10-1-2011

# Increasing serving size increases amount consumed: Catch-22.

Natalina Zlatevska
*Bond University*, Natalina_Zlatevska@bond.edu.au

Chris Dubelaar
*Bond University*, Chris_Dubelaar@bond.edu.au

Stephen S. Holden
*Bond University*, sholden@bond.edu.au

**Increasing Serving Size Increases Amount Consumed: Catch-22**[1]

Natalina Zlatevska
nzlatevs@bond.edu.au

Chris Dubelaar
cdubelaa@bond.edu.au

Stephen S Holden
sholden@bond.edu.au

Bond University, School of Business

*Abstract*

The effect of serving size on consumption is well-established (see Chandon and Wansink, 2011 for a review). The larger the serve, the greater the amount consumed. However, little attention has been given to quantifying the serving size effect. We know that size influences volume consumed, but by how much? The present research used a meta analysis of 67 studies, and a combined N of 2792 respondents, to determine the relative effect of serving size on consumption volume (*d*=.47). More importantly, we extended our analysis to determine the absolute size of the effect: we found that a doubling of serving size increases consumption by 22%. Finally, we show that the serving size effect is larger among adults than children.

[1] Working Paper, December 2011. This paper was first presented at Bond University, October 2011. A short abstract was submitted to the Society for Consumer Psychology's First International Conference (Florence, 2012), and a full paper is being prepared for submission to a journal.

**Increasing Serving Size Increases Amount Consumed: Catch -22**

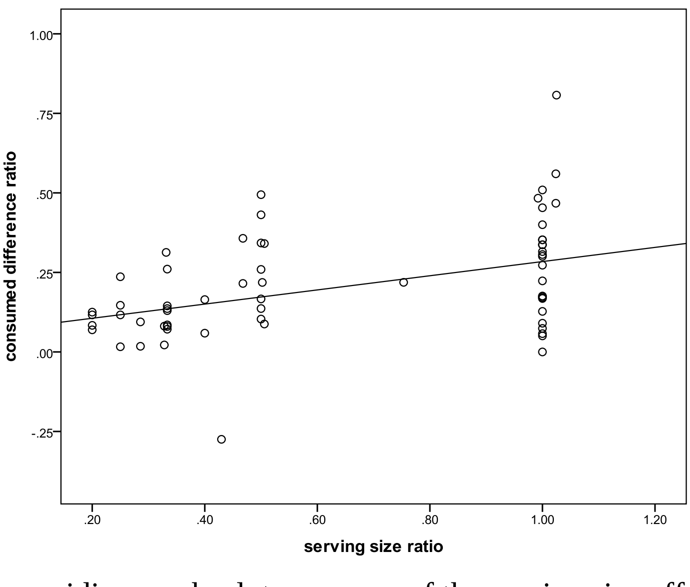
The effect of serving size on consumption is well-established (see Chandon and Wansink, 2011 for a review). The larger the serve, the greater the amount consumed. However, little attention has been given to quantifying the serving size effect. We know that size influences volume consumed, but by how much? The present research used a meta analysis to determine the effect of serving size on consumption volume. We also develop an absolute measure of the effect in line with psychophysical theory, in particular Weber's Law (1834).

A meta-analysis using 67 separate studies with a combined N of 2792 respondents, revealed a substantial and significant effect of serving size on consumption (*d*=.469, $CI_{95}$=[.376, .562]), see Table 1). A moderator analysis shows the serving size effect to be reliable across a number of different domains (see Table 2). Although the effect varies under a range of conditions, the only significant difference observed was that the effect is significantly smaller for children relative to adults ($d_{adult}$=.55 vs $d_{children}$=.24, see Table 2).

While the serving size effect would be characterized as 'moderate' by Cohen (1988), speaking of the 'size' of the effect sizes is, as he acknowledges problematic. For instance, in the current dataset, the size of an effect depends to a great extent on the size of the difference between the 'large' and 'small' serves. To avoid the problem of relative effect size measures and in order to develop an absolute measure of the serving size effect, we developed ratio measures that captured the relative change in serving sizes (the size of the difference between the large serve and the small serve divided by the small serve size) and the relative change in consumption (between large and small serve). We then regressed the change in amount consumed on the change in amount served. Each individual study included in the regression was weighted according to the meta-analytic weights which are a function of sample sizes and standard errors.

Our results show that the change in serving size significantly predicts the change in consumption (B=.22, t=26.43, $p < .001$; see Figure 1). Importantly, the regression coefficient tells us that if the serving size doubles (i.e., the large serve is 100% larger than the small serve), the consumption is 22% higher than in the small serve condition.

**FIGURE 1**




In addition to providing an absolute measure of the serving size effect, we note that this result is in line with the notion that the serving size effect is perceptually driven

(Wansink and Van Ittersum 2003; Chandon and Wansink, 2006; Chandon and Ordabayeva, 2009; Van Ittersum and Wansink 2012). A number of researchers have considered the idea that the subjective experience of serving size is a constant ratio of the physical serving size as with many psychophysical functions (e.g., Krider, Raghubir and Krishna 1999; Chandon and Wansink, 2006). Accordingly and very much in line with Weber's Law (1834), we find that the change in consumption (reflecting a subjective experience) is a constant ratio of change in serving size as follows

$$\Delta C/C_s = .22^* (\Delta S/S_s)$$

'$\Delta C$' represents change in consumption (L-S)
$C_s$ represents consumption from small serve
'$\Delta S$' represents change in serving size
$S_s$ represents small serving size

We now examine how the serving size effect varies by moderators. Our earlier reported moderator analysis revealed that children were significantly less affected by serving size manipulations than adults. Entering a dummy variable for children into our regression based on changes in consumption and serving size, we re-confirmed that adults and children were differentially affected by serving size. Importantly, our analysis allowed us to determine that the serving size effect coefficient among adults is .296 ($t$=4.88, $p$<.001) while the coefficient for the dummy variable for children was negative and significant ($B$ =-.110, $t$=-2.49, $p$=.005) implying that the coefficient for children is .186. That is, children will increase consumption by 19% if the serving size is doubled, adults will increase their consumption by 30%. These results suggest that, while children are susceptible to the serving size effect, they are significantly less susceptible than adults implying that the serving size effect may have a strongly learned component. One might speculate that children are better able to know when to stop eating by instinct, and that environment (exhortations by parents to eat more or eat everything on the plate) diminishes this natural talent and leads to a strengthening of the serving size effect.

