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The Three-Factor Eating Questionnaire-R18 Polish version: factor structure analysis among normal weight and obese adult women

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Summary

Aims: The present study aimed to examine construct validity of the Three-Factor Eating Questionnaire-R18 (TFEQ-R18) and to investigate variables of the following phenomena: cognitive restraint, uncontrolled eating and emotional eating in normal weight women and women with obesity.

Methods: The research sample comprised 237 participants (200 with normal weight and 37 obese); the TFEQ-R18 was distributed to all participants at the same time.

Results: We found that the three-factor structure is invariant at each level – configural, metric, scalar and strict. Individuals with obesity scored significantly higher than individuals within normal weight range in uncontrolled eating (p = 0.005) and emotional eating (p = 0.053).

Conclusions: Ambiguities between the results of the current and other studies may be explained in terms of controlling the shared variance and measurement error, since only up to date summarized scores were compared across groups.

uncontrolled eating, cognitive restraint, emotional eating, normal weight, obesity

INTRODUCTION

Much research exists on improper eating habits in children [1,2], adolescents [3] and adults [4]. Eating habits can be disturbed on three levels: cognitive (e.g. knowledge and awareness connected with eating), emotional (e.g. emotions felt while eating) and behavioral (e.g. food choices and meal preparation) [5]. Incorrect eating behavior is associated with both eating disorders and obesity [1,6,7], and an increase in the prevalence of both has recently been observed [8-10]. Disordered eating habits are associated with specific tendencies – cognitive restraint, uncontrolled eating and emotional eating [4,5].

The term 'cognitive restraint' refers to placing restrictions on food, not taking into account the sensations of hunger and satiety [11,12]. The objective of cognitive restraint is body weight con-

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trol [5]. This concept applies classic restraint theory, which posits that the use of food restrictions is associated with a higher risk of binge eating and eating in response to negative emotions [13-15]. The concept of cognitive restraint has been mostly explored in the context of obesity [11,12]. Existing research provides evidence that cognitive restraint is greater among overweight and obese individuals compared to underweight and normal weight individuals [4,16]. Overall, the higher the body mass index (BMI) and body fat mass, the stronger the tendency towards these restrictions [16].

The tendency towards uncontrolled eating is associated with an intake of an excessive amount of food (more than usual) [5], which is especially present in overweight and obese individuals [17]. Uncontrolled eating refers to perceived hunger – the lesser the sense of control, the greater the difficulty in correctly determining the state of hunger [5]. Moreover, the disinhibition related to eating is associated with BMI [18]. However, two studies reported no difference in uncontrolled eating between people with abnormal body weight (underweight, overweight and obesity) and normal weight [4,16].

The concept of emotional eating refers to eating in response to various negative emotions [4,5]. Food is a regulator of the emotional state experienced by the individual [19-22]. The term 'emotional eating' was developed on the basis of observation [23]. It was noted that people with obesity have difficulty in distinguishing physiological experience (e.g. hunger) from emotional experience [24]. In the group with obesity, experiencing negative emotions increases the risk of bingeing on food [4,23,25]. Similarly, more recent research suggests that the tendency towards emotional eating mediates the relationship between BMI and episodes of binge eating [26]. People with obesity have the highest intensity of emotional eating compared with people who are underweight, overweight and of normal weight [4]; however, there are also studies that do not support this conclusion [16]. Recent research shows that gender, age and education are related to emotional and uncontrolled eating as well as cognitive restraint [18]. In addition, both body image and nutritional characteristics can be dissimilar in people with normal body weight and obesity [16,18,27]. Individuals with normal weight are more satisfied with their body and have a healthier diet compared with those with obesity [3,6,16,18,27].

The Three-Factor Eating Questionnaire (TFEQ) [17] is a measure of human eating behavior assessing cognitive restraint, disinhibition and hunger. The first version of the TFEQ contains 51 items; it was further modified by Karlsson et al. [5] who, basing on factor analyses on obese samples, abbreviated the measure to 18 items and re-conceptualized the disinhibition as uncontrolled eating and hunger as emotional eating. The abbreviated version was also successfully tested within the normal weight population [4,27], which suggests that the three-factor structure is not determined by BMI.

There have been numerous studies investigating the psychometric proprieties of the TFEQ over the past decade. The TFEQ was adapted to Swedish [5], French [27], Finnish [4], Greek [28], Malay [29], Spanish [16] and German [30].

