



## General psychopathology and impulsivity as the pretreatment predictors of medical nutrition therapy outcome in the overweight and obese women

Opšta psihopatologija i impulsivnost kao pokazatelji potencijalnog ishoda medicinske nutritivne terapije kod predgojaznih i gojaznih žena

Vesna Tepšić Ostojić\*, Danijela Ristić-Medić†, Tatjana Mraović‡,  
Zoran Bukumirić§, Nadja Vasiljević||, Milan Latas¶\*\*

Military Medical Academy, \*Clinic for Psychiatry, ‡Institute of Hygiene and Medical Ecology, Belgrade, Serbia; University of Belgrade, Institute for Medical Research, †Centre of Research Excellence in Nutrition and Metabolism, Belgrade, Serbia; University of Belgrade, Faculty of Medicine, §Institute for Medical Statistics and Informatics, ||Institute of Hygiene and Medical Ecology, Belgrade, Serbia; Clinical Centre of Serbia, ¶Clinic of Psychiatry, Belgrade, Serbia; University of Belgrade, \*\*Faculty of Medicine, Belgrade, Serbia

### Abstract

**Background/Aim.** Obesity is the chronic disease and health threatening condition. The number of obese people in the world has taken epidemic conditions. Medical nutritional therapy is the first choice in the treatment of obesity, but it is also accompanied with a great percentage of attrition and a significant weight regain. The aim of our study was to evaluate if psychiatric and specific psychological factors (impulsivity) could be the predictors of successful weight loss. **Methods.** A study sample consisted of 84 consecutive overweight/obesity women, 20 to 40 years old, who were willing to adhere to the medical nutrition therapy after the initial anthropometric measurements were performed. All participants received a personalized nutritional counseling and a daily diet treatment with 20% caloric restriction from estimated daily energy requirement. At the beginning of the study, the 90-item Symptom Check-list (SCL-90) and the 30-item Barratt Impulsiveness scale (BIS-11) were administrated. At the end of six months of caloric restriction, the conventional diet therapy and control weight measurement, the patients were divided into two groups: the group I – 40 participants (48%) who lost  $\geq 10\%$  of their

initial body weight (successful group) and the group II – 44 participants (52%) who lost  $< 10\%$  of their initial weight (unsuccessful). **Results.** There were no significant differences between groups in the demographic data (age, education level, employment, marital status), baseline anthropometric measurements, and in the general psychopathology total score. Groups I and II were significantly different in the total BIS-11 score ( $p < 0.001$ ) and in Factor II (motor impulsivity) ( $p < 0.05$ ). **Conclusion.** Even though the successful and unsuccessful diet responded participants did not differ in the general psychopathology and symptom dimensions, our results pointed out impulsivity as a discriminative factor between them. The total impulsivity and Factor II (motor impulsivity) as an indicator of binge eating were higher in the unsuccessfully responding overweight/obese women on the conventional diet treatment. A focus on impulsivity in a psychotherapeutic work might lead to better outcomes in the medical nutrition therapy.

### Key words:

body mass index; diet therapy; impulsive behaviour; obesity; overweight; surveys and questionnaires; treatment outcome.

### Apstrakt

**Uvod/Cilj.** Gojazost je hronično oboljenje sa značajnim nepovoljnim efektima na zdravlje, a broj gojaznih osoba u svetu dostigao je epidemijske razmere. Medicinska nutritivna terapija je terapija izbora, ali je njena uspešnost

ograničena zbog značajnog procenta odustajanja, kao i ponovnog dobijanja na težini koje je prate. Cilj ove studije je bio da se proceni da li psihijatrijski i specifični psihološki faktori (impulsivnost) mogu biti pokazatelji pozitivnog ishoda lečenja. **Metode.** Studijom je bilo obuhvaćeno ukupno 84 predgojaznih i gojaznih žena životnog doba 20–40 godi-