*Conclusions*

The results reported here make a number of important contributions. The meta-analysis provides the relative size of the serving size effect. However, the development of ratio measures of change in serving size and consumption allows for the absolute quantification of this effect. Consumption can be expected to increase by 22% when the serving size is doubled. The result shows consumption to be a constant ratio of serving size and supports the notion that the serving size effect is perceptual. And finally, while the effect is fairly reliable and general, it is found to be stronger among adults and weaker among children.

Some clear public policy implications may be drawn from the findings. First, the size of the serving size effect should encourage a move away from super-sizing and other larger serving size promotions. It might also encourage the adoption of smaller sizes – although critics may be quick to note that to get a 22% reduction in consumption requires a *halving* of current serving sizes. And finally, it is encouraging to see that children are less susceptible to the serving size effect than adults, and perhaps attention needs to be given to sustaining the apparently natural resistance of children to serving size manipulations.

In summary, there is a Catch-22 to larger serving sizes. Serve twice as much, you will eat 22% more!

**TABLE 1**

META ANALYTIC RESULTS (RANDOM-EFFECTS MODEL)

| Variable | k[a] | d[b] | Z | P | $CI_{95}$ Lower Bound | $CI_{95}$ Upper Bound | Q | (d.f) | $I^2$ |
|---|---|---|---|---|---|---|---|---|---|
| SERVING SIZE | 67 | .469 | 9.907 | 0.000 | 0.376 | 0.562 | 285.190 | (66) | 76.858 |

[a] k = number of studies
[b] d = standardized difference in means – A positive value indicates that individuals consumed more from large (treatment) relative to small (control) serves. Mean differences were considered significant when the confidence interval did not include zero. When calculating standardised differences in means, and performing tests of moderators, a random effects perspective was taken (Hunter and Schmidt 2000).

**TABLE 2**

MODERATOR ANALYSIS (RANDOM-EFFECTS MODEL)

| Moderator | k | d | Z | P | $CI_{95}$ Lower Bound | $CI_{95}$ Upper Bound | Q | (d.f) | $I^2$ |
|---|---|---|---|---|---|---|---|---|---|
| GENDER | | | | | | | | | |
| Male | 10 | .742 | 5.945 | .000 | .497 | .986 | 48.710 | 9 | 81.523 |
| Female | 24 | .429 | 5.747 | .000 | .283 | .576 | 74.897 | 23 | 69.291 |
| Both | 33 | .418 | 6.268 | .000 | .287 | .548 | 137.894 | 32 | 76.794 |
| CHILDREN | | | | | | | | | |
| Child | 17 | .239 | 2.585 | .010 | .442 | .657 | 29.598 | 16 | 45.942 |
| Adult | 50 | .549 | 10.001 | .000 | .058 | .421 | 248.858 | 49 | 80.310 |
| HEALTHINESS | | | | | | | | | |
| Healthy | 12 | .399 | 3.677 | .000 | .186 | .612 | 84.440 | 11 | 77.702 |
| Unhealthy | 41 | .442 | 7.195 | .000 | .321 | .562 | 148.969 | 40 | 73.149 |
| Both | 14 | .652 | 5.725 | .000 | .429 | .875 | 49.331 | 13 | 84.604 |
| FOOD FOCUS | | | | | | | | | |
| Focus | 57 | .423 | 8.486 | .000 | .325 | .521 | 24.814 | 56 | 73.696 |
| No-Food Focus | 10 | .721 | 5.966 | .000 | .484 | .958 | 248.858 | 9 | 82.979 |

Chandon, Pierre and Brian Wansink (2011), "Is Food Marketing Making us Fat? A Multi-disciplinary Review," *Foundations and Trends in Marketing*, 5(3), 113-196.
Chandon, Pierre and Brian Wansink (2006), "Is Obesity caused by calorie Underestimation? A psychophysical Model of Meal Size Estimation," *Journal of Marketing Research*, 44(February), 84-99.
Chandon, Pierre and Nailya Ordabayeva (2009), "Supersize in One Dimension, Downsize in Three Dimensions: Effects of Spatial Dimensionality on Size Perceptions and Preferences," *Journal of Marketing Research*, 46(December), 739-753.
Cohen, Jacob (1988), *Statistical Power Analysis for the Behavioral Sciences*, 2e, Academic Press, NY, New York.
Krider, Robert E., Priya Raghubir and Aradhna Krishna (2001), "Pizzas: π or Square? Psychophysical Biases in Area Comparisons, *Marketing Science* , 20(4), 405-425.
Van Ittersum, Koert and Brian Wansink (2012), Plate Size and Colour Suggestibility: The Delboeuf Illusion's Bias on Serving and Eating Behavior," *Journal of Consumer Research*
Wansink, Brian and Koert Van Ittersum (2003), "Bottoms Up! The Influence of Elongation on Pouring and Consumption Volume," *Journal of Consumer Research*, 30(December), 455-463.