Psychometric Properties of the Weight Locus of Control Scale (MWLCS): study with Spanish individuals of different anthropometric nutritional status.[1]

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CIBEROBN is an initiative of the ISCIII (Instituto de Salud Carlos III, Spain).We thank the PREDIMEDPLUS Biobank Network, part of the National Biobank Platform of Instituto de Salud Carlos III for storing and managing biological samples.We thank to Research Council (Grant 340918), and PROMETEO Grant (17/2017) from the Generalitat Valenciana.

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Abstract

The Multidimensional Weight Locus of Control Scale (MWLCS) measures a person's beliefs regarding the control or lack of control over his/her body weight. **Purpose:** We aim to evaluate the factorial structure and psychometric properties of the MWLCS with Spanish normal weight, overweight and obese samples. **Methods:** The research was carried out in two different studies. The first included a sample of 140 normal weight participants, selected out of a 274 sample recruited with an online survey. Study 2 was carried out in a sample of 633 participants recruited from the PREDIMED-Plus study. Out of them, 558 participants fulfilled the weight criteria and were categorized into: overweight (25 < BMI < 29.99; N = 170), obese class I (30 < BMI < 34.99; N = 266), and obese class II (35 < BMI < 39.99; N = 122) patients. Exploratory and confirmatory factor analysis were used to evaluate the factor structure of the MWLCS, and reliabilities and Spearman's correlations were estimated. Invariance measurement was tested across the three subgroups of weight in Study 2.**Results**: Athree-factor structure indicating weight locus of control factors (internal, chance, and powerful others) was supported, both via EFA in the normal weight sample and CFA in the overweight and obese samples. In the normal weight sample, the powerful others dimension was positively related to BMI and the dimensions of the Dutch eating behaviors questionnaire. Additionally, the scale showed evidence of scalar invariance across the groups with different weight conditions. **Conclusions:** This scale seems to be a psychometrically appropriate instrument and its use is highly recommended when designing interventions for overweight or obese individuals.

Level of evidence: Level V, descriptive study

Keywords: Locus of Control, Obesity, Health, Weight.

Introduction

Obese individuals are encouraged to lose 5% to 10% of their initial body weight to improve their health and quality of life[1]. This goal can be achieved using different approaches, like behavioral interventions that include three principal components: diet, physical activity, and behavioral therapy[2]. However, in the absence of further treatment, patients typically regain weight after termination of this programs [2, 3].In order to improve the efficacy of the weight loss interventions, it is important to considerate patients characteristics and its implications for weight loss; variables as weight loss goals, weight loss patterns, life events, social support, attitudes, motivation, self-efficacy, or locus of control, among others[4].

Developing a deeper understanding of the relationship between individuals' perceptions of control and their investment in maintaining a healthy lifestyle is critical when designing interventions. The concept of locus of control (LOC) refers to peoples' beliefs about how controllable or uncontrollable events are for them [5]. If the person believes that there is a causal relationship between his/her own behavior or his/her own relatively permanent characteristics and certain event, it is termed as a belief of "internal control". When the event is perceived by the person as not being entirely dependent upon his/her own action and perceives it as a result of external forces, it is termed a belief of "external control"[5]. Internal LOC has been considered a relevant variable when studying weight control [6]and has been proposed by several researchers as a potential predictor of success [7, 8], adherence [9, 10], and less weight regain after weight loss program [10–12]. Internal LOC is also connected with healthy behavior choices [13] and healthy habits [14]. On the contrary, external LOC was positively related to citing external etiology of overweight, several external barriers to physical activity, and having a negative view of social support[15],furthermore, it relates more to a poor self-assessed health [6, 16]and difficulties in weight loss maintenance and sedentary activities [11].

Despite of its importance, there is only one scale developed specifically to measure LOC regarding weight loss, the Weight Locus of Control Scale (WLOCS) [17]. Trying to solve the problems of the low internal consistency of this scale, Stotland and Zuroff developed the Dieting Beliefs Scale [18], which consists of 16 items with a three-factor structure, one internal factor and two external factors. However, it was validated only with a sample of normal weight women.

