RESEARCH
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The Mindful Eating Behavior Scale: Development and Psychometric Properties in a Sample of Dutch Adults Aged 55 Years and Older

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ABSTRACT

Background Earlier scales on mindful eating do not measure mindful eating independent from emotional or external eating, or mindful eating in common situations.

Objective The objective was to develop a new instrument to measure the attention element of mindful eating, the Mindful Eating Behavior Scale (MEBS), and to compute the internal structure, reliabilities, and convergent validity of this scale.

Design A cross-sectional ancillary study within the Longitudinal Aging Study Amsterdam was conducted between fall 2014 and spring 2015.

Participants/setting Participants were 1,227 Dutch adults aged 55 years and older from the Longitudinal Aging Study Amsterdam.

Main outcome measure A selection of 20 items from existing instruments was used to design an initial version of the MEBS.

Statistical analyses performed The internal structure of the MEBS was evaluated using an exploratory structural equation modeling approach on half of the sample and confirmatory factor analysis on the whole sample to develop the final version of the scale. The measurement invariance of the scores was tested with respect to sex, age, and body mass index. Reliabilities of subscales were determined with Cronbach's α. To test convergent validity, the scores of the new scale were correlated with theoretically relevant variables.

Results Two items were deleted because of low item loadings and one item because of high correlated uniqueness. The final confirmatory factor analysis model with 17 items and four domains (Focused Eating, Hunger and Satiety Cues, Eating with Awareness, and Eