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Finding a golden mean in the context of eating control mechanisms: restrictive and uncontrolled eating styles clusters and comparing them in relation to other selected eating behaviours and body mass index among Polish women during COVID-19

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Abstract

Referring to the presence of the binge–restrict cycle, it was hypothesized that Polish women exhibiting both highly restrictive and highly uncontrolled eating styles would demonstrate significantly greater maladaptive eating behaviors—such as emotional eating in response to both positive and negative emotions—lower levels of adaptive eating behaviors (e.g., mindful eating), and a higher body mass index (BMI) compared to those with low levels of these eating styles during the COVID-19 pandemic.

Material and method: Participants (N = 710; *M*_{age} = 26.17, *SD* = 9.00) completed the following instruments: the Three-Factor Eating Questionnaire, the Positive-Negative Emotional Eating Scale, the Mindful Eating Scale, and a sociodemographic survey.

Four distinct clusters were identified and labeled as follows:
(a) Cluster 1 (*n* = 115): high restrictive and high uncontrolled eating style,
(b) Cluster 2 (*n* = 203): low restrictive and high uncontrolled eating style,
(c) Cluster 3 (*n* = 236): high restrictive and low uncontrolled eating style,
(d) Cluster 4 (*n* = 156): low restrictive and low uncontrolled eating style.

Results: The results indicated that women in Cluster 1 (high restrictive and high uncontrolled eating style) reported significantly greater engagement in maladaptive eating behaviors (e.g., emotional eating in response to negative emotions), lower levels of mindful eating, and a higher BMI compared to women in Cluster 4 (low restrictive and low uncontrolled eating styles).

In summary**,** the findings from three of the four comparisons were consistent with the initial hypothesis. The only exception was emotional eating in response to positive emotions, where no significant difference was observed between Cluster 1 and Cluster 4.

eating styles; mindful eating; body mass index; obesity; disordered eating

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INTRODUCTION

Healthy eating behaviors play a crucial role in promoting both mental and physical health [1]. It is also well established that eating patterns are

influenced by multiple factors, including awareness and nutritional knowledge [2]. Research to date—both Polish (e.g., [3]) and international (e.g., [4,5])—has highlighted the impact of stressful events, such as the COVID-19 pandemic, on changes in eating behaviors. Numerous studies have demonstrated that dietary habits were altered during the pandemic [1,5,6], with reported increases in food intake, snacking, alcohol consumption, and the use of processed foods due to prolonged periods of confinement [7]. The World Health Organization had previously emphasized the importance of monitoring human eating behaviors, even prior to the pandemic [8].

It is well established that certain eating behaviors are associated with negative health outcomes, particularly restrictive eating—e.g., the intentional and excessive limitation of food intake [9]—and uncontrolled eating, i.e., eating in response to internal cues (e.g., extreme hunger) or external cues (e.g., the smell or visual appeal of food) that trigger eating urges [10].

Research indicates that the concept of overeating is closely linked to a perceived loss of control during eating episodes. This loss of control is strongly associated with eating-related psychopathology (e.g., disordered eating patterns, emotional dysregulation) [11,12], which in turn may contribute to the development of obesity [13]. The link between obesity and binge eating has been supported by findings from, among others, a study conducted in Spain [14], where 87% of individuals diagnosed with binge eating disorder also met the criteria for obesity.

Overeating may function as both a cause and a consequence of obesity, underscoring the complexity of the relationship between the two phenomena [15]. Notably, binge eating has also been associated with dietary restriction. According to dietary restraint theory [16], individuals who engage in restrictive dieting may experience episodes of binge eating, particularly in response to stressful circumstances. This pattern appears to be influenced by sociocultural pressures that emphasize thinness, which may lead to dietary restriction and, subsequently, increase the risk of overeating [17].

