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Psychometric evaluation of the Barriers to Healthy Eating Scale: Results from four independent weight loss studies

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Abstract

Objective: The purpose of this study was to evaluate the psychometric properties of the 22-item Barriers to Healthy Eating (BHE) scale in four independent weight loss studies conducted over 13 years.

Methods: Principal axis factoring with Promax rotation were performed to reveal the underlying factor structure. Internal consistency was assessed using Cronbach's α and convergent validity by correlating the baseline BHE with WEL total and subscale scores. Predictive validity was examined by the association of BHE change with weight loss over 6 months.

Results: The four studies had similar gender (82.9%–89.9% female) and race (70.5%- 81.4% white) distributions. Factor analyses suggested removal of two items, and a three-factor structure: self-control and motivation (10 items), daily mechanics (7 items), and social support (3 items). Cronbach's α for the 20-item BHE ranged from 0.849 to 0.881 across the four studies. The BHE and the WEL total and subscale scores were all negatively correlated with each other, showing good convergent validity (r = 0.12–0.544, *ps*<0.05). BHE change was associated with 0–6 month weight loss (r = 0.282–0.450, *ps*<0.05).

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Conclusions: The BHE scale showed very good psychometric properties over time, supporting its use in measuring barriers to one's ability to adopt or maintain a healthy eating plan.

Keywords

psychometric assessment; healthy diet; obesity; weight loss

Introduction

Standard behavioral treatment (SBT) for obesity has been used in weight loss clinical trials for nearly two decades (1). Dietary modification is one of the key components of SBT and research has demonstrated that reducing energy intake by 500 to 1000 kilocalories per day will result in approximately one to two pounds of weight loss per week (2). Although studies demonstrate that adherence to the eating plan is crucial for losing weight and maintaining weight loss (3–5), there is ample evidence that adherence to a weight-reducing dietary plan declines over time (6–8). To develop effective strategies to support a person's dietary adherence, it is essential to identify and measure the barriers that may thwart dietary adherence among individuals who are in weight loss treatment.

Studies of perceived barriers to adopting and maintaining healthy diets have revealed three types of barriers: external, individual and social barriers. The most frequently reported barriers are external such as cost (9, 10), time constraints (10–12), and availability of healthy food options at neighborhood grocery stores (13). Individual barriers include lack of will power (9–12), lack of knowledge (14), poor taste of food, and absence of satiety (15). Social barriers include lack of social support (16) and pressure from family and friends (17). Measurement of barriers has varied among studies with several researchers using qualitative inquiry such as focus groups or interviews to examine perceived barriers to healthy eating (13–16). Other investigators had participants select items from a list of barriers generated from the existing literature (9–12). However, no study has investigated the psychometric properties of the various used instruments.

In the absence of a standard, validated instrument measuring barriers to healthy eating, Jeffery, Wing, Thorson et al. developed the Barriers to Healthy Eating (BHE) scale in 1993 based on their extensive experience in weight loss treatment. Three subscales were proposed: emotion, daily mechanics, and social support. The BHE scale was later modified by Burke and Smith in 1998 with the addition of new items (18) and has been used in four clinical weight loss studies. The results of an earlier examination regarding the BHE's internal consistency and predictive validity supported its use in measuring barriers to healthy eating (18). However, no in-depth examination regarding its psychometric properties has been performed.

The main purpose of this secondary analysis was to evaluate the psychometric properties of the BHE scale in four independent weight loss studies across 13 years including three randomized controlled trials (RCT) and one prospective descriptive study. Specifically, we examined the internal consistency, factor structure, convergent validity, and predictive validity of the BHE scale in our samples of adults participating in clinical weight loss studies. An a priori hypothesis was established to examine the convergent and predictive validity of the BHE scale. We hypothesized that the more barriers one person had, the less confident they would be in their capability to control their eating in various contexts (i.e., feeling depressed, celebrating). Predictive validity was determined by correlating the BHE change scores with the 0~6 months weight loss. We expected that a perceived decrease of barriers to healthy eating was associated with greater weight loss over the 6 months.

