Appetite 91 (2015) 336–342

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Temperamental factors in severe weight cycling. A cross-sectional study ☆

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ARTICLE INFO

Article history:
Received 22 November 2014
Received in revised form 10 April 2015
Accepted 22 April 2015
Available online 27 April 2015

Keywords:
Weight cycling
Temperament
Reward sensitivity
Effortful control

ABSTRACT

Objective: Weight cycling is a prevalent phenomenon in obese individuals. There is evidence that temperamental factors are associated with obesity and subgroups among the obese have been identified based on reactive and regulative aspects of temperament. *Methods:* We aimed at investigating the association between reactive and regulative aspects of temperament and severe weight cycling in overweight and obese individuals of a representative German population sample (n = 923). Participants completed questionnaires assessing weight parameters including BMI and weight cycling, sensitivity to punishment and to reward (BIS/BAS scales), self-regulatory abilities (effortful control scale), depressive symptoms, and binge eating. *Results:* Severe weight cycling was more common in women, and was associated with higher reward sensitivity, higher current and maximum-ever BMI, higher weight suppression, more depressive symptoms, and a higher prevalence of binge eating. In contrast, sensitivity to punishment and effortful control were not associated with severe weight cycling. Also, the interaction between sensitivity to reward and effortful control did not predict weight cycling. *Discussion:* Higher reward sensitivity might not only render individuals vulnerable for weight regain but might also be associated with a higher frequency of weight loss attempts due to the putative rewarding properties of the initial success in weight loss at the early stages of a diet. Temperamental factors should be considered in the treatment of obesity.

Introduction

Weight cycling, defined as repetitive periods of intentional weight loss followed by unintentional regain of body weight, appears to be a prevalent but ill-defined phenomenon in obese individuals (Mason et al., 2013; Mehta, Smith, Muhammad, & Casazza, 2014). Based on animal studies and longitudinal human epidemiological studies weight cycling has repeatedly been associated with increased somatic morbidity and mortality. For example, the risk to develop hypertension was associated with weight cycling in animal studies and a large epidemiological study in humans (Schulz et al., 2005). The clinical value of weight loss interventions was even called into question because of the risk of weight cycling (Bosy-Westphal & Müller, 2014; Mason et al., 2013; Schulz et al., 2005). A recent review of the current literature, however, denied resilient evidence that weight cycling is causally associated with increased mortality risk or severe adverse health effects (Mehta et al., 2014), but the authors clearly stated that studies are difficult to compare because of different definitions, designs, populations, outcome measures and follow-up durations. Methodological issues also occur when analyzing weight cycling. Properly addressing these methodological issues eliminated the common opinion that weight cycling negatively impacts changes in body composition or the success of future weight loss attempts (Bosy-Westphal & Müller, 2014). On the other hand, the rather optimistic conclusions of Mehta et al. (2014) are partly based on studies that only observed one episode of unintentional weight regain after an intentional weight loss period. This situation does not properly reflect the problem of weight cycling.

In contrast to the association between somatic morbidity and weight cycling, the literature on the association between psychosocial functioning and weight cycling is scarce. In most (National Task Force on the Prevention and Treatment of Obesity, 2000) but not all (Messier et al., 2014) studies, weight cycling appeared to be unrelated to mental disorders such as depression. However, weight cycling has shown to be related to lower general mental well-being and somewhat lower quality of life (Marchesini et al., 2004; National Task Force on the Prevention and Treatment of Obesity, 2000). Interestingly, there are surprisingly few studies investigating the association between depressive symptoms and weight cycling. A consistent positive association was found between binge eating and weight cycling (Field, Manson, Taylor, Willett, & Colditz,

☆ *Acknowledgements:* MdZ and AM are responsible for study design and data analysis. MdZ, SE, and AM were significantly involved in data interpretation, were involved in writing the paper, and gave final approval of the submitted version. *Conflict of interest:* The authors declare no conflict of interest.
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http://dx.doi.org/10.1016/j.appet.2015.04.064
0195-6663/

2004; Marchesini et al., 2004; National Task Force on the Prevention and Treatment of Obesity, 2000).

Whether deleterious to somatic and mental health or not, the threat of weight regain or cycling is still one of the largest problems in clinical obesity care and we cannot offer functional solutions to prevent weight cycling. After some time of successful food restriction and weight loss, biological as well as psychological factors may increase the vulnerability to lose control with increased subsequent risk for weight regain.

There is evidence that temperamental factors not inherently related to eating behavior are associated with body weight status (Dietrich, Federbusch, Grellmann, Villringer, & Horstmann, 2014). Temperament refers to biologically determined individual differences in behavior tendencies. In obesity, reactive and regulative aspects of temperament have been investigated. According to Gray's Reinforcement Sensitivity Theory (Gray & McNaughton, 2000), reactive temperament represents bottom-up regulation of behavior. Two systems are differentiated, the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS). While BIS inhibits behavior that may result in negative, punishing or non-rewarding consequences, BAS is sensitive to the rewarding consequences of behavior and promotes approach tendencies. With respect to psychopathology, BIS has been linked to anxiety and depression, while BAS underlies impulsive behaviors (Bijttebier, Beck, Claes, & Vandereycken, 2009; Müller, Claes, Wilderjans, & de Zwaan, 2014). Thus, whereas BIS is related to punishment sensitivity, BAS is related to reward sensitivity which can be defined as motivation to approach naturally pleasurable behaviors and to find them rewarding (Davis, Strachan, & Berkson, 2004). In opposition to reactive aspects of temperament, regulative aspects of temperament represent a top-down regulation, including effortful control, executive functioning, or even "will-power". Effortful control refers to the ability to voluntarily activate or inhibit impulses to act (Derryberry & Rothbart, 1997).