na, koje su bile motivisane za medicinsku nutritivnu terapiju. Sve ispitanice su prošle individualno savetovanje i dobile dnevni plan ishrane koji je podrazumevao kalorijsku restrikciju od 20% u odnosu na procenjene dnevne energetske potrebe. Na početku studije sprovedeno je antropometrijsko merenje i primenjene su Lista simptoma od 90 pitanja (*90-item Symptom Check-list*) i Baratova skala impulsivnosti (*Barratt Impulsiveness scale* (BIS-11)). Nakon šest meseci primene kalorijski restriktivnog načina ishrane ponovljena su antropometrijska merenja. Ispitanice su podeljene u dve grupe: 40 ispitanica (48%) koje su izgubile  $\geq 10\%$  od početne telesne mase (uspešne) i 44 ispitanice (52%) koje su izgubile  $< 10\%$  od početne telesne mase (neuspešne). **Rezultati.** Nije bilo značajne razlike između grupa ispitanica u odnosu na demografske karakteristike (godine života, stepen obrazovanja, zaposlenost, bračni status) i antropometrijske parametre na početku studije, kao i na skor opšte psihopatologije i dimenzije simpto-

ma. Statistički značajna razlika između uspešnih i neuspešnih predgojaznih/gojaznih ispitanica dobijena je za ukupni BIS-11 skor ( $p < 0.001$ ) i za Faktor II (motorna impulsivnost) ( $p < 0.05$ ). **Zaključak.** Ispitanice sa ponovljenim lošim odgovorom nisu se razlikovale po opštoj psihopatologiji od onih sa uspešnim odgovorom na nutritivnu terapiju. Naši rezultati ukazuju na impulsivnost kao mogući pokazatelj ishoda lečenja. Ukupna impulsivnost i motorna impulsivnost kao indikator povremenog impulsivnog prejedanja bili su viši u grupi predgojaznih/gojaznih ispitanica koje nisu postigle terapijski cilj. Psihoterapijski rad na impulsivnosti možda bi mogao doprineti boljem ishodu medicinske nutritivne terapije.

#### Ključne reči:

**telesna masa, indeks; dijetetska terapija; ponašanje, impulsivno; gojaznost; telesna masa, prekomerna; ankete i upitnici; lečenje, ishod.**

## Introduction

Obesity is the chronic disease defined as excess body fat<sup>1</sup>. The basic pathophysiological mechanism of the accumulation of excess body fat is basically very simple – energy intake is higher than energy consumption<sup>2</sup>. In the light of this fact, the solution to the problem of obesity seems relatively easy – to reduce the intake, or increase the energy consumption. Even though the solution seems logical and easily feasible, the number of obese people in the world has taken epidemic conditions; 35% of the adult population is overweight, while 12% obese is considered as a “global pandemic”<sup>3</sup>. About 35% of the adult population in Serbia are overweight and 21% are obese, while in the self-evaluation only 16.9% of the population consider themselves to be obese<sup>4</sup>. Obesity is the health threatening condition. Empiric and scientific data confirmed its clear association with plethora of medical conditions (metabolic syndrome, type 2 diabetes, ischemic heart disease, stroke, inflammation, apnea, certain carcinoma, etc.)<sup>1,5-7</sup> and decreased quality of life<sup>8,9</sup>. If the current trend of increased morbidity and mortality due to obesity continues, the life expectancy in future could decrease for the first time in modern history<sup>10</sup>. However, it is important to point out that there is evidence that people with obesity are confronted with structural discrimination in their everyday life<sup>11</sup>.

Even though obesity is considered to be an interplay of genes and environment<sup>12</sup>, research focus has been moving from the metabolism, resting metabolic rate and energy expenditure. A recent research points out that the environmental variables are of greater importance in determining eating behavior than the biological ones<sup>13,14</sup>.

In the contemporary culture, a person's physical appearance exceeds the importance of aesthetic liking and becomes one of the main social markers of success, or stigma. On the opposite social pole, there is the extremely obesogenic environment with aggressively marketed cheap calories that are not only easy-to-get but also highly palatable and rewarding (saturated in fat, sugars and/or salt)<sup>14</sup>. Hedonic eating is promoted while physiological and physical activity is discour-

aged by modern technology (cars, smart phones, etc.). But not everyone becomes obese despite the environmental temptations. The answer may be in the individual differences. Someone's reaction to the environmental conditions could be influenced by the psychiatric conditions such as anxiety and depression, personality traits, or other psychological factors such as impulsivity that they do, or do not possess<sup>15</sup>. All those factors play a role in the etiology and/or maintenance of obesity.

Treatment of obesity includes the medical nutritional therapy (MNT), physical activity, behavioral techniques, pharmacotherapy and bariatric surgery. MNT is the “gold standard” in the treatment of obesity<sup>16,17</sup>. The conventional dietary treatment is based on an energy deficit, which can be achieved in many ways, but most experts agree that the optimal daily deficit is 500 to 1,000 kcal, which leads to a loss of about 0.5 to 1 kg per week that can be recommended for everyday practice<sup>16</sup>. This therapy yields good results in some patients, but it is also accompanied with a great percentage of attrition (20%–80%) and a significant weight regain<sup>17,18</sup>. Differences in the individual results in the obese subjects integrated in the weight-loss treatment, lead to analyse the potential pre-treatment predictors of weight control<sup>19</sup>.

Thus, the aim of our study was to evaluate if psychiatric and specific psychological factors (impulsivity) could be the predictors of successful weight loss.

## Methods

### Participants

This study was designed as a prospective cohort study with two measurements. It was realised from October 2015 to May 2016.

The anthropometric measurements and MNT was performed in the Centre of Research Excellence in Nutrition and Metabolism, Institute for Medical Research, Belgrade while the psychiatric interview and psychometric measurements were conducted in the Psychiatric Clinic, Clinical Center of Serbia, Belgrade.

The study enrolled 84 consecutive patients who were willing to treat obesity in the Centre of Research Excellence in Nutrition and Metabolism, the Institute for Medical Research in Belgrade. The inclusion criteria for our investigation were female gender, age between 20 and 40 years, overweight and obese class I with the body mass index (BMI) between 25 and 34.9 kg/m<sup>2</sup> and self-reported weight stable ( $\pm 2$  kg) for 3 months before the start of the diet treatment. The exclusion criteria were: the history of psychiatric illness, inflammatory or infective diseases, hypertension, diabetes mellitus, cardiovascular, cerebrovascular and malignant disease.

The written informed consent was obtained from all participants prior to participation in the study, and only those who were volunteered to take part in the investigation were included. The study protocol was approved by the Ethics Committee, Faculty of Medicine, the University of Belgrade and carried out in accordance with the principles of the Declaration of Helsinki

#### *Anthropometric parameters*

The anthropometric parameters were measured at the baseline and at the end of six-month treatment. The body height and weight of participants wearing light clothes and without shoes were measured. The participants were weighed with a lever-actuated balance to the nearest 0.1 kg. The BMI was calculated as weight (kg)/height (m) squared. The same qualified nutritionist did the measurements for all participants.

#### *Medical nutrition therapy*

After completing the anthropometric measurements, the participants were referred to a diet therapist for MNT. All participants received a personalized nutritional counseling and the daily diet treatment with 20% caloric restriction from the estimated daily energy requirement was prescribed individually<sup>20</sup>. The dietary treatment was based on the conventional-type of intervention with the energy limitation and balanced macronutrient composition. The dietary intake was controlled by the size of portion, food choice and composition. The daily energy requirements were calculated according to the obesity treatment guidelines issued by the US National Institute of Health and Food and Nutrition Board<sup>20</sup>.

After six months of caloric restriction, the convectional diet therapy and the control weight measurements, the patients were divided into two groups. The first group included 40 (48%) participants who lost  $\geq 10\%$  of their initial body weight (successful – group I), and second included 44 (52%) participants who lost  $< 10\%$  of their initial weight (unsuccessful – group II).

#### *Psychopathology measures*

Before starting MNT, all patients were interviewed with a standard psychiatric interview by the same psychiatrist. The patients had 90 min in a quiet place to fulfill the questionnaires.

The demographic characteristics were investigated by the 4-item sociodemographic self-reported questionnaire designed for this study. Four items were related to age, education (elementary school, high school, college, university degree), employment (employed, unemployed, student), and marital status (married/with partner, single, divorced).

For the purpose of this study, the two self-administered questionnaires were used the 90-item Symptom Check-list (SCL-90)<sup>21</sup> and the 30-item Barratt Impulsiveness scale (BIS-11)<sup>22</sup>. The SCL-90 was administered as the screening instrument for the assessment of psychiatric psychopathology as a possible predictor of the MNT outcome. The items were rated on a 5-point scale of distress (ranging from “not at all” to “extremely”). There are nine primary symptom dimensions: somatisation, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism.

The BIS-11 was developed to measure impulsiveness as seen by this author (motor aspect, an attentional aspect, and a planning aspect). It is one of the most used scales for the measurement of impulsiveness. It consists of 6 first-grade and 3 second-grade factors. The factor labels with definitions are as follows: Factor 1, attention – “focusing on the task at hand”; Factor 2 – motor impulsiveness “acting on the spur of the moment”; Factor 3, self-control – “planning and thinking carefully”; Factor 4, cognitive complexity – “enjoy challenging mental task”; Factor 5, perseverance – “a consistent life style”; Factor 6, cognitive instability – “thought insertions and racing thoughts”. The second-grade factors combine two first-grade factors. Factor I, attentional impulsiveness combines attention and cognitive instability. Factor II, motor impulsiveness combines the first-grade factors, motor impulsiveness and perseverance. The factor of non-planning impulsiveness III is combined with cognitive complexity and self-control.

#### *Statistical analysis*

The statistical data analysis was performed using the IBM SPSS Statistics 22 (IBM Corporation, Armonk, NY, USA). The results were presented as the frequency (percentage) and mean  $\pm$  SD. The  $\chi^2$  test was used to test the differences between the nominal data (frequencies). The *t*-test was used for the numeric data with a normal distribution. For the ordinal data, the Mann-Whitney *U* test was used. All *p*-values less than 0.05 were considered significant.

## **Results**

The sociodemographic characteristics of participants are presented in Table 1. The majority of participants of both I and II groups had the high school degree (55% vs 50%, respectively) and were employed (48% vs 66%, respectively) and most commonly were married/with a partner (40% vs 47%, respectively). There were no significant differences between the groups regarding the age, employment and marital status.

The anthropometric parameters of participants are shown in Table 2. There were not significant differences between groups in the body weight before starting MNT and in the BMI at the baseline of the study, but after 6 months, the body weight and BMI were significantly different ( $p < 0.001$ ) in the Group I and Group II with the average weight loss of  $15.89 \pm 4.65$  kg and  $2.63 \pm 1.81$  kg, respectively. The loss from the initial body weight in the Group I, expressed in percentage, was  $19.17 \pm 4.78\%$  (range 30.79–11.60%) and in the Group II, it was  $3.16 \pm 2.3\%$  (range 7.67–2.53%).

The average scores of particular domains obtained from the SCL-90 questionnaire are presented in Table 3. The results indicate that both groups had similar scores in nine primary symptom dimensions, and that there were not the significant differences found in the symptom dimensions and the total score.

In Table 4, the average scores of particular domains obtained from the BIS-11 questionnaire with the first- and second-grade factors are shown. There were the statistically significant differences observed between the Groups I and II in the Factor II ( $p < 0.05$ ) and in the total BIS-11 score ( $p < 0.001$ ).

**Table 1****Sociodemographic characteristics of overweight/obesity women (n = 84)**

Characteristics	Total	Group I	Group II	<i>p</i>
	84 (100%)	40 (48%)	44 (52%)	
Age (years), mean $\pm$ SD	30.38 $\pm$ 5.95	29.40 $\pm$ 6.10	31.27 $\pm$ 5.74	0.152
Education, n (%)				0.700
elementary school	2 (2)	1 (2)	1 (2)	
high school	44 (53)	22 (55)	22 (50)	
college	12 (14)	5 (13)	7 (16)	
university degree	26 (31)	12 (30)	14 (32)	
Employment, n (%)				0.125
employed	48 (57)	19 (48)	29 (66)	
unemployed	16 (19)	11 (27)	5 (11)	
student	20 (24)	10 (25)	10 (23)	
Marital status, n (%)				0.696
married/with partner	36 (43)	16 (40)	20 (47)	
single	8 (10)	5 (13)	3 (8)	
divorced	40 (47)	19 (47)	21 (45)	

**Group I – participants who lost  $\geq 10\%$  of their initial body weight; Group II – participants who lost  $< 10\%$  of their initial body weight; SD – standard deviation;  $p < 0.05$  considered significant.**

**Table 2****Anthropometric parameters of patients**

Characteristic	Total	Group I	Group II	<i>p</i>
	mean $\pm$ SD (min-max)	mean $\pm$ SD (min-max)	mean $\pm$ SD (min-max)	
Body height, m	1.67 $\pm$ 0.07 (1.51–1.84)	1.67 $\pm$ 0.04 (1.55–1.75)	1.65 $\pm$ 0.08 (1.51–1.84)	0.971
Body weight, kg				0.491
initial	81.56 $\pm$ 9.77 (60.7–103.9)	82.34 $\pm$ 9.40 (60.7–98.1)	80.86 $\pm$ 10.14 (65.0–103.9)	
final	72.68 $\pm$ 10.87 (50–100)	66.52 $\pm$ 8.28 (50–81.3)	78.29 $\pm$ 9.91 (63–100)	< 0.001
BMI, kg/m <sup>2</sup>				0.682
initial	29.46 $\pm$ 2.69 (25.29–34.83)	29.58 $\pm$ 2.79 (25.29–34.83)	29.34 $\pm$ 2.62 (25.34–34.75)	
final	26.71 $\pm$ 3.50 (19.85–34.75)	23.99 $\pm$ 2.62 (19.85–30.33)	28.50 $\pm$ 2.74 (23.97–34.75)	< 0.001
Weight loss, kg	8.95 $\pm$ 7.50 (0.00–29.50)	15.89 $\pm$ 4.65 (9.40–29.50)	2.63 $\pm$ 1.81 (0.00–7.10)	< 0.001
(%)	-10.78 $\pm$ 8.84 (-30.79–2.53)	-19.17 $\pm$ 4.78 (-30.79–11.60)	-3.16 $\pm$ 2.3 (-7.67–2.53)	< 0.001
Weight loss participant expected, kg	17.73 $\pm$ 6.20 (5–30)	17.78 $\pm$ 5.43 (7–30)	17.68 $\pm$ 6.88 (5–30)	0.945

**BMI – body mass index.**

**For other abbreviations see under Table 1.**

**Table 3****Psychiatric psychopathology of participants**

SCL – 90 symptom dimensions	Total	Group I	Group II	<i>p</i>
	mean ± SD	mean ± SD	mean ± SD	
Somatization	1.50 ± 0.46	1.53 ± 0.47	1.48 ± 0.46	0.684
Obsessivity-compulsive	1.58 ± 0.57	1.63 ± 0.69	1.54 ± 0.45	0.458
Interpersonal sensitive	1.54 ± 0.60	1.50 ± 0.65	1.57 ± 0.55	0.632
Depression	1.53 ± 0.53	1.55 ± 1.62	1.51 ± 0.43	0.771
Anxiety	1.65 ± 0.62	1.69 ± 0.72	1.61 ± 0.51	0.589
Anger-hostility	1.35 ± 0.44	1.33 ± 0.47	1.36 ± 0.41	0.813
Phobic anxiety	1.17 ± 0.31	1.11 ± 0.20	1.22 ± 0.38	0.095
Paranoid ideation	1.50 ± 0.60	1.44 ± 0.54	1.56 ± 0.65	0.385
Psychoticism	1.20 ± 0.31	1.21 ± 0.39	1.19 ± 0.22	0.838
Total score	1.48 ± 0.42	1.48 ± 0.48	1.48 ± 0.37	0.939

**SCL-90 – 90-item Symptom Check-list.**

For other abbreviations see under Table 1.