Another relevant scale developed to measure LOC, is the Multidimensional Health Locus of Control Scale (MHLCS)[19]. It measures health-related control beliefs. With two parallel forms (A and B) differentiates between "internal control", "powerful others", and "chance". High "internal control" reflects personal responsibility for affecting health status, while "powerful others" and "chance", reflects external control. This scale has been used in many studies, and its distinction among three main subtypes of LOC has contributed to a finer understanding of the role of control cognitions in influencing health behavior[20]. This MHLCS targets general health-related behaviors as it was deliberately constructed not to be specific to any health condition. The need for a condition-specific LOC scale that could be easily adapted for people with different existing medical (or health related) conditions drove Wallston, Stein and Smith [21] to develop the Form C of the MHLCS. This scale concluded with a four-factor structure (in exploratory factor analysis) and showed acceptable psychometric properties (Cronbach's alpha > .70), good test-retest reliability and significant relationships with appropriate counterparts, in the original study in aNorth-American sample composed by four different health conditions (rheumatoid arthritis, chronic pain, diabetes and cancer)[22].Despite the widespread use of the MHLCS in health research, it has never been used to specifically target weight LOC.

Furthermore, there are several cultural aspects that has never been reported related to the perception of weight LOC that could be interacting. Culture, defined as the unique shared values, beliefs, and practices of a group, can influence the behaviors of individuals by affecting their thoughts, feelings, acceptance, and adoption of health education messages[23]. For example, in previous studies in a sample of Spanish women it was found that the most frequently reported internal barriers to follow a diet were the lack of willpower or difficulties in changing habits, and the most reported external barrier was cooking [24].

This study aims to present a weight LOC scale adapted from the Form C of the MHLCS[21],in both normal weight and overweight and obese Spanish sample. For this purpose, we have studied the factorial structure of the scale, offered estimates of its reliability across samples, gathered evidence of external validity with correlations between related constructs, and studied its measurement invariance across groups of weight.

Method

Two studies were carried out, with two different samples: one with the general population (Study 1), and the second one with the overweight and obese population (Study 2).

Study 1 - General Sample

Participants and procedure.

A total of 274 participants were recruited with an online survey specifically developed and it was disseminated in several websites, and from the University of Valencia and Jaume I University (both in Spain). All participants (from 18 to 75 years old) were asked to sign an informed consent. They fulfilled several self-reports, including socio-demographic information. After accessing the link, people voluntarily agreed to participate and filled out the survey´s scales and questionnaires. BMI was calculated using self-reported height and weight values provided by participants. Participants with a BMI lower than 18 and higher than 25were excluded. The final sample was composed by 140 participants. The main descriptive of the sample were: (a) age, M = 33.03 years(range from 18 to 59), SD =9.54; (b) BMI, M= 21,97 kg/m^2 (range from 18.94 to 24.90), SD = 1.71.In this sample, 78.4% were women and 21.6% were men.

Instruments.

Multidimensional Weight Locus of Control Scale (MWLCS). This scale was adapted from Form C of the MHLCS[21]specifically for measuring weight LOC into Spanish by experts on weight loss treatment and researchers, and then back-translated by two native bilingual English-Spanish. It consists of 18 items that measure person´s beliefs about where does control over his/her body weight lie, using a 6-point Likert type format. It is composed by a four factor structure: internal, chance, doctors, and other people”. The scale was translated and adapted into Spanish language following specific guidelines [25].

Dutch Eating Behavior Questionnaire (DEBQ)[26, 27]. This questionnaire measures eating styles that may contribute to or attenuate the development of becoming overweight. It comprises 33 items and 3 subscales that measure emotional eating, restraint, and external eating. Emotional eating refers to eating in response to emotional arousal states, such as anger, fear or anxiety. External eaters eat in response to environmental food cues, such as the sight and smell of food; and restraint eating refers to attempts to lower the body weight by the conscious restriction of food intake. It has been used the Spanish validation made by Cebolla, Barrada, Van Strien, Oliver and Baños[28]. The Cronbach's alpha coefficients of the scales and also the Pearson's correlation coefficients to assess interrelationships between scales indicate that the scales have a high internal consistency and factorial validity[27]. The Cronbach's alphas in the present sample were .95 for emotional eating, .87 for restraint and .90, for external eating. We also gathered evidence of validity with a confirmatory factor analysis in which the original three-factor structure was tested, with adequate results: χ^2 (492) = 665.196 (p< .001), CFI = .935, TLI = .930, RMSEA = .086 [.068,.102].

