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External eating mediates the relationship between impulsivity and unhealthy food intake☆

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HIGHLIGHTS

- Impulsivity has been associated with both increased food intake and external eating.
- We examined the mediating role of external eating on impulsivity and food intake.
- Specific components of impulsivity interactively predicted food intake.
- External eating mediated the relationship between motor impulsivity and food intake.
- Potential interventions could target either impulsivity or external eating.

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ABSTRACT

Recent evidence from the eating domain shows a link between impulsivity and unhealthy food intake. However, the mechanism underlying this relationship remains unclear. One possibility is an external eating style, which has been linked to both impulsivity and food intake. The current study investigated the potential mediating role of external eating in the relationship between impulsivity and food intake. Participants were 146 undergraduate women who completed measures of impulsivity and external eating, and took part in a laboratory taste test as a behavioural index of unhealthy snack food intake. It was found that attentional and motor impulsivity interacted in predicting sweet food intake, but only motor impulsivity predicted both external eating and sweet food intake. Furthermore, the relationship between motor impulsivity and food intake was mediated by external eating. These findings support the development of interventions aimed at targeting specific aspects of impulsivity in order to reduce unhealthy eating behaviour.

1. Introduction

Unhealthy eating behaviour, such as consuming too much food high in fat and/or sugar, has been linked to weight gain as well as overweight or obesity [18]. One acknowledged contributing factor to the increasing rates of overweight and obesity over the last few decades is an "obesogenic" environment, where high caloric food is easily accessible and available [18]. However, not all individuals overeat and/or gain weight indicating that there are differences in susceptibility to such an environment [8]. Recent evidence suggests that personality traits such as impulsivity may increase the likelihood of overeating in the face of such an environment, which in turn, can lead to weight gain. Impulsivity refers to the general tendency to act or think without regarding the consequences [28], and has been linked to engaging in a variety of unhealthy behaviours such as gambling, alcohol abuse, and smoking [19].

Over recent years, a growing number of studies have demonstrated that impulsivity is also associated with unhealthy eating behaviour, particularly overeating [12,13,15]. Specifically, research has shown that impulsivity is associated with increased food intake during a laboratory taste test in both healthy weight [12,13,15] and overweight or obese women [2]. Naturalistic studies have also shown that impulsivity is related to increased body mass index (BMI) [3,9], and that highly impulsive people are more likely to be overweight or obese [29–32,37,49]. Recently, Meule and Platte [27] found that two forms of impulsivity, namely attentional (an inability to focus attention or concentrate) and motor (acting without thinking), interacted in predicting increased percent body fat in a sample of young women. Accordingly, they concluded that specific aspects of impulsivity should be examined.

The previous literature shows that a general tendency to be impulsive, as well as particular aspects of this trait, is linked to increased food intake and weight. However, what remains unanswered is how a

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general personality trait, such as impulsivity, is translated into eating-related outcomes. One potential mechanism might be an external eating style, which refers to a heightened responsiveness to external food-related cues (e.g., the sight or smell of attractive food) in the environment [42]. Research has demonstrated that external eating is associated with increased impulsivity. Specifically, studies have found a positive correlation between impulsivity and external eating in overweight and obese individuals [11,35], as well as in restrained eaters [10]. Furthermore, Hou et al. [20] found that both attentional and motor impulsivity were positively correlated with external eating in healthy weight women.

External eating has also been linked to overeating. Research has shown that among healthy weight women, external eating is linked to increased self-reported energy intake over three days [25] and one month [1]. In addition, experimental studies have found that an external eating style is positively correlated with laboratory based food intake in adolescent girls [46], candy consumption in children [50], and unhealthy snack food intake in healthy weight women [34]. External eating has also been associated with increased BMI in a healthy weight sample [7], as well as obesity in children [5] and adults [4]. The idea that increased responsiveness to external food cues is related to overeating underlies Schachter's classic externality theory [38]. Thus, external eating has been found to be associated with both impulsivity and overeating, suggesting a potential mediating role.

The few studies to consider all three of these components (i.e., impulsivity, external eating, overeating) have examined a related issue, namely whether particular environmental cues trigger overeating in impulsive individuals. Guerrieri et al. [12] manipulated one 'external' environmental aspect that is associated with increased eating, namely food variety. Specifically, half of the participants received monotonous food during a bogus laboratory taste test, while the other half received food that varied in colour. The study found that although highly impulsive individuals consumed more food, food variety was not associated with increased food intake. In contrast, a follow-up study by Guerrieri et al. [13] used food that varied in form, taste, and texture, as well as colour, and found that for highly impulsive individuals, those in the variety group consumed more food than those in the monotonous group. In both of these studies external eating was manipulated as an environmental cue. However, external eating can also be conceptualised as a habitual style or trait, as there exist stable individual differences in eating in response to food cues. To date, only one study has investigated the role of an external eating style (using the External Eating Subscale of the Dutch Eating Behaviour Questionnaire; [40]) in the link between impulsivity and eating. Specifically, Jasinska et al. [23] found that external eating partially mediated the relationship between motor impulsivity and BMI.

