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An examination of the factor structure of the Goldfarb Fear of Fat Scale in clinical and non-clinical samples of Polish women

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ABSTRACT

Although associations between fear of fat and eating disorders (ED) have been frequently studied, it appears that the construct of fear of fat requires in-depth understanding to determine whether it is similar in individuals diagnosed with bulimia nervosa, anorexia nervosa, and individuals from the general population. The purpose of our study was to confirm the factor structure of the Goldfarb Fear of Fat Scale (GFFS) in clinical and non-clinical settings. This issue has not yet been investigated in the literature. Data were collected from 126 female patients diagnosed with ED and a total of 581 women from the general population. Our findings are highly consistent with the original single-factor structure of GFFS but only in the clinical sample. In the non-clinical sample, a good fit to the data has been achieved with a two-factor model composed of Fear of gaining weight and Fear of losing control over eating/weight. The Polish version of GFFS demonstrated good psychometric properties. It can be used as a fast screening tool to identify individuals with eating disorders and those at risk of developing such disorders. We recommend the two-factor model for non-clinical samples and the one-dimensional model for clinical samples for both research and practice.

1. Introduction

In the search for an answer to the question what motivates women to engage in weight-loss dieting (Chow et al., 2019; Dalley & Buunk, 2009, 2011; Dalley et al., 2012; Levinson & Byrne, 2015; Levinson & Rodebaugh, 2012; Woud et al., 2011) research has been conducted both in clinical (Cooper et al., 2007; Rushford, 2006; Linardon et al., 2018) and non-clinical samples (Chow et al., 2019; Dalley & Buunk, 2009, 2011; Dondzilo et al., 2019; Rodgers et al., 2018).

Fear of fat is a frequent experience, especially among women, and is often associated with a spectrum of eating disorders (ED), ranging from problematic eating patterns in the general population to eating disorder psychopathology in clinical samples (e.g., drastic calorie restriction, using a food substitute, skipping meals, vigorous or compulsive exercise, laxatives, oral diuretics - Linardon et al., 2018; Tuffa et al., 2020). Fear of fat is associated with eating disorders observed in individuals with bulimia nervosa or anorexia nervosa (Chernyak & Lowe, 2010; Goldfarb et al., 1985) and it is used as a diagnostic criterion for these disorders (cf. Chow et al., 2019; Cooper et al., 2007; Woud et al., 2011).

Fear of fat has also been reported in non-clinical settings. It can be useful in predictions of restrictive eating (e.g., as an indicator of the development of bulimic symptomatology in adolescent girls - Bennett et al., 1991). The source of the fear of fat is the stigmatization of female obesity associated with the discrimination against overweight individuals in modern Western societies (Flynn, 1997). A stereotypical image of femininity in the Western media is dominated by the thin body, which consequently leads to the formation of anti-fat attitudes in many women (Jarman et al., 2021; Selensky & Carels, 2021; Webb et al., 2016; Woud et al., 2011). The tendency to internalize these sociocultural attitudes toward women's body shape can activate two motivational orientations: approaching the thin ideal (drive for thinness) and avoiding the stigma of fatness (fear of fat) (Dondzilo et al., 2019; Levitt, 2003, 2004).

Recent findings suggest that fear of fat is one of the key motivational factors in the development of eating disturbances (Chow et al., 2019) and may play a crucial role in the potential onset or

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maintenance of eating disorder symptoms compared to the drive for thinness (Dondzilo et al., 2019). It is important to note that women with more fear of fat engage in more restrained eating (Chow et al., 2019). The study of Dalley and Buunk (2009, p. 217) has provided evidence that women who engage in frequent dieting for the purpose of weight-loss tend to do so to avoid becoming fat, rather than to be thin. These findings are consistent with other studies in non-clinical samples, according to which people who restrict themselves in eating are more strongly motivated by a desire to avoid weight gain than by a desire to achieve an extremely low body weight (Chernyak & Lowe, 2010). In the case of individuals with bulimia nervosa their motivation is both to avoid fatness and to achieve thinness (Chernyak & Lowe, 2010).

Researchers have used several concepts similar to the fear of fat, such as feeling fat (Cooper et al., 2007; Linardon et al., 2018), fear of gaining weight (Rushford, 2006; Slof-Op't Landt et al., 2017), or fat phobia (Robinson et al., 1993). While these concepts may appear similar, they call attention to slightly different elements. Feeling fat is a subjective somatic sensation of having excessive weight, which does not necessarily reflect an actual amount of body fat (see Mehak & Racine, 2019). This construct consists of many components, including physical body sensations, excessive attentiveness to one's body, a perceived sense of inadequacy, the fear of being judged (Major, Viljoen, & Nel, 2019). Fear of gaining weight, in turn, is one of the essential diagnostic criteria for anorexia nervosa (i.e., DSM-IV, see also Rushford, 2006; Linardon et al., 2018). However, not all patients treated for this eating disorder report weight-related concerns (e.g., nonfat phobic anorexia nervosa - Borgers et al., 2021; Carter & Bewell-Weiss, 2011). The importance of fear of weight gain for the onset and maintenance of eating disorders has been the subject of intense research in recent years (Borgers et al., 2021; Carter & Bewell-Weiss, 2011; Rodgers et al., 2018; Rushford, 2006). Fear of gaining weight and fear of fatness seem to be connected since they have in common the emotional motivation to take action to reduce or maintain weight. However, fear-based motivation may be a barrier to healthy eating behaviors due to sociocultural pressures for socially desirable body shape and weight. Experiencing weight stigma may cause stress and negative emotions that impede the ability to effectively self-regulate food intake and engage in positive health behaviors (Major et al., 2020). Fat phobia, weight stigma, and weight bias refer to negative social attitudes, stereotypes, and discrimination against people based on their weight (Lacroix, Alberga, Russell-Mathew, McLaren, & von Ranson, 2017; Lee, Hunger, & Tomiyama, 2021; Pearl et al., 2018; Pearl & Puhl, 2014; Robinson, Bacon, & O'Reilly, 1993; Tomiyama et al., 2018) and have several negative consequences for psychological well-being and physical health (Puhl et al., 2021; Tomiyama et al., 2018; Major et al., 2020). Robinson et al. (1993, p. 468) stated that fat phobia is "a pathological fear of fatness". Stigmatizing experiences can negatively affect body image, self-esteem, and overall psychological functioning and are never justified even if they might motivate certain individuals to change eating behaviors (Latner et al., 2009).

