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Title: Personal relative deprivation increases self-selected portion sizes and food intake

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Running head: Relative deprivation and eating behaviour

Abstract

Cues and experiences of the deprivation of financial/material resources have been associated with increased caloric intake and risk for overweight/obesity. Given that social comparisons may serve as a powerful reference for the adequacy of one's standing and resources, the present research tested whether subjective feelings of personal relative deprivation (PRD) or "losing out" to others stimulates calorie selection and intake. Study 1 demonstrated that self-reported chronic experiences of PRD positively predicted calories selected for a portion and consumed during an ad-libitum meal. Study 2 revealed that experimentally-induced PRD resulted in an increase in the amount of calories selected on a portion selection task and a stronger desire to consume the foods. Consequently, these findings demonstrate that chronic and acute subjective deprivation of non-food resources may contribute to socioeconomic gradients in obesity, and that perceived social inequality may have inherently obesogenic properties that promote excess calorie intake.

Keywords: Inequality, obesity, socioeconomic status

Introduction

The prevalence of obesity has become a significant societal issue given its impact on both the individual (co-morbidities like cardiovascular disease and diabetes) (WHO, 2016) and community (health costs) (Dobbs et al., 2014). While shifts in consumption norms such as increasing portion sizes and availability of cheap calorie-dense foods have been implicated as features of an increasingly obesogenic environment, there is emerging data suggesting that societal-level inequality of resources and opportunities may also promote obesity, diabetes, and increased caloric intake patterns (Eibner & Evans, 2005; Elgar et al., 2016; Pickett & Wilkinson, 2015). Yet, it remains unclear whether inequality directly promotes obesogenic behaviours, or serves as an indirect proxy for obesogenic environments (e.g. poorer quality or access to healthier foods). The present study seeks to demonstrate how the experience of personal feelings of deprivation relative to others may directly promote the selection and consumption of excess calories.

A growing body of evidence suggests a positive relationship between perceived resource scarcity and obesogenic eating behaviours (Hill et al., 2016; Laran & Salerno, 2013). While non-human animals almost exclusively monitor and appraise the availability of food resources from the environment, human motivation for acquisition and consumption of caloric resources may also be shaped by perceived insecurities in critical non-food resources, such as money, material goods, and status, given that such resources provide access to food and are necessary for thriving (Briers et al., 2006; Cheon & Hong, 2017). Accordingly, prior research has suggested that the perceived insufficiency of material resources and harshness of the broader environment may alter one's relationship with food in favour of more calorie-dense options. For instance, evolutionary perspectives, such as life-history theory and optimal foraging theory, has suggested that exposure

to cues signalling environmental harshness and scarcity of resources results in an increase in preference and consumption of high- compared with low-calorie foods (Laran & Salerno, 2013; Swaffield & Roberts, 2015). Furthermore, insecurity and dissatisfaction with financial resources have been associated with desire for calorie-dense foods (Briers & Laporte, 2013). Recent reports also indicate that people who experienced low (compared to high) socioeconomic status (SES) during their childhood are more prone to eating in the absence of hunger (Hill et al., 2016), suggesting that experiences of chronic deprivation may alter or program one's future relationship with food to favour intake and storage of excess energy.

Low objective SES and economic insecurity have been critically linked with obesity (Nettle et al., 2016; Sobal & Stunkard, 1989). But importantly, appraisal of inequality and scarcity of critical resources may not be best derived by an individual's absolute possession or access to such resources, but instead by social comparisons with the perceived abilities and fortunes of others (Dunning & Hayes, 1996; Festinger, 1954). Growing evidence indicates that an individual's perception of their own worth, and socioeconomic standing (subjective socioeconomic status; SSES) relative to others may be more heavily weighted and predictive of indicators of health and well-being compared with actual standing or objective indicators of SES like income, education and job statuses (Adler et al., 2000; Boyce et al., 2010; Demakakos et al., 2008). Supporting these findings and applying them to eating behaviour, a recent study has demonstrated that an experimentally-induced state of low subjective SES or social class may stimulate appetite and increase caloric intake from both snack and meal contexts (Cheon & Hong, 2017). In light of these findings, it appears that SES gradients of obesity may only be indirectly and partially driven by perceived scarcity and dissatisfaction with material resources and opportunities. Instead, subjective feelings of deprivation or "losing out" relative to others

may be a key and more proximal factor driving increased appetite and caloric intake in response to perceived signals of scarcity, inequality, or competition for crucial resources in the environment.