**Table 4****Impulsiveness in the participants**

BIS factors	Total	Group I	Group II	<i>p</i>
	mean ± SD	mean ± SD	mean ± SD	
Attention	15.13 ± 2.14	14.78 ± 2.42	15.45 ± 1.81	0.147
Motor impulsiveness	17.07 ± 3.10	16.6 ± 3.51	17.5 ± 2.65	0.198
Self-control	13.64 ± 2.65	13.73 ± 2.83	13.56 ± 2.50	0.789
Cognitive complexity	13.07 ± 1.54	13.00 ± 1.66	13.13 ± 1.44	0.688
Perseverance	8.13 ± 1.74	8.25 ± 1.60	8.02 ± 1.87	0.553
Cognitive instability	7.40 ± 1.93	7.15 ± 2.09	7.63 ± 1.77	0.252
FACTOR I	22.54 ± 3.22	21.92 ± 3.63	23.09 ± 2.72	0.097
FACTOR II	25.08 ± 3.65	24.10 ± 3.67	25.98 ± 3.44	< 0.05
FACTOR III	26.38 ± 3.87	26.65 ± 3.52	26.14 ± 3.84	0.543
Total score	72.21 ± 9.06	68.57 ± 10.79	75.52 ± 5.42	< 0.001

**BIS – Barratt Impulsiveness Scale.**

For other abbreviations see under the Table 1.

**Discussion**

In the light of the fact that obesity has become the epidemic health threatening condition, its effects on physical health were extensively studied and well-documented<sup>5-7,16</sup>. However, the relationship between the psychiatric and/or psychological factors and etiology and obesity treatment is complicated and not well-known.

Our study showed that the obese/overweight participants, who were apparently healthy and homogenous regarding age, education level, employment and marital status, had different outcomes adhering to the same MNT protocol for six months.

The participants did not differ in the general psychopathology and its symptom domains measured with the SCL-90. Our results pointed out impulsivity measured as the total impulsivity on the BIS-11 as a pretreatment predictor of the MNT outcome. The total impulsivity and its Factor II (motor impulsivity), being significantly higher, and the Factor I (attentional impulsivity), was higher in the participants who lost < 10% of their initial weight (Group II).

The symptoms of general psychopathology and obesity in both groups shared similar risk factors like dietary habits, level of physical activity and sedentary lifestyle<sup>23</sup>. Although one might expect a positive correlation between general psy-

chopathology and etiology and negative response on obesity treatment, the research evidence was not entirely clear. It is not easy to detect causality i.e., which comes first: from obesity, or from psychopathology. Some studies showed the positive correlation between obesity and the general psychopathology. It was shown for the following domains: somatization<sup>24</sup>, interpersonal sensitivity<sup>25</sup>, depression<sup>26,27</sup>, anxiety<sup>26,27</sup>, anger-hostility<sup>28</sup> and psychoticism<sup>25</sup>. Also, in several studies, mood disorders are found to be frequent, especially in the morbidly obese patients seeking an obesity treatment<sup>29</sup>. As well, the overweight and obese patients are not rare among those who were diagnosed with mood disorders<sup>29</sup>. But, in contrast to these findings, a lot of studies found no relationship between obesity and general psychopathology<sup>30,31</sup>. In several community studies, the mood disorders were not found among the obese persons<sup>32</sup>. There was some evidence that the levels of anxiety among the obese persons are equal with those who seek the general medical or surgical treatment and that required obesity treatment may be the actual cause of anxiety<sup>30</sup>.

No differences in the SCL-90 scores between the Group I and Group II general psychopathology (i.e., somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism) could be explained by the fact that the women who will-

ingly began treatment of obesity were different from those who did not consider the general psychopathology levels. One could hypothesize that the overweight and obese women who participated in a weight-loss treatment had a lower level of general psychopathology when compared to those who did not, and therefore were more prone to start MNT. So, our results did not show that general psychopathology was a pretreatment predictive factor of medical nutrition outcome.

