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Interactive and indirect effects of trait impulsivity facets on body mass index

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ABSTRACT

Impulsivity is a personality trait that may be a risk factor for overweight and obesity. Increasing evidence suggests, however, that only specific facets of impulsivity are associated with eating- and weight-related variables. Moreover, there seem to be interactive effects such that eating-related self-regulation is low when more than one impulsivity facet is elevated. Finally, the effect of impulsivity on body weight appears to be indirect, that is, is mediated by eating behaviors. In the current study, 790 adults (83% female, 80% students) completed a short form of the *Barratt Impulsiveness Scale* and the *Perceived Self-Regulatory Success in Dieting Scale* online and reported their current height and weight. Scores on attentional and motor impulsivity were interactively associated with perceived self-regulatory success in weight regulation: Higher attentional impulsivity was associated with lower perceived self-regulatory success at high levels of motor impulsivity, but not at low levels of motor impulsivity. A moderated mediation model revealed an indirect effect of attentional impulsivity on body mass index (BMI) via perceived self-regulatory success in weight regulation at high, but not low levels of motor impulsivity. Non-planning impulsivity was unrelated to perceived self-regulatory success in weight regulation and BMI. Results support previous findings such that attentional and motor impulsivity are interactively associated with eating- and weight-related measures. Specifically, eating-related self-regulation is low when both attentional and motor impulsivity levels are high. Moreover, results further support that self-reported trait impulsivity is not directly related to BMI, but indirectly via eating behaviors as potential mediators.

1. Introduction

Impulsivity refers to a predisposition toward rapid, unplanned actions without regard to possible negative consequences of these actions (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). High impulsivity levels have been suggested to contribute to overweight and obesity (Guerrieri, Nederkoorn, & Jansen, 2008). For example, obese children and adults reacted more impulsively than normal-weight participants did in behavioral tasks (e.g., go/no-go, stop signal, or delay discounting tasks; Fields, Sabet, & Reynolds, 2013; Mobbs, Iglesias, Golay, & Van der Linden, 2011; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006; Nederkoorn, Smulders, Havermans, Roefs, & Jansen, 2006; Weller, Cook, Avsar, & Cox, 2008; Wirt, Hundsdörfer, Schreiber, Kesztyüs, & Steinacker, 2014). Similarly, obese children and adults reported higher impulsivity than normal-weight participants did using questionnaire measures (Mobbs, Crépin, Thiéry, Golay, & Van der Linden, 2010; Nederkoorn, Braet, et al., 2006; Rydén et al., 2003). Furthermore, higher impulsivity (lower motor response inhibition in particular) prospectively predicted weight gain or lower weight loss in children (Nederkoorn, Jansen, Mulkens, & Jansen, 2007; Reinert, Po'e, & Barkin, 2013).

Although this converging evidence exists, findings are inconsistent. For example, scores on impulsivity measures were unrelated to body weight in several studies in children and adults (e.g., Fields et al., 2013; Hendrick, Luo, Zhang, & Li, 2012; Koritzky, Yechiam, Bukay, & Milman, 2012; Loeber et al., 2012; Verdejo-García et al., 2010). In other studies, impulsivity was associated with body weight or weight gain, but only as a function of moderating variables such as responsiveness to food cues in children and adults (Houben, Nederkoorn, & Jansen, 2014; Meule & Platte, 2016; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010).

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These inconsistent findings may partly be explained by small effect sizes of the relationship between impulsivity and body mass index (BMI) and the fact that only specific facets of impulsivity are associated with body weight (Emery & Levine, 2017; Meule & Blechert, 2016; Mobbs et al., 2010). For example, one of the most widely used self-report measures for the assessment of impulsivity, the *Barratt Impulsiveness Scale* (BIS; Stanford et al., 2009), comprises three subscales representing *attentional impulsivity* (i.e., inability to focus attention or concentrate), *motor impulsivity* (i.e., acting spontaneously or without thinking), and *non-planning impulsivity* (i.e., lack of future orientation or forethought; Patton, Stanford, & Barratt, 1995). Emerging evidence suggests that particularly attentional impulsivity is associated with self-reported eating behaviors and body weight (Meule & Blechert, 2016; Meule, 2013). In addition, elevated motor impulsivity has been reported in eating disorder patients who binge eat (Claes, Nederkoorn, Vandereycken, Guerrieri, & Vertommen, 2006; Nasser, Gluck, & Geliebter, 2004; Rosval et al., 2006).

Based on these observations, it has been speculated that there might be interactive effects between attentional and motor impulsivity in relation to eating behaviors and body weight. Specifically, high attentional impulsivity may be related to moderate overeating through reward-sensitive mechanisms, but may be particularly crucial (e.g., clinically relevant) in combination with high motor impulsivity, indicating low inhibitory control (Meule, 2013). Indeed, such interactive effects between impulsivity facets have been found in recent studies. Higher scores on attentional impulsivity in combination with higher scores on motor impulsivity related to higher percent body fat and self-reported binge eating severity in female students (Meule & Platte, 2015), intake of sweet foods in the laboratory in female students (Kakoschke, Kemps, & Tiggemann, 2015), and addiction-like eating in obese adults (Meule, de Zwaan, & Müller, 2017). To conclude, it appears that when both attentional and motor impulsivity levels are high, individuals exhibit low eating-related self-regulation.