rethe aggregate level and use measures like income (Gini coefficient; Yitzhaki, 1979) to quantify levels of inequality (as a proxy for deprivation) across the population (Adjaye-Gbewonyo & Kawachi, 2012; Smith et al., 2012). While this provides for a useful and convenient appreciation of the relationship between inequality and obesity, it is unrepresentative of, and does not allow for individual-level examination of a relationship between actual feelings of deprivation and obesity. Personal relative deprivation (PRD) has been generally defined as subjective feelings of dissatisfaction, resentment and wanting, resulting from negative (typically upward) social comparisons and the belief that one is deprived of a desired outcome (Crosby, 1976; Smith et al., 2012). Of relevance, heightened feelings of PRD have been shown to result in a greater drive to compensate for this perceived discontent - promoting behaviour consistent with resource seeking (i.e. gambling and increased materialism) (Callan et al., 2011; Mishra & Novakowski, 2016; Zhang et al., 2015). Interestingly, this increased inclination for resource seeking does not appear to be domain restricted, given the evidence that demonstrates an overlapping and interchangeable relationship between material and food resource domains (Briers et al., 2006; Kim et al., 2010; Nelson & Morrison, 2005; Xu et al., 2015).

Considering the above, we propose that PRD or unfavourable upward social comparisons may be an especially powerful modulator of appetite and potentially drive the relationship between resource insecurity and stimulated appetite (and subsequent eating behaviour). However, despite prior cross-sectional and correlational studies on the link between relative deprivation and obesity risks (Elgar et al., 2016; Eibner & Evans, 2005), there is a notable lack

empirical/experimental research directly examining the causal influence of the subjective state of PRD on actual eating behaviours that risk obesity (i.e., selection and consumption of greater calories). Accordingly, there has only been one recent study that has examined the links between poverty, relative financial inequality and caloric consumption behaviour (Bratanova et al., 2016). Yet this research was not designed as a direct examination of the effect of the subjective experience of relative deprivation on eating behaviours given that it experimentally manipulated poverty concerns (signalling absolute deprivation or scarcity of resources) rather than relative personal deprivation, which operates independently of actual resource scarcity or poverty. Furthermore, while the authors also observed increased caloric consumption as a result of an experimental manipulation of inequality, this effect was driven by anxiety associated with an anticipated interaction with someone who was richer or poorer, rather than subjective experience of deprivation. Therefore, establishing a direct relationship between PRD and increased caloric intake would provide additional information of the proximal psychological mechanisms through which obesogenic food preferences and eating behaviours manifest from environmental and psychosocial factors such as perceived harshness/scarcity of the environment (Laran & Salerno, 2013; Swaffield & Roberts, 2015), low subjective SES (Cheon & Hong, 2015; Hill et al., 2016), and social inequality and disadvantage (Elgar et al., 2016; Wilkinson & Pickett, 2006). Specifically, that the underlying mechanism may not simply be the perceived insufficiency of SES resources per se, but a profound state of subjective deprivation that insufficient SES resources creates.

These findings would also provide additional support for the notion that among humans, psychological and physiological systems that monitor and regulate motivation towards food-based and critical non-food resources (e.g., money, status) may functionally overlap (Briers &

Laporte, 2013; Cheon & Hong, 2015; Xu et al., 2015). Practically, these insights could also inform potentially novel psychologically-based interventions for mitigating socioeconomic and inequality-based disparities in obesity.