Other non-adaptive eating behaviours include emotional eating, which is influenced by stress, emotions (positive or negative) and other individual feelings about food [18]. This way of eating often serves as a form of comfort, a way to regulate one's mood, or a way to cope with feelings that one cannot control. We then overconsume, overeat or, on the contrary, we limit food to suppress our depressing feelings. It often happens that the so-called vicious cycle of dieting and overeating. Dieting in response to, for example, dissatisfaction with one's figure or weight may cause overeating, which in turn causes feelings of guilt and subsequent dieting [19]. Studies show that emotional eating is positively related to weight gain, this is usually due to the fact that people who eat emotionally are more likely to consume sugary and high-fat foods [20]. Emotional eating can result from both positive and negative emotions. Emotional eaters often activate the link between food and reward, that is, they obtain through food a reward effect that alleviates negative mood [21]. Originally, the concept of eating in response to negative emotions derives from psychosomatic theory [22,23], according to which it is an inappropriate response to distress, a consequence of the inability to distinguish between hunger and negative internal states or the use of food to reduce emotional stress [24]. Interestingly, most of the research to date focuses on emotional eating in response to negative emotions, but there is evidence that positive emotions can also increase food intake [26,27], which may be related to increased enjoyment of food or increased motivation to enjoy food [28,29]. However, the mechanisms behind eating in response to positive emotions are less clear, with some researchers believing that eating in response to positive and negative emotions are two different constructs [30].

In addition to maladaptive eating behaviours, there has been increased interest among researchers in mindful eating, which involves making conscious food choices, developing the ability to distinguish physical and mental signals of hunger and satiety [31], and following a healthy diet in response to these signals [32]. Previous research describes that the state of mindfulness is negatively associated with unhealthy eating styles, such as uncontrolled eating and emotional eating [33], while being positively associated with healthy eating behaviours [34].

In summary, both excessive control over eating (i.e., restrictive eating style) and a lack of control

(i.e., uncontrolled eating style) may contribute to the development or persistence of maladaptive eating behaviors, as well as weight gain or difficulty maintaining a healthy body weight. These patterns are often associated with the emergence of the binge–restrict cycle [35,36]. Based on this, we hypothesized that Polish women exhibiting both highly restrictive and highly uncontrolled eating styles would report significantly greater maladaptive eating behaviors (i.e., emotional eating in response to both positive and negative emotions), lower levels of adaptive behaviors (i.e., mindful eating), and higher body mass index compared to those with low levels of these eating styles during the COVID-19 pandemic.

METHODS

Participants and procedure

Our online cross-sectional study was conducted via Google Forms and the data was collected among Polish women during COVID-19 (from December 2020 to December 2021). The study was approved by the Ethics Committee and conducted in accordance with the Helsinki Declaration (2001). Information about the study was disseminated through free announcements on social media. Participation in the study was voluntary and anonymous. Information about the study included a general description of the purpose of the study, information that the study was intended for women over 18 years of age and contact details of the study authors. If the recipient of the advertisement was interested in participating in the study, he or she contacted the authors of the study, who sent the participant a link to the survey. The survey included informed consent to participate in the study, a sociodemographic survey, and the questionnaires listed below (please see the measures section).

Participants (N = 710 women over 18 years of age) had a mean of: (a) age 26.17 (SD = 9.00), (b) weight 62.82 (SD = 13.33), (c) height 166.65 (SD = 6.33), (d) body mass index 22.60 (SD = 4.55). At the time of the study, 350 participants declared using various methods of weight reduction, and the most common forms were (multiple choice questions): (a) 238 unsustainable forms of dietary restriction, (b) 320 physical activities, (c) 56 other compensatory behaviours (e.g. misuse of laxatives, self-induced vomiting, diet pills or diuretics).

MEASURES

The Three-Factor Eating Questionnaire

This 18-item questionnaire was used to assess restrictive and uncontrolled eating styles [10,37]. It included a 4-point scale from 1 (false) to 4 (true) for most of the items. The higher the score, the greater the level of restrictive and uncontrolled eating styles [10,37]. Cronbach's alpha coefficient was: (a) 0.81 for restrictive eating styles, (b) 0.86 for uncontrolled eating.

The Positive-Negative Emotional Eating Scale

This 19-items questionnaire was used to assess emotional eating in relation to positive and negative emotions [38]. It involved a 5-point scale ranging from 0 (never) to 4 (very often). The higher the score, the higher the level of emotional eating [38]. Cronbach's alpha coefficient was: (a) 0.92 for emotional eating in relation to positive emotions, (b) 0.96 for emotional eating in relation to negative emotions.

The Mindful Eating Scale

This 28-item questionnaire was used to assess mindful eating (a general scale and six subscales: acceptance, awareness, non-reactivity, routine, distractibility, unstructured; Hulbert-Williams et al. 2014). It included a 5-point scale ranging from 1 (never) to 4 (usually). The higher the score, the higher the level of mindful eating [39]. Cronbach's alpha coefficient was 0.80 for a general scale.

Sociodemographic survey

It was used to assess age, self-reported weight, and height (to calculate body mass index), as well as questions regarding the use of weight reduction methods.

RESULTS

Cluster analysis

Statistical analyses were performed with IBM SPSS Statistic version 28. A two-step cluster analysis (with Schwarz's Bayesian criterion) was used to identify clusters based on restrictive and uncontrolled eating styles [40]. The four clusters were labelled and characterized, as follows:: (a) Cluster 1 (N = 115): highly restrictive and highly uncontrolled eating style, (b) Cluster 2 (N = 203): low restrictive and highly uncontrolled eating styles, (c) Cluster 3 (N = 236): highly restrictive and low uncontrolled eating style, (d) Cluster 4 (N = 156): low restrictive and low uncontrolled eating styles.

Comparison of the four clusters

The assumptions for conducting parametric tests were satisfied, including normal distribution of the data, homogeneity of variance, independence of observations, and the absence of extreme outliers. Subsequently, an analysis of variance (ANOVA), followed by Bonferroni-adjusted post hoc tests for pairwise comparisons, was performed to compare the four previously identified clusters with respect to selected eating behaviors—specifically, maladaptive behaviors such as emotional eating in response to positive and negative emotions, and adaptive behaviors such as mindful eating—as well as body mass index (BMI) among Polish women during the COVID-19 pandemic (Table 1). p-values < 0.05 were considered statistically significant.

Table 1. Comparing cluster: the post hoc Bonferroni test ANOVA

	Cluster 1 (*N* = 115): high restrictive and high uncontrolled	**Cluster 2 (*N* = 203)**: low restrictive and high uncontrolled	**Cluster 3 (*N* = 236)**: high restrictive and low uncontrolled	**Cluster 4 (*N* = 156)**: low restrictive and low uncontrolled	
	M (SD)				*Post hoc*
	F(3, 706) = 8.01, p < 0.001, η^2 = 0.03 (95% CI [0.01,0.06])				
Emotional eating in relation to positive emotions	8.42 (5.89)	9.91 (6.06)	7.19 (5.68)	8.07 (5.86)	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 3*** 2 vs. 4* 3 vs. 4
	F(3, 706) = 61.29, p < 0.001, η^2 = 0.21 (95% CI [0.15,0.26])				
Emotional eating in relation to negative emotion	20.20 (11.53)	20.34 (11.38)	10.64 (8.55)	9.35 (8.71)	1 vs. 2 1 vs. 3*** 1 vs. 4*** 2 vs. 3*** 2 vs. 4*** 3 vs. 4
	F(3, 706) = 87.96, p < 0.001, η^2 = 0.27 (95% CI [0.22,0.32])				
Mindful eating	72.63 (11.03)	77.78 (8.29)	83.69 (6.84)	86.85 (6.83)	1 vs. 2*** 1 vs. 3*** 1 vs. 4*** 2 vs. 3*** 2 vs. 4*** 3 vs. 4***
	F(3, 706) = 11.69, p < 0.001, η^2 = 0.05 (95% CI [0.02,0.08])				

