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Full Length Article

The partitioning paradox: The big bite around small packages

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ABSTRACT

We replicate the research of Do Vale et al. (2008) and Scott et al. (2008) showing that the diet-conscious tend to eat more when a portion is broken into multiple smaller partitions than when it is unpartitioned. The results show that the partitioning paradox is clearer when diet-consciousness is manipulated than measured. A meta-analysis reveals that the partitioning paradox among the diet-conscious is a medium size effect, but also that partitioning has an opposite and equal size effect on the non-diet conscious: they eat more from the unpartitioned than the partitioned package.

1. Introduction

While smaller served portions lead people to eat less (Zlatevska, Dubelaar, & Holden, 2014), the effect of partitioning a portion (e.g., multiple 100 cal or bite-size pieces in one package) has an apparently paradoxical effect. When a fixed portion of food is partitioned into numerous, smaller self-contained packages, diet conscious (or "restrained") consumers eat *more* from the partitioned than the unpartitioned packages (Do Vale, Pieters, & Zeelenberg, 2008; Scott, Nowlis, Mandel, & Morales, 2008). This is a serious concern given that food marketers are developing and promoting partitions (e.g., 100-calorie or bite-size snack packs) as ideal for the diet-conscious.

Do Vale, Pieters, and Zeelenberg's (2008) and Scott, Nowlis, Mandel, and Morales' (2008) Studies 2 and 3 (hereafter DPZ and SNMM) provided consistent directional, but not always statistically significant evidence showing the diet-conscious eat more from a partitioned portion for a variety of foods (chips, M&Ms, cookies); a variety of total portion sizes (200 g vs ~40–50 g); and varying lengths of time of exposure to the foods (20 to 40 min) (see Table 1 for a full comparison). DPZ produce strong results by treating diet-consciousness as a situational variable which they manipulated. SNMM with more equivocal results (see Table 1) treated diet-consciousness as an individual trait variable which they measured.

In our replication, we partitioned a 200 g portion of M&Ms, and both manipulated and measured diet consciousness. We replicated the key results of both DPZ and SNMM. We also found the result from measured diet-consciousness more equivocal. We explore further whether the partitioning paradox was a "consumption bias" (as suggested by SNMM), and whether the effect disappears when subjects were encouraged to be mindful of the food while eating (Wansink, 2010).

2. Replication

We recruited 108 university students (46% male, 54% female) to participate in a pair of studies about "Consumer Activism" and "Body Image" for which they received course credit. In the consumer activism study, respondents were given 10 min to complete a questionnaire. They were simultaneously presented with a bowl containing packages of M&Ms and were told, "Help yourself to any candy that you want — we have tons". Each participant completed this part of the study in isolation from others. After 10 min, the questionnaire and the bowl of M&Ms were removed, and amount consumed recorded.

The design was a $2 \times 2 \times 2$ between-subjects design, the three factors being partitioning, manipulated diet-consciousness, and measured diet-consciousness. Partitioning was manipulated by providing respondents with 200 g of M&Ms either in a single (1×200 g) plastic ziplock bag or divided between four bags (4×50g). To manipulate diet-consciousness, we followed DPZ asking respondents to first complete a body image questionnaire comprising Herman and Polivy's (1980) 10-item Dietary Restraint scale, two items from the Oliver and Bearden (1985) Dieting Questionnaire, 16 items making up the Body

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Table 1
Design and results of original and replication studies.

	Do Vale, Pieters, Zeelenberg (DPZ) Study 2	Scott, Nowlis, Mandel, Morales (SNMM) Study 2	Scott, Nowlis, Mandel, Morales (SNMM) Study 3	Replication	Extension: food focus
Partitioning					
Few large	2 × 200 g packs chips	1 × 200 kcal (=40 g) bag of regular M&Ms	1 bag (4 large cookies) (240 kcal = ~48g)	1 × 200 g bag of M&Ms	1 × 200 g bag of M&Ms
Many small	9 × 45 g packs	4 × 50 kcal bags of mini-M&Ms	4 bags (2 small cookies each) (240 kcal)	4 × 50 g bags	4 × 50 g bags
Diet consciousness	*Manipulated*: "Self-regulatory concerns" activated by responding to body-image scales (Garner, Olmstead, & Polivy, 1983; Herman & Polivy, 1975) "diet-consciousness scale"); height & weight	*Measured*: "Dietary Restraint" median split based on Herman and Polivy (1980) scale		*Manipulated*: placement of Body Satisfaction Questionnaire *Measured*: median split based on Herman and Polivy (1980) scale	*Manipulated*: placement of Body Satisfaction Questionnaire
Sample size	n = 140	n = 343	n = 96	n = 77	n = 59
Time exposed to snacks	20 min (or less)	40 min		10 min	10 min
Activity while food was available	Evaluating TVCs	Completing unrelated questionnaires		Completing unrelated questionnaires	Evaluating M&Ms & completing unrelated questionnaires
Results					
Normal (few large vs many small)	63.6 g vs 53.3 g $p =$ N.S.	129.7 kcal vs 81.1 kcal, $p < .001$	119.2 kcal vs 99.2 kcal $p =$ N.S	14.4 g vs 3.2 g $p =$ N.S.	
Diet-conscious (few large vs many small)	23.5 g vs 46.1 g $p < .05$	88.1 kcal vs 100.4 kcal, $p =$ N.S	55.6 kcal vs 106.4 kcal $p = .076$	16.7 g vs 44.4 g $p = .008$	20.0 g vs 24.8 g $p = .542$

Satisfaction and the Drive for Thinness subscales (Garner et al., 1983), and self-reported height and weight.[1] In the control where diet-consciousness was not activated, the same questionnaire was administered, but after the consumer activism questionnaire and after exposure to the M&Ms.

In measuring diet-consciousness, we followed SNMM by using a median split based on Herman and Polivy's (1980) 10-item Dietary Restraint scale in the Body Image questionnaire creating higher and lower diet-consciousness groups.

While manipulated and measured diet-consciousness were crossed, there was a potential order-effect as the measure of diet-consciousness was included in the manipulation of diet-consciousness. An ANOVA showed that measured diet-consciousness did not vary by whether it was measured prior to exposure to the M&Ms (in the consumer activism study) or after ($F(1,99) = 0.01$, *NS*). We had no a priori expectation of whether and how manipulated and measured diet-consciousness might interact.

Subjects ate an average of 19.4 g (or 10%) of the 200 g of M&Ms that they were provided. Over half (57.4%) ate none of the M&Ms, and those that ate any of the M&Ms ate 43.2 g on average. An ANOVA found a main effect of activated diet-consciousness ($M_{ADC} = 29.3$ g vs $M_{NDC} = 9.0$ g, $F(1,93) = 22.2$, $p < .001$), measured diet-consciousness ($M_{HDC} = 17.0$ g vs $M_{LDC} = 22.0$ g, $F(1,93) = 5.4$, $p = .02$) and of partitioning ($M_{1 \times 200} = 14.9$ g vs $M_{4 \times 50} = 24.7$ g, $F(1,93) = 8.63$, $p = .004$). More important, the interaction of partitioning with manipulated diet-consciousness was significant ($F(1,93) = 12.97$, $p = .001$, see Fig. 1), replicating the results of DPZ, and the interaction of partitioning with measured diet-consciousness was significant ($F(1,93) = 6.51$, $p = .012$, see Fig. 1), replicating the results of SNMM (Studies 2 and 3).

Significantly more was consumed from the 4 × 50 g packages than the 1 × 200 g when diet-consciousness was activated ($M_{4 \times 50 \text{ g}} = 46.5$ g vs $M_{1 \times 200 \text{ g}} = 17.6$ g,[2] $F(1,53) = 7.57$, $p = 0.008$). While the higher diet-consciousness group also showed that more was consumed from the 4 × 50 g than the 1 × 200 g packages, the result was not significant ($M_{4 \times 50 \text{ g}} = 22.0$ g vs $M_{1 \times 200 \text{ g}} = 12.7$ g, $F(1,50) = 1.40$, $p = 0.242$).

A third two-way interaction, the interaction of manipulated diet-consciousness with measured diet-consciousness was also significant ($F(1,93) = 6.51$, $p = .012$). An examination of the means suggests the lower diet-consciousness group ate more after activation of diet-consciousness (37.9 g vs 22.5 g) while the consumption by the higher diet-consciousness group was little affected by activation (10.1 g vs 8.0 g).

In sum, we replicated the partitioning paradox such that consumption by the diet-conscious appears to be higher from partitioned than unpartitioned portions, but the result attributable to measured and therefore individual diet-consciousness was more equivocal as was observed in SNMM. We believe that this may be attributed to the fact that the scale measuring dietary-consciousness was poor. The coefficient alpha for Herman and Polivy (1980) was low ($\alpha = 0.54$). In addition, the measure of diet-consciousness was uncorrelated to apparently obvious measures of diet-consciousness such as "Are you currently on a diet?" suggesting that the measure lacked validity (Rossiter, 2002). The interaction of manipulated with measured diet-consciousness reported above suggests that the manipulation may have washed out measured diet-consciousness, particularly among the lower group.

In order to get some idea of the size of the partitioning paradox effect, we conducted a meta-analysis of the available studies including

[1] Our approach varied from DPZ as follows: we used Herman and Polivy's (1980) 10-item Dietary Restraint scale in place of Herman and Polivy's (1975) 5-item Concern with Food and Eating scale; we relied on self-reported heights and weights where DPZ measured subjects' height and weight while the subject was standing in front of a mirror, and DPZ called their instrument a "body satisfaction" questionnaire.

[2] The observed means in the paired comparison were 44.4 g vs 16.7 g. The slight difference is due to some observations being dropped from the omnibus test due to missing data on other variables.