Data analysis.

Descriptive statistics were computed for all MWLCS items. Skewness andKurtosis range was computed. Factor structure was analyzed using Exploratory Factor Analysis (EFA). The analyses were performed with Mplus 8.1[29].According to the ordinal nature of the data and its non-normality weighted least square mean and variance adjusted (WLSMV) estimation was used. As regards the rotation, Promax rotation was used. In order to assess the fit of the model, the chi-square statistic, the Root mean square error of approximation (RMSEA) and the Root Mean Square Residual (RMSR) were used. Both RMSEA and RMSR indicate better model fit with lower values. The range of the RMRS is calculated based upon the scales of each indicator, and it can be difficult to interpret [30]. The RMSEA, instead, always ranges from 0 to 1, with several cut off points proposed: 0.08 [31], 0.07 [32], or .06 [33] show a good fit.

For estimations of internal consistency, Cronbach’s alpha and McDonald's Omega (ω [34] were computed. Furthermore, evidence of external validity was obtained with Spearman’scorrelations between the scale and age, BMI, and DEBQ were calculated.

Results.

Descriptive statistics of the items are shown in Table 1.The highest mean score was obtained for item 12, which states that the most important thing for losing weight is what a person does for oneself. The lowest mean score was obtained for item 15, which states that gaining weight is a matter of destiny. The assessment of the distribution of data showed that our data is characterized by a non-normal distribution (Skewness range:-2.17-3.03; Kurtosis range:-1.04-11.48).

INSERT TABLE 1 HERE

Results of model fit can be seen in Table 2.Models 3, 4 and 5 factors showed an adequate fit, with RMSEA and RMSR values under .07. When factor loadings were examined, items in Model 3 showed a similar pattern of relations to the one proposed by the original authors of the MHLC. Furthermore, this was the most parsimonious solution and differences in RMSEA and RMSR between this model and Models 4 and 5 were negligible. Thus, Model 3 was retained as it was the most parsimonious solution and appropriately represented the structure of data.

INSERT TABLE 2 HERE

The resulting structure coincided with the one proposed by the authors for the Form A and B of the MHLCS[21], except for three items that showed cross-factor loadings and were removed. As shown in Table3, items 1, 6, 8, 12, and 17 had statistically significant and higher factor loadings in factor 1 (internal); items 3, 5, 7, 14, 18 in factor 2 (powerful others); and items 4, 9, 11, 15, and 16 in factor 3 (chance).Items with cross-factor loadings were item 2 (loading in factors 1 and 2), item 10 (factors 2 and 3); and item 13 (similarly loading in the three factors). The "Internal" factorrefers to a person´s beliefs that his/her body weight is dependent upon his/her own actions. The "chance" factor refers to a person´s beliefs that his/her body weight is determined by external forces that are beyond his/her control like fate, luck or destiny. The "powerful others" factor refers to a person´s beliefs that his/her body weight is determined by the influence of doctors or others such as friends and family.

INSERT TABLE 3 HERE

Cronbach´s alpha estimates for the three subscales of the MWLCS were .72 for the internal factor, .82 for the chance factor,and .65 for the powerful others factor. McDonald's Omega, in turn, showed values of .82, .89 and .71, respectively. The Spearman's correlations of the three sub-scales of the MWLCS with demographic variables and DEBQ are shown in Table 4. "Internal" correlated positively with restraint eating. "Chance" factor did not show statistically significant correlations. Finally, "Powerful Others" factor positively correlated with BMI, emotional eating, restraint eating, and external eating.

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Study 2 - Overweight and Obese Sample

Participants and procedure.