Body mass index	22.93 (5.79)	23.27 (5.02)	23.10 (4.02)	20.75 (2.89)	1 vs. 2 1 vs. 3 1 vs. 4*** 2 vs. 3 2 vs. 4*** 3 vs. 4***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

DISCUSSION

The overall aim of the study was to compare clusters distinguished on the basis of levels of restrictive and uncontrolled eating styles in relation to other selected eating behaviours (maladaptive eating behaviours as emotional eating in relation to positive and negative emotions and adaptive eating behaviours such as mindful eating) and body mass index among Polish women during COVID-19. The results obtained in three out of four comparisons are consistent with the assumed hypothesis. Results showed that women with high restrictive and high uncontrolled eating styles (Cluster 1) have significantly greater maladaptive eating behaviours as emotional eating in relation to negative emotions), lower adaptive eating behaviours such as mindful eating and higher body mass index than those with low levels of these eating styles (Cluster 4). Therefore, the result inconsistent with the hypothesis was obtained only in relation to emotional eating in relation to positive emotions (Cluster 1 and 4 did not differ significantly).

Considering the reports of the American Psychiatric Association (2013) that disordered eating most often involves restrictive eating, overeating, or purging, our results confirm this relationship in terms of dietary restrictions and overeating. Numerous studies prove that dietary restrictions cause overeating. For example, a study of overweight patients with BED found that emotional eating was associated with binge eating frequency [41]. Other evidence includes studies of women suffering from bulimia nervosa, which proved that their dietary restrictions led to binge eating [42], and studies conducted among adolescents show a relationship between the use of a restrictive diet and binge eating [43,44].

Individuals with high uncontrolled and restrictive eating styles may tend to exhibit maladaptive eating behaviours such as emotional eating [24], which was confirmed in our study. Often, people with a high uncontrolled eating style may also follow diets, even very restrictive ones, to control their weight [45]. Research shows that the ability to refrain from certain behaviours [46], here refraining from eating by restrictive diets, is a psychological factor that favours behavioural and physiological reactions such as appetite and food intake disturbances, which in turn leads to obesity [47]. Similar findings indicating that self-control through diet may not result in weight loss were made by de Ridder [48] and Kuijer et al. [49].

In this study, women with high uncontrolled and restrictive eating styles (Cluster 1) have higher BMIs than the other groups. Interestingly, studies show various associations between restrained eating and body weight, such as restriction as a useful strategy for weight control [50], restriction as a positive strategy for weight restriction [51]. Individuals who are characterized by restrictive eating often abandon self-imposed restrictions [50], going between cycles from restricting food intake to eating out of control again. This happens most often because cognitive control of food intake is disrupted by emotional as well as cognitive factors [52]. We note a similar functioning mechanism in our results regarding maladaptive eating behaviours in the group (Cluster 1), but its complete confirmation would require longitudinal research.

Previous studies confirm that a high level of mindful eating leads to a reduction in restrictive eating styles and a decrease in emotional and uncontrolled eating [53,54], which is confirmed in our study, as individuals with a high restrictive and uncontrolled eating style (Cluster 1)

have a low level of mindful eating in contrast to the group with a low restrictive and uncontrolled eating style (Cluster 4). Numerous studies confirm that the COVID-19 pandemic situation may have contributed to changes in eating behavior such as emotional eating [3,55], which was also confirmed in our study.