To fulfil these objectives, we conducted two studies to examine the role of PRD on eating behaviour. Rather than measuring only hypothetical food preferences or relatively superficial eating situations (e.g., amount of candies consumed) as some prior studies linking appetite with resource scarcity have, we investigated the impact of PRD on more ecologically-valid eating behaviours in meal contexts involving concerns of fullness and satiety. We hypothesize that i) self-reported chronic tendencies and ii) an experimentally induced condition of subjective PRD will be associated with the selection and consumption of higher-calorie portion sizes.

Study 1 Methods

The purpose of study 1 was to investigate the relationship between self-reported PRD and, food-related decisions (selection of portions) and behavior (actual consumption of food). We expected that participants who reported higher levels of PRD would (i) select larger food portion sizes in a computer-based food portion selection task (PST), (ii) self-serve themselves larger portions of food in the *ad-libitum* lunch meal provided, and (iii) consume larger portions of food in the *ad-libitum* lunch meal.

Participants

Ninety-two participants (age, 24 ± 2 years; 54 men; BMI, 21.4 ± 3.0 kg/m²) were recruited from a Singaporean university. Participants were each compensated \$5 and a self-served *ad-libitum* lunch (which was consumed during the experiment) for completing the study. The research was

approved by the university's institutional review board (IRB) and written consent obtained from all participants.

Procedure and Materials

Participants arrived at the lab and were briefed on the session proceedings as a group. After providing informed consent, participants completed assessments of appetite ratings of hunger, fullness, satiety, desire to eat, and prospective food consumption ("How much do you think you could eat?") using 100-point (mm) visual analogue scales. Next, participants completed a computerized PST that was modelled on prior computerized assessments of portion selection and intended food consumption (Brunstrom & Rogers, 2009; Brunstrom et al., 2008; Wilkinson et al., 2012). The present PST involved using a computer program developed to display high-resolution images of diverse foods served on the same dinner plate with user-controlled portion sizes. Fifteen different food items (e.g. fried rice, penne pasta, chicken nuggets, roast duck noodles, fruit salad, mozzarella pizza, chicken rice and M&Ms) were presented to the participants in a randomized order. For each food, participants could dynamically increase or decrease the portion size displayed in equicaloric steps ranging from 20 to 1000 kcals in 20 kcal increments (consisting of 50 images per food) by pressing the right or left arrows on the computer keyboard (see Figure 1). Participants were required to select their ideal portion of each food item from the series of food portion images, that they thought best represented the amount they would consume to reach satiety (*"Please select the amount of food that you like to eat for your next meal?"*). Prior studies have suggested that such computerized PSTs can reliably predict actual self-served and consumed portions for a given food presented in the task (Wilkinson et al., 2012). For a review of the computer based expected satiety methods and their application see (Forde et al., 2015).

Following the PST, participants completed a number of surveys pertaining to general demographics and individual differences, like the Personal Relative Deprivation (PRD) Scale (Callan et al., 2011) which assessed the degree to which the participant feels subjectively worse off compared with others (i.e., “When I think about what I have, compared to others, I feel deprived”). Participants rated their agreement for each item on a 6-point Likert scale, which were summed to create a composite score, with the higher scores indicating higher levels of PRD (Cronbach $\alpha = 0.70$).

Following these measures, participants were provided ad-libitum access to a lunchtime test-meal of *Yang Chow* fried rice (rice, wok-fried together with egg, cut-up chicken, vegetables, shrimp) - a popular, commonly consumed local dish. The food was prepared and served ready to eat in buffet trays on the days of the experiment by a professional catering company. Participants were informed that they could serve themselves any amount of fried rice they wanted and were also explicitly told they could have more than one serving if they wished. The same standard dinner plates that the foods were displayed on for the computerized PST were provided to participants to self-serve and consume their lunch. After participants finished their meal, they completed the same appetite ratings from the beginning of the study. The fried rice (together with the plate) was weighed immediately after participants served themselves and after completion of their meal. The amount of food left (if there was any) on each participant’s plate along with the weight of the empty plate was also recorded to derive separate measures of the i) amount of food the participant served themselves at the buffet line and ii) amount of food actually consumed. After the session, the caloric density of the fried rice (165 kcal/100g) was determined via a commercially available near-infrared calorie-analysis device (*Calorie Answer*, Joy World Pacific, Aomori, Japan) (Lau et al., 2016).