Although differences in various BMI groups have often been investigated [4,27,31], suggesting that the obese population scores significantly higher, those comparisons were not methodologically justified. To compare two or more different groups, it is necessary to establish measurement invariance which informs whether individuals from compared groups understand the questionnaire in the same way (i.e. whether the number of factors is the same, whether the loadings on these factors are similar, and whether the error variances are equal). As these questions were not addressed in existing research [4,27,31], we aimed to fill this gap. In general, there are four levels of measurement invariance: configural, which informs whether factor structures are similar across groups; metric, which informs whether factor loadings are similar; scalar, which informs whether intercepts are equal; and strict, which informs whether residual variances are equal across groups [32]. In terms of practical utility, establishing metric invariances allows comparison of correlates of the construct of interest across groups; scalar invariance allows comparison of latent mean scores of the construct; and only strict measurement invariance allows comparison of mean scores [33]. In a common factor model, each item is composed of two uncorrelated components: factor loading, which represents observed variance, and residuals, which represent measurement error variance. If those errors are non-invariant across compared groups, it is impossible to assess whether the significance of observed differences is due to real differences or due to measurement error. Although it is not necessary to assess a strict measurement invariance since a scalar invariance allows for meaningful latent mean score comparisons [34] (where, owing to structural equation modeling, measurement error is calculated and latent variables more adequately represent constructs of interest than a simple summarized mean score), it is still important information that helps interpret past and ongoing studies.

In the present study, we aimed to examine the construct validity of the TFEQ-R18 and to evaluate cognitive restraint, uncontrolled eating and emotional eating in normal weight women and women with obesity.

MATERIALS AND METHODS

Participants

The study involved 237 participants aged 18–51. The group comprised 200 females with normal weight (from 18.5 to 24.99) and 37 females with obesity (BMI ≥ 30). The mean age of the first group was 24.56 years (SD = 7.59) and of the second 32.46 years (SD = 15.85). The average BMI in the normal weight group was 21.39 (SD = 1.81) and in the group with obesity 34.08 (SD = 3.66). The last socio-demographic variable was education. Detailed information is presented in Table 1.

Table 1. Education among normal weight and obese adult women

	Normal weight individuals	Individuals with obesity[a]
	% (N)	% (N)
Secondary education	6.00% (12)	2.94% (1)
High school graduate	17.50% (35)	23.53% (8)
University student	52.50% (105)	32.35% (11)
University graduate	24.00% (48)	41.18% (14)
	200	34

[a.] Information missing from three individuals

Also, all participants assessed their eating behavior. Detailed information is presented in Table 2.

Table 2. Characteristics associated with nutrition among normal weight and obese adult women

	Normal weight individuals % (N)	Individuals with obesity % (N)
Subjective assessment – healthy eating		
Yes	57.00% (114)	43.24% (16)
No	43.00% (86)	56.76% (21)
Breakfast, daily		
Yes	82.50% (165)	70.27% (26)
No	17.50% (35)	29.73% (11)
Lunch, daily		
Yes	88.00% (174)	91.89% (34)
No	12.00% (24)	8.11% (3)

Supper, daily		
Yes	74.00% (148)	70.27% (26)
No	25.00% (50[a])	27.03% (10[c])
Eating fruit		
Yes	60.00% (120)	75.68% (28)
No	39.00% (78[a])	24.32% (9)
Eating vegetables		
Yes	66.00% (132)	64.87% (24)
No	32.50% (65[b])	32.43% (12[c])
Milk and milk products (e.g. yoghurt, kefir, buttermilk, cheese)		
Yes	63.50% (127)	62.16% (23)
No	36.50% (73)	37.84% (14)
Protein (e.g. poultry, eggs, soy, fish, peas)		
Yes	61.50% (123)	70.27% (26)
No	37.00% (74[b])	27.03% (10[c])
Meals per day		
1	0	0
2	6.00% (12)	8.11% (3)
3	26.00% (52)	35.14% (13)
4	36.00% (72)	35.14% (13)
5	27.50% (55)	10.81% (4)
6	4.50% (9)	5.40% (2[a])
More than 6	0	0
Snacking between meals	199[c]	37
Always	4.50% (9)	2.70% (1)
Often	29.00% (58)	27.03% (10)
Sometimes	46.50% (93)	51.35% (19)
Rarely	18.00% (36)	16.22% (6)
Never	1.50% (3)	2.70% (1)
Snacks[d]		
Fruit	33.50% (67)	40.54% (15)
Vegetables	1.50% (3)	5.40% (2)
Sweets	49.50% (99)	35.14% (13)
Other	19.50% (39)	40.54% (15)

[a.] Two individuals did not answer the question.
[b.] Three individuals did not answer the question.
[c.] One individual did not answer the question.
[d.] Participants could select multiple responses.