This is study used the baseline data within the frame of the PREDIMED-Plus study, a 6-year multicenter, randomized, parallel-group, primary prevention clinical trial conducted in Spain to assess the effect of an intensive weight loss intervention program based on an energy-restricted traditional Mediterranean diet, physical activity promotion and behavioural support (intervention group), compared to a usual care intervention and energy-unrestricted Mediterranean diet recommendations (control group). A more detailed description of the PREDIMED-plus study and the study protocol is available at http://predimedplus.com/wp-content/uploads/2016/07/Protocolo_PREDIMED_PLUS_eng_23112016_adl.pdf.

This study was registered at the International Standard Randomized Controlled Trial (ISRCT; http://www.isrctn.com/ISRCTN89898870) with number 89898870. All participants were recruited and randomized from October 2013 to April 2016 across 23 centres from different universities, hospitals and research institutes of Spain. Each of these centres recruited participants from several Primary Care Health Facilities belonging to the National Health System. The eligible participants were community-dwelling adults (aged between 55 and 75 years in case of men; and between 60 and 75 years in women) with overweight/obesity (BMI between 25 and 40 kg/m2), who met at least three components of the metabolic syndrome according to the updated harmonized criteria of the International Diabetes Federation and the American Heart Association and National Heart, Lung and Blood Institute [35]. Specific PREDIMED-plus exclusion criteria can be found in the website http://predimedplus.com/en. Participants included in the current analysis provided data on cognitive performance and depressive symptoms, as well as detailed specification of BMI, physical conditions and sociodemographic data. Additionally, glucose and HbA1c concentrations were measured at the same time point of the mood and cognitive assessment. All participants provided written informed consent, and the study protocol and procedures were approved according to the ethical standards of the Declaration of Helsinki by the Research Ethics Committees from all the participating institutions.

Exclusion criteria for the present analysis were: (1) reported dementia (2) head trauma, learning disability or intellectual disabilities; (3) presence of depression or a lifetime mental disorder according to DSM-5. Finally, all the included participants presented glucose levels within the normal range during the neuropsychological assessment. Overall, 633 patients (322 women) voluntarily agreed to participate in our study and signed the informed consent. Out of them, 558 participants fulfilled the weight criteria and were categorized into: overweight (25 < BMI < 29.99; N = 170), obese class I (30 < BMI < 34.99; N = 266), and obese class II (35 < BMI < 39.99; N = 122) patients. Mean age was 65.47 (SD=4.81). BMI means were 28.31 kg/m2 (SD = 1.05; overweight), 32.46 kg/m2 (SD = 1.40; obese class I), and 37.27 kg/m2 (SD = 1.56; obese class II), respectively.

Instruments.

Participants completed demographic questions, screening questions for eating disorders and the MWLCS, as in Study 1.

Data analysis.

Descriptive statistics were computed for all MWLCS items in each of the different subsamples or weight groups. The factorial structure obtained in Study 1 was tested via Confirmatory Factor Analysis (CFA) in each of the subsamples. Model fit was assessed using several fit criteria, as recommended in the literature [33, 36]: (a) Chi square statistic [30]; (b) the comparative fit index (CFI), with values of more than .90 indicating a good representation of the data (and, ideally, .95[33]); and (c) the root mean squared error of approximation [RMSEA, 37], with values of .08 or less for an excellent fit (the RMSEA uses errors of prediction and measurement to assess the degree of match between the hypothesized and true models).

Once the factorial structure was tested across the three groups of weight, the invariance routine was carried out. Following [38,39] recommendations, measurement invariance of factor loadings, intercepts and means was tested. Firstly, the *configural or baseline model* was tested, with the three-factor structure estimated in the three weight subsamples. This model goodness of fit is used as the baseline fit to which compare the rest of the models. Secondly, *weak or metric invariance* was evaluated. In this model factor loadings are constrained across samples. Thirdly, the *strong or scalar invariance model* was tested. In this model the intercepts are constrained across samples. If the model is tenable, it means that both the meaning (factor loadings) and the levels of the underlying items (intercepts) are equal across groups. Finally, and if scalar invariance holds, correlations among factors can also be constrained, pointing the same relation among the constructs in the different groups of weight. If the scalar model holds, latent mean comparisons can be compared across groups.