Methods

We performed a secondary analysis from three separate clinical weight loss trials and one prospective descriptive study applying SBT among individuals who were overweight or obese. The four parent studies received approval from the Institutional Review Board (IRB) of the University of Pittsburgh. Participants were recruited from multiple community settings over 13 years (2002 to 2015) in the greater Pittsburgh area. Eligible participants were adults who had a body mass index (BMI) of 27 to 43, were able to complete a 5-day food diary, and willing to be randomized to either of the treatment groups. The upper age limits were removed for the recent studies, SELF and EMPOWER, due to older participant's competency in using mobile technology for dietary self-monitoring. Individuals were excluded if they were 1) pregnant or intended to become pregnant during the study period, 2) under treatment for psychiatric disorders, 3) recently or currently participating in other weight loss treatment, 4) physically limited and unable to engage in physical activity, or 5) consuming ≥ four alcoholic drinks per day. Data from 631 participants were retained after removing individuals who enrolled in two or more of the four studies. Each study sent questionnaires to participants every 6 months. For this analysis, only baseline data of the Weight Efficacy Lifestyle Questionnaire (WEL), as well as the BHE and weight data assessed at baseline and 6 months were used.

Parent study designs and participants

The PREFER Trial (N=176) was a four-group, 18-month RCT that examined the effects of dietary treatment (standard calorie- and fat-restricted vs. lacto-ovo-vegetarian) with or without treatment preference, as part of the SBT for weight loss intervention (19). Baseline assessments were conducted between 2002 and 2004.

The SMART Trial (N=197, 2006–2008) was a three-group, 24-month RCT testing the efficacy of different self-monitoring methods on weight loss. Participants were randomized to one of three treatment groups: 1) paper diary; 2) personal digital assistant (PDA); or 3) PDA + feedback (20).

The SELF Trial (N=129, 2009–2011) was a two-group, 18-month RCT that examined the effect of enhancing individual self-efficacy in addition to the SBT on weight loss maintenance, health-related quality of life and adherence to treatment. Participants were randomized to one of two groups: SBT vs. SBT+ self-efficacy enhancement (21).

The EMPOWER Study (N=129, 2011–2015) was a one-group, 12-month prospective study designed to identify dietary lapses during intentional weight loss (22). Ecological momentary assessment was used to assess the context surrounding lapses and relapses related to intentional weight loss regimens.

Measures

Barriers to Healthy Eating (BHE) Scale.—The BHE scale consists of 22 items that assess the perceived barriers to following a specific dietary plan in the past 6 months. Barriers were rated on a 5-point scale ranging from 1 (not at all a problem) to 5 (a very important problem). A total score was obtained by summing the 22 ratings, with higher scores indicating more barriers. Scale completion takes 3 minutes.

Weight Efficacy Lifestyle (WEL) Questionnaire.—The WEL questionnaire is a 20-item scale that measures confidence in one's ability to control eating in various contexts (e.g., home, work, social settings) and in different emotional states (e.g., depressed, stressed, celebratory).[23] Participants rated their confidence on a 10-point Likert scale with 0 meaning not confident to 9 meaning very confident. The total score ranges from 0 to 180, with higher scores indicating greater levels of self-efficacy. This instrument has five subscales (negative emotions, availability, social pressure, physical discomfort, positive activities) with four items in each subscale. Cronbach's coefficient α ranged from 0.70 for the Positive Activities subscale to 0.90 for the Social Pressure subscale (23). Scale completion takes approximately 5 minutes.