We carried out our study in a number of Polish institutions located in the Silesia and Mazovia regions (e.g. university, company, hospital) from January to March 2016. Inclusion criteria were as follows: age between 18 and 60 years, normal weight for first group (BMI from 18.5 to 24.9) and BMI greater than 30 for the second group (as this is the principal cut-off point for obesity according to the WHO's classification), and a written consent to participate in research. Having no eating disorder diagnosis was an exclusion criterion.

Informed consent was obtained from all individuals included in the study. The study was approved by the local ethics committee (no. WKEB31/01/2016).

MEASURES

The TFEQ-R18 is a brief measure of eating behaviors, covering cognitive restraint of eating, uncontrolled eating and emotional eating. It comprises 17 items rated on a four-point Likert scale and an additional item to rate, on an eight-point Likert scale, how often respondents restrain their eating. For the purpose of analysis, we recoded that item into four categories (responses 1 and 2 were recoded into 1; 3 and 4 into 2; 5 and 6 into 3; and 7 and 8 into 4). The reliability estimates for each scale were excellent: $\alpha_{\text{Cognitive Restraint}} = 0.78$, $\alpha_{\text{Uncontrolled Eating}} = 0.84$, and $\alpha_{\text{Emotional Eating}} = 0.86$.

STATISTICAL ANALYSES

In order to compare results between the group within a normal weight range and the obese group, we conducted multi-group confirmatory factor analysis (MGCFA). Before MGCFA, we assessed the structure of the measure in both groups using confirmatory factor analysis (CFA). In evaluating measurement invariance fit, we followed stringent criteria for unequal groups proposed by Chen [35]. The configural model should be well fitted to the data (i.e. CFI > 0.900; root mean square error of approximation (RMSEA) < 0.08) [36]; the difference between configural and metric models in CFI should not exceed 0.05 and 0.010 in RMSEA; and the difference between metric and scalar models in CFI should not exceed 0.05 and 0.010 in RMSEA. However, Chen [35] developed those criteria using continuous data and maximum likelihood estimation, which is not applicable to our categorical data. Moreover, Muthén [37] recommends omitting the metric model when measuring invariance analysis with ordered categorical data direct analysis from the configural to the scalar model; thus we treated those recommendations rather as pointers in interpretation. In all our analyses, we used polychoric correlation matrices and used weighted least squares with means and variances adjusted estimation to reflect the categorical character of our data [38] using Mplus v. 7.2 [39].

RESULTS

Firstly, we assessed whether the three-factor model fits the data well independently in the compared samples using CFA, the results of which (including the correlations between latent variables) are presented in Figure 1.

Table 3. Results of multi-group confirmatory factor analysis of the Three Factor Eating Questionnaire across normal weight and obese adult women

Model	$\chi^2_{(df)}$	p	CFI	RMSEA
Configural	$483.41_{(264)}$	0.001	0.943	0.084
Scalar	$505.42_{(312)}$	0.001	0.950	0.072
Scalar versus configural	$22.01_{(48)}$	0.571	Δ = 0.007	Δ = 0.012

The tested models are well fitted to the data; ΔCFI do not exceed and ΔRMSEA slightly exceeds Chen's [35] recommendations. Therefore, one can conclude that the structure of the TFEQ is invariant across differentiated weight groups at the scalar level and the latent mean scores can be compared. Differences in latent mean scores of the TFEQ factors are presented in Table 4.