Models included in the invariance measurement routine were compared both with chi-square differences and with CFI differences. These latest are subjective criteria, which have been lately recommended to make inferences on the differences between models

[40] argued that a CFI difference of 0.050 or less could be considered negligible, whereas other authors suggested that this difference should not exceed 0.010[41]. All the models were performed with Mplus 8.1[31]. Again, weighted least square mean and variance adjusted (WLSMV) estimation was used. For reliability estimations, we used Cronbach's alpha and McDonald's omega for each of the dimensions.

Results.

Item statistics for each subsample are shown in Table 1. The CFA models with the three-factor structure obtained in Study 1 showed adequate fit in the three subsamples of weight, as it is shown in Table 5.

INSERT HERE TABLE 5

Once the model was tested in the three subsamples with adequate results, the invariance measurement routine was carried out. The configural model fitted the data adequately (see Table 5), and it was consequently retained as the baseline model. When metric invariance was tested, statistically significant differences were found between the chi-squares, but the CFI and the RMSEA slightly improved. Following Little [40] and Cheung and Rensvold [41]criteria the metric invariance model was retained. Then, scalar invariance was tested. Again, statistically significant differences were found between the chi-squares, but with a small decrease in the CFI (.010), complying with both Little [40] and Cheung and Rensvold [41] criteria, and an improvement in the RMSEA was observed. Finally, a scalar model with constrained correlations was tested, with statistically significant differences between chi-squares, but a small increase in CFI and RMSEA. Thus, the scalar invariant model with constrained correlations was retained as the most parsimonious model, with its factor loadings and intercepts presented in Table 6.

INSERT HERE TABLE 6

As the scale was metric invariant across groups, means comparisons can be made at latent level. Overweight, obese class I, and obese class IIdid not show differences in levels of internal and chance. They showed, however, differences regarding the powerful others level. Compared to overweight, obese class I showed higher levels on the dimension of powerful others: mean difference = 0.694, standard error = 0.223, p = .002. Obese class II also showed greater levels of powerful others when compared to the overweight sample: mean difference = 1.461, standard error = 0.339, p< .001. Finally, evidence of reliability was gathered. As the scale offered evidence of scalar invariant, they were calculated with data from the three groups merged. Cronbach's alpha values were .659 for internal, .798 for chance, and .500 for powerful others. McDonald's omega, in turn, had values of .806, .891, and .617, respectively.

Discussion

This study aimed to estimate the psychometric properties of a weight LOC questionnaire based on an adaptation of Form C of the MHLCS, infour different samples (normal weight, overweight, obese class I, and obese class II), coming from two different studies. The results of the EFA with the normal weight population sample and the CFA carried out with the overweight and obese samples supported a three-factor structure composed by the Internal, Chance, and Powerful Others factors, as in forms A and B of the MHLCS. It should be pointed out that in the form C the factor powerful others was divided between “doctors” and “Others”, which means that they differentiatebetween medically trained personnel, and of other people in a manner that they do not when considering their more general health. In the present scale we are not actually measuring a specific medical or health related condition, but a specific health behavior like weight LOC, furthermore it scale has not been used out of a specific medical condition.

This factorial structure showed, however, low factor loadings for items 5 (“I am directly responsible for the increase or decrease of my weight”) and 7 (“If my weight increases it's my own fault”), from the Powerful Others factor. Because of this, the reliability of this dimensions was also limited. However, this was the dimension with better evidence of external validity, being positively related to BMI, emotional eating, restraint eating, and external eating. Because of these reasons, the dimensions was maintained. However, further studies should examine the items composing the scale, in order to better comprehend if the poor contribution to these items to Powerful Others can be generalized to other populations.

Results regarding measurement invariance pointed the absence of measurement bias when groups of different weight conditions were compared. This is of special importance in order to take group mean comparisons [42], in this case across groups with diverse weight problems. This is the first time the invariance measurement of the scale is tested. As the scale showed evidence of scalar invariance, latent means were compared, showing higher levels of Powerful Others for those samples with higher weight (specifically, the obese class I and obese class II groups). This is in line with previous literature, which has pointed the relationship between LOC and weight gain [9-12] This is, as far as we know, the first time evidence in this regard has been pointed in an measurement error-free context, and with a specific scale for populations with weight problems.

It is interesting to note how internal control and restrained eating correlates. This eating style which us related to eating disorders [43] and also, is predictor of weight gain [44]. In fact, in previous literature internal LOC has shown also a particular negative associations in specific samples, for example, high internal LOC has shown to be related to a difficulty in adapting to family life and marriage and stress, or even can be maladaptive in individuals facing a severe illness[45], or has shown correlations with increased depression and anxiety in terminally ill cancer patients [46].

"Powerful others" factor, showed a significant and positive correlation with BMI, and eating styles, including restrain eating.These means that the relationship between restrained eating and LOC is more complex than expected, and it need further analysis to check, for example, which is the ideal LOC to engage in a treatment.In fact, the results between powerful others and eating behaviors are expected. Eating behaviors refers to a complex interplay amongst physiological, psychological, social and genetic factors that influence food preferences and quantity of food intake [47], and show strong associations with obesity and eating disorders [43]. In fact, the relationship between external LOC and worst mental health has been proved in previous literature, in other health conditions like prenatal depression[48], infertility[49], anxiety [50]or in general population[51].

Some limitations of the study should be considered. First, test-retest analysis were not conducted and therefore further information about the stability of the scale is needed.Second, data in this study is cross-sectional, which means that no firm conclusions about the directionality of the obtained associations can be drawn. Third, for the study with the overweight and obese population, further questionnaires should have been administered in order to obtain more detailed information regarding their general health, eating attitudes and eating styles. Fourth, we cannot measure sensitivity of the measure, further studies should include this type of analysis. And, finally, the Powerful Others factor has shown some problems regarding items 5 and 7. Further studies on the behavior of this dimension in samples from other populations and cultures would be welcomed.

Conclusion

In conclusion, the results with the Spanish MWLCS show that weight LOC is a multidimensional construct composed by three factors and this scale has proven to be a valid measure of LOC regarding weight. Furthermore, the scale has shown to be scalar invariant across samples with different weight conditions, and its use seems to be applicable when designing interventions for overweight or obese individuals. It is important for dietitians, doctors, psychologists and practitioners to consider this evaluation when designing interventions for patients who are overweight or obese and for researchers when targeting this population. Furthermore, there are no previous studies analyzing weight LOC in obese Spanish sample. Spain, like the rest of the Europe shows an alarming increase in obese population, with impact of health response and economic costs. A deeper understanding about the attitudes and beliefs about weight, and its possible impact over weight loss treatment could generate better response and programs to understand and treat obesity. It has important clinical implications as it offers relevant information for a better understanding of certain behaviors and it enables to create more specific and adequate treatment guidelines for our patients.

Compliance with ethical standards

The study protocol and procedures were approved according to the ethical standards of the Declaration of Helsinki by the Research Ethics Committees from all the participating institutions.

Conflict of interest

The authors declare that they have no conflict of interest.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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Table 1: Means (M), Standard deviation (SD), Skewness (Sk), and Kurtosis (K), for all MWLCS Items and Dimensions in each of the samples under study

	Study 1				Study 2											
	Normal weight				Overweight				Obese Class I				Obese Class II			
Variables	M	SD	Sk	K	M	SD	Sk	K	M	SD	Sk	K	M	SD	Sk	K
LC1	4.72	1.21	-1.46	1.98	4.63	1.50	-1.07	.19	4.68	1.54	-1.22	.49	4.84	1.40	-1.36	1.09
LC2	2.51	1.53	.98	-.08	2.84	1.82	.48	-1.22	2.71	1.73	.52	-1.15	2.71	1.63	.61	-.83
LC3	2.39	1.31	.55	-.86	3.54	1.79	-.21	-1.37	3.68	1.80	-.25	-1.38	4.00	1.61	-.55	-.90
LC4	1.65	.90	1.87	*4.59*	2.05	1.48	1.25	.41	2.00	1.53	1.44	.85	1.97	1.34	1.38	1.02
LC5	1.80	.94	.96	-.04	2.39	1.58	.78	-.65	2.84	1.76	.50	-1.16	3.66	1.83	-.20	-1.40
LC6	4.75	1.13	-1.38	2.14	5.05	1.44	-1.76	2.22	5.15	1.22	-1.83	*3.04*	4.98	1.35	-1.67	2.30

LC7	2.45	1.49	.60	-.90	2.40	1.69	.80	-.80	2.76	1.81	.43	-1.38	2.83	1.71	.40	-1.23
LC8	4.38	1.30	-.83	.13	4.83	1.53	-1.39	.95	4.95	1.50	-1.52	1.26	4.82	1.47	-1.25	.70
LC9	1.62	.84	2.05	*6.34*	1.72	1.37	2.00	2.99	1.76	1.36	1.87	2.45	1.97	1.47	1.50	1.18
LC10	1.34	.69	2.38	*5.78*	2.02	1.51	1.37	.66	2.19	1.63	1.13	-.17	2.55	1.76	.73	-.90
LC11	1.40	.65	2.13	*6.89*	1.69	1.34	2.14	*3.67*	1.76	1.40	1.91	2.61	2.03	1.52	1.39	.70
LC12	5.27	1.06	-2.27	*5.84*	5.39	1.19	-2.61	*6.72*	5.33	1.15	-2.31	*5.33*	5.23	1.25	-2.13	*4.28*
LC13	1.93	1.23	1.27	.65	3.64	1.84	-.21	-1.43	3.98	1.72	-.54	-.95	4.33	1.62	-.77	-.48
LC14	4.07	1.25	-.65	.06	5.01	1.37	-1.66	2.16	5.19	1.21	-1.88	*3.25*	5.34	.97	-2.27	*6.75*
LC15	1.33	.68	2.31	*5.33*	1.57	1.11	2.44	*5.91*	1.61	1.16	2.24	*4.55*	1.76	1.20	1.58	1.65
LC16	1.35	.62	1.91	*3.93*	1.77	1.46	2.03	2.96	1.84	1.43	1.69	1.70	2.11	1.51	1.27	.46
LC17	4.82	1.33	-1.37	1.23	5.30	1.22	-2.32	*5.18*	5.24	1.35	-2.06	*3.35*	5.43	.97	-2.32	*6.51*
LC18	2.80	1.43	.23	-1.21	3.41	1.74	-.09	-1.36	3.86	1.74	-.50	-1.08	4.29	1.49	-.83	-.08

Internal	4.79	0.83	-0.70	0.19	5.02	0.94	-1.56	2.97	5.06	0.92	-1.26	1.51	4.86	0.68	0.12	-1.04
Chance	1.47	0.57	1.59	*3.52*	1.77	0.95	1.41	1.61	1.80	1.03	1.70	2.98	2.54	1.33	0.56	-0.10
Powerful	2.70	0.83	-0.09	-0.68	3.35	0.91	-0.22	-0.21	3.67	0.98	-0.12	-0.53	3.66	0.75	-0.98	2.08

Note: Discrepant values of Skewness and Kurtosis are marked in italics.

Table 2: EFA Results for 1 to 5 Factors Solutions with Promax rotation

	χ^2	df	*p*	RMSEA	RMSR
Model 1	705.719	135	< .001	.176	.190
Model 2	263.379	188	< .001	.095	.094
Model 3	167.537	102	< .001	.069	.067
Model 4	131.414	87	.001	.061	.056
Model 5	93.910	72	.051	.046	.044

Notes: Model 1 = one-factor solution; Model 2 = two-factor solution; Model 3 = three-factor solution; Model 4 = four-factor solution; Model 5 = five-factor solution. RMSEA = Root mean square error of approximation (RMSEA); RMSR = Root Mean Square Residual.

Table 3: Factor loadings in the three-factor solution obtained in the EFA.

	F1	**F2**	**F3**
LC1	**.520**	-.042	-.206
LC2	-.399	-.321	.179
LC3	.116	**.578**	.090
LC4	-.274	.097	**.716**
LC5	.167	**.632**	.031
LC6	**.847**	.233	..264
LC7	.242	**.500**	.319
LC8	**.776**	.155	-.246
LC9	-.184	.158	**.865**
LC10	.039	*.552*	*.668*
LC11	-.291	.075	**.801**
LC12	**.657**	.226	-.252
LC13	*.365*	*.422*	*.344*
.179LC14	.149	**.556**	-.047
LC15	-.442	-.101	**.829**
LC16	-.228	.130	**.827**
LC17	**.634**	.253	-.093
LC18	.158	**.577**	.259

Notes: Higher factor loadings have been marked in bold. Cross factor loadings have been marked in italics.

Table 4: Spearman´s Correlations between the three subscales of the MWLCS and other demographic variables and questionnaires

	INTERNAL	CHANCE	POWERFUL OTHERS
Age	.111	-.142	.014
BMI	.090	-.074	.294**
DEBQ Emotional eating	.019	-.008	.245*
DEBQ Restraint eating	.222*	-.060	.398**
DEBQ External eating	-.119	.082	.326**

Notes: * $p < .05$; ** $p < .01$. DEBQ = Dutch Eating Behavior Questionnaire.

Table 5. Confirmatory factor analyses and set of nested models to test for measurement invariance

	χ^2	df	*p*	CFI	RMSEA	RMSEA CI	ΔCFI	Δ χ^2	Δdf	*p*
CFA overweight sample	174.496	87	< .001	.921	.078	[.061, .095]	-	-	-	-
CFA obese class I sample	210.084	87	< .001	.941	.074	[.061, .086]	-	-	-	-
CFA obese class II sample	128.363	87	.002	.967	.063	[.038, .086]	-	-	-	-
Configural invariance	574.632	264	<.001	.930	.080	[.071, .089]	-	-	-	-
Metric invariance	597.500	291	<.001	.931	.076	[.067, .085]	.001	52.449	27	.002
Scalar invariance	778.671	429	<.001	.921	.067	[.059, .074]	-.010	176.786	138	.001
Scalar invariance with constrained correlations	765.022	435	<.001	.925	.065	[.057, .072]	.004	176.786	13	.004

Note: CFI = Comparative Fit Index; RMSEA = Root Mean Squared Error of Approximation; RMSEA CI = RMSEA 90% confidence interval.

Table 6. Unstandardized and standardized factor loadings and intercepts' thresholds for the scalar invariant model with constrained correlations

Item	Factor loadings				Intercepts				
	UN	ST over-weight sample	ST obese class I sample	ST obese class II sample	ν_1	ν_2	ν_3	ν_4	ν_5
1	1.000	.707	.544	.494	-1.853	-1.483	-1.202	-0.642	0.305
2	---	---	---	---	---	---	---	---	---
3	1.000	.707	.422	.446	-0.851	-0.380	-0.075	0.413	1.320
4	1.000	.707	.564	.620	0.280	0.835	1.209	1.695	2.138
5	0.257	.249	.277	.295	-0.315	0.169	0.430	0.863	1.387
6	1.527	.837	.800	.759	-2.854	-2.541	-2.131	-1.527	-0.151
7	0.162	.159	.178	.190	-0.119	0.243	0.419	0.883	1.545
8	0.928	.680	.629	.578	-1.945	-1.660	-1.353	-0.858	-0.028
9	1.459	.825	.838	871	0.814	1.703	2.118	2.591	3.282
10	---	---	---	---	---	---	---	---	---
11	1.325	.798	.812	.850	0.793	1.586	1.975	2.438	2.896
12	1.033	.718	.669	.619	-2.440	-2.207	-2.056	-1.562	-0.491
13	---	---	---	---	---	---	---	---	---
14	0.994	.705	.744	.766	-2.307	-1.883	-1.654	-0.892	0.319
15	1.416	.817	.830	.865	0.894	1.971	2.476	3.112	3.666
16	1.539	.839	.851	.882	0.729	1.669	2.009	2.619	3.118
17	1.272	.786	.743	.697	-2.684	-2.306	-2.165	-1.680	-0.583
18	0.509	.453	.496	.521	-0.865	-0.463	-0.235	0.439	1.327

Notes: UN= unstandardized estimates (constrained to equality across samples); ST= standardized estimates. All factor loadings were statistically significant ($p < .001$).