Weight.—Weight was assessed on a 6-month interval in each study using a Tanita scale (Tanita Corporation of America, Inc., Illinois, USA). Percent weight change of the first 6 months was used to establish the predictive validity of the BHE scale. Percent weight change was calculated as ((6-month weight – baseline weight)/baseline weight) * 100%.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) release version 25 (IBM Corporation, Armonk, NY). We first conducted analyses for each of the four sequentially conducted studies in order to examine the internal consistency and validity of the BHE over time, and to investigate potential changes in factor structure due to barrier variations and associations as a result of the dynamically changing food environment. Analyses were then conducted for all studies combined with a sufficient sample size (N=631) to determine whether the factor structures derived from individual studies can be replicated. Frequency counts with percentages were used for categorical variables, while means and standard deviations (SD) were used for continuous variables. To examine the normality of the 22 BHE items, the Kolmogorov-Smirnov test combined with visual examinations of histograms was performed. The Mahalanobis distance was used to identify multivariate outliers among BHE items, with a value of 48.268 ($p<.001$, $df=22$) or greater used to identify a multivariate outlier. Missing data were assessed in terms of the amount and pattern of missingness (i.e., where the data are missing and whether the missing values were related to the observed values on other variable under study). A small proportion (n=9, 1.4%) of the sample had one response missing on random BHE items. There were no differences in the baseline characteristics of participants with and without missing data for the total sample as well as the individual study, which suggested that participants with completed cases were a random subset of the sample, and therefore only participants with complete data on the BHE were used for the analysis.

To examine the appropriateness of conducting the factor analysis, Kaiser-Meyer-Olkin (KMO) index and Bartlett test statistic were computed. The KMO index measures sampling adequacy, and is calculated by the sum of partial correlations in relation to the sum of correlations. A KMO value of 0.80 or above indicates that data were suitable to undergo factor analysis (24). A significant Bartlett test indicates that the observed inter-item correlation matrix diverges significantly from an identity matrix, suggesting the inter-item correlation matrix is appropriate for factor analysis (25). We used communality values to indicate the proportion of the variance in each item that is explained by the factors; values less than 0.40 are considered low communalities, meaning the item shared little variability in common with the other items in the scale and should be considered for removal after examining the pattern matrix. A value of 0.60 to 0.80 is considered high communalities, suggesting the extracted factors represent the item well (26). Exploratory factor analysis (EFA) via principal axis factoring (PAF) was conducted to examine the underlying structure of the BHE. Promax (oblique) rotation method was applied in an attempt to achieve a simpler factor structure and to allow the factors to be correlated. The number of factors extracted was determined based on eigenvalues, scree plot, and simple structure (i.e. no or few cross loadings), as well as interpretability (i.e., theoretically meaningful). For eigenvalues that are slightly above one, the 95% confidence intervals (CIs) were examined to check if the eigenvalues were significantly greater than one (27). The minimum loading of an item on a factor considered in this analysis was 0.32. A cross-loading item was determined as an item that loaded at 0.32 or greater on two or more factors (28). Loading of cross-loading items was further determined by examining the interpretability and item-scale correlation. Items were removed if they did not meet any loading criteria.

We used Cronbach's alpha to estimate the internal consistency of the BHE total and subscale scores. Cronbach's alpha coefficients equal to 0.80 or greater were considered evidence for good reliability of a scale (29). In addition, inter-item correlations were computed to check for possible redundancy among items. Items with correlations higher than 0.80 were considered to be potentially redundant. Convergent and predictive validity were examined using the Pearson product moment correlations or Spearman's rank-order correlations wherever appropriate. Moderate negative correlations between the BHE and the WEL total or subscale scores would suggest good convergent validity of the instrument. Finally, we evaluated the predictive validity by correlating the BHE change scores with 0–6 months weight change. Since participants received weight loss intervention in the study that has changed their perceptions of barriers to healthy eating over time, thus we employed changes in BHE scores and weight loss to demonstrate the predictive evidence of the instrument.