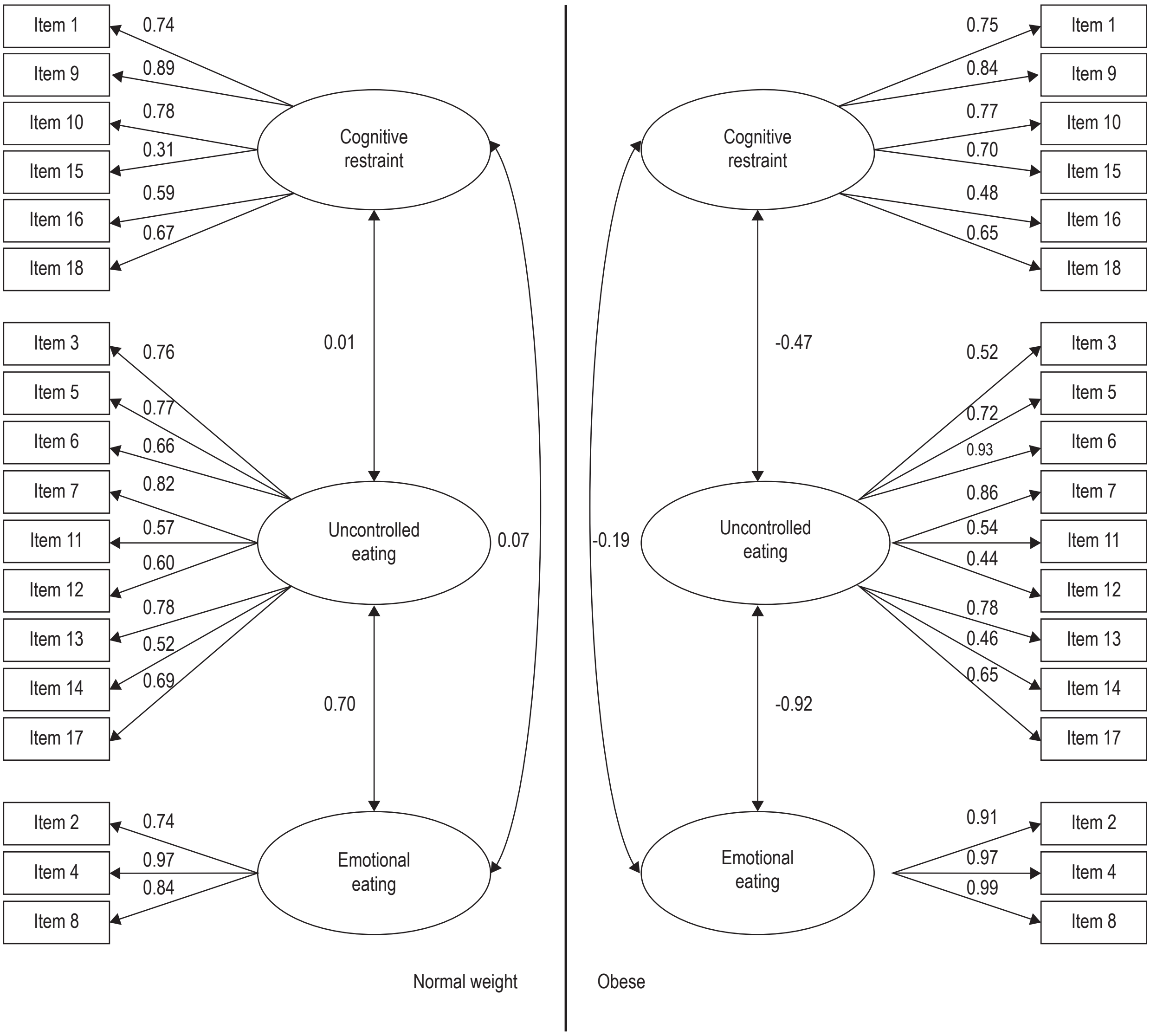

Figure 1 The three factor models with standardized factor loadings in normal weight and obese adult women

The model in the normal weight group ($\chi^2_{(132)}$ = 275.48; p < 0.001; CFI = 0.947; TLI = 0.938; RMSEA = 0.074 (90%CI = 0.061–0.086); p < 0.001; WRMR = 1.11) was well-fitted to the data; whereas the model in the obese group ($\chi^2_{(132)}$ = 208.37; p < 0.001; CFI = 942; TLI = 0.933; RMSEA = 0.125 (90%CI = 0.092–0.157); p < 0.001; WRMR = 1.06) was less well-fitted (admittedly, indicated only by RMSEA). Because the three-factor structure was confirmed in both groups, we ran the MGCFA (Table 3).

Table 4. Differences in latent scores of the Three Factor Eating Questionnaire between normal weight and obese adult women

Latent factor	Mean[a]	F	p
Cognitive restraint	-0.089	0.61	0.541
Uncontrolled eating	-0.288	2.40	0.016
Emotional eating	-0.385	1.93	0.053

[a.] The negative value of the mean suggests higher scores in individuals with obesity.

Among the three analyzed latent means, obese individuals scored significantly higher than individuals within the normal weight range on uncontrolled eating and emotional eating. There were no differences in cognitive restraint.