In this article, we focus on the concept of fear of fat and its measurement. Although fear of fat is one of the key motivational factors in developing eating disorders (Dondzilo et al. 2019; Levitt, 2003), still "relatively little is known about how the experience of feeling fat differs in clinical and non-clinical groups" (Cooper et al., 2007, p. 366; see also Linardon et al., 2018). The phenomenon of fear of fat requires further research and deepening of the understanding of subjective experiences among women in clinical and non-clinical samples (Ambwani et al., 2007; Dalley & Buunk, 2011; Linardon et al., 2018; Woud et al., 2011). Given the evidence of the influence the fear of fat can have on weight control behaviors, measures used to assess the fear of fat must be valid and reliable. It is critical to fully understand the interrelationships between the fear of fat and problematic eating behaviors in women with ED in clinical samples and women in the general population (non-clinical samples).

Research into fear of fat has generally relied on self-report measures (Woud et al., 2011). One of the better-known scales for measuring the fear of fat is the Goldfarb Fear of Fat Scale (GFFS; Goldfarb et al., 1985). The GFFS was used by researchers in numerous studies in both clinical (e.g. Chernyak & Lowe, 2010; Latner, 2008; Latner et al., 2009; Osman et al., 2006; Rushford, 2006; Shaw et al., 2012) and non-clinical samples (e.g. Ambwani et al., 2007; Abrams et al., 1993; Akan & Grilo, 1995; Bennett et al., 1991; Lewis et al., 1997; Osman et al., 2006; McLean et al., 2017; Rucker & Cash, 1992). However, to our knowledge, no research has been undertaken so far to examine whether the GFFS factor structure is the same in the clinical and non-clinical samples. For example, Ambwani et al. (2007) have presented evidence for uni-dimensionality of GFFS in a group of Spanish and Euro-American students with normal Body Mass Index (BMI). As a limitation of their study, they pointed out the homogeneity of their samples, suggesting the need to collect additional evidence about the factor structure of GFFS in clinical samples.

In view of potential differences in the experience of fear of fat in the clinical and non-clinical samples, it appears important to examine whether the structure of the GFFS measurement tool is the same in individuals diagnosed with bulimia nervosa, anorexia nervosa (clinical sample), and individuals from the general population (non-clinical sample). Therefore, the purpose of this study, conducted on Polish women, was to verify the reliability and validity of the Goldfarb Fear of Fat Scale (GFFS) in the clinical and non-clinical samples. We expected the Polish version of GFFS: (1) to have satisfactory reliability and validity, and (2) to maintain the single-factor structure of the original GFFS.

2. Method

2.1. Participants and procedure

The study comprised three groups of female participants: a clinical treatment-seeking sample with an eating disorder and two non-clinical samples from the general population. We decided to test two non-clinical samples to confirm the factor structure of the tool on a larger number of samples, and to check the structural stability. The study was conducted in Poland and all the participants were Polish residents. Data were collected from March 2017 to September 2019.

The research procedures complied with institutional and international ethical standards (Declaration of Helsinki) and were approved by the Ethics Committee of the University of Silesia in Katowice. The subjects underwent an informed consent procedure prior to completing the paper and pencil questionnaires. All the participants completed a brief demographic information questionnaire. No incentive was offered for participation in the study.

2.1.1. Eating-disorder participants: Clinical sample

A total of 135 female participants were recruited from clinical settings, such as Eating Disorders Therapy Centers or specialized hospital units in the South of Poland. Nine participants (6.7%) were excluded for excessive (over 50%) missing data. Patients meeting the following criteria: presence of psychotic symptoms and psychoactive substance abuse or addiction, were excluded. Therefore, the final dataset included 126 females. Patients were diagnosed with DSM-5 eating disorders at the treatment facilities by psychiatrists. Of 126 women with eating disorders, 49 (38.9%) met the criteria for anorexia nervosa (AN) restricting type, 33 (26.2%) met the criteria for anorexia nervosa binge eating/purging type, and 44 (34.9%) met the criteria for bulimia nervosa (BN). The subjects were a mean age of 24.4 years (SD = 4.7).