Impulsivity could be defined as “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others”<sup>33</sup>. Therefore, it was seen as a multidimensional construct. The self-report questionnaires and behavioral measurements such as the task of inhibiting motor response or delaying discounting, measure a different aspect of impulsivity. Impulsivity measured by the self-reported questionnaires and behavioral measurements was a risk factor for a range of maladaptive behaviors, such as overeating, binge eating and substance abuse, or in bipolar disorder, or attention-hyperactivity disorder<sup>33</sup>.

The BIS-11 scale used in this study measured total impulsivity and three second-grade factors: motor impulsiveness (act without thinking), attentional impulsiveness (no focus on the present task), and non-planning impulsiveness (lack of orientation to the future).

In our study, the women in the Group II had the higher scores of total impulsivity compared to the women in the Group I. Our findings were in accordance with the results of other studies that self-reported impulsivity was higher in the obese individuals<sup>14, 15, 34</sup>. Davis et al.<sup>35</sup> found the positive association of overeating and the preference for sweet and fatty food with impulsivity in the general population. Also, it was shown that those two factors were in a relationship with the BMI<sup>32</sup>. The relevant literature data provided evidence that the higher scores on impulsivity were found not only in the participants with negative dieting outcome<sup>16</sup>, as it was in our study, but also in the participants exhibiting food cravings<sup>36</sup>, emotional eating<sup>37</sup> and restraint eating<sup>38</sup>. All those phenomena are important for the development, maintenance and treatment of obesity<sup>34, 37</sup>.

Attentional impulsivity measured with the BIS-11 subscales is the most often linked with overeating<sup>15, 34, 37</sup>. The women who did not achieve  $\geq 10\%$  of weight loss in our study had tendency to higher score for attentional impulsivity (attentional impulsiveness combined the first-grade factors attention and cognitive instability) than the ones who did it. Attentional impulsivity may be the reason why, in the participants engaged in the weight-loss program, the highly palatable food came to the focus and became a trigger for eating<sup>15, 37</sup>.

In our study, the motor impulsivity score (motor impulsiveness combined the first-grade factors, motor impulsiveness

and perseverance) was a significantly higher in the Group II (unsuccessful responders) than in the Group I (the successful restrictive diet treatment responders). The literature data suggest that motor impulsivity is less often linked to obesity itself<sup>15</sup>. The higher scores were found in the individuals that were engaged in the binge eating behavior and the higher scores on motor impulsivity were referred to bulimia nervosa and the anorexia nervosa binge/purge type, but not for the anorexia nervosa restrictive type<sup>15, 38</sup>. Non-planning impulsivity was rarely linked to obesity, and our results were in accordance with the mentioned investigation. So, it seems that a combination of high attentional and motor impulsivity might be partly responsible for overeating as well as a clinically significant binge eating.

This study has some limitations. Firstly, we did not divide overweight and obese women into separate groups. However, there is evidence that the overweight and the obese women showed the same weight loss from the initial body weight during the same treatment period<sup>39</sup>. Secondly, the data on impulsivity must be more precise if the self-reported measures were accompanied with the behavioral ones (inhibiting motor response, or delaying discounting).

### Conclusion

The results of our study showed that the obese/overweight women in both groups – the successful and unsuccessful responders, who were apparently healthy, did not differ in age, education level, employment and marital status, but had different outcomes of the same MNT protocol for six months. The participants, who lost 10%, and more or less than 10% of their initial body weight, did not differ in the general psychopathology. Even though the successful and unsuccessful diet responders did not differ in general psychopathology, our results pointed out that impulsivity could be the pretreatment predictor of the outcome. The overweight/obese women as the unsuccessful diet responders had the higher total impulsivity and motor impulsivity scores. Our data highlighted the role of total impulsivity and Factor II (motor impulsivity) as an indicator of binge eating that may contribute to a poor response to the conventional diet weight loss treatment. The focus on impulsivity in the psychotherapeutic work integrated into the weight-loss treatments might lead to the better outcome in MNT.

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