Although assessment of differences between latent means is more meaningful than between summarized scores, we also tested the strict measurement invariance model, where all residual variances were held equal across compared groups. The strict model was well fitted to the data ($\chi^2_{(330)}$ = 538.88; p < 0.001; CFI = 0.946; RMSEA = 0.073). The ΔCFI between this and the scalar model is 0.004 and the ΔRMSEA is 0.001; thus, we concluded that in the current sample the three-factor structure across individuals within the normal weight range and those in the obese range is invariant at the strict level.

DISCUSSION

Our findings generally disagree with existing literature which argues that cognitive restraint related to eating is more likely to be higher in individuals with obesity than in those within normal weight range [4,16], as we did not find any differences in cognitive restraint between obese and normal weight groups. Other research [40] shows that in overweight individuals stronger cognitive restraint is positively associated with lower BMI (this is related to reduction of food intake), and the group with normal body weight has the opposite tendency (this is related to an increased risk of bingeing).

The results of the current study may be additionally explained in the context of age and education [41]. In females, the higher the degree of flexible restrictions on eating, the lower the body fat and waist circumference [18]. Cognitive restraint is positively associated with BMI in individuals with normal body weight (this relationship is not found in overweight people) [42]. High BMI is an important predictor of increased restriction eating [42], as is education (lower level of education is associated with weaker tendency towards dietary restrictions) and age (the level of restrictions increases with age) [41]. Another explanation for the level of cognitive restraint can be exercise and profession, because some professions are associated with food intake and body weight control (e.g. athletes, models) [42-44].

Our results revealed differences ($p = 0.053$) in emotional eating between females within the normal weight range and those with obesity. These results have also been reported in previous studies [4], but other studies produced results inconsistent with these findings [16]. Studies have shown that the level of emotional eating depend on age and level of education [42]. With better education and younger age, the tendency towards emotional eating increases [41]. It can therefore be concluded that differences between the results obtained in the current and other studies are due to socio-demographic differences between samples.

Another explanation for our results may be the internal-external theory of hunger [45,46]. Individuals with obesity tend to respond to external cues of hunger (e.g. time elapsed since the last meal, visual availability of food), whereas non-obese people tend to respond more to internal cues of hunger (e.g. stomach contractions, glucose/fat levels) [45,46]. This theory is associated with the term 'external eating', which is defined as eating in response to the visual availability, smell and taste of food (regardless of the association with hunger-satiety) [7,46]. On the one hand, the tendency to eat in response to external stimuli is considered adaptive, because it refers to human survival in times of food shortages [47,48]. On the other hand, external eating promotes overeating in response to external food cues [49,50]. Longitudinal research shows that in individuals with obesity, emotional eating and external eating moderate the relationship between BMI and binge eating disorder [26].

We have provided evidence that individuals within normal weight range differ from the obese group only in uncontrolled eating. These results are consistent with a previous study [17]. In contrast, results obtained by Anglé et al. [4] and Jáuregui-Lobera et al. [16] are inconsistent. Provencher et al. [18] reported that in women and men with obesity, disinhibited eating and the susceptibility to hunger are higher than in normal weight and overweight individuals.

Obesity is associated with low interoceptive awareness, which coexists with difficulties in the identification, processing and regulation of the emotional state [51-53]. In addition, obesity signifies non-adaptive coping strategies and the regulation of emotional state through food [54]. There is a high probability that due to strong stigmatization and alienation, individuals with obesity are faced with negative emotions and cope by engaging in (emotional) eating [55-58]. Determinants of BMI can also be configured in various styles of eating: cognitive restraint (vs. unrestrained), uncontrolled eating (vs. controlled) and emotional eating (vs. unemotional) [30, 59, 60].

All of the observed ambiguities between the results of current and other studies may be explained in terms of controlling the measurement bias. Establishing measurement invariance is essential for meaningful group comparisons [61]. Without strict invariance, researchers who compare the summarized scores do not control whether they compare respondents' true scores or error variances. Thus, one may doubt such analyses. The current study is the first to take into account existing error variance in the assessment of differences between individuals within normal weight range and the obese with regard to eating behaviors.

In conclusion, in addition to the above explanations for the differences between the current and past studies, there may be an overriding problem that determines the existing styles of eating and determines their level of intensity and adaptability. The core of the problem can be the level of emotional dysregulation [60, 62]. People with high emotional awareness are more likely to modulate their emotions more adaptively without turning to food. However, individuals with low emotional regulation skills will very often use food to cope with stress and negative emotions. In this sense, any style of eating can serve to regulate mood [63,64]. Then, if a person breaks food restrictions, has the episodes of uncontrollable eating or eats emotionally, the resulting guilty feelings will make them try to reduce negative emotions by re-engaging with these eating styles [64].

LIMITATIONS

Certain limitations should be highlighted. Firstly, the relatively small sample size of the obesity group may hinder the generalizability of the current results. Secondly, the size of the two samples is unequal (200 vs. 37). Thirdly, no information was gathered about the participants' mental and somatic illnesses, which may have led to potential differences between normal weight and obese adults. Fourthly, the model in the obese group was rather poorly fitted to the data, as suggested by RMSEA. This was most probably due to the small sample size, resulting in a low power of the tested model (as the value of RMSEA is a quotient of the root of the difference between χ^2 and the number of degrees of freedom, with the root of the product between χ^2 and the number of participants within the sample, a small obese sample size could also secondarily influence results). Despite the fact that RMSEA suggested poor fit, factor loadings were high and we did not implement any post-hoc modifications (i.e. correlating error residual variances). Moreover, the TFEQ-R18 was designed as a measure for obese individuals; thus, these results are consistent with the literature [5].

Notwithstanding its limitations, the study is valuable in adding to the knowledge about eating behaviors in normal weight individuals as well as those with obesity. Individuals with obesity scored significantly higher than individuals within normal weight range on uncontrolled eating. In addition, we found that the three-factor structure of the TFEQ-R18 is invariant at each level – configural, metric, scalar and strict.

REFERENCES

1. Baños RM, Cebolla A, Etchemendy E, Felipe S, Rasal P, Botella C. Validation of the Dutch Eating Behavior Questionnaire for Children (DEBQ-C) for use with Spanish children. Nutr Hosp. 2011; 26(4): 890–898.
2. Dzielska A, Mazur J, Małkowska-Szkutnik A, Kołoło H. Adaptacja polskiej wersji kwestionariusza Three-Factor Eating Questionnaire (TFEQ-13) wśród młodzieży szkolnej w badaniach populacyjnych. [Polish adaptation of the Three-Factor Eating Questionnaire (TFEQ-13) in school population]. Probl Hig Epidemiol. 2009; 90(3): 362–369.
3. Hautala LA, Junnila J, Helenius H, Väänänen AM, Liuksila PR, Räihä H, et al. Towards understanding gender differences in disordered eating among adolescents. J Clin Nurs. 2008; 17(13): 1803–1813.
4. Anglé S, Engblom J, Eriksson T, Kautiainen S, Saha M-J, Lindfors P, et al. Three factor eating questionnaire-R18 as a measure of cognitive restraint, uncontrolled eating and emotional eating in a sample of Young Finnish females. Int J Behav Nutr Phys Act. 2009; 6: 41.
5. Karlsson J, Persson L-O, Sjöström L, Sullivan M. Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) study. Int J Obesity. 2000; 24(12): 1715–172.
6. Braet C, Claus L, Goossens L, Moens E, Van Vlierberghe L, Soetens B. Differences in eating style between overweight and normal-weight youngsters. J Health Psychol. 2008; 13(6): 733–743.
7. van Strien T, Oosterveld P. The children's DEBQ for assessment of restrained emotional and external eating in 7-to 12 – year-old children. Int J Eat Disorder. 2008; 41(1): 72–81.
8. National Association of Anorexia Nervosa, Associated Disorders. Eating Disorders Statistics. 2016. Available from: http://www.anad.org/get-information/about-eating-disorders/eating-disorders-statistics/

9. Smink FRE, van Hoeken D, Hoek HW. Epidemiology of eating disorders: incidence prevalence and mortality rates. Curr Psychiat Rep. 2012; 14(4): 406–414.
10. World Health Organization. Obesity and Overweight. 2015. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/
11. Herman CP, Mack D. Restrained and unrestrained eating. J Personality. 1975; 43(4): 647–660.
12. Herman CP, Polivy J. Anxiety restraint and eating behavior. J Abnorm Psychol. 1975; 84(6): 666–672.
13. Herman CP, Polivy J. The self-regulation of eating: theoretical and practical problems. In: Baumeister RF, Vohs KD, editors. Handbook of Self-Regulation: Research Theory and Applications. New York NY: Guilford Press; 2004: pp. 522–535.
14. Lowe MR. Restraint theory: the search for mechanism. Paper presented at the 92nd Annual Convention of the American Psychological Association. Toronto, Ontario, Canada, August; 1984: pp. 24–28.
15. Polivy J, Herman CP. If at first you don't succeed. False hopes of self change. Am Psychol. 2002; 57(9): 677–689.
16. Jáuregui-Lobera I, García-Cruz P, Carbonero-Carreño R, Magallares A, Ruiz-Prieto I. Psychometric properties of Spanish version of the Three-Factor Eating Questionnaire-R18 (TFEQ-Sp) and its relationship with some eating – and body image-related variables. Nutrients. 2014; 6(12): 5619–5635.
17. Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint disinhibition and hunger. J Psychosom Res. 1985; 29(1): 71–83.
18. Provencher V, Drapeau V, Tremblay A, Després JP, Lemieux S. Eating behaviors and indexes of body composition in men and women from the Québec family study. Obes Res. 2003; 11(6): 783–792.
19. Bekker MHJ, Van de Meerendonk C, Mollerus J. Effects of negative mood induction and impulsivity on self-perceived emotional eating. Int J Eat Disorder. 2003; 36(4): 461–469.
20. Macht M, Haupt C, Ellgring H. The perceived function of eating is changed during examination stress: A field study. Eat Behav. 2005; 6(2): 109–112
21. Macht M, Simons G. Emotions and eating in everyday life. Appetite. 2000; 35(1): 65–71.
22. van Strien T, Frijters JE, Bergers GP, Defares PB. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained emotional and external eating behavior. Int J Eat Disorder. 1986; 5(2): 295–315.
23. Bruch H. Psychological aspects of overeating and obesity. Psychosomatics. 1964; 5(5): 269–274.
24. Evers C, De Ridder DTD, Adriaanse MA. Assessing yourself as an emotional eater: mission impossible? Health Psychol. 2009; 28(6): 717–725.
25. Slochower J. Excessive Eating: the Role of Emotions and Environment. New York NY: Human Sciences Press; 1983.
26. van Strien T, Herman CP, Verheijden MW. Eating style overeating and weight gain. A prospective 2-year follow-up study in a representative Dutch sample. Appetite. 2012; 59(3): 782–789.
27. De Lauzon B, Romon M, Deschamps V, Lafay L, Borys J-M. The Three-Factor Eating Questionnaire-R18 is able to distinguish among different eating patterns in a general population. J Nutr. 2004; 134(9): 2372–2380.
28. Kavazidou E, Proios M, Liolios I, Doganis G, Petrou K, Tsatsoulis A, et al. Structure validity of the Three-Factor Eating Questionnaire-R18 in Greek population. J Hum Sport Exercise. 2012; 7(1): 218-226.
29. Rosnah I, Noor Hassim I, Shafizah AS. A systematic translation and cultural adaptation process for Three-Factor Eating Questionnaire (TFEQ-R21). Med J Malaysi. 2013; 68(5): 424–434.
30. Löffler A, Luck T, Then FS, Sikorski C, Kovacs P, Böttcher Y, et al. Eating behaviour in the general population: an analysis of the factor structure of the German version of the Three-Factor-Eating – Questionnaire (TFEQ) and its association with the body mass index. PLoS ONE. 2015; 10: e0133977.
31. Gallant AR, Tremblay A, Perusse L, Bouchard C, Despres J-P, Drapeau V. The Three-Factor Eating Questionnaire and BMI in adolescents: results from the Quebec Family Study. Br J Nutr. 2010; 104(7): 1074–1079.
32. Meredith W. Measurement invariance factor analysis and factorial invariance. Psychometrika. 1993; 58: 525–543.
33. Gregorich SE. Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using confirmatory factor analysis framework. Medical Care. 2006; 44(11): S78–SS94.
34. Davidov E, Meuleman B, Cieciuch J, Schmidt P, Billiet J. Measurement equivalence in cross-national research. Annu Rev Sociol. 2014; 40: 55–75.
35. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. Structural Equation Modeling. 2007; 14: 464–504.
36. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling. 1999; 6: 1–55.
37. Muthén BO. Measurement invariance with multigroups. 2013. Available from: http://www.statmodel.com/discussion/messages/9/11980.html?1408576010.
38. Rhemtulla M, Brosseau-Liard PE, Savalei V. When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. Psychol Methods. 2012; 17: 354–373.
39. Muthén LK, Muthén BO. Mplus User's Guide (7th ed.). Los Angeles, CA: Muthén, Muthén; 2012.
40. Johnson F, Pratt M, Wardle J. Dietary restraint and self-regulation in eating behavior. Int J Obesity. 2012; 36(5): 665–674.

41. Barrada JR, van Strien T, Cebolla A. Internal structure and measurement invariance of the Dutch Eating Behavior Questionnaire (DEBQ) in a (nearly) representative Dutch community sample European Eating Disorder Review. Eur Eat Disord Rev. 2016; 24(6): 503–509.
42. De Lauzon-Guillain B, Basdevant A, Romon M, Karlsson J, Borys JM, Charles MA. Is restrained eating a risk factor for weight gain in a general population? Am J Clin Nutr. 2006; 83(1): 132–138.
43. Pietrowsky R, Straub K. Body dissatisfaction and restrained eating in male juvenile and adult athletes. Eat Weight Disord-St. 2008; 13(1): 14–21.
44. Swami V, Szmigielska E. Body image concerns in professional fashion models: are they really an at-risk group? Psychiat Res. 2012; 207(1-2): 113–117.
45. Schachter S. Obesity and eating. Internal and external cues differentially affect the eating behavior of obese and normal subjects. Science. 1968; 161(3843): 751–756.
46. Schachter S. Some extraordinary facts about obese humans and rats. Am Psychol. 1971; 26(2): 129–144.
47. Neel JV. Diabetes mellitus: A 'thrifty' genotype rendered detrimental by 'progress'? Am J Hum Genet. 1962; 14(4): 353–362.
48. Rodin J. Current status of the internal-external hypothesis for obesity. What went wrong? Am Psychol. 1981; 36(4): 361–372.
49. Bryant EJ, King NA, Blundell JE. Disinhibition: its effects on appetite and weight regulation. Obes Rev. 2008; 9(5): 409–419.
50. Polivy J, Herman CP. An evolutionary perspective on dieting. Appetite. 2006; 47(1): 30–35.
51. Füstös J, Gramann K, Herbert BM, Pollatos O. On the embodiment of emotion regulation: interoceptive awareness facilitates reappraisal. Soc Cogn Affect Neur. 2013; 8(8): 911–917.
52. Herbert BM, Pollatos O. The body in the mind: on the relationship between interoception and embodiment. Top Cogn Sci. 2012; 4(4): 692–704.
53. Terasawa Y, Fukushima H, Umeda S. How does interoceptive awareness interact with the subjective experience of emotion? An fMRI Study. Hum Brain Mapp. 2013; 34(3): 598–612.
54. Hemmingsson E. A new model of the role of psychological and emotional distress in promoting obesity: conceptual review with implications for treatment and prevention. Obes Rev. 2014; 15(9): 769–779.
55. Lazarevich I, Irigoyen-Camacho ME, Velazquez-Alva MC, Salinas-Ávila J. Psychometric characteristics of the Eating and Appraisal Due to Emotions and Stress Questionnaire and obesity in Mexican university students. Nutr Hosp. 2015; 31(6): 2437–2444.
56. Ogden J. Psychologia odżywiania się. Od zdrowych do zaburzonych zachowań żywieniowych. [The psychology of eating. From healthy to disordered eating behaviours]. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego; 2011.
57. Stunkard AJ, Faith MS, Allison KC. Depression and obesity. Biol Psychiat. 2003; 54(3): 330–337.
58. van Strien T, Cebolla A, Etchemendy E, Gutiérrez-Maldonado J, Ferrer-García M, Botella C, et al. Emotional eating and food intake after sadness and joy. Appetite. 2013; 66: 20–25.
59. Leehr EJ, Krohmer K, Schag K, Dresler T, Zipfel S, Giel KE. Emotion regulation model in binge eating disorder and obesity: a systematic review. Neurosci Biobehav Rev. 2015; 49: 125–134.
60. Micanti F, Iasevoli F, Cucciniello C, Costabile R, Loiarro G, Pecoraro G, et al. The relationship between emotional regulation and eating behaviour: a multidimensional analysis of obesity psychopathology. Eat Weight Disord. 2016; 22(1): 105–115.
61. Van De Schoot R, Schmidt P, De Beuckelaer A, Lek K, Zondervan-Zwijnenburg M. Measurement invariance. Front. Psychol. 2015; 6: 1064.
62. Leahy RL, Tirch D, Napolitano L. Regulacja emocji w psychoterapii. Podręcznik praktyka [Emotion Regulation in Psychotherapy A Practitioner's Guide]. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego; 2014.
63. Czepczor K, Brytek-Matera A. Jedzenie pod wpływem emocji. [Eating under the influence of emotions] Warszawa: Difin; 2017.
64. Rossy L. The Mindfulness-Based Eating Solution: Proven Strategies to End Overeating, Satisfy Your Hunger, and Savor Your Life. Oakland: New Harbinger Publications; 2016.