The average Body Mass Index (BMI = kg/m^2) was 19.1 (SD = 3.6, range: 13.6–29.4), with 11.1% of the sample very severely underweight (BMI < 15), 9.5% severely underweight (BMI 15–16), 26.2%

underweight (BMI 16 – 18.5), 44.5% normal weight (BMI 18.5–25), and 8.7% overweight (BMI > 25). All the subjects participated in treatment programs or psychotherapy for eating disorder, with 37 (29.3%) currently in inpatient treatment programs and the remaining 89 (70.6%) attending various forms of psychotherapy (individual and/or group psychotherapy). Most of them were simultaneously using pharmacology as supportive therapy (n = 81, 64.3%). More than one-third of subjects were hospitalized in the past (n = 47, 37.3%). Demographic characteristics of the participants are presented in Table 1.

2.1.2. Non-clinical sample (general population participants): Sample 1

The first non-clinical sample was composed of 296 female subjects with a mean age of 30.8 years (*SD* = 11.9). Participation was voluntary and anonymous. Women who agreed to take part in the study were aged ≥ 18. Subjects were recruited among female university students, their friends, and relatives. The announcement of recruitment of women for our study was also distributed by psychologists, educators, students who agreed to cooperate with our research team. The questionnaires were administered to participants individually. The mean Body Mass Index (BMI = kg/m^2) was 22.4 (*SD* = 4.3, range: 14.0–45.0). Most participants were high school or university graduates and reported living in medium-size or large cities (see Table 1).

2.1.3. Non-clinical sample (general population participants): Sample 2

The second non-clinical sample with a total of 287 subjects was recruited from the general population of women with a mean age of 34.3 years (*SD* = 13.6). The mean Body Mass Index (BMI = kg/m^2) was 22.9 (*SD* = 4.2, ranged 16.6–46.0). We used the same criteria of inclusion to the sample and a similar method of recruiting as in sample 1. Participants completed the questionnaires anonymously. Sample 1 and sample 2 were similar in terms of the education level and place of residence.

2.2. Measures

2.2.1. Goldfarb Fear of Fat Scale (GFFS)

The GFFS was designed by Goldfarb, Dykens and Gerrard (1985) to assess the individual's fear of weight gain and becoming fat (e.g. "My biggest fear is becoming fat"; "If I eat even a little, I may lose control and not stop eating"). It is a self-report measure consisting of 10 items assessed on a 4-point scale, from 1 = very untrue to 4 = very true. The original version of the GFFS has good test-retest reliability and discriminant validity (Goldfarb et al., 1985). The test is useful to differentiate between individuals with bulimia nervosa, chronic dieters, and non-dieting women. To evaluate the validity of the scale, Goldfarb et al. (1985) assessed female high school, college and university students, and eating disorders patients. Results showed that women with bulimia nervosa and anorexia nervosa scored significantly higher on the GFFS than the women from non-clinical samples. The original scale is one-dimensional (Goldfarb et al., 1985).

The GFFS was translated from its original English version into Polish by a team of translators. Then, two professional English translators (one of whom was native English) made a back-translation. In the next step, another bilingual team compared and discussed the original and the back-translated version of the questionnaire to verify the semantic equivalence. There were no substantial differences between the original and back-translated versions. The GFFS was administered in both clinical and non-clinical samples.

Table 1
Sociodemographic characteristics of clinical and non-clinical participants.

Demographics	Clinical sample		Non-clinical sample 1		Non-clinical sample 2	
	N = 135		*N = 296*		*N = 287*	
BMI (*Mean / SD*)	19.1	3.6	22.4	4.3	22.9	4.2
Age (*Mean / SD*)	24.4	4.7	30.8	11.9	34.3	13.6
Marital status (n / %)						
Married	12	9.5	82	27.7	116	40.4
Cohabiting	31	24.6	109	36.8	83	28.9
Single	83	65.9	105	35.5	88	30.7
Place of residence *(n / %)*						
Village	25	18.1	62	20.9	63	22.0
Small city	16	11.6	52	17.6	48	16.7
Medium city	65	47.1	128	43.2	107	37.3
Large city	20	14.5	54	18.2	69	24.0
Education *(n / %)*						
Primary school	9	6.5	4	1.4	2	0.7
Vocational	80	58.0	12	4.1	15	5.2
High school	37	26.8	157	53.0	130	45.3
University degree	12	8.7	123	41.6	140	48.8

Note. Small city < 50 000 citizens; Medium city 50 000–300 000 citizens; Large city > 300 000 citizens

2.2.2. Trait Anxiety Scale (STAI)

The State-Trait Anxiety Inventory, STAI (Spielberger, 1983; Polish adaptation: Wrześniewski et al., 2006) is a self-rating measure of anxiety, consisting of two parts. In our study we used only one part of the inventory: the Trait Anxiety Scale (T-Anxiety), which evaluates relatively stable aspects of a general propensity to be anxious. The questionnaire consists of 20 items referring usual feelings towards oneself (e.g., "I am satisfied"; "I worry too much over something that really doesn't matter"). Respondents mark the answers on a 4-point scale (from almost never to almost always). The Trait Anxiety Scale was administered in the clinical and non-clinical samples. The STAI has evidenced good internal consistency in the clinical sample (α = .84), as well as in the non-clinical sample (α = .88). Exact values of the McDonald's omega and Cronbach's alpha reliability coefficients are presented in Table 2.

