

# Measuring Social Processes in Weight Management: The Weight-Related Interactions Scale (WRIS)

Elizabeth Rieger (✉ [Elizabeth.Rieger@anu.edu.au](mailto:Elizabeth.Rieger@anu.edu.au))

Australian National University <https://orcid.org/0000-0002-8865-5831>

Yee Fong Lee

Australian National University

Conal Monaghan

Australian National University

Kristy Zwickert

Australian National University

Kristen Murray

Australian National University

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## Research Article

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# Abstract

## Purpose

This study sought to develop a psychometrically-sound measure to assess effective and ineffective forms of input from others for managing one's weight, namely, the Weight-Related Interactions Scale (WRIS).

## Methods

Participants ( $n = 736$ ) were adults in the overweight/obese weight range who completed the WRIS and measures of weight-specific social support, emotional eating, weight-related stigma, eating-specific self-efficacy, and social desirability.

## Results

Exploratory and confirmatory factor analyses of the WRIS supported a three-factor solution of 'Criticism', 'Minimization', and 'Collaboration' as forms of weight-related input from others. Support was found for the reliability and the concurrent, convergent, and divergent validity of the WRIS.

## Conclusions

The WRIS is a promising new instrument for comprehensively assessing the input of others in relation to managing one's weight, eating, and physical activity.

## Level of evidence:

Level III. Evidence obtained from well-designed cohort or case-control analytic studies.

## Introduction

Given their limited efficacy, there have been increasing calls for obesity prevention and treatment approaches to move beyond a focus on the individual to more comprehensively and coherently address social processes. As has been noted, "Interventions on individual behaviors and choices fail ... to account for the social relational conditions that influence personal choices and behaviors and [hence] limit the effectiveness and impact of obesity interventions" [1, p.1]

The literature on social processes in obesity provides robust support for the call to implement multilevel interventions of this kind. The vast bulk of this research has focused on the construct of social support, which is broadly defined as the emotional, instrumental, informational, and appraisal input provided by

people in one's social network that promote positive changes [2]. Social support has been found to be predictive of weight status and weight-related variables such as dietary patterns [3]. Systematic reviews [4] and meta-analyses [5] of treatment studies also attest to the beneficial role of social support in weight management for individuals in the overweight and obese weight ranges. The benefit of involving significant others in obesity treatment has been particularly established in paediatric obesity, where family-based treatment has long been a pivotal approach [6]. Social support may even help to mitigate against the intergenerational transmission of obesity [7].

Yet this preponderance of research focusing on the construct of social support in obesity fails to capture the complex association between the input of significant others and weight management [8]. Individuals with obesity may not only experience low social support in relation to their eating, physical activity, and weight, they may also be subject to negative interactions with others that serve to (intentionally or unintentionally) hinder goal attainment - a phenomenon referred to as social undermining [9]. Highlighting the relevance of both social support and social undermining for weight management, one study found that baseline social support for healthy eating and physical activity was associated with less weight gain at 24 months, while social undermining of healthy eating was predictive of greater weight gain among participants in a workplace program [10].

There are also anomalous findings, however, regarding the association between social support/undermining and weight management. Specifically, several studies have found an inverse relationship between baseline social support and weight loss outcomes for adults in the overweight and obese weight ranges participating in behavioral weight loss programs [11-14]. These anomalous findings may be due at least in part to limitations in the scales used to measure social support and undermining. Specifically, each of the aforementioned studies utilized the Social Support for Eating Habits (SSEH) and the Social Support for Physical Activity (SSPA) scales, which measure the enacted support and undermining of healthy eating and physical activity patterns, respectively, provided by family and friends [15]. While commonly administered in the obesity context, neither the original nor the modified [12,16] versions of the SSEH and SSPA scales were developed using a sample within the overweight and obese weight range. A study examining the psychometric properties of the SSEH and SSPA scales in a sample of adults with obesity found only partial support for their concurrent validity [17]. For example, higher encouragement for healthy eating as measured by the SSEH scale was unexpectedly associated with a higher level of problem eating behaviors. The researchers speculated that so-called encouragement for healthy eating (e.g., family/friends "encouraged me not to eat 'unhealthy foods' when I'm tempted to do so" and "reminded me not to eat high fat, high sugar foods") might actually be perceived by people with obesity as controlling and critical, and hence trigger problem eating behaviors. It cannot be assumed that behaviors perceived as helpful/supportive in non-obese populations are similarly perceived among those in the overweight or obese weight range, especially given the latter's experience of pervasive stigmatization [18], which could result in even well-intentioned behaviors being perceived as further criticism.

An advance in the development of a psychometrically-sound measure of social support in overweight and obesity is the Weight Management Support Inventory (WMSI) developed by Rieder and Ruderman [19]. The WMSI has the advantage of having been developed on an overall overweight and obese sample with a mean body mass index (BMI = kg/m<sup>2</sup>) of 28.0 (although participants with BMIs as low as 20 were included, that is, participants for whom weight loss would be contraindicated and for whom perceptions of what constitutes support may differ from those in the overweight or obese weight range). While preliminary support has been found for the psychometric properties of the WMSI, it does not provide a comprehensive measure regarding the input of social network members on an individual's weight management since it eschews any items measuring ineffective forms of input from others, that is, social undermining. This omission is noteworthy since people with overweight or obesity report that their interactions with social network members regarding their weight are predominantly of a negative nature [20]. For instance, one study found that 90% of women with obesity rarely or never experienced effective support for healthy eating from their friends, while 78% reported rarely or never experiencing effective support for healthy eating from their family [12].

