Eating Behavior and Obesity at Chinese Buffets

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Objective: The aim of this study was to investigate whether the eating behaviors of people at all-you-can-eat Chinese buffets differs depending upon their body mass. The resulting findings could confirm or disconfirm previous laboratory research that has been criticized for being artificial.
Methods and Procedures: Trained observers recorded the height, weight, sex, age, and behavior of 213 patrons at Chinese all-you-can-eat restaurants. Various seating, serving, and eating behaviors were then compared across BMI levels.
Results: Patrons with higher levels of BMI were more likely to be associated with using larger plates vs. smaller plates (OR 1.16, $P < 0.01$) and facing the buffet vs. side or back (OR 1.10, $P < 0.001$). Patrons with higher levels of BMI were less likely to be associated with using chopsticks vs. forks (OR 0.90, $P < 0.05$), browsing the buffet before eating vs. serving themselves immediately (OR 0.92, $P < 0.001$), and having a napkin on their lap vs. not having a napkin on their lap (OR 0.92, $P < 0.01$). Patrons with lower BMIs left more food on their plates (10.6% vs. 6.0%, $P < 0.05$) and chewed more per bite of food (14.8 vs. 11.9, $P < 0.001$).
Discussion: These observational findings of real-world behavior provide support for laboratory studies that have otherwise been dismissed as artificial.

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Obesity has been linked to a greater prevalence of affordable, easily accessible, and large portions of food (1,2). Nowhere is this abundance more evident than at the growing number of all-you-can-eat restaurants, such as Chinese buffets (3). To better understand the relationship between obesity and easily accessible food—including many lab-suggested relationships—we investigated differences in the eating behavior of patrons at Chinese buffet restaurants.

RESEARCH METHODS AND PROCEDURES

Following Institutional Review Board approval, 22 trained observers coded the behavior of 213 patrons at 11 all-you-can-eat Chinese buffet restaurants across the United States. Buffet patrons were randomly selected as they entered the restaurant. Observers sat in unobtrustive locations in the restaurants and recorded the behavior of randomly selected patrons on a coding sheet from the time they were seated at the restaurant until the time they left.

Observers recorded important behaviors, but also estimated variables such as age, height, and weight. Although such visual estimates have been shown to be somewhat inaccurate (4,5), training has been shown to improve these estimates with the worst estimates still resulting in very high correlations (6,7).

Two sessions of weight, height, and age estimation were conducted with observers, and they were also provided with photos of various people and their weights as further benchmarks to use when estimating weight. In addition, a visual body shape chart of 32 body typologies (16 for men; 16 for women) was used to improve and to assess the accuracy of their estimates ($\alpha = 0.857$). To estimate height more accurately, observers used the known height of buffet glass hardware as a benchmark from which patrons' height could be assessed as they stood to serve themselves food.

The seating, serving, and eating behaviors that were observed and coded were largely suggested by laboratory studies suggesting the environmental cues that influence intake (8). Each coding sheet included three different categories of observation.

The first category examined seating behavior. Observers coded whether patrons sat at a booth vs. a table and whether patrons faced the buffet while eating vs. their side or back. Increased effort has been shown to decrease consumption (9). Because booth seating (vs. table seating) may make it more difficult to return to the buffet (i.e., eating companions may need to move, heavier patrons may not comfortably fit) it would be expected that this type of habitual seating would be related to lower BMIs. Increased salience of food has also shown to increase consumption (10). Patrons facing the buffet are expected to have higher BMIs than those whose side or back are toward the buffet. The continual salience of food that one is facing might keep it too temptingly top-of-mind.

The second category of observation included serving behaviors. Observers coded whether the patrons browsed the buffet

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before serving themselves or whether they immediately began serving themselves when first approaching the buffet. Because plate sizes and—as a result—portion sizes have become increasingly larger (11) and people generally "clean their plate" (12), the size of the plate they were using was also coded.

The third general category of behavior examined was eating behavior itself. Patrons' use of chopsticks vs. forks, their placement of napkin (napkin on lap, napkin not on lap), their average number of chews, and their estimated plate waste were recorded. The use of smaller utensils compared to large utensils has been shown to decrease intake in part because of the consumption norms that they imply (13,14). The use of chopsticks and smaller plates (compared to forks and larger plates) suggest smaller amounts of food that should be eaten. Those using these smaller utensils would be expected to have lower BMIs than those who use larger utensils. This is because it is assumed that patrons' utensil use is not unique to the single eating occasion noticed in this study—patrons who eat with smaller utensils probably always eat with smaller utensils. The placement of a napkin on a patron's lap may also be related to lower BMIs. This may be because napkin wearing is reflective of table manners, which has been associated with more careful consumption monitoring (15). Careful consumption monitoring is expected not to be unique to patrons' eating behavior at the buffet, but a general tendency.

Increased chewing per bite of food has been shown to be related to lower BMIs (16) partly because of the influence of chewing on satiety (17). It is expected that patrons who chew more per bite will also have lower BMIs. This is because those who chew more per bite probably always chew more per bite. It was also believed that patrons with larger BMIs would eat a higher percentage of food on their plate (15).

To predict buffet behaviors, a series of generalized estimating equations were modeled with binary distributions for binary dependent variables (such as chopsticks vs. forks) and with normal distributions for continuous variables (such as average leftovers or average chews per bite). Generalized estimating equation was used to account more powerfully for the possibility of inter-observer correlations. To accomplish this, each generalized estimating equation included an observer variable (random effect) to account for this potential bias. Additional covariates included the buffet patrons' sex and their estimated age. These equations allowed for the testing of the unique effect of BMI on any particular buffet behavior. All analyses were performed using SPSS statistical software (version 14.0; SPSS, Chicago, IL), and a P value <0.05 was considered statistically significant.

RESULTS

As **Table 1** indicates, the 213 patrons were grouped into categories that represented the bottom third ($n = 71$), middle third ($n = 70$), and top third ($n = 72$) of their estimated BMI. These generally corresponded to the common descriptors given to normal weight, overweight, and obese individuals. Significant differences were found between all pairings of BMI groups on estimated BMI (bottom: 22.0, middle: 26.7, top, 35.3; all P s < 0.05) and body weight (bottom: 141.1, middle: 175.9, top, 236.8; all P s < 0.05). Because there were significant differences between BMI groups for patrons' sex and perceived age, these variables were used as covariates in all subsequent analyses.

Seating behavior

As predicted, estimated BMI was related to buffet patron seating behavior (**Table 2**). Low BMI patrons were more likely to be seated at a booth (vs. a table) as compared to high BMI patrons (38.2% vs. 15.9%; $z = 3.0$, $P = 0.002$). Although not statistically significant, every unit increase in BMI resulted in 4% lower odds of sitting at a booth (OR, 0.96; $P = 0.13$).

Interestingly, a greater proportion of high BMI patrons faced the buffet while eating compared to low BMI patrons (41.7% vs. 26.8%; $z = 1.9$, $P = 0.05$). Each unit increase in BMI resulted in 10% greater odds of facing the buffet while eating (OR, 1.10; $P < 0.001$).

Serving behavior

One's estimated BMI was also related to how buffet patrons served themselves and how they ate. A majority of low BMI patrons browsed the buffet (vs. immediately serving themselves) compared to high BMI patrons (71.0% vs. 33.3%; $z = 4.7$, $P < 0.001$). Specifically, every unit increase in BMI results in 8% lower odds of browsing the buffet (OR, 0.92; $P < 0.001$).

As suggested in previous research, when selecting plates from the buffet line, high BMI patrons were more likely to use larger plates than low BMI patrons (98.6% vs. 86.3%; $z = 2.7$, $P = 0.01$). Each unit increase in BMI results in 16% greater odds of using a large plate (OR, 1.16; $P < 0.01$).

Eating behavior

Low BMI patrons (bottom third) were more likely to be observed using chopsticks compared with higher (top third) BMI patrons (23.5% vs. 8.7%; $z = 2.4$, $P = 0.02$). Specifically, every unit increase in BMI results in 10% lower odds of using chopsticks (OR, 0.90; $P < 0.05$).

Table 1 Demographic differences between bottom, middle, and top third of BMI distribution

	BMI bottom third ($n = 71$) mean (s.d.; range)	BMI middle third ($n = 70$) mean (s.d.; range)	BMI top third ($n = 72$) mean (s.d.; range)
BMI	22.0 (2.1; 13.5–24.4)[a]	26.7 (1.3; 24.9–29.2)[b]	35.3 (5.0; 29.5–51.5)[c]
Body weight	141.1 (24.6; 60–190)[a]	175.9 (175.9; 140–230)[b]	236.8 (36.1; 170–325)[c]
Age (years)	35.3 (14.7; 8–75)[a]	40.8 (14.3; 18–70)[b]	43.4 (13.4; 18–80)[b]
Sex (percent male)	40.6%[a]	51.4%[a,b]	64.7%[b]

BMI groups are analyzed using one-way ANOVAs (except χ^2 for sex difference). Different superscripts indicate significant differences between groups ($P < 0.05$).

Table 2 Relationships between buffet observations and BMI

	BMI bottom third (range = 13.5–24.4)	Middle third (range = 24.9–29.2)	Top third (range = 29.5–51.5)	OR (95% CI)
Serving behavior				
Browse buffet (vs. serve self immediately)	71.0%[a]	47.1%[b]	33.3%[b]	0.92 (0.88–0.97)***
Large plate (vs. only small)	86.3%[a]	98.6%[b]	98.6%[b]	1.16 (1.04–1.30)**
Seating behavior				
Sat at booth (vs. table)	38.2%[a]	47.8%[a]	15.9%[b]	0.96 (0.91–1.0)[†]
Facing food (vs. side or back)	26.8%[a]	37.1%	41.7%[b]	1.10 (1.06–1.12)***
Eating behavior				
Chopsticks (vs. fork)	23.5%[a]	7.4%[b]	8.7%[b]	0.90 (0.82–0.99)*
Napkin on lap (vs. not on lap)	50.0%[a]	16.7%[b]	23.5%[b]	0.92 (0.87–0.97)**
Average chews per bite (average no. of chews)	14.8[a]	14.0[a]	11.9[b]	—
Average leftovers (% remaining from plates)	10.6%[a]	7.0%[b]	6.0%[b]	—

Three different analyses are represented: (i) differences in percentages are tested via proportion tests (*z*-tests). Different roman superscripts indicate significant differences between groups ($P < 0.05$); (ii) odds ratios are estimated from generalized estimating equations based on a binary response distribution; (iii) means from "average leftovers" and "chews per bite" estimated from generalized estimating equations based on a normal distribution.*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; [†]P = not significant ($P = 0.13$).

These lower BMI patrons were more likely to place a napkin on their lap compared to high BMI buffet patrons (50.0% vs. 23.5%; $z = 4.3$, $P = 0.001$). Every unit increase in BMI results in 8% lower odds of placing a napkin on their lap (OR, 0.92; $P < 0.01$).

Low BMI patrons also left more food on their plate than either medium or high BMI patrons (10.6% vs. 7.0% and 6.0%; Wald χ^2 (2, $n = 198$) = 8.53, $P = 0.014$). This generalized estimating equation analysis modeled with a normal distribution for the dependent variable also controlled for the random effect of observer bias and the fixed effects of sex, perceived age, and number of return trips to the buffet. These low BMI patrons also chewed bites of food, on average, more than medium or high BMI patrons (14.8 chews per bite vs. 14.0 and 11.9; Wald χ^2 (2, $n = 198$) = 38.6, $P < 0.001$).

DISCUSSION

Observational findings show association not causation. Interestingly, these findings are notably consistent with important principles of food intake that have been isolated only in highly controlled—but sometimes artificial—laboratory situations. Such principles relate to food convenience (serving without browsing or using a fork instead of chopsticks), consumption norms (using larger plates), and salience (facing the food) (8). As such, these observational findings provide ecological support for many laboratory studies that have been criticized as artificial.

Other findings—such as number of chews per bite of food and average leftovers—are less robust: patrons' eating behavior was noted by one observer—not many. Thus, inter-rater reliabilities of these particular measures were not obtained. Yet, research that has incorporated many observers to record the eating behavior of one has found remarkably high concordance between observers on the same type of variables used in this study (14–16). Additionally, it has been found that bite size decreases as a meal continues, suggesting that chews per bite may similarly decrease (18). Because we only used the first 10 bites of food as a surrogate for the entire meal, assessment of average chews per bite for the entire meal may have been overestimated. While this may be, a patron's BMI was shown to be predictive of this initial chewing behavior.

Although controlled for in this study, sex and BMI were not modeled as an interacting influence on food-related behaviors. A cursory review of the literature pertaining to the possibility of this type of interaction effect on food-related behaviors did not produce any evidence of its existence (2,8,13); yet, a claim of it not existing based on lack of evidence is hardly an unyielding claim. Further research may wish to examine possible interaction effects of sex and BMI on food-related behaviors examined in this study.

The silver lining to all of these findings, in tandem with laboratory findings, is that they reinforce that small changes in one's environment may lessen one's tendency to overeat (19). Those involved with clinical work could reinforce the importance of making food less convenient (leaving serving bowls off the table), reducing consumption norms (using smaller plates), and reducing the salience of food (replacing the cookie jar with a fruit bowl).

DISCLOSURE

The authors declared no conflict of interest.

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