2.2.3. Eating Disorder Inventory-3 (EDI-3)

The Eating Disorder Inventory-3, EDI-3 (Garner, 2004; Polish adaptation, Żechowski, 2008) is a self-report questionnaire designed to assess the symptoms of eating disorders and the associated aspects of the personality as well as psychological traits relevant to eating pathology. The EDI-3 consists of 91 items and 12 subscales. Participants assess statements on a 6-point scale from 1 (always) to 6 (never). In our study, we decided to use the following subscales: The Drive for Thinness (DT, 7 items), Perfectionism (P, 6 items), Bulimia (B, 8 items), Body Dissatisfaction (BD, 10 items), and Interoceptive Deficits (ID, 9 items). The DT and P subscales were administered both in the clinical and non-clinical samples. Three remaining subscales were administered only in the clinical sample. Internal consistency for all the subscales was good in both samples: (α's = .86 –.91) in the clinical, and (α's = .80 –.86) in the non-clinical one.

2.2.4. The Rosenberg Self-Esteem Scale (RSES)

The Rosenberg Self-Esteem Scale, RSES (Rosenberg, 1965; Polish adaptation Łaguna et al., 2007) consists of 10 items to assess global feelings of self-worth by measuring positive and negative feelings about self (e.g., "I feel I have a number of good qualities"). Responses are given on a 4-point scale (0 - strongly agree; 3 – strongly disagree). The scale was administered only in the non-clinical sample. Internal consistency for this measure was adequate (α = .77).

Table 2
Descriptive statistics and reliability coefficients.

	Clinical sample				Non-clinical sample 1				Non-clinical sample 2			
	M	*SD*	α	ω	*M*	*SD*	α	ω	*M*	*SD*	α	ω
Fear of fat (GFFS)	30.1	7.7	.90	.91	20.3	6.8	.87	.88	19.6	6.8	.88	.89
Fear of gaining weight (GFFS-GW)					13.7	4.7	.85	.85	13.6	4.7	.82	.83
Fear of losing control over eating/weight (GFFS-LC)					13.9	2.9	.82	.82	6.0	2.9	.87	.88
Trait Anxiety (STAI)	58.4	8.1	.84	.85	44.4	8.8	.88	.89				
Drive for thinness (EDI-DT)	32.6	8.3	.86	.87	22.8	6.0	.70	.79				
Perfectionism (EDI-P)	24.5	6.5	.80	.80	19.3	7.3	.74	.83				
Interoceptive Deficits (EDI-ID)	40.8	9.3	.84	.86								
Bulimia (EDI-B)	27.9	11.6	.91	.92								
Body Dissatisfaction (EDI-BD)	41.1	9.9	.87	.88								
Self-esteem (RSES)					21.4	4.5	.77	.84				

2.2.5. Satisfaction with body and weight

Satisfaction with body and weight were measured using single items that estimate subjective level of satisfaction with both aspects. Both items were evaluated on a 4-point scale (1 – not at all, 5 – very much), depending on the level of satisfaction. Both items were administered only in the non-clinical sample.

2.3. Statistical analyses

The JASP 0.1.11 was used to perform all the analyses presented in this article. To verify hypotheses 2, the 10-item GFFS scale was examined to assess uni-dimensionality and determine the best fit to the data in the clinical and non-clinical samples. Therefore, three separate confirmatory factor analyses (CFAs) were conducted to assess the goodness of fit of the single-factor model. A diagonally weighted least squares (DWLS) method was used to compute the parameters of the models, which is an appropriate estimator for ordinal or non-normal data (Christoffersson, 1975; Jöreskog & Sörbom, 1981). As for indicators of adequacy of fit, a comparative fit index (CFI) and Tucker–Lewis index (TLI) > .90, and root mean square error of approximation (RMSEA) < .08 were used (Hu & Bentler, 1998). We also reported the values of the chi-square test, together with their statistical significance, because some research showed that statistical insignificance of this statistics may be a helpful indicator to avoid misspecification of the model while using the DWLS estimation (Nye & Drasgow, 2011).

Wherever the results of the analysis indicated inadequate fit of the one-factor model in the non-clinical samples, we decided to closely examine the factor structure of the scale in the first non-clinical sample using exploratory factor analysis (EFA), and next assess the fit of the obtained model in the second non-clinical sample.

Exploratory factor analysis (EFA) was conducted to test the GFFS factor structure in the non-clinical sample. A parallel analysis was used to determine the number of factors. The main aim of the method was to generate variables for test sets by factor loadings and isolate such a number of components for which the eigenvalue is not lower than 95th percentile of the expected eigenvalue obtained by test sets (cf. Green et al., 2012). Because of non-normal distribution of data, we used minimum residual (MinRes) method to estimate the factor loadings (Jöreskog, 2003). Assuming a high level of similarity and shared variance between facets of GFFS, factor loadings were rotated using the Oblimin method. We considered factor loading as significant when its value was greater than.40 (Field, 2013).

After that, we ran CFA to determine the goodness of fit of the two-factor model in the second non-clinical sample and the clinical sample. The assumptions of that analysis were identical as in the previous stages. Next, we tested the measurement invariance of the scale in the two non-clinical samples. For this purpose, we conducted a multi-group confirmatory factor analysis. Four levels of the measurement invariance were tested: configural (identical factor structure), weak (equality of factor loadings), strong (equivalence between latent means), and strict invariance (invariance in residual variances; Brown, 2015).

We assumed that configural invariance is supported if the same factor structure simultaneously is presenting a satisfactory fit for both groups. The fits of following restricted models were compared in terms of their fit indices values. We assumed that a non-significant increase in the χ^2 value (relative to *df*) in the constrained model in comparison to the unconstrained model is indicating that the constrains across groups were possible. Also, we considered the change in both RMSEA and CFI coefficients, as those criteria are less sensitive to sample size distortion comparing to the $\Delta\ \chi^2$. If the drop in CFI of the constrained model relative to the unconstrained model is not exceeding.002, and simultaneously the increase in RMSEA is not exceeding.007, the constrained model is accepted (Meade et al., 2008).

To assess the reliability of the measure (also, to verify hypothesis 1), we computed Cronbach's α coefficients and McDonald's omega total coefficients. Also, to provide more comprehensive information about the reliability of the test, we computed Pearson's *r* correlation coefficients to check the test-retest reliability of the given test.

Finally, to verify criterion validity (hypothesis 1), we computed Pearson's *r* correlation coefficients to check relationships between GFFS and other questionnaires (see Section 2.2). However, we used Spearman's *rho* correlation coefficient to analyze the correlation between GFFS, body satisfaction, and weight satisfaction. The main reason for this decision was that both types of satisfaction were measured using an ordinal (4-point) scale, while Pearson's *r* requires that both correlated variables be interval variables.

3. Results

3.1. Descriptive statistics and reliability of the GFFS

Descriptive statistics (mean, standard deviation) and reliability coefficients for the GFFS and the validation measures are given in Table 2. The GFFS demonstrates satisfactory internal consistency (Table 2) for the clinical sample: α = .90 [95% CI:.875;.926], ω = .91. Average inter-item correlation is moderate: *r* = .48, with a lower correlation with the general score obtained for item 4 (*r* = .27). Also, the scale demonstrates satisfactory internal consistency for the both non-clinical samples - sample 1: α = .87 [95% CI:.852;.894], ω = .88; sample 2: α = .88 [95% CI:.855;.887], ω = .88. Average inter-item correlation is moderate (non-clinical sample 1: *r* = .42; non-clinical sample 2: *r* = .43), with the lowest correlation with the general score obtained for item 4 (non-clinical sample 1: *r* = .43; non-clinical sample 2: *r* = .46).

All the scales used in our analysis demonstrated satisfactory (equal or above.80) level of reliability. Also, regarding the non-clinical sample the GFFS showed excellent test-retest reliability (*n* = 119; general scores, as well as both subscales: *r* = .97, *p* < .001).

Table 3
Goodness of fit of the GFFS one-factor model: Confirmatory factor analysis.

	χ^2 (*df*)	χ^2 /*df*	CFI	TLI	RMSEA	90% CI RMSEA
Clinical sample	24.28 (35)	.69	1.00	1.00	.00	.000 – .025
Non-clinical sample 1	90.90*** (35)	2.60	.98	.97	.07	.055 – .092
Non-clinical sample 2	110.58*** (35)	3.16	.96	.95	.09	.069 – .105

Note. TLI = Tucker-Lewis index, CFI = Comparative Fit Index; RMSEA = root mean square error of approximation; RMSEA 90% CI = 90% confidence interval of the RMSEA; $\chi 2$ (*df*) = chi-square with degrees of freedom. * ** $p < .001$

3.2. Confirmatory factor analysis: One-factor model in clinical and non-clinical samples

Confirmatory factor analysis was performed to examine the factorial structure of the Polish version of the GFFS. The original one-factor model proposed by Goldfarb et al. (1985) was verified. Results of the analysis are presented in Table 3.

The results indicate a very good fit of the proposed model in the clinical sample: $\chi^2(35) = 24.28$, $p = .913$, $\chi^2/df = .69$, CFI = 1.00, TLI = 1.00, RMSEA = .00, 90% CI [.000,.025]. All items are significantly related to the general latent factor (all $p < .001$; fully standardized regression weights ranging from.28 to.88). However, the results indicate a borderline fit of the proposed one-factor model in the first non-clinical sample: $\chi^2(35) = 90.90$, $p < .001$, $\chi^2/df = 2.60$, CFI = .98, TLI = .97, RMSEA = .07, 90% CI [.055,.092]; and unsatisfactory fit for the second non-clinical sample: $\chi^2(35) = 110.58$, $p < .001$, $\chi^2/df = 3.16$, CFI = .96, TLI = .95, RMSEA = .09, 90% CI [.067,.105].

Also, modification indices (MI) calculated for the two non-clinical groups suggested the covariance between items within the model. It is recommended to correlate some indicators of latent construct if there is a reasonable justification for the existence of such covariation (Brown, 2015). However, in this case, MI suggested six covariations. Keeping in mind that the GFFS is relatively short (10 items), such changes seem to impact both parameters in the model and model hypothesized a priori, as there was no theoretical explanation for such modifications.

3.3. Exploratory factor analysis in the non-clinical sample

Both Bartlett's test of sphericity and Kaiser-Meyer-Olkin test showed that data were factorable and some inter-item correlations were moderate or high, χ^2 (45) = 1340.17; $p < .001$, KMO = .87. The results indicated that all items constitute three latent factors. One of them consists of two items, which cannot provide satisfactory reliability of the scale. Thus, we decided to fix the number of factors to two. In Table 4, rotated factor loadings for two-factor solution are presented.

The first factor is conceptualized as "Fear of gaining weight". It consists of seven items, for example "I believe there is a real risk that I will become overweight someday". The second factor is defined as "Fear of losing control over eating/weight". It consists of three items, for example "I feel like all my energy goes into controlling my weight".

It should be noted that item 7 ("There is nothing that I can do to make the thought of gaining weight less painful and frightening") had noticeably cross-loaded both factors, although its loading on Factor 2 was larger (.40 and.50, respectively). Also, this item did not seem conceptually related to the fear of losing control. In fact, it covers some negative emotional reactions regarding gaining weight. Therefore, having in mind this conceptual similarity, we decided to place this item within Factor 1.

Both facets have satisfactory level of reliability in two non-clinical samples (see Table 2). Also, both factors are strongly positively related: $r = .61$, $p < .001$ (see Table 7).

Table 4
Factor loadings for two-factor model (non-clinical sample 1): Exploratory factor analysis.

GFFS items	Factor 1Fear of gaining weight	Factor 2Fear of losing control over eating/ weight	Uniqueness
Item 1	**.95**	.	.20
Item 2	**.70**	.	.43
Item 3	**.64**	.	.51
Item 4	**.43**	.	.78
Item 5	**.52**	.	.61
Item 6	**.45**	.	.67
Item 7	**.40**	**.50**	.38
Item 8	.	**.86**	.29
Item 9	.	**.67**	.49
Item 10	.	**.81**	.38

Note. Uniqueness - the percentage of the variance of the given variable that is not explained by the latent factor. Factor loadings greater than.40 were bolded.

3.4. Confirmatory factor analysis: Two-factor model in the non-clinical sample

CFA was performed to confirm the factorial structure of the Polish version of the GFFS in the second non-clinical sample. The results indicate satisfactory fit of the two-factor model: $\chi^2(34) = 77.06$, $p < .001$, $\chi^2/df = 2.27$, CFI = .98, TLI = .97, RMSEA = .06, 90% CI [.047,.086]. Therefore, consistent with the outcome of the EFA, the CFA indicates that the two-factor solution seems to be more appropriate in the non-clinical sample.[4]

3.5. Measurement invariance of the two-factor model across two non-clinical samples

Next, we tested measurement invariance of the scale comparing to the results obtained in the non-clinical samples 1 and 2. In this case, measurement invariance was conducted as a replication test to ensure that the two-factor model proposed previously works equivalently across different non-clinical subsamples. Detailed results of the analysis are presented in Table 5.

The two-factor model shows satisfactory fit in both samples. Therefore, configural invariance is supported, confirmed by satisfactory values of fit indices: $\chi^2(66) = 115.74$, $p < .001$, RMSEA = .05, 90% CI [.035,.066], CFI = .99. Also, all levels of measurement invariance could be assumed across both groups, as evidenced by a non-significant drop in the model fit indicated by $\Delta\chi^2$ values. The changes in both RMSEA and CFI are inconsiderable, meeting the benchmarks assumed in the study and supporting the stability of the proposed factor structure in the non-clinical sample.

The both facets present satisfactory levels of reliability: $\alpha = .82$ [95% CI:.789;.853], $\omega = .83$ for Fear of gaining weight, and $\alpha = .87$ [95% CI:.843;.893], $\omega = .88$ for Fear of losing control over eating/weight, respectively.

[4] To make sure that fit of the proposed model is indeed satisfactory, we also checked the model fit in non-clinical sample 1. Results indicated satisfactory fit of the given model: $\chi^2(34) = 54.75$, $p = .014$, $\chi 2/df = 1.61$, CFI = .99, TLI = .99, RMSEA = .05, 90% CI [.021,.067]. Also, model performed satisfactory for two combined non-clinical samples: $\chi^2(34) = 122.33$, $p < .001$, $\chi 2/df = 3.60$, CFI = .98, TLI = .97, RMSEA = .06, 90% CI [.054,.080].

Table 5
Measurement invariance of the two-factor model across two non-clinical samples.

Model	χ^2 (*df*)	Δ χ^2 (Δ *df*)	RMSEA	RMSEA 90% CI	Δ RMSEA	CFI	Δ CFI
Configural	115.74*** (66)		.051	.035 –.066		.988	
Metric	124.88*** (78)	9.14 (12)	.045	.030 – .060	-.006	.989	-.001
Scalar	128.55** (85)	3.67 (7)	.042	.026 – .056	-.003	.990	-.001
Strict	135.32** (95)	6.77 (10)	.038	.022 – .052	-.004	.991	-.001

Note. CFI = Comparative Fit Index; RMSEA = root mean square error of approximation; RMSEA 90% CI = 90% confidence interval of the RMSEA; χ^2 (*df*) = chi-square with degrees of freedom; Δ = change from previous model. * $p < .05$; * * $p < .01$; * ** $p < .001$

Table 6
Correlations of GFFS with other measures (clinical sample) - Pearson's *r* coefficients.

		1	2	3	4	5	6	7
1	Fear of fat (GFFS)	–						
2	Trait Anxiety (STAI)	.44 * **	–					
3	Drive for Thinness (EDI-DT)	.76 * **	.50 * **	–				
4	Interoceptive Deficits (EDI-BD)	.55 * **	.61 * **	.56 * **	–			
5	Bulimia (EDI-B)	.55 * **	.34 * **	.42 * **	.49 * **			
6	Body dissatisfaction (EDI-BD)	.66 * **	.32 * **	.53 * **	.35 * **	.57 * **	–	
7	Perfectionism (EDI-P)	.36 * **	.28 * **	.18 *	.44 * **	.24 * **	.19 *	–

Note. * $p < .05$; * * $p < .01$; * ** $p < .001$

Table 7
Correlations of GFFS with other measures (non-clinical sample 1) - Pearson's *r* coefficients.

		1	2	3	4	5	6	7
1	Fear of fat (GFFS)	–						
2	Fear of gaining weight (GFFS-GW)	.94***	–					
3	Fear of losing control over eating/weight (GFFS-LC)	.84***	.60***	–				
4	Trait Anxiety (STAI)	.45***	.36***	.48***	–			
5	Drive for thinness (EDI-DT)	.74***	.71***	.59***	.39***	–		
6	Perfectionism (EDI-P)	.25***	.23***	.22***	.28***	.20***	–	
7	Self-esteem (RSES)	.40***	.34***	.39***	.72***	.36***	.17**	–

Note. * $p < .05$; * * $p < .01$; * ** $p < .001$

3.6. Criterion validity

The results in the clinical sample (Table 6) confirm strong, positive associations between the GFFS, and both the drive for thinness ($r = .76$, $p < .001$) and body dissatisfaction ($r = .66$, $p < .001$). In addition, the relationships between fear of fat, and other subscales of EDI-3 are also positive, but moderate, ranging from $r = .36$, $p < .001$ for correlation with perfectionism, to $r = .55$, $p < .001$ for correlations both with interoceptive awareness and bulimia.

The results in the non-clinical sample (Table 7) show moderate, positive associations between trait anxiety, GFFS ($r = .45$, $p < .001$), and it facets ($r = .36$, $p < .001$ and $r = .48$, $p < .001$, respectively). Also, drive for thinness is strongly positively related to both GFFS general score ($r = .74$, $p < .001$) and its subscales ($r = .71$, $p < .001$ and $r = .59$, $p < .001$, respectively).

Perfectionism measured by EDI-3 is weakly associated with GFFS ($r = .25$, $p < .001$) and its facets ($r = .23$, $p < .001$ and $r = .22$, $p < .001$, respectively). Finally, self-esteem is positively, moderately related to GFFS ($r = .40$, $p < .001$) and weakly associated with its facets ($r = .34$, $p < .001$ and $r = .39$, $p < .001$, respectively).

Also, regarding the non-clinical sample, we used Spearman's *rho* coefficient to assess the relationships between the levels of satisfaction with body, satisfaction with weight, and GFFS. Results (Table 8) show that GFFS is moderately associated with both satisfaction with body (*rho* = −.44, $p < .001$), and satisfaction with weight (*rho* = −.47, $p < .001$). Consistently, satisfaction with body was related to GFFS's facets (*rho* = −.43, $p < .001$ and *rho* = −.36, $p < .001$, respectively). Finally, satisfaction with weight was moderately related to GFFS's subscales (*rho* = −.36, $p < .001$ and *rho* = −.39, $p < .001$, respectively).

4. Discussion

The main aim of our study was to verify the psychometric properties of the Polish version of the GFFS in the clinical and non-clinical samples. We hypothesized the questionnaire: (1) to have satisfactory reliability and validity, and (2) to maintain the single-factor structure of the original GFFS in the clinical and non-clinical samples.

The first objective was to verify the reliability and validity of the Polish version of the GFSS in the clinical and in non-clinical samples. It has been found that GFFS is a reliable and valid measure for the assessment of fear of fatness. The Cronbach's α reliability for the clinical sample is.90 and for the non-clinical samples is also high (sample 1 α = .87; sample 2 α = .88). Therefore, the first hypothesis formulated in our study was supported. These results correspond closely with the findings of the authors of the original version of the GFFS (α = .85; Goldfarb et al., 1985) as well as reported by other researchers. For example, in non-clinical samples of Euro-American and Spanish women alphas were = .89;.88, respectively (Ambwani et al., 2007). Osman et al. (2006) reported similar psychometric properties (α = .88) in a non-clinical group of women and men. Convergent validity of the Polish version of the GFFS is corroborated by the positive, high correlation with the drive for thinness, both in the clinical and non-clinical samples. Correlation between the GFFS and other eating disorders measures (EDI-3) shows a high (body dissatisfaction scale) or moderate (bulimia scale) level in the clinical sample. These findings provide evidence of the criterion validity of scores.

The second objective was to confirm the factorial structure of the GFFS in both clinical and non-clinical samples. The results of the CFA

Table 8
Correlations of GFFS with other measures (non-clinical sample 1) - Spearman's *rho* coefficients.

		1	2	3	4	5
1	Fear of fat (GFFS)	–				
2	Fear of gaining weight (GFFS-GW)	.94***	–			
3	Fear of losing control over eating/ weight (GFFS-LC)	.84***	.60***	–		
4	Satisfaction with body	-.44***	-.43***	-.36***	–	
5	Satisfaction with weight	-.47***	-.45***	-.39***	.77***	–

Note. * $p < .05$; * * $p < .01$; * ** $p < .001$

indicate that the Polish version of the GFFS has the same unidimensional factor structure as the original GFFS developed by Goldfarb et al. (1985), but only in the clinical sample. In the non-clinical samples, a good fit is obtained with a model comprising two factors. The first factor encompasses six items measuring fear of gaining weight, whereas the second one consists of four items assessing fear of losing control over eating/weight. Therefore, the second hypothesis seems to be partially supported, with the restriction that unidimensionality can be confirmed only in the clinical sample.

Consequently, the factorial structure disclosed in this study differs from the one assumed by Goldfarb et al. (1985) for the general population of women. Our results indicate that there is a need in the non-clinical samples to divide the scale and define two narrower subscales: Fear of gaining weight and Fear of losing control over eating/weight. Thus, the fear of fat has a crucial twofold motivational ingredient that drives women to engage in dieting or dysfunctional eating behaviors with main intention to control food intake. For women who do not have eating disorders (non-clinical sample), these two fear-related motivational components play an important role in weight control behaviors. These findings are in line with the general concept of fear of fat in people with eating disorders. Goldfarb et al. (1985, p. 332) emphasized that "anorectic and bulimic patient's chief complaint is typically a fear of losing control and becoming fat", although they did not clearly identify the components of the fear of fat. We believe that the results of our study have shed some light on the factorial structure of fear of fat in specific clinical and non-clinical samples with eating problems.

This study has several strengths. First, similarly to the original GFFS, the Polish version of the GFFS has shown good psychometric properties. Secondly, to our knowledge, this is the first attempt to test the one-factor structure of the GFFS both in clinical and non-clinical samples. The revealed differences in factor structure of GFFS raise some questions regarding theoretical interpretation of this construct, which may be interpreted differently in both groups. Therefore, a more comprehensive discussion regarding the structure of fear of fat would be needed. Another strength of this investigation is a relatively large sample of women from the general population, which could enhance the generalizability of the findings and adequacy of sampling.

Understanding the complexity of factorial structure can have theoretical as well as practical consequences. Our findings can be useful for health promotion specialists, counselors, and researchers involved in eating disorder studies. Although the fear of fat is a common experience among women in general and clinical populations, there can be differences in the level of fear of fat and assessing its components. In a clinical setting, the fear of fat is interpreted as one general factor. In the non-clinical populations we can analyze it more precisely as it consists of two components: fear of gaining weight and fear of losing control over eating/weight.

Assessment of fear of fat in individuals, particularly young women, is essential to deepen our understanding of the motivations for restrained eating (Levitt, 2003) and promoting healthy eating behaviors (Chow et al., 2017). The identification of a two-factor solution in the general female population enables a more in-depth analysis of the motivation for dieting based on fear of fat. Therefore, this tool can be used to screen individuals at risk for eating disorders. Roth and Armstrong (1993) suggested that a questionnaire with only one summary score may sometimes hide significant information. A detailed analysis of the two components of fear of fat seems particularly valuable in a non-clinical population when taking preventive actions against health risk behaviors (e.g., restrictive dietary). In future research it would be interesting to examine whether these two factors equally contribute to disordered eating symptoms.

We should also mention some limitations of the study. First, we included exclusively female subjects. Our choice was consistent with the original research by Goldfarb et al. (1985); however, it significantly narrowed the generalizability of the results. According to Ambwani et al. (2007) there are differences in fear of fatness among men and women in the general population – women reported more fear than men. Therefore, future research should take into consideration men to evaluate the validity of the scale and its measurement invariance across gender. Moreover, the low diversity of the education level in the non-clinical samples can be a bias affecting the objectivity of the findings. Besides, since in the non-clinical settings we recruited participants via convenience and snowball sampling, the results should be generalized with caution. Also, it is essential to note that despite proving that the proposed two-factor model was relatively stable in both non-clinical samples, we collected limited evidence for measurement invariance. Both non-clinical samples were similar and recruited from the same population. Therefore, the results of this test should be interpreted with due caution. Also, as a recommendation for future research, it is crucial to gather more information about measurement invariance in different, more heterogeneous non-clinical samples. Finally, we should mention that non-clinical groups were not screened for eating disorders symptomatology or diagnosis. In the instruction given to participants it was stated that women with diagnosed eating disorders could not take part in the study. However, we could not be sure that every participant complied with this requirement. Therefore, a more sophisticated screening procedure seems to be necessary in future research. Another limitation was that we did not use the same subscales of the Eating Disorder Inventory (EDI-3) in all samples. In future research more specific scales for measuring attitudes and behaviors concerning eating, body dissatisfaction and self-evaluation should be used.

We emphasize the need for replicating our findings related to the factor structure of the GFFS using more sophisticated methods of sampling, e.g. random sampling. Also, multicultural research would be valuable to deepen the understanding of the structure of fear of fat. Such comparative analyses, although scarce, have already been conducted using the GFFS tool in the non-clinical setting. For example, according to Ambwani et al. (2007) Spanish women have generally reported less fear of fat than Euro-Americans.

5. Conclusion

The GFFS is a brief measure of fear of fat with high internal consistency. Although several new measurement instruments have been developed in the recent years to evaluate the fear of fat and the risk of eating pathology (e.g., Fear of Food Measure - Levinson & Byrne, 2015; Eating Disorder Examination, EDE-Q - Fairburn & Beglin, 1994; Antifat Attitudes Questionnaire - Crandall, 1994; Eating Loss of Control Scale – Blomquist et al., 2014), the GFFS remains a valuable screening tool because of its brevity, ease of administration, strong psychometric properties, and applicability both to clinical and non-clinical settings. The results obtained in this study support the single-factor structure of the original GFFS (Goldfarb et al., 1985). However, this conclusion is only valid for the clinical sample. In the non-clinical samples, a good fit to the data has been achieved with a

two-factor model. These factors are Fear of gaining weight and Fear of losing control over eating/weight.

CRediT authorship contribution statement

Hanna Przybyła-Basista: Conceptualization, Methodology, Investigation, Data collections, formal analysis, Interpretation of findings, Writing – original draft, Writing – review & editing, Supervision, **Krystyna Buszman**: Conceptualization, Investigation, Data collections, Data curation, Interpretation of findings, **Maria Flakus**: Conceptualization, Methodology, Statistical and formal analysis, Interpretation of findings, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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