed. One hour later, each participant completed a questionnaire. Each plate was collected and plate waste was recorded and subtracted from how much each had initially taken.

Participant characteristics between the study groups were compared using *t* tests. The volume of food served and eaten was analyzed with a 2-way analysis of covariance, which used bowl size and sex as factors between participants. Body mass index (calculated as weight in kilograms divided by the square of height in meters), body weight, hours since prior meal, age, and education were used as covariates. A power analysis indicated a power of 0.91 for detecting an effect size of 0.50 at the 5% confidence level with a sample of 20 in each cell.

Five participants (1 woman in the large-bowl group; 3 women and 1 man in the small-bowl group) did not take a snack and were not included in the primary analyses. A sensitivity analysis was conducted that assumed the nonparticipant in the large-bowl group had consumed the least amount recorded among the women in that group, and that the nonparticipants in the small-bowl group had consumed the greatest amount recorded among same-sex participants in that group.

Table 1. Characteristics of Individuals*

	Size of Serving Bowl		
	Small (n = 16)	Large (n = 19)	*P* Value†
Sex, No. (%)			
Male	9 (56)	12 (63)	.68
Female	7 (44)	7 (37)	
Body mass index‡	24.0 (22.2-25.8)	24.8 (23.5-26.0)	.47
Body weight, kg	71.7 (64.4-79.0)	75.0 (70.4-79.6)	.72
Time since last meal, h	4.5 (4.2-4.9)	4.5 (4.3-4.7)	.98
Age, y	25.1 (23.3-27.0)	24.4 (23.8-24.9)	.39
College education, y	4.5 (4.3-4.7)	4.7 (4.2-5.2)	.40

*Values are expressed as median (range) unless otherwise indicated.
†Comparison between groups using *t* test.
‡Calculated as weight in kilograms divided by the square of height in meters.

Table 2. Amount of Food Served and Consumed*

	Size of Serving Bowl		
	Small (n = 16)	Large (n = 19)	*P* Value†
Food served, g			
Total	52.6 (14-110)	80.5 (28-152)	.02
Men	70.6 (25-110)	96.6 (64-152)	.05
Women	29.6 (14-56)	53.0 (28-82)	.12
Calories served			
Total	277 (74-579)	423 (147-800)	.02
Men	371 (132-579)	508 (337-800)	.05
Women	156 (74-295)	279 (147-431)	.12
Food consumed, g			
Total	47.8 (13-96)	74.8 (25-123)	.01
Men	62.6 (25-96)	88.9 (64-123)	.02
Women	28.9 (14-55)	50.7 (25-82)	.17
Calories consumed			
Total	251 (68-505)	393 (132-647)	.01
Men	329 (132-505)	468 (337-647)	.02
Women	152 (74-289)	267 (132-431)	.17

*Values are expressed as median (range) unless otherwise indicated.
†Comparison between groups using analysis of covariance and adjusted for body mass index, body weight, hours since last meal, age, and education.

All analyses were performed using SPSS statistical software (version 11.0, SPSS Inc, Chicago, Ill). A *P* value $<.05$ was considered statistically significant.

Results. Comparing the study groups, the participants who took snacks were similar with respect to their body mass index, weight, hours since their prior meal, age, education, and sex (**TABLE 1**). There were no significant differences in these characteristics between these participants and the 5 persons who did not take a snack.

Participants serving from large bowls took 53% (146 calories) more and consumed 56% (142 calories) more than those who served from small bowls ($P=.02$ and $P=.01$, respectively) (**TABLE 2**). The effect of serving bowl size on intake was not significantly influenced by body weight ($P=.22$), hours since prior meal ($P=.25$), age ($P=.20$), or education ($P=.71$). Men ate more than women ($P=.04$), and the effect

of serving bowl size on consumption was statistically significant for men ($P=.02$) but not women ($P=.17$).

In the sensitivity analysis to estimate the potential impact of the 5 nonparticipants, the effect of bowl size remained significant ($P=.02$).

Comment. Small environmental factors can have a large influence on food consumption.[4] At this party, large serving bowls led to a 56% greater intake (a mean of 142 more calories/person). The size of a serving bowl (or of a portion) may provide a consumption cue that implicitly suggests an appropriate amount to eat.[5] Larger bowls, like larger packages or portions, may suggest that a proportionately larger amount is appropriate to consume. Although this study was not conducted in a medical setting, it is possible that if a physician giving diet-related advice recommends using smaller serving bowls, patients may serve themselves smaller portions.

Portion distortion has generally focused on how consumption cues lead people to overeat less healthy, energy-dense foods. An appropriate area for further research is whether these same cues, ie, larger serving bowls, can be used to encourage people to eat greater amounts of healthier foods such as fruits and vegetables.

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3. Diliberti N, Bordi PL, Conklin MT, Roe LS, Rolls BJ. Increased portion size leads to increased energy intake in a restaurant meal. *Obes Res*. 2004;12:562-568.
4. Wansink B. Can package size accelerate usage volume? *J Marketing*. 1996;60:1-14.
5. Wansink B. Environmental factors that unknowingly influence the consumption and intake of consumers. *Annu Rev Nutr*. 2004;24:455-479.

CORRECTIONS

Incorrect Data: In the Clinical Review entitled "A Simplified Approach to the Management of Non–ST-Segment Elevation Acute Coronary Syndromes" published in the January 19, 2005, issue of *JAMA* (2005;293:349-357), incorrect data were reported. In the "Anticoagulation" rows of the Table on Page 352, "creatinine clearance <60 mL/min" should have been reported as "<30 mL/min." Also, in the center column on page 353, "creatinine clearance <60 mL/min [1.0 mL/s]" should have been reported as "<30 mL/min [0.5 mL/s]."

Incorrect Information: In the Medical News & Perspectives article "Michael E. DeBakey, MD: Father of Modern Cardiovascular Surgery" published in the February 23, 2005, issue of *JAMA* (2005;293:913-918), President John F. Kennedy was erroneously described as one of the world leaders who were treated by DeBakey. DeBakey worked with Kennedy on medical legislation for Medicare.

Reference Error: In the Review entitled "Bariatric Surgery: A Systematic Review and Meta-analysis" published in the October 13, 2004, issue of *JAMA* (2004;292:1724-1737), there was a reference error. The Swedish Obese Subjects Intervention Study has not published any of its mortality data. On page 1736, column 1, first full paragraph, sentences 4 and 5 should be deleted. Sentence 6 should be "MacDonald et al[57] reported that diabetic patients treated with an oral hypoglycemic had a 4.5% annual mortality rate for 9 years of follow-up compared with a 1% mortality rate in diabetic patients who underwent gastric bypass."

Error in Table: In the Preliminary Contribution entitled "Detection of Paternally Inherited Fetal Point Mutations for β-Thalassemia Using Size-Fractionated Cell-Free DNA in Maternal Plasma" published in the February 16, 2005, issue of *JAMA* (2005;293:843-849), there was an error in Table 2. On pages 847 and 848, Table 2 should have read as follows. For each case (2 rows), the genotype and results (circulating fetal DNA and chorionic villus sampling) information (3 columns) was switched for mother and father. For example, in case 1 for paternal *IVSI*-1 mutation, "Codon 39/N" and "*IVSI*-1" and "*IVSI*-1/N" should be in the row with "Mother," and "*IVSI*-1/N" should be in the row with "Father" in that order. The subsequent rows of genotype and results information should be switched for each case for the rest of the Table. Also, on page 848, the column heading "Patient Sex" should read "Parent."