Another consideration when examining associations between impulsivity and obesity is how an impulsive personality translates into higher body weight. Specifically, as impulsivity is a construct that does not cover energy intake or expenditure, it is implausible that it affects fat mass directly. Higher impulsivity can only lead to higher body weight through mediating mechanisms, for example, eating behavior. Accordingly, some studies showed that the relationship between trait impulsivity and body weight was mediated by eating-related measures such as frequent food cravings, low perceived self-regulatory success in weight regulation, and addiction-like eating (e.g., Meule & Blechert, 2017; Murphy, Stojek, & MacKillop, 2014; VanderBroek-Stice, Stojek, Beach, & MacKillop, 2017). Importantly, this indirect effect was observed even in the absence of a directly observable relationship between impulsivity and body weight (i.e., total effect).

Recently, we sought to combine these findings in a sample of children and adolescents by examining the interactive effect between attentional and motor impulsivity (moderation) and the indirect effect of impulsivity on body weight (mediation) in one model (moderated mediation; Meule, Hofmann, Weghuber, & Blechert, 2016). It was found that motor impulsivity moderated the indirect effect of attentional impulsivity on BMI through perceived self-regulatory success in weight regulation. Specifically, there was an indirect effect of higher attentional impulsivity on higher BMI through lower perceived self-regulatory success in weight regulation, but this indirect effect was only present in children and adolescents who had high motor impulsivity levels.

In the current study, we sought to replicate this model in an adult sample. Specifically, it was expected that there would be an indirect effect of attentional impulsivity on BMI through perceived self-regulatory success in weight regulation as a function of motor impulsivity: higher attentional impulsivity was expected to indirectly relate to higher BMI via lower perceived self-regulatory success in weight regulation, but only in individuals with high motor impulsivity (Fig. 1).

2. Methods

2.1. Participants and procedure

Data were collected in an online survey at www.unipark.com. Participants were recruited via e-mails to student mailing lists at several German and Austrian universities, via social networks, and via a posting on the website of the German version of Psychology Today. The study included a short form of the BIS (BIS-15), the *Perceived Self-Regulatory Success in Dieting Scale* (PSRS), and other questionnaires. Participants also indicated their current height and weight, among other sociodemographic data. Every question required a response in order to continue. Completion of the study lasted approximately eight to ten minutes. Three × 50 € were raffled among participants who completed the survey. The website was visited 1396 times and $n = 805$ participants completed the entire set of questions. Twelve participants were excluded from analyses because they answered questions too rapidly (total completion time of less than five minutes). Three participants, who reported a very young or old age (12, 14 and 87 years old), were excluded from analyses, leaving a final sample size of $n = 790$.

Most participants were women (82.9%, $n = 655$) and had German (81.3%, $n = 642$) or Austrian (14.2%, $n = 112$) citizenship. The majority of participants were students (79.6%, $n = 629$), employed (11.4%, $n = 90$), or pupils (4.70%, $n = 37$). Mean age was $M = 24.7$ years ($SD = 6.79$). Mean BMI was $M = 22.3$ kg/m^2 ($SD = 3.93$). Seventy-six participants (9.60%) were underweight (BMI < 18.5 kg/m^2), 583 participants (73.9%) had normal weight (BMI = 18.5–24.9 kg/m^2), 92 participants (11.7%) were overweight (BMI = 25.0–29.9 kg/m^2), and 38 participants (4.80%) were obese (BMI ≥ 30.00 kg/m^2).

2.2. Measures

Perceived Self-Regulatory Success in Dieting Scale (PSRS). The PSRS (Meule, Papies, & Kübler, 2012) is a three-item questionnaire for measuring how successful individuals are in watching their weight and in losing weight, and how difficult it is for them to stay in shape. Response categories are anchored *not successful/not difficult* and *very successful/very difficult* (scored from 1 to 7). Thus, higher values indicate higher perceived self-regulatory success in weight regulation. Internal consistency was $\alpha = 0.696$ in the current study.

Barratt Impulsiveness Scale – short form (BIS-15). The BIS-15 (Meule, Vögele, & Kübler, 2011; Spinella, 2007) is a 15-item short form of the BIS-11 for measuring trait impulsivity. Response categories range from *rarely/never* to *almost always/always* (scored from 1 to 4). Thus, higher values indicate higher impulsivity. Internal consistencies were $\alpha = 0.670$ (attentional), $\alpha = 0.734$ (motor), and $\alpha = 0.794$ (non-planning) in the current study.

2.3. Data analyses

Linear regression analyses were used to examine moderation and mediation effects with PROCESS for SPSS (Hayes, 2013). Specifically, a moderated mediation model (model no. 7 in PROCESS) was tested, in which scores on attentional and motor impulsivity and their two-way interaction were used as predictors of PSRS scores (i.e., the mediating variable) and, in a second regression, attentional impulsivity and PSRS scores as predictors of BMI (Fig. 1).