Results

Sample characteristics of the four studies are presented in Table 1. A total of 631 participants from studies were middle aged (48.04 ± 10.06 years old), primarily female (86.1%), White (75.1%) and had a BMI (33.94 ± 4.28 kg/m^2). Participants in the latter two studies (SELF and EMPOWER) were significantly older than those in the earlier two studies (PREFER and SMART) ($ps < 0.001$). Given the pattern observed, the differences in age were likely due to the elimination of an upper age limit for SELF and EMPOWER.

The baseline BHE total mean scores across the four sequential studies were 60.77±14.63), SMART 61.75±13.85, SELF 62.08±13.46), and EMPOWER 59.14±13.23 for PREFER, SMART, SELF, and EMPOWER, respectively. We did not find significant differences in the baseline BHE total and subscale scores among the studies. Although the distribution for the 22 items were not normal in individual studies, no floor or ceiling effects were observed based on the frequency distributions.

Construct Validity via Factor Structure

PREFER Study—Among the 176 participants in the PREFER study, one multivariate outlier and four participants with missing values on certain BHE items were removed from the factor analysis. The KMO index was 0.851, suggesting that the data were appropriate for factor analysis. The Bartlett test of sphericity was significant (χ^2 = 1264.93, p < 0.001), indicating that the correlational matrix of the BHE items is not an identity matrix (i.e., has off-diagonal values that are non-zero) and is appropriate for factor analysis. Application of PAF revealed five factors with eigenvalues greater than one; however, the fifth factor was not retained since its eigenvalue was not significantly different from one. The four retained factors explained 51.48% of the total item variance. The median communality for the 22 BHE items was 0.394 (range 0.218 – 0.674) with eleven items being less than 0.40.

SMART Study—In the SMART study (N = 197), data from ten individuals (five were considered outliers and five had missing values) were removed, resulting in a sample of 187. The KMO index was 0.826 and the significant Bartlett test of sphericity (χ^2 = 1432.31, p<0.001) demonstrated the appropriateness of conducting the PAF. The PAF with Promax rotation revealed four factors with eigenvalues significantly greater than one, and the four-factor structure accounted for 51.37% of the total item variance. The median value of the communalities for the 22 BHE items was 0.406 (range 0.159 – 0.659) with eleven items less than 0.4.

SELF Study—In the SELF Trial (N = 129), no missing data or outliers were identified. The KMO index was 0.789, which was slightly below 0.8 but still PAF was performed for the data. The Bartlett test of sphericity was significant (χ^2 = 970.782, p < 0.001) indicating the appropriateness of conducting PAF analysis. After examining the 95% CIs of the eigenvalues, four factors were retained that explained 51.41% of the total item variance. The median value of the communalities for the 22 BHE items was 0.427 and ranged from 0.210 to 0.613 with nine items less than 0.40.

EMPOWER Study—In the EMPOWER study (N = 128), only one outlier was removed from the factor analysis. The KMO index was 0.840, and the Bartlett test of sphericity was significant (χ^2 = 907.782, p < 0.001). First, three factors with eigenvalues significantly greater than one were extracted. However, factor loadings were not clear given the content of the items on each factor; thus, we further examined the four-factor structure as observed in the three earlier studies and the five-factor structure, and their corresponding item loadings. The four-factor solution provided a clearer factor structure with few item cross-loadings and better interpretation of item loadings on factors. Thus, we retained the four-factor structure explaining 51.94% of the total item variance. The median of the communalities for the 22

BHE items was 0.425 (range 0.200 – 0.658) with eight items having communalities less than 0.40. A change to the factor structure was observed in the EMPOWER study compared to the three earlier studies. The factor accounted for the most variance in previous studies became the second factor in the EMPOWER study.

In summary, a four-factor structure for the BHE was suggested from examinations of individual studies. However, a closer examination of the factor structure across four studies revealed that one factor was not stable when tested across studies as evidenced by inconsistency of the items identified for the factor in each study, while the other three factors were fairly well replicated with the majority of items consistently loading across studies. Given that the majority of item communalities were in the range of low to moderate and several items loaded weakly on this factor, a further inspection with a large sample size by combining subjects from four studies together was performed to derive a quality factor solution.