The aim of the present study was to investigate the role of impulsivity and external eating in food intake. We chose to measure actual food intake in the laboratory, as a way of directly observing behavioural responses to food cues that can lead to weight gain and increased BMI [51]. Following the suggestion of Meule and Platte [27], we examined the individual and combined effects of three forms of impulsivity (attentional, motor, and non-planning) using the Barratt Impulsiveness Scale [36]. Thus, the current study offered a more comprehensive investigation of the potential mediating role of external eating in the relationship between impulsivity and increased food intake. Specifically, we tested the prediction that individuals with high motor impulsivity (alone and in combination with attentional impulsivity) would be more likely to report an external eating style, which in turn would lead to a greater intake of unhealthy snacks in the laboratory.

2. Method

2.1. Participants

Participants were 144 women recruited from the Flinders University undergraduate student population. They were aged 17 to 28 years ($M = 20.20$, $SD = 2.64$). Most participants ($n = 112$, 78%) were within the healthy weight range (i.e. 18.5–24.9 kg/m^2), with a mean BMI of 22.9 kg/m^2 ($SD = 5.11$). Only women were recruited as they have shown a greater tendency to overeat [7]. Participants were included if they spoke English as their first language, liked most foods, and did not have any food allergies or dietary requirements. Participants were instructed to eat something 2 h before the scheduled testing session, and to refrain from eating until the study time to ensure that hunger was equalised across participants. All participants reported having complied with this instruction.

2.2. Measures

2.2.1. Barratt Impulsiveness Scale — Version 11 (BIS-11)

Trait impulsivity was assessed by the widely used BIS-11 [36]. The BIS-11 comprises 30 items which assess three aspects of impulsivity: attentional (e.g., 'I am restless at the theatre or lectures'), motor (e.g., 'I do things without thinking'), and non-planning (e.g., 'I am more interested in the present than the future'). Participants were asked to indicate how well each of the items related to them on a four-point scale ranging from Rarely/Never (=1) to Almost Always/Always (=4). Scores are summed to provide a total score with higher scores reflecting higher levels of impulsivity. The BIS-11 has been shown to have good convergent validity, test–retest reliability, and internal reliability [36,39]. In the present sample, internal reliability for the total scale was good ($\alpha = .85$), and ranged from $\alpha = .67$ to .71 for the subscales, which is comparable with previous samples ($\alpha = .59$ to .74, [39]; $\alpha = .60$ to .78, [27]).

2.2.2. External eating

External eating was measured by the External Eating subscale of the Dutch Eating Behaviour Questionnaire (DEBQ; [40]). This subscale consists of 10 items about eating in response to external cues in the environment (e.g. 'If you see or smell something delicious, do you have a desire to eat it?'). Participants were asked to indicate how well each of the items related to them on a five-point scale ranging from Never (=1) to Very Often (=5). Responses for each item were averaged to produce an external eating score, with higher scores reflecting higher levels of external eating. The External Eating subscale of the DEBQ has been shown to have good construct validity [43], predictive validity [41], and internal reliability [40]. In the present sample, internal reliability was also good ($\alpha = .81$).

2.2.3. Consumption

Consumption was measured using a so-called taste test. Participants were presented with a platter comprising four snacks (two sweet and two savoury): M&Ms, chocolate-chip biscuits, potato chips, and pretzels. The four foods were presented in equally-filled separate bowls and were chosen as they are commonly consumed and are bite-sized to facilitate eating. The presentation order of the bowls was counterbalanced across participants using a 4×4 Latin square. Participants were instructed to taste and rate each snack on several dimensions (e.g., flavour, likelihood of purchase). They were given 10 min to complete their ratings and told that they could try as much of the food as they liked. The amount of each food consumed was calculated by subtracting the weight (in grams) of the snacks after the taste test from the weight of the snacks before the taste test. The weight in grams for each snack food was then converted into the number of kilojoules consumed and summed to produce two measures of food intake, one for sweet and one for savoury food.

2.3. Procedure

Participants were recruited for a study entitled "Food Preferences and Eating Habits". The study took place in a quiet room in the Food Laboratory in the School of Psychology at Flinders University, South Australia. The testing session lasted approximately 30 min. After providing informed consent, participants provided some background information, followed