In summary, the obesity field is in need of an instrument with strong psychometric properties that comprehensively assesses effective and ineffective forms of input from social network members. As such, the purpose of the present study is to develop and evaluate the psychometric properties of a new measure for social processes in weight management, namely, the Weight-Related Interactions Scale (WRIS), which measures the frequency of both social support and social undermining for eating, physical activity, and weight management. The following research questions will be evaluated:

- (1) Does the factor structure of the WRIS include subscales of both social support and social undermining in a sample of adults in the overweight or obese weight range?
- (2) What is the internal consistency of the WRIS scales identified via factor analysis?
- (3) Is the concurrent validity of the WRIS subscales and total scale supported by correlating with another measure of social support for weight management (WMSI)? Also, is the convergent validity of the WRIS subscales and total scale supported by correlating (albeit less so) with constructs expected to be related to support for weight management, including measures of weight-related stigma and emotional eating (negatively correlated with support and positively correlated with undermining) and eating-related self-efficacy (positively correlated with support and negatively correlated with undermining)?
- (4) Is the discriminant validity of the WRIS supported in terms of non-associations between the WRIS subscales and total scale and a measure of social desirability?

## Method

### Participants

A total of 736 eligible participants were recruited via posting on a university student portal ( $n = 64$ ), Facebook and online forums ( $n = 31$ ), and Amazon's Mechanical Turk ( $n = 641$ ). The data from an additional 104 participants were removed because they responded affirmatively to the validity check items [21]. Participants were eligible to take part if they were aged 18 years or older and had a BMI of at least 25 [22]. The study was approved by the relevant institutional review board (protocol 2017/508), with all participants providing informed consent.

The total sample was comprised of two sub-samples, with Sample 1 ( $n = 368$ ) used for the exploratory factor analysis (EFA) and Sample 2 ( $n = 368$ ) used for the confirmatory factor analysis (CFA). The demographic characteristics of Sample 1, Sample 2, and the full sample are shown in Table 1. Between group differences were found in age,  $t(734) = -3.50, p < 0.001$ , country of birth,  $\chi^2(39, 736) = 105.52, p < .001, V = .34$ , ethnicity,  $\chi^2(8, 736) = 32.15, p < .001, V = .21$ , and educational level,  $\chi^2(7, 736) = 20.03, p = .008, V = .16$ .

## Measures

The following measures, together with questions ascertaining basic demographic variables, were administered online through the data collection platform Qualtrics, 2018.

**Weight-Related Interactions Scale (WRIS).** The initial item pool of 57 items for the WRIS was generated from the two superordinate categories (i.e., 'effective support' and 'ineffective support') and their subcategories (four subcategories of effective support and six subcategories of ineffective support) derived from a detailed qualitative analysis involving 22 adults in the obese weight range about their perspectives on the availability and effectiveness of the support they received in managing their eating, physical activity, and weight [20]. To strengthen content validity, two sets of raters (three independent clinical psychologists specializing in eating and weight disorders and 10 adults with obesity) reviewed the initial item pool to ensure it fully captured the positive and negative social interactions of people with obesity regarding their eating, physical activity, and weight. Items were modified or added in line with their recommendations. The resulting 50 items were operationalised by asking respondents to rate the frequency of weight-related behaviors from social network members over the past three months on a five-point Likert scale ranging from 1 (*never*) to 5 (*very often*).

**Weight Management Support Inventory [21].** The WMSI is a 26-item self-report questionnaire designed to assess perceived support for weight management from significant others in the past four weeks (e.g., 'Others give me pep talks about sticking to my diet'). Items are rated on a scale from 1 (*never*) to 5 (*daily*), with higher scores indicating higher frequency of weight management support. The WMSI has preliminary psychometric support [21]. Cronbach's alphas for the WMSI scales in the current study were  $\alpha = .90$  (Emotional),  $.90$  (Instrumental),  $.94$  (Informational),  $.91$  (Appraisal), and  $.97$  (total scale).

**Weight Self-Stigma Questionnaire [23].** The WSSQ is a 12-item, self-report questionnaire that measures experiences of weight stigma in overweight/obese populations. It includes two subscales: Fear of Enacted Stigma (e.g., 'Others are ashamed to be around me because of my weight') and Self-Devaluation

(e.g., 'I caused my weight problems'). Items are rated on a scale from 1 (*completely disagree*) to 5 (*completely agree*), with higher scores indicating higher levels of self-stigma. There is support for the WSSQ's psychometric properties [23], including acceptable internal consistency in the present study ( $\alpha = .86, .81, \text{ and } .89$  for the Fear of Enacted Stigma, Self-Devaluation, and total scales, respectively).

**Revised Emotional Eating Scale [24].** The revised EES is a 25-item, self-report questionnaire that measures the extent to which various emotions lead to urges to eat (Arnow et al., 1995). Items (e.g., 'Feeling sad leads me to an urge to eat to a certain extent') are rated on a scale from 1 (*no desire to eat*) to 5 (*overwhelming urge to eat*). It has support for its psychometric properties [24], including acceptable internal consistencies in the current study ( $\alpha = .91, .90, .86, \text{ and } .95$  for the Depression, Boredom, Anxiety/Anger, and total scales, respectively).

**Weight Efficacy Lifestyle Questionnaire [25].** The WEL is a 20-item, self-report questionnaire that measures self-efficacy in managing one's eating in potentially challenging situations (e.g., 'I can resist eating when I am anxious'), with respondents rating their confidence to resist urges to eat on a scale from 0 (*not confident at all*) to 9 (*very confident*). It has been found to be psychometrically-sound [25], including acceptable internal consistencies in the present study for its five subscales of Negative Emotions ( $\alpha = .81$ ), Social Pressure ( $\alpha = .82$ ), Physical Discomfort ( $\alpha = .78$ ), Positive Activities ( $\alpha = .69$ ), and Availability of Food ( $\alpha = .85$ ), which are summed to yield a total score ( $\alpha = .81$ ).

**Short Marlowe-Crowne Social Desirability Scale [26].** The MCSDS is a short form of the original 33-item scale [27] consisting of 10 true-false items that assess the tendency to respond in a socially desirable manner (e.g., 'I'm always willing to admit it when I make a mistake'). Higher scores indicate a greater tendency to respond in a socially desirable manner. The psychometric properties of the short form of the MCSDS have received some support [28]. However, the MCSDS had poor internal consistency in the current study ( $KR-20 = .55$ ).

## Results

The analytic strategy entailed identifying the WRIS factor structure using EFA in Sample 1 followed by CFA in Sample 2. The new WRIS subscales and total scale were then subjected to concurrent, convergent, and discriminant validity analysis utilising Pearson's correlations in the combined sample.

### Exploratory Factor Analysis

EFA was conducted on Sample 1 ( $n = 368$ ) to determine the underlying factor structure of social interactions in the overweight/obesity context using the Psych package for R [29] and Robust Maximum Likelihood Estimation (MLR). There were no missing data or univariate outliers (using  $p < .001$ ) [30]. The data were considered appropriate for factor analysis with significant Bartlett's test of sphericity ( $\chi^2(1225) = 24609.82, p < .001$  [31]) and Kaiser-Meyer-Olkin adequacy test ( $KMO = .96$  [32]), with the sample size appropriate given these results.

The optimal number of factors was determined using the Scree test [33,34] and parallel analysis (95<sup>th</sup> percentile, 1000 iterations [35]). Oblique factor rotation was used (Direct Oblimin) because we expected factors to correlate. The Scree test, parallel analysis, and optimal co-ordinates all supported three factors in the data (see Figure 1). We therefore extracted and evaluated the three-factor solution and removed two items based on poor factor loadings or communalities ( $< .32$ ), and four items that cross-loaded onto several factors ( $> .32$ ).

The first factor was labelled 'Criticism' (11 items), with items relating to unsolicited advice and/or negative and often critical comments made by significant others. The second factor was labelled 'Minimization' (15 items), with items describing significant others as providing an environment that encourages unhealthy behaviors and discourages healthy behaviors. The third factor was labelled 'Collaboration' (15 items), with items depicting the active involvement of significant others to support weight management behaviors in a way that is consistent with cultivating respect, autonomy, and self-efficacy.

Each subscale accounted for adequate variance in the data (see Table 2), without cross-loadings and with strong factor loadings (i.e.,  $\geq .45$ ). The Criticism and Minimization subscales were strongly correlated ( $r = .58, p < .01$ ), the Criticism and Collaboration subscales were moderately correlated ( $r = .30, p < .01$ ), and the Minimization and Collaboration subscales were uncorrelated ( $r = .01, p = .88$ ). Estimates of internal consistency for the subscales and total scale were high (see Table 2), with Cronbach's alphas of at least .91 and McDonald's omegas of at least .93.

### **Confirmatory Factor Analysis**

The hypothesised three-factor solution was then investigated using CFA in Sample 2 using Lavaan package for R [36] and MLR estimation. Three models were investigated to identify which solution best reproduced the covariance in the data: 1) a one-factor model where the final items all loaded onto a Support construct, 2) a two-factor model where both Criticism and Minimization items loaded onto an Undermining construct while Collaboration items loaded onto a Support construct, and 3) the three-factor structure identified in the EFA with each Criticism, Minimization, and Collaboration item loading onto their respective subscales. The model's ability to reproduce the covariation in the data and to be appropriately specified was evaluated using the following fit indices: root mean square error of approximation (RMSEA)  $\leq .06$ , standardised root mean square residual (SRMR)  $\leq .08$ , and confirmatory fit index (CFI)  $\geq .90$  [37].

The one-factor and two-factor models did not have adequate model fit estimates, whereas the three-factor model reproduced the variation seen in the data well (see Table 3), and significantly improved model fit estimates over the two-factor alternative,  $F(770, 775) = 1246.05, p < .001$ . All items loaded strongly onto their factor and no additional sources of model strain were identified (see Figure 2). Additionally, a WRIS total score was calculated by summing the three subscale scores (reverse-scoring the Criticism and Minimization subscales) so that higher scores indicate receiving greater social support and less social undermining.

## Concurrent Validity

Concurrent validity was investigated by correlating the WRIS with the measures of weight-specific (WMSI) social support (see Table 4). As expected, the Collaboration subscale was strongly correlated with all types of weight-specific support. Unexpectedly, however, the Criticism and Minimization subscales were also significantly and positively associated with the WMSI, with medium to large effect sizes [38] for the Criticism subscale and small effect sizes for the Minimization subscale. In contrast, the WRIS total scale was negatively, although weakly, associated with the WMSI.

## Convergent and Discriminant Validity

Convergent validity was examined by correlating the WRIS scales with measures of weight-related stigma, emotional eating, and eating self-efficacy (Table 4). As expected, the Criticism and Minimization subscales were positively correlated, and the total scale was negatively correlated, with all dimensions of stigma and emotional eating, with medium to large effect sizes. Unexpectedly, the Collaboration subscale was also significantly correlated with weight-related stigma and with eating in response to anger/anxiety, but with small effect sizes.

As expected, the Collaboration subscale and total scale were positively associated with self-efficacy in relation to controlling one's eating across each of the domains, with small to medium effect sizes. Further supporting the validity of the Criticism and Minimization subscales were their non-significant or negative correlations with self-efficacy, albeit of small effect sizes.

Supporting the discriminant validity of the WRIS, there were either no or small correlations between the WRIS total and subscales and social desirability as measured by the MCSDS.

## Discussion

The purpose of this study was to address a noteworthy gap in the literature through the development of an instrument that assesses a comprehensive range of behaviors comprising social support and social undermining for managing weight in a sample of adults in the overweight/obese weight range. The results provided preliminary support for the psychometric properties of the WRIS.

In terms of the construct validity of the WRIS, factor analyses yielded a three-factor solution comprised of Criticism, Minimization, and Collaboration that was replicated across both samples, despite significant differences in some demographic variables. All three subscales, as well as the total scale, were highly internally consistent.

Items indexing Critical social input are comprised of negative, intrusive, and judgmental comments and behaviors engaged in by significant others regarding the weight and weight-control behaviors of individuals with obesity. They include unsolicited advice and/or criticism on what individuals 'should' and 'should not' be doing about their weight, negative comments regarding the person's weight status or capabilities, and instances of obesity stigma. Minimizing an individual's weight-related concerns can be

understood as significant others providing an environment that discourages healthy, and encourages unhealthy, weight-related behaviors (e.g., through modeling an unhealthy lifestyle). In contrast, the Collaboration subscale items depict significant others who affirm individuals for their weight-control efforts, engage in problem-solving, express confidence in the individual's abilities in weight management, and/or co-participate in the individual's weight management plan. In essence, these behaviors by significant others are responsive, affirming, and supportive of the individual's weight-related goals rather than imposing their own goals on the individual (as in Critical behaviors) or disregarding the individual's goals (as in Minimizing behaviors). The WRIS total score indexes the overall quality of the weight management support received by people with obesity. Individuals with high total scores experience minimal criticism and pressure to change their weight-related behaviors (Criticism), as well as low levels of behaviors by others that indicate disengagement from the individual's weight-related goals (Minimization), while instead receiving high levels of sensitive, affirming, and responsive input from others to pursue their weight-related goals (Collaboration).

This tripartite structure of social input (i.e., Collaboration, Criticism, and Minimization) regarding weight management among adults with obesity has some convergence with the structure found in pediatric obesity of authoritative, authoritarian, and indulgent/uninvolved caregiver responses, respectively [8]. It also has some overlap with the support evident among the carers of people with eating disorders, which similarly shows the use of effective support as well as ineffective forms of support characterized by input of a critical, hostile nature from others (referred to as expressed emotion in the eating disorders literature) and minimizing behaviors (referred to as accommodating and enabling behaviors in eating disorders research such as co-participating in problematic behaviors) [39].

In addition to construct validity, there was also some support for the concurrent validity of the WRIS. Specifically, higher Collaboration was strongly associated with higher weight-specific support (WMSI), with all correlations of a large effect size. On the other hand, rather than an expected inverse relationship, higher WMSI scores were also positively linked with Criticism (medium effect sizes) and Minimization (small effect sizes). Despite the fact that the WMSI was developed to measure effective weight management support, these results suggest that it might also be indexing ineffective forms of support. For instance, the WMSI items "others remind me to watch what I eat" or "others tell me about the calorie or fat content of foods" might be perceived as critical and controlling by someone in the obese weight range, especially given the pervasive nature of obesity stigma [18]. Since the WMSI appears to be comprised of at least some forms of ineffective support, this might also account for its negative correlations with the WRIS total score. However, since these correlations were of a small effect size, their significance might also be an artefact of the large sample size.

Evidence also emerged for the convergent validity of the WRIS, with the total scale having the expected pattern of results across each of the measures. That is, a support network characterised by higher support (i.e., higher Collaborative input and lower Critical and Minimizing input) from significant others for weight management was associated with lower internalized stigma, higher self-efficacy in managing one's eating even in challenging situations, and less emotional eating in response to negative emotions.

Regarding the latter, weight-specific support might help to buffer against the effects of distressing emotions on eating. For instance, it is possible that individuals with higher WRIS total scores have less vulnerability to engage in emotional eating because of lower social stressors (less Critical and Minimizing input), lower access to unhealthy food when emotionally vulnerable (less Minimizing input), and more effective support for them to adhere to or get back on track with their weight management goals in the context of distressing emotions (more Collaborative input).

Evidence was also found for the convergent validity of each of the WRIS subscales, with the social undermining subscales related to negative constructs and the social support subscale related to positive constructs. Specifically, greater Criticism and Minimization were both moderately to strongly associated with higher internalized stigma and emotional eating. These associations are concerning given that obesity stigma has been found to predict increases in obesity over time, theorised to be due at least in part to the distressing emotions induced by stigma that can result in emotional eating [40]. There was less evidence for an association between either Critical or Minimizing input and self-efficacy in managing one's eating, with the significant, negative correlations of a small effect size. In contrast, scores on the Collaboration subscale were consistently correlated with self-efficacy for managing one's eating across challenging situations of a small to moderate effect size. These consistent associations were to be expected since the Collaboration subscale items either directly (e.g., others 'Told me they believe in my ability to make healthy changes and manage my weight') or indirectly (e.g., others 'Helped me to identify solutions to weight loss problems') assess support behaviors likely to increase people's self-efficacy for managing their eating even in challenging situations. However, there were significant, albeit small, correlations between Collaboration and self-stigma, indicating that Collaborative support for weight management may not be sufficient to counteract the negative impacts of Critical and Minimizing behaviors of others on self-stigma, especially if these effective and ineffective forms of weight management support are engaged in by the same support network (e.g., there was a correlation of .30 between the Criticism and Collaboration subscale scores). Also unexpected was the positive correlation (again of a small effect size) between Collaboration and emotional eating in response to anxiety/anger. One possibility is that people with obesity who are experiencing more problems with urges to eat in response to negative emotions elicit more helpful support from others given that the Collaboration subscale includes such items (e.g., others 'Helped me to manage food cravings effectively').

Finally, results supported the discriminant validity of the WRIS, with no evidence that people with higher engagement in socially desirable responding are less likely to endorse critical or minimizing input from others or more likely to report collaborative input.

## **Strengths and Limits**

Despite the promising findings for this novel measure of weight-related social interactions, there are limitations stemming from the study's cross-sectional design that should be considered when interpreting the results and informing future research. First, the use of a cross-sectional study limits the ability to specify any causal impact of different types of social input on self-stigma, emotional eating, and self-

efficacy. Second, the test-retest reliability and prospective validity of the WRIS (e.g., whether WRIS scores predict weight changes) awaits investigation. Relatedly, future experimental and prospective research is required to provide stronger evidence for characterizing the behaviors in the Collaboration subscale as indeed effective forms of support and the behaviors in the Criticism and Minimization subscales as ineffective forms of social input by investigating the impact of these behaviors on eating, physical activity, and weight.

Overall, the findings of the present study support the reliability and validity of the WRIS. Its tripartite structure suggests that the social landscape experienced by people with obesity is characterized by both effective and ineffective forms of weight-related interactions with significant others, indicating that a comprehensive measure must include both types of social input. A focus on the social networks of people with obesity is consistent with calls for shared responsibility for the promotion of healthier eating and physical activity patterns by individuals, government agencies, industry, educational and occupational settings, the media [41,42] and, as the current research suggests, the social network members of people with obesity.

### **What is already known on this subject?**

Results are inconsistent regarding the impact of social support on weight-related variables. Studies have utilized measures with questionable psychometric properties in overweight/obese populations. There is no psychometrically-sound instrument that comprehensively assesses the effective and ineffective behaviors of social network members regarding weight management.

### **What this study adds?**

Social responses for weight management can be categorized as Critical, Minimizing or Collaborative. There is support for the reliability and validity of the WRIS as a new self-report questionnaire that comprehensively indexes the weight-related interactions experienced by people with overweight/obesity. The WRIS enables research focused on enhancing understanding of the effective and ineffective forms of support for weight management and for informing weight-loss interventions.

## **Declarations**

**Funding.** No funding was received for conducting this study.

**Competing interests.** The authors have no financial or non-financial interest to declare.

**Availability of data and material.** The dataset generated and analyzed during the current study is not publicly available due to ethical restrictions but is available from the corresponding author on reasonable request.

**Code availability.** Not applicable

**Authors contributions.** All authors contributed to the study conception and design. Material preparation was performed by Elizabeth Rieger, Yee Fong Lee, Kristen Murray, and Kristy Zwickert. Data collection and analysis were performed by Elizabeth Rieger, Yee Fong Lee, and Conal Monaghan. The first draft of the manuscript was written by Elizabeth Rieger and Yee Fong Lee, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Ethics approval.** This study was approved by the Human Research Ethics Committee of the Australian National University (protocol 2017/508).

**Consent to participate.** Informed consent was obtained from all individual participants included in this study.

**Consent for publication.** All individual participants provided informed consent regarding publishing their data.

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## Tables

<b>Table 1</b> <i>Participant Demographics</i>			
	Sample 1 ( <i>n</i> = 368)	Sample 2 ( <i>n</i> = 368)	Full sample ( <i>n</i> = 736)
	<i>M (SD)</i>		
Age*	31.23 (10.07)	33.82 (10.04)	32.52 (10.13)
Height (m)	1.68 (.13)	1.68 (.12)	1.68 (.12)
Weight (kg)	87.00 (20.97)	87.20 (19.13)	87.10 (20.05)
BMI (kg/m <sup>2</sup> )	30.74 (5.49)	30.78 (5.24)	30.76 (5.37)
	<i>n (%)</i>		
Gender			
Male	196 (53.26%)	178 (48.37%)	374 (50.82%)
Female	170 (46.20%)	190 (51.63%)	360 (48.91%)
Other	2 (.54%)	-	2 (.27%)
Country of birth*			
Australia	71 (19.29%)	25 (6.79%)	96 (13.04%)
India	91 (24.73%)	96 (26.09%)	187 (25.41%)
United States	163 (44.29%)	213 (57.88%)	376 (51.09%)
Other	43 (11.68%)	34 (9.24%)	77 (10.46%)
Ethnicity*			
Australian Aboriginal or Torres Strait Islander	1 (.27%)	2 (.54%)	3 (.41%)
Australian/New Zealander	60 (16.30%)	24 (6.52%)	84 (11.41%)
Western European	104 (28.26%)	107 (29.08%)	211 (28.67%)
Eastern European	31 (8.42%)	47 (12.77%)	78 (10.60%)
Asian	98 (26.63%)	78 (21.20%)	176 (23.91%)
Middle Eastern	3 (.82%)	3 (0.82%)	6 (.82%)
Indian	36 (9.78%)	41 (11.14%)	77 (10.46%)
African	11 (2.99%)	24 (6.52%)	35 (4.76%)
Other	24 (6.52%)	42 (11.41%)	66 (8.97%)
Education level*			

Completed primary school	1 (.27%)	4 (1.09%)	5 (.68%)
Completed Year 10 or equivalent	-	1 (.27%)	1 (.14%)
Complete Year 12 or equivalent	70 (19.02%)	40 (10.87%)	110 (14.95%)
Trade / technical / vocational training	16 (4.35%)	16 (4.35%)	32 (4.35%)
Diploma / Certificate	29 (7.88%)	41 (11.14%)	70 (9.51%)
Bachelor's degree	192 (52.17%)	185 (50.27%)	377 (51.22%)
Master's degree	55 (14.95%)	66 (17.93%)	121 (16.44%)
Doctoral degree	5 (1.36%)	15 (4.08%)	20 (2.72%)

Note. BMI = Body Mass Index.

\* Difference between samples is significant at the  $p < .001$  level.

<b>Table 2</b> Scale Items and Factor Loadings for the WRIS			
		Criticism Subscale	
#	Scale Items	Rotated Factor Loadings	Communalities
1	Provided weight loss advice when I did not specifically request it	.65	.48
2	Criticised me when I ate high-calorie foods	.83	.64
3	Criticised me when I ate more than I needed	.78	.60
4	Pressured me to lose weight	.79	.61
5	Told me that I would not be able to manage my weight in the longer-term, so why even try	.55	.52
6	Criticised the amount or type of physical activity I do	.61	.45
7	Criticised my physical competence or abilities	.72	.61
8	Blew it out of proportion when I experienced a setback	.67	.61
9	Made negative comments about my appearance	.74	.59
10	Made a joke about my weight to me or others	.76	.60
11	Made comments to others about my weight loss efforts without my permission	.65	.59

Table 2 (continued)			
		Minimization Subscale	
#	Scale Items	Rotated Factor Loadings	Communalities
12	Encouraged me to eat high-calorie foods, saying things like 'one won't make a difference' or 'don't worry about your weight'	.55	.36
13	Brought home food(s) that are unhelpful for my weight-control efforts	.72	.50
14	Offered me food(s) that I am trying to reduce	.78	.55
15	Pushed high-calorie food on me when I was trying to control my calorie intake	.78	.61
16	Served me large portions when I was trying to control my portion-sizes	.71	.56
17	Refused to eat healthy foods with me	.56	.48
18	Were inactive and sedentary	.55	.39
19	Became annoyed when I encouraged them to eat healthy foods	.58	.50
20	Became annoyed when I encouraged them to engage in physical activity	.55	.50
21	Ate high-calorie foods in front of me	.71	.48
22	Ate for reasons other than hunger (when bored or stressed etc.)	.61	.44
23	Did not want to engage in physical activity with me	.61	.44
24	Minimised the importance of healthy eating and physical activity in their own life	.58	.50
25	Offered, purchased, or shared high-calorie foods while socialising with me	.72	.49
26	Served high-calorie foods at social gatherings	.66	.41

Table 2 (continued)			
		Collaboration Subscale	
#	Scale Items	Rotated Factor Loadings	Communalities
27	Engaged in physical activity with me	.62	.37
28	Prepared healthy meals with me	.70	.47
29	Engaged in meal planning for weight-control	.68	.55
30	Helped to reduce the availability of high-calorie foods at home	.67	.58
31	Shared a meal or snack with me to help reduce meal portions	.69	.54
32	Helped me to manage food cravings effectively	.73	.67
33	Complimented me on changing my eating habits ("Keep it up", "We are proud of you")	.76	.56
34	Sensitively responded when I made eating and physical activity decisions that hindered my weight loss goals	.73	.56
35	Told me they believe in my ability to make healthy changes and manage my weight	.80	.59
36	Helped me to identify solutions to weight loss problems	.82	.69
37	Listened to me when I was trying to solve weight-control problems	.79	.56
38	Showed an interest in understanding the challenges of managing my weight without judging me	.80	.58
39	Asked me how they can best support me in managing my weight	.83	.68
40	Helped remind me of the important reasons I want to lose weight when I am feeling unmotivated	.80	.69
41	Made supporting my weight management efforts a priority in their own life	.82	.74