Further to the remaining comparisons (showing the results of additional analyses beyond the main hypothesis) presented in Table 1 it can be observed that statistically significant differences were between: (a) Cluster 2 (low restrictive and high uncontrolled eating styles) and Cluster 4 (low restrictive and low uncontrolled eating styles) in terms of all analysed variables (Cluster 2 had a higher level of maladaptive behaviours as emotional eating in relation to positive and negative emotions and BMI, as well as a lower level of adaptive eating behaviours such as mindful eating than Cluster 4); (b) Cluster 2 (low restrictive and high uncontrolled eating styles) and Cluster 3 (high restrictive and low uncontrolled eating styles) in terms of three analysed variables (Cluster 2 had a higher level of maladaptive behaviours as emotional eating in relation to positive and negative emotions, as well as a lower level of adaptive eating behaviours such as mindful eating than Cluster 3); (c) Cluster 3 (high restrictive and low uncontrolled eating styles) and Cluster 4 (low restrictive and low uncontrolled eating styles) in terms of two analysed variables (Cluster 3 had a higher level of BMI and a lower level of mindful eating than Cluster 4); (d) Cluster 1 (high restrictive and high uncontrolled eating styles) and Cluster 3 (high restrictive and low uncontrolled eating styles) in terms of two analysed variables (Cluster 1 had a higher level of emotional eating in relation to negative emotions and a lower level of mindful eating than Cluster 3); (e) Cluster 1 (high restrictive and high uncontrolled eating styles) and Cluster 2 (low restrictive and high uncontrolled eating styles) in terms of one analysed variables (Cluster 1 had a lower level of mindful eating than Cluster 2). The remaining comparisons are statistically insignificant.

Groups characterized by unhealthy eating styles present more maladaptive eating behaviours, such as emotional eating (in relation to positive and negative emotions). It should be noted that the present study was conducted during the COVID-19 pandemic, which numerous studies have shown to be associated with experiencing negative emotions, stress and negative changes in eating behaviour (e.g.) [5,7]. Thus, if we consider the different physiological mechanisms underlying each emotion, e.g. a low-arousal emotion such as sadness, which can increase food intake, and a high-arousal emotion such as fear, which in turn can decrease food intake [24], the results of our study would confirm this relationship. Numerous studies show that people who eat under the influence of negative emotions eat more sweets [56], overconsume unhealthy foods [57] and high-fat snacks [58]. Emotional eating associated with positive emotions is most often associated with the consumption of junk food [59]. As our study showed, clusters characterized by unhealthy eating styles also had higher BMIs, given the COVID-19 pandemic situation, which increases stress, and it is well known that it is stress that is associated with increased consumption of high-calorie foods [60], which can lead to increased body weight in the long run. Clusters characterized by unhealthy eating styles exhibited lower attentive eating, which implies a reduction in the severity of unhealthy eating styles [53], which would presumably help nullify maladaptive eating behaviours. There is evidence that an increase in mindfulness is correlated with a decrease in problematic eating behaviours, such as emotional eating (i.e.) [61]. *[Consider using 'e.g.' instead of 'i.e.' here.]*

In summary, it is well established that combating obesity through dietary restriction alone is often ineffective and may even contribute to weight gain (e.g., [62]). In light of the present findings, obesity treatment should adopt a multidisciplinary approach that integrates dietary modifications (e.g., through dietitian support), physical activity (e.g., guided by physiotherapists), and the targeting of maladaptive behaviors (e.g., via psychological interventions) [63,64].

By way of conclusion, these preliminary findings may mean that unhealthy eating styles may favour other maladaptive eating behaviours and may be risk factors for weight gain or difficulty maintaining a healthy weight. However, these are only preliminary findings based on a cross-sectional study and they need to be verified by longitudinal studies. Other limitations of this study include: (a) no men in the sample,

(b) measurement of variables is based on self-report, (c) emotions related to the COVID-19 pandemic have not been explored, (d) lack of assessment of the mental state of study participants, (e) lack of information regarding dietary history, duration of the diet, information on whether the diet previously brought the intended effects, (f) lack of information on whether the participants currently suffer from a somatic disease

Further longitudinal research is needed to confirm the results of our study, which could argue for the design of health-based interventions focusing on the quality of eating behaviours and preventing falling into the binge-restrict cycle in patients undergoing treatment for overweight and obesity.

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