The Four Studies Combined (N=631)—After removing nine participants with any missing data and 13 participants who were identified as multivariate outliers in the total sample, PAF with Promax rotation was applied to the data for the remaining 609 participants. The KMO measure of sampling adequacy was 0.889, which is above the recommended 0.8, and the Barlett's test of sphericity was found to be highly significant ($\chi^2 = 3879.60$, $p < 0.001$). The CIs of the eigenvalues suggested a three-factor structure accounting for 46.67% of the total item variance. The median of the commonalities of BHE items was 0.446 (range 0.158 – 0.624) with seven items having communalities less than 0.40.

The three-factor structure of the BHE scale based on the total sample replicated the three stable factors that were determined from each individual study. Items with high loadings on the first factor were related to self-control and motivation (e.g., 'when I am very hungry I have trouble controlling what I eat' and 'losing weight is rewarding but I have trouble staying motivated to keep off the weight I lost'); items on the second factor were related to barriers regarding daily mechanics (e.g., 'I find it difficult to select the appropriate foods when shopping'), and items on the third factor reflected barriers related to social support (e.g., 'my family does not support my efforts to change my diet') (Table 2).

Three items did not load on any factor (items 6, 7, and 18) in the total sample. Item 6 'It is difficult to find time to plan appropriate meals for myself' represents one's time management ability, which is an important construct when measuring barriers to healthy eating, thus was retained and added to the daily mechanics factor after consulting with the domain expert. Item 7, 'I don't see any benefits from my efforts to lose weight' did not load on any of the extracted factors. In the individual studies item 7 failed to load in SMART and EMPOWER and loaded poorly in PREFER and SELF. This may be because Item 7 is not directly addressing the concept of healthy eating. Item 18 'The taste of low-fat/low-calorie foods is different' did not load on any extracted factors and may be due to the non-applicable item content in the current food industry. The tastes of the reduced fat/calorie food have improved largely over the past decade, and the increasing variety of the low fat/

calorie food options provide more choices that work for many people. Thus, the revision or removal of these two items needs to be considered.

Items 1 and 21 cross-loaded moderately on two factors, reflecting that the content of these items may have multiple dimensions of meaning. For example, item 21, relating to eating control when with family, cross-loaded on two factors (i.e. self-control and motivation, social support) rather than strongly loading on one factor. Participants may interpret and respond differently to the items in varying situational contexts, which may explain the problems in replicating the factor structure in individual studies. Further clarification of these items may be required.

Internal Consistency

The internal consistency for the 22 BHE items in our sample of 631 adults participating in weight loss studies was 0.874 and became 0.871 after removing BHE Items 7 and 18. Table 3 presents the internal consistency and the inter-item correlations for the 20-item BHE scale and the three retained factors across studies. Cronbach's α for the 20-item BHE scale was 0.881, 0.868, 0.849, and 0.871 in the PREFER, SMART, SELF and EMPOWER studies, respectively, consistently demonstrating evidence of good internal consistency of the BHE regardless of the time period. Inter-item correlations ranged between 0.003 and 0.616; thus, no redundant items were observed. The correlations between item and subscale scores ranged from 0.265 to 0.651.

Convergent Validity

A significant negative moderate correlation between the WEL total and the BHE total scores was consistently observed across the individual studies. Correlation values were −0.503, −0.564, −0.523, and −0.532 ($ps < 0.001$) for the PREFER, SMART, SELF, and EMPOWER studies, respectively, providing good support for convergent validity of the BHE scale. When examining the BHE and WEL subscales in each study, as in the hypothesized direction, the BHE factor one was moderately correlated with three of the WEL subscales including social pressure, availability, and negative emotions ($rs = -0.319$ to -0.617, $ps < 0.01$).

Predictive Validity

Our findings showed supporting evidence for the predictive validity of the BHE instrument. The BHE total scores were significantly related to the 6-month weight loss outcome; correlation coefficients were 0.343, 0.450, 0.282, 0.351 in the PREFER, SMART, SELF, and EMPOWER study, respectively.

Discussion

This is the first study that validated an instrument measuring barriers to healthy eating in the context of intentional weight loss. The BHE scale was used in four studies over 13 years and performed consistently well in terms of internal consistency. Also, the results provide substantial evidence of the BHE's convergent validity and predictive validity. As expected, individuals who perceived greater barriers tended to have lower self-efficacy for eating control based on the WEL. The changes in BHE total scores were related to the percent weight change over the 6 months, providing strong evidence of predictive validity.

The three-factor structure of the BHE scale appears to be a reproducible and meaningful solution. Although the factor analysis of each individual study points to a four-factor structure solution, item loadings on all factors could not be fully replicated across studies. One possible explanation for the unstable structure is that the sample size in each individual study was relatively small given the complexity of the scale, which compromised the factor solution quality according to MacCallum et al (31). Moreover, we observed weak overdetermined factors as represented by poor exhibition of simple structure and not having a large number of high loadings on factors. Considering the low communalities of the BHE items and existence of weakly determined factors, sample size has a greater impact on the factor solution quality. MacCallum et al. suggested that a sample size over 500 was necessary to derive a high-quality factor solution (31). Therefore, our three-factor structure, as indicated by the factor analysis results combining all 631 participants would yield a more reliable factor solution and accounted for 46.67% of the total item variance.

The factor structures and the variance accounted for by each factor in individual studies provide insightful information. Daily mechanics, the factor that accounted for the second largest proportion of variance, accounted for a larger proportion of variance in the EMPOWER study. This increase may indicate that people became more conscious of food selection. Evidence exists that a shift from preparing home-cooked foods to eating out has slowed the last decade (32). People pay more attention to food selection and preparation today, especially among our middle aged, well-educated and health conscious participants. Concurrently, limited food options have become less of a barrier (33) replaced by an array of healthy food options.

The BHE scale can help researchers identify and understand barriers associated with dietary adherence as well as enhance behavioral interventions that support weight loss. The study's major strength is that we evaluated the BHE to establish its psychometric properties in four independent weight loss studies spanning a 13-year period. The results confirm that the BHE possesses good psychometric properties over time and also that it can be recommended for assessing barriers to healthy eating. A study limitation is its limited generalizability. The majority of the participants were white, middle-age females with obesity. Thus, we suggest that future studies examine the psychometric properties of the 20-item BHE scale in samples that include the full adult age spectrum, better male representation, those less educated and minority groups.

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What is already known about this subject?

- Dietary modification is a key component in behavioral weight loss intervention.
- Adherence to a weight-reducing dietary plan declines over time and barriers exist that may thwart dietary adherence.
- There is an absence of a standard and validated instrument to measure barriers to healthy eating.

What does your study add?

- This study validated an instrument measuring barriers to healthy eating in the context of weight loss.
- The psychometric evidence was demonstrated and compared in four independent weight loss studies over 13 years.
- Effective strategies can be developed to support a person's dietary adherence once barriers are identified.

Table 1.

Sociodemographic characteristics of participants in four studies

Study Characteristics	PREFER	SMART	SELF	EMPOWER	Studies Combined
n	176	197	129	129	631
Years enrolled	2002–2004	2006–2008	2009–2011	2011–2015	2002–2015
Age, years Mean (SD)	44.03 (8.76)	46.60 (9.15)	52.97 (9.59)	50.80 (10.75)	48.04 (10.06)
BMI, kg/m^2 Mean (SD)	34.02 (4.09)	33.94 (4.46)	33.44 (3.87)	34.35 (4.65)	33.94 (4.28)
Sex, % female	86.90%	84.80%	82.90%	89.90%	86.1%
Race, % white	70.50%	77.70%	71.30%	81.40%	75.1%
Education, years Mean (SD)	15.20 (2.54)	15.61 (2.96)	15.91 (3.06)	16.46 (2.90)	15.73 (2.89)

Table 2.

Factor structure of the BHE scale in the four studies combined (N=609)

		Factor loadings		
Item #		**F1**	**F2**	**F3**
	Factor 1: Self-control and Motivation			
BHE5	I use food as a reward or treat for myself	.719		
BHE11	When I am very hungry I have trouble controlling what I eat.	.690		
BHE12	Losing weight is rewarding but I have trouble staying motivated to keep off the weight I lost.	.660		
BHE16	I never feel that my appetite is satisfied when I am trying to lose weight.	.653		
BHE10	I have difficulty controlling my eating when I am with friends.	.650		
BHE14	I feel deprived when I have to restrict so many foods.	.643		
BHE4	It is difficult to motivate myself to eat appropriately.	.581		
BHE21	When I am with my family I find it difficult to watch what I eat.	.440		.322
BHE20	When I am busy or feeling overwhelmed, I find it difficult to remember all the rules about what foods are appropriate.	.387		
BHE19	Resisting tempting high fat/high calorie foods in my work setting is difficult.	.320		
	Factor 2: Daily Mechanics			
BHE15	I find it difficult to select the appropriate foods when shopping.		.834	
BHE9	I don't know what foods I should eat to lose weight.		.773	
BHE13	Changing my diet to reduce calories and fat seems too complicated.		.522	
BHE8	It is difficult to shop for one person in the grocery store.		.448	
BHE17	The foods that are reduced in fat and the calories cost more than I can afford.		.418	
BHE3	I have trouble estimating appropriate portion sizes.		.352	
BHE6	It is difficult to find time to plan appropriate meals for myself.		.297	
	Factor 3: Social Support			
BHE2	My family does not support my efforts to change my diet.			.611
BHE22	My friends do not support me when I try to change my eating.			.441
BHE1	Appropriate food is not available in my home.		.345	.390
Proportion Variance Explained		.30	.10	.07

Table 3.

Internal consistency and inter-item correlations for the three factors of the BHE scale in individual studies and study combined

		Individual study				Combined (N=609)
		PREFER (N=171)	SMART (N=187)	SELF (N=129)	EMPOWER (N=128)	
Factor 1 (10 items)	Cronbach's α	0.854	0.853	0.853	0.806	0.850
	Range of inter-item correlation	0.224–0.488	0.171–0.579	0.141–0.612	0.163–0.583	0.224–0.567
	Range of item-total correlation	0.459–0.637	0.409–0.662	0.424–0.684	0.376–0.575	0.440–0.635
Factor 2 (7 items)	Cronbach's α	0.773	0.765	0.665	0.786	0.758
	Range of inter-item correlation	0.222–0.616	0.123–0.569	.003–0.500	0.144–0.593	0.145–0.576
	Range of item-total correlation	0.403–0.649	0.367–0.683	0.183–0.560	0.400–0.651	0.365–0.651
Factor 3 (3 items)	Cronbach's α	0.554	0.512	0.409	0.580	0.520
	Range of inter-item correlation	0.153–0.380	0.145–0.375	0.038–0.314	0.200–0.483	0.113–0.392
	Range of item-total correlation	0.313–0.485	0.262–0.421	0.143–0.437	0.300–0.485	0.265–0.461
BHE (20 items)	Cronbach's α	0.881	0.868	0.849	0.865	0.871
	Range of inter-item correlation	0.017–0.616	0.001–0.579	0.003–0.612	0.002–0.593	0.018–0.576
	Range of item-total correlation	0.343–0.636	0.306–0.624	0.144–0.639	0.331–0.616	0.326–0.609

Factor 1 = Self-control and Motivation; Factor 2 = Daily Mechanics; Factor 3 = Social Support.