Study 1 Results

Seventeen participants (age, 23 ± 4 years; 11 men; BMI, 22.8 ± 3.9 kg/m²), who were actively dieting, were excluded from the analysis for Study 1. Seventy-five participants (age, 22 ± 8 years; 43 men; BMI 21.4 ± 3.1 kg/m²) were included in the analysis for Study 1.

Eating Behaviour Outcomes

We conducted partial correlation analyses to determine whether self-reported PRD was associated with increased portion selection and intake patterns. The analysis controlled for prospective consumption appetite ratings (assessed at the start of the session) since participants' levels of appetite were not standardized (e.g., requiring fasting or providing a standardized breakfast) and could serve as a source of undue individual variation and noise. Furthermore, this question has been demonstrated to be the appetite rating to be most predictive of subsequent food intake (Barkeling et al., 1995). Participant gender was also controlled for given sex differences in typical portion sizes (Benton, 2015).

Consistent with our hypotheses, self-reported chronic tendencies for PRD was positively associated with hypothetical portion selection (computerized task), $r(71) = 0.259$, $p = 0.027$, (Figure 2A) and actual calories self-served, $r(71) = 0.305$, $p = 0.009$, (Figure 2B) and consumed $r(71) = 0.303$, $p = 0.009$, (Figure 2C) during the ad-libitum lunch test meal¹. Of note, computer survey-based portion selection was overall positively correlated with actual self-served, $r(71) = 0.320$, $p = 0.006$, and consumed, $r(71) = 0.269$, $p = 0.021$, portions.

¹ Partial correlational results are still supported even after exclusion of outliers (> 2 and 3 standard deviation)

Study 1 Discussion

As hypothesised, Study 1 demonstrated that self-reported, domain general, chronic tendencies for PRD are positively associated with portion selection for both computerized and real food (actual amount of food self-served and consumed). As participants reported greater dispositional experiences of dissatisfaction and deprivation of opportunities and resources as a result of social comparisons, they also exhibited greater portion size selection and actual caloric intake. While the present study provides initial support for a relationship between subjective feelings of deprivation of non-food resources and consumption of food, the causal role of PRD remains unknown.

Study 2 Methods

The main aim of this study was to determine PRD's causal role in stimulating appetite and producing behaviors reflecting increased food intake by experimentally manipulating feelings of PRD. Following a manipulation of subjective feelings of relative deprivation and unfairness, participants completed the computerized PST used in Study 1. Actual self-served and consumed portions for an ad-libitum meal were not assessed in Study 2 given that i) Study 1 and prior research (Wilkinson et al., 2012) have demonstrated that portion sizes selected on the computerized portion task is a reliable proxy for actual food intake, and ii) participants typically consume almost all of the food (approximately 92%) they select for themselves for a portion (Wansink & Johnson, 2015).

Participants

One hundred and fifty-eight students (age, 21 ± 2 years; 66 men; BMI 20.5 ± 5.4 kg/m²) from a Singaporean university were recruited. Sample size calculation was based on a previous comparable study from our lab (Cheon & Hong, 2017) and determined to be 128 participants (Power: 0.8, $d = 0.5$) (Faul et al., 2009). Participants were each compensated \$5 for completing the study, which was approved by the university's IRB.

Procedure and Materials

Participants were randomly assigned into one of two experimental groups: i) relatively deprived (RD) ($n=61$) or ii) control (CON) ($n=61$). The experimental procedure was similar for both conditions except for the manipulation employed. Participants completed the measure of appetite ratings used in Study 1, before reading and imagining themselves in a scenario involving the allocation of an annual bonus at work modified from a prior study that experimentally induced feelings of deprivation (van den Bos et al., 2015). In both conditions, participants read the same opening to the scenario:

“Imagine that you are working as a consultant at a medium-sized company. The company has two similar departments that are only slightly different in the clients they serve. Each department holds approximately 15 persons. Your position is in one of the two departments. So far, you feel valued by the management. Furthermore, the secondary benefits are very good, so you are pretty happy about your position. Every year, the company awards a year-end bonus to both departments, to thank them for their hard work. Thus, when the end of the year is coming into sight, you already start thinking about how to spend the bonus this year.”

In the RD condition, participants were told to imagine that they received a smaller amount of bonus as compared to their co-workers in the same department, even when it appeared that the participant performed well and was valued. They were presented with the following closing text:

“Without warning or explanation, the management reveals that the bonus would be different for each employee this year. You will receive \$850 this year, whereas your 14 immediate co-workers each will receive \$1,500”.

On the other hand, in the CON condition, participants were told to imagine that everyone in the department received the same amount for the bonus (\$850), and read the following closing:

“The management reveals that the bonus would be the same for all employees this year. You and all other employees will receive \$850 this year”.

Importantly, to isolate and assess the effect of subjective feelings of relative deprivation (rather than actual resources received or actual deprivation) on appetite and portion selection patterns, the absolute amount of the bonus that participants were told they would receive was the same (i.e. \$850) for both RD and CON conditions.

After reading their respective scenario (RD vs. CON), participants completed a manipulation check involving their reactions to the scenario using a 7-point agreement scale– (*“How fair do you think the \$850 bonus was? How fair do you feel you were treated? To what extent do you feel that the bonus of \$850 was right?”*), followed by the Brief Mood Introspection Scale (BMIS) (Mayer & Gaschke, 1988). These measures of fairness (in the BMIS) served as reflections/proxies of feelings of relative deprivation.

Following the manipulation, participants completed a shortened version of the computerized PST used in Study 1 in which 10 food items used from the PST in Study 1 were presented. Participants were similarly asked to select an amount of food which best represented what they would serve themselves for their next meal. After participants finished the PST, they completed a number of questions regarding each of the foods that had been presented: liking, fillingness (expected satiation), frequency of consumption, and desire to consume the food. Finally, participants answered an additional question regarding the scenario they read (*“How grateful do you feel about your bonus?”*) the PRD Scale (Cronbach $\alpha = 0.70$), and the Three-Factored Eating Questionnaire that included cognitive restraint (Cronbach $\alpha = 0.76$), uncontrolled eating (Cronbach $\alpha = 0.83$) and emotional eating (Cronbach $\alpha = 0.85$) subscales.

Study 2 Results

As per Study 1, 36 participants (age, 21 ± 2 years; 14 men; BMI 21.3 ± 2.8 kg/m²), who were actively dieting, were excluded from the analysis for Study 2. A hundred and twenty-two participants (age, 21 ± 2 years; 52 men; BMI 20.2 ± 5.9 kg/m²) were included in the analysis.

Manipulation and Affect Check

A manipulation check in the form of questions pertaining to the unfairness of situation were presented to participants after the manipulation. As expected of situations that would elicit acute feelings of PRD, participants in the RD condition reported that they felt more negative mood, $F(1,120) = 9.514$, $p = 0.003$ $\eta_p^2 = 0.073$, perceived the situation to be less fair (composite score of three questions regarding fairness of the scenario presented), $F(1,120) = 99.326$, $p < 0.001$,

$\eta_p^2 = 0.453$, and were less grateful for the outcome, $F(1,120) = 27.151$, $p < 0.001$ $\eta_p^2 = 0.185$ (Table 1).

Individual Differences in Eating Habits

There were no statistically significant differences between the two groups in the measures for dietary restraint, uncontrolled eating, and emotional eating (Table 2).

Eating Behaviour Outcome

An analysis of covariance (ANCOVA), controlling for ratings for prospective food consumption and gender (as per Study 1), revealed that participants who were randomised into the RD condition selected, on average, more calories (larger portion sizes) on the computer-based PST compared with participants allocated into the control group, $F(1,118) = 4.774$, $p \leq 0.031$ $\eta_p^2 = 0.031$ (Figure 3). Furthermore, desire to consume food was also found to be stronger in participants allocated into the RD group as compared with participants of the control group, $F(1,118) = 4.437$, $p \leq 0.037$, $\eta_p^2 = 0.036$ (Figure 4). To examine whether negative mood elicited by the RD manipulation was driving increased appetite and portion selection rather than PRD *per se*, we conducted the ANCOVAs again with the inclusion of negative mood on the BMIS as an additional covariate. Significant effects of the manipulation (RD) were maintained for the amount of calories (food portion) selected, $F(1,117) = 4.300$, $p = 0.040$, $\eta_p^2 = 0.035$, even when controlling for negative mood, suggesting that the acute experience of PRD may contribute to increased portion sizes independent of the activation of stress-induced or emotional eating.

Study 2 Discussion

In line with our hypothesis, in Study 2, participants who were led to feel relatively deprived selected larger portions in the PST (accounting for prospective consumption appetite ratings and gender) and reported a stronger desire to eat the foods presented to them on the PST. In addition to conceptually replicating the findings from Study 1, by suggesting a direct causal link between PRD and eating behaviour consistent with overconsumption, Study 2's findings further suggest i) PRD is a proximal psychological mechanism through which perceived social inequality (unequal distribution of bonuses for equal performance) may promote obesogenic eating behavior, and ii) subjective feelings of deprivation on non-food and food-based resources (i.e., hunger) may functionally overlap.

General Discussion

The main aim of the two present studies was to demonstrate the influence of individual-level subjective feelings of PRD on eating behaviour. Drawing from existing literature on i) the influence of social comparisons on materialistic pursuits (Callan et al., 2008; Callan et al., 2011; Zhang et al., 2015) and ii) behavioural economics of the overlapping functionality of monetary and caloric resources (Briers & Laporte, 2013; Briers et al., 2006), we proposed that feelings of PRD would have a significant impact on stimulating appetite and energy intake. In support of our hypotheses, outcomes from the present research suggest that both chronic (individual trait) and acute (experimentally induced) states of PRD may result in selection of larger food portions and consumption of greater energy from a meal.

The present investigation is among the first to experimentally investigate the impact of PRD on actual eating behaviour that may contribute to obesity. Consistent with previous research demonstrating that PRD (both as a dispositional trait and situationally induced) results in a

greater tendency towards resource seeking (Callan et al., 2008; Callan et al., 2011; Zhang et al., 2015), we observed that PRD was associated with a similar inclination towards caloric resources. This finding supports the notion that, the belief and subjective experience of being deprived of a deserved outcome relative to similar others, may be sufficient to promote compensatory resource seeking behaviour to “right the perceived injustice” (Callan et al., 2008; Zhang et al., 2015). Consequently, the perceived deprivation of a non-food resource (i.e., monetary bonus), especially of one deemed deserved, may co-activate an overlapping motivation for food intake. Briers and colleagues (2013; 2006) provided evidence that financial dissatisfaction resulted in increased motivation to replenish their need for financial resources by consuming caloric resources. Behavioral neuroscience studies have also shown that food and monetary rewards activate and engage overlapping regions of the brain (Breiter & Borsook, 2001; O'Doherty et al., 2002), although distinct brain networks responsive to both reward types have also been observed (Simon et al., 2015). This overlap of subjective deprivation and drive for food-based and crucial non-food resources may have had adaptive benefits given that social standing and material resources (for humans) may indirectly provide advantaged access to food or compensate for food scarcity.

One limitation of our current studies is that our findings for the experimental manipulation of PRD on eating behaviour (Study 2) are limited to the specific domains of relative deprivation of monetary resources (i.e., a yearly bonus). To account for this limitation, Study 1 involved a domain-general measure of chronic experiences of PRD, given that participants are expected to base their reports of feelings of deprivation based on the domains and resources that personally matter most to them. Nonetheless, future research should examine the role of domain-specificity of comparisons for PRD on health-related outcomes. Another limitation of the current research is

the absence of a relative “advantage” condition, where participants are experimentally manipulated to feel like that they were in a position of benefit/gain. Accordingly, it is not known if such an experience (“of advantage”), will result in increased, decreased or similar consumption levels. Although, we speculate that there will not be a change in eating behaviour resulting from relative advantage given that prior research found no difference in caloric intake between being manipulated to feel higher in perceived SES compared with a neutral condition (Cheon & Hong, 2017). Lastly, the current studies involved recruiting participants from a relatively advantaged group (university students). Whether similar outcomes may be observed in a less privileged or socioeconomically disadvantaged population may require future research to determine.

Recent examinations on the role of perceived harshness/scarcity of the environment, insecurity of material and financial resources, and low subjective socioeconomic status on body-mass and food preferences have revealed that socioeconomic inequality may be a key characteristic of obesogenic environments (Bratanova et al., 2016; Cheon & Hong, 2017; Drewnowski & Darmon, 2005; Elgar et al., 2016; Nettle et al., 2016; Wilkinson & Pickett, 2006). By revealing how PRD that may be produced by such environmental cues of insecurity promotes greater caloric selection and intake, the findings from the present study demonstrate how inequality transforms into obesogenic behaviours, and consequently socioeconomic disparities in the burden of obesity observed in many developed nations. Given the ubiquitousness and centrality of social comparisons to human experiences (Festinger, 1954), efforts and interventions to reduce rising levels of obesity may be incomplete without addressing social inequality and its psychological consequences.

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Conflict of interest

The authors declare no conflict of interest.

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Figure 1 –Example of food portion-size images (presented individually) displayed on the portion selection computer program. Keyboard commands to increase (right arrow key) or decrease (left arrow key) food portion images correspondingly changed the portion size of displayed by the image in 20 kcal increments ranging from 20 to 1000 kcal (50 images total per food).

520 Figure 2 – Correlations – amount selected on portion selection task vs. relative deprivation (A),
521 amount of test meal that participants served themselves vs. relative deprivation (B) and amount
522 of test meal that participants consumed vs. relative deprivation (C) ($n = 75$).

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527 Figure 3 – Average amount of energy selected for food items on the portion selection task for the
528 relatively deprived and the control condition (n=122).[#]Significantly different from control
529 condition (p = 0.031). Standard errors are represented by the error bars attached to the columns.

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Figure 4 – Mean ($\pm$ SE) perceived desire to consume food for the relatively deprived and control experimental conditions ($n = 122$). #Significantly different from control. ($P \leq 0.037$). Standard errors are represented by the error bars attached to the columns.

Table 1 – Means and standard deviations of questions used for the manipulation check.

#Significantly different from control. ($P \leq 0.050$).

	Relatively Deprived (n=61)		Control (n=61)	
	<i>Mean</i>	<i>Std. Dev</i>	<i>Mean</i>	<i>Std. Dev</i>
Average perceived fairness from bonus	2.33 [#]	1.35	4.63	1.19
Self-reported positive mood levels	41.43 [#]	6.18	44.70	5.54
Gratefulness for bonus	3.87 [#]	1.40	5.05	1.09

Table 2 – Means and standard deviations of eating behaviour type. Means did not significantly differ between the two conditions.

	Relatively Deprived (n=61)		Control (n=61)	
	<i>Mean</i>	<i>Std. Dev</i>	<i>Mean</i>	<i>Std. Dev</i>
Cognitive Restraint	2.13	0.62	2.20	0.61
Uncontrolled Eating	2.43	0.53	2.40	0.53
Emotional Eating	2.26	0.79	2.18	0.74