Successfully losing large amounts of weight requires severely restricting food intake, tightly controlling eating impulses, and abstaining from the potentially rewarding consequences of eating for a relatively long period of time. Dieting requires sustained control over the immediately rewarding experience of ingesting palatable food for the long-term reward of weight loss and improved health. There is evidence that successful dieters show greater activation of the dorsal prefrontal cortex compared to non-dieters which indicates a greater inhibition of hedonic feeding or more "self-discipline" (Appelhans, 2009). Self-control has been negatively associated with BMI in most epidemiological studies and has emerged as a consistent predictor of successful weight loss in clinical studies (Jokela et al., 2013).

While "conscientiousness" and "self-control" have consistently been shown to have a protective function with regard to weight (re)gain, "neuroticism", "impulsivity" and "sensitivity to reward" appear as risk factors of weight (re)gain (Gerlach, Herpertz, & Loeber, 2015). In healthy adult women, sensitivity to reward was found to positively predict overeating and a preference for food high in fat and sugar which in turn predicted a higher BMI (Davis et al., 2007). Higher sensitivity to reward was also associated with higher attrition from weight loss programs (Krotzky, Dieterle, Rice, Jordan, & Bechara, 2014). Sensitivity to reward and self-control, thus, may exert partly counteracting functions (Gerlach et al., 2015). Individuals with a high reward sensitivity and low self-control might respond particularly sensitively to food-associated stimuli, resulting in a high failure rate of weight loss diets. In other words, overeating could be conceptualized as an overactive motivational system and/or underactive regulative system – also called the "two system model" (Krotzky et al., 2014).

Among obese individuals, subtypes have been identified based on reactive and regulative aspects of temperament (Claes, Vandereycken, Vandeputte, & Braet, 2013; Leombruni et al., 2014; Matton, Goossens, Braet, & Vervaet, 2013; Müller et al., 2014). More emotionally dysregulated and undercontrolled obese individuals were characterized by increased presence of psychopathology such as binge eating, depression, and attention deficit hyperactivity disorder (ADHD) compared to more resilient and high functioning obese individuals. These subtypes might be predictive with respect to obesity persistence and treatment response including the problem of weight cycling. To our knowledge, the association between severe weight cycling and temperament among overweight and obese subjects has not yet been explored.

The purpose of this study was first to examine the prevalence of severe weight cycling among overweight and obese individuals from a German general population sample and to characterize severe weight cyclers by comparing sex, age, weight parameters, depressive symptoms, and the occurrence of binge eating between severe weight cyclers and non-severe weight cyclers. In addition, we aimed at investigating the association between reactive and regulative aspects of temperament and severe weight cycling. Since there is no literature on the relationship between weight cycling and temperamental factors, we modelled our hypothesis according to the results of the association between temperament and BMI, weight loss, overeating, and weight loss maintenance. We assumed that the "two system model" (Krotzky et al., 2014) might be useful in also explaining severe weight-cycling. Therefore, we particularly hypothesized that severe weight cyclers would be characterized by higher levels of reactive (BAS) and lower levels of regulative (effortful control) temperament compared to non-severe weight cyclers.

Methods

Design and subjects

We conducted a cross-sectional survey of a randomly selected sample of the German general population with the assistance of an independent demography-consulting agency (USUMA, Berlin, Germany). Subject aged between 18 and 65 years from all over Germany were contacted from May to June 2011. For the sample selection, a "mixed-mode-method" was used. First, a sample was selected using the ADM-master sample (Behrens et al., 2014). In a second step, a random sample of households was chosen proportionally to the population density in the region. Third, a target subject of the household was randomly identified with the Kish selection grid (Kish, 1949). In sum, a total of 4212 persons were asked to complete the questionnaire online or in written form. Although web-based data collections introduce a response bias (age, sex, education), they do not seem to have much influence on outcome variables. Using data from the current study, Mayr et al. (2012) did not find that the method of data collection seems to have a direct impact on the results of self-rating scales and weight measures.

Finally, 56% (n = 2286) of the selected sample participated in the study. Written informed consent was obtained from all participants. The population-based survey met the ethical guidelines of the International Code of Marketing and Social Research Practice by the International Chamber of Commerce and the European Society for Opinion and Marketing Research. We only analyzed those participants who were overweight or obese at the time of the survey and who had complete data regarding all dependent and independent variables, resulting in a total of 923 participants (427 women, 46%, and 496 men, 54%).

Assessment

Measures/Instruments

All participants received a questionnaire packet either online or in written form and completed the following assessment instruments.