Table 2 (continued)			
Subscale			
Criticism	Minimization	Collaboration	
Proportion of Total Variance (Proportion of Scale Variance)			
.16 (.30)	.21 (.31)	.17 (.39)	
α (Confidence Interval)			
.93 (.92 - .94)	.93 (.92 - .94)	.95 (.95 - .96)	
ω (Confidence Interval)			
.93 (.92 - .94)	.93 (.92 - .94)	.95 (.95 - .96)	
<p><i>Note.</i> Factors were rotated with the Direct Oblimin method. Only items with factor loadings above .32 are shown. The internal consistencies for the full sample were: Criticism (<math>\alpha = .93</math>; 95% CI = .93 - .94; <math>\omega = .93</math>; 95% CI = .93 - .94), Minimization (<math>\alpha = .93</math>; 95% CI = .92 - .94; <math>\omega = .93</math>; 95% CI = .92 - .94), Collaboration (<math>\alpha = .95</math>; 95% CI = .95 - .96; <math>\omega = .95</math>; 95% CI = .95 - .96), and total scale, <math>\alpha = .91</math>; 95% CI = .90 - .92; <math>\omega = .94</math>; 95% CI = .93 - .95.</p>			

<b>Table 3</b> Model Fit Indices for Support for Weight Management ( $n = 368$ )						
Model	$\chi^2$	$df$	CFI	SRMR	RMSEA	RMSEA CI
One-factor	4757.95*	594	.506	.164	.136	.132- .140
Two-factor	3785.61*	901	.739	.112	.091	.088 - .094
Three-factor	1886.08*	770	.900	.069	.059	.055 - .063
<p><i>Note.</i> CFI = comparative fit index, RMSEA = root mean-square error of approximation, SRMR = standardised root mean square residuals. * <math>p &lt; .001</math></p>						

**Table 4** *Correlations Between the WRIS and External Measures*

	Pearson Correlations			
	WRIS Criticism	WRIS Minimization	WRIS Collaboration	WRIS Total
<b>WMSI</b>				
Emotional	.60***	.30***	.63***	-.16***
Instrumental	.51***	.20***	.69***	-.03
Informational	.56***	.29***	.64***	-.13***
Appraisal	.50***	.29***	.63***	-.09*
Total	.58***	.29***	.69***	-.11**
<b>WSSQ</b>				
Self-Devaluation	.54***	.46***	.25***	-.41***
Fear of Enacted Stigma	.45***	.43***	.14***	-.40***
Total	.52***	.47***	.21***	-.43***
<b>EES</b>				
Anxiety/Anger	.54***	.44***	.27***	-.38***
Depression	.39***	.41***	.05	-.41***
Boredom	.33***	.39***	.06	-.35***
Total	.47***	.47***	.14***	-.43***
<b>WEL</b>				
Negative Emotions	-.08*	-.11**	.23***	.22***
Availability	.06	-.05	.30***	.15***
Social Pressure	.01	-.10**	.31***	.21***
Physical Discomfort	-.14***	-.09*	.10**	.18***
Positive Activities	-.07	-.05	.18***	.16***
Total	-.05	-.10**	.27***	.22***
MCSDS	<.001	.13***	-.17***	-.15***

*Note.* WMSI = Weight Management Social Inventory; WSSQ = Weight Self-Stigma Questionnaire; EES = Revised Emotional Eating Scale with Boredom Subscale; WEL = Weight Efficacy Lifestyle Questionnaire; MCSDS = Short Marlowe-Crowne Social Desirability scale

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

\*\*\* Correlation is significant at the 0.001 level (2-tailed).

## Figures

### Non Graphical Solutions to Scree Test

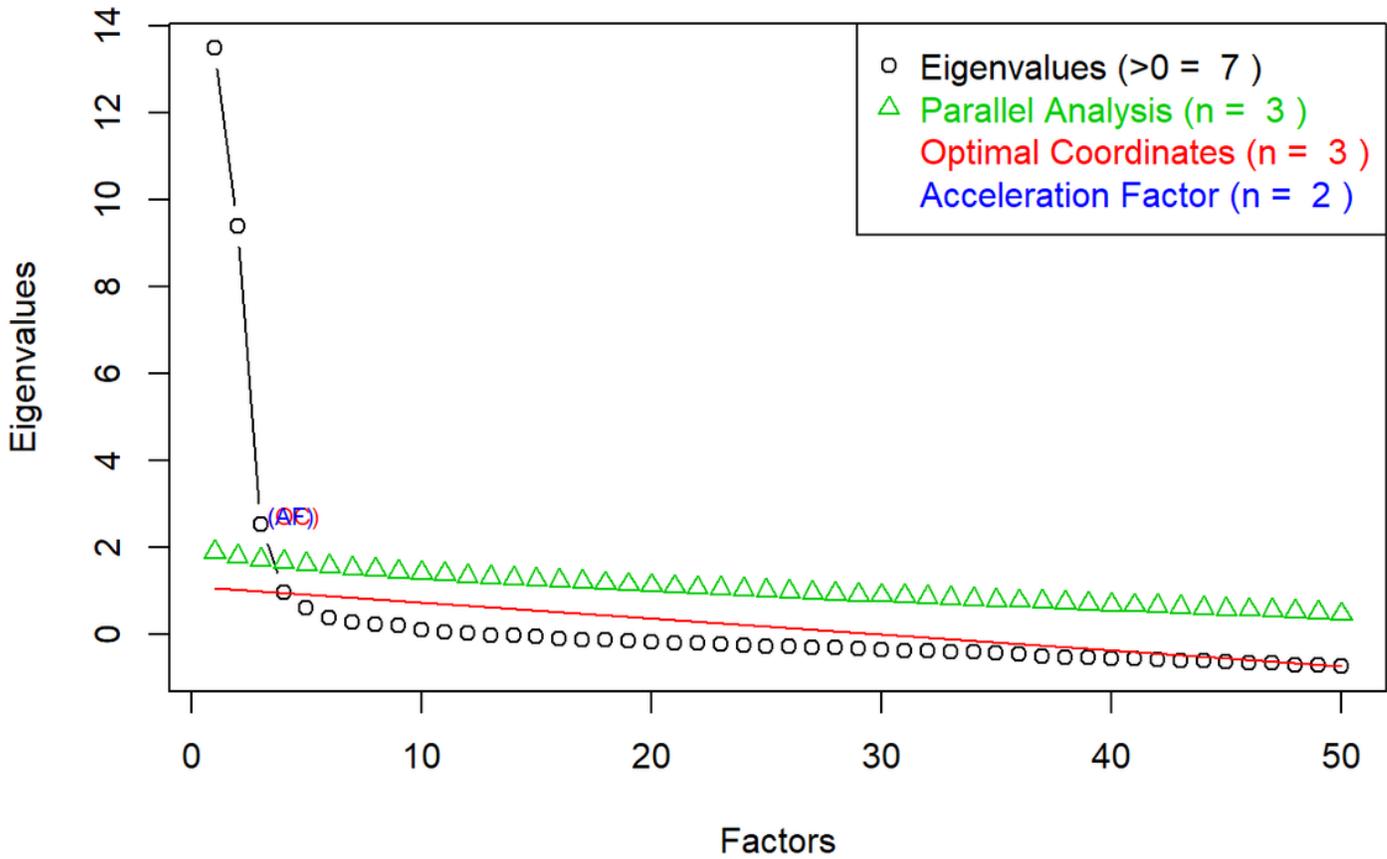
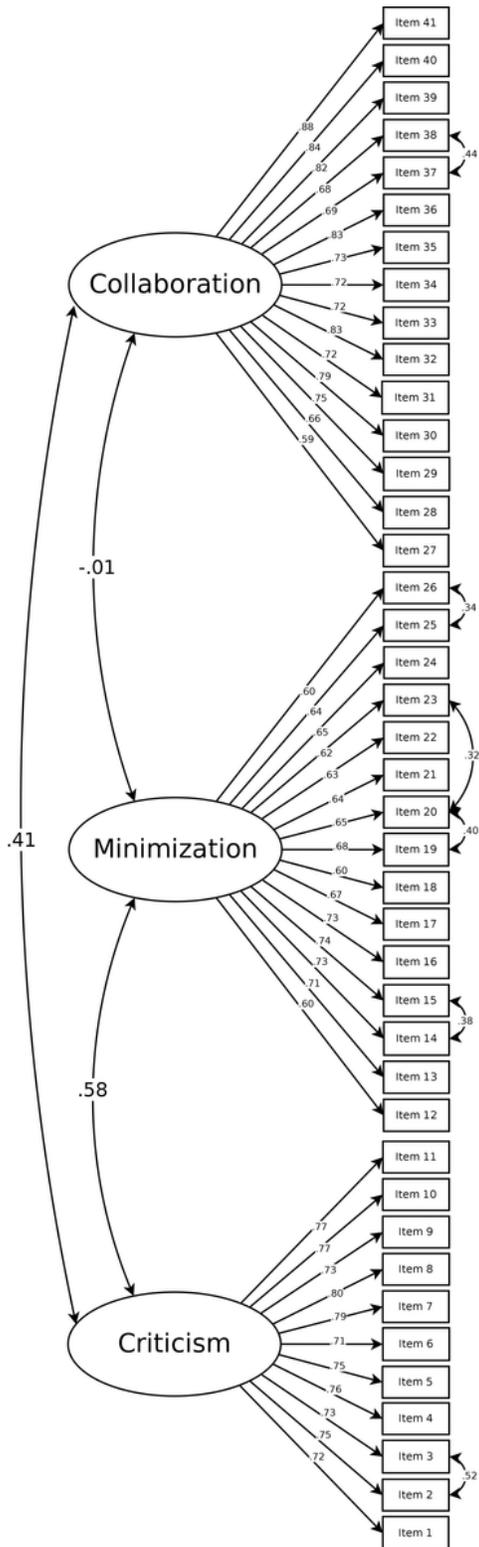


Figure 1

Non-graphical solutions to Scree test. Figure created using the Psych package for R [29]



**Figure 2**

Correlated Residuals using Psych Package for R [29] with Robust Maximum Likelihood Estimation. Criticism and Minimization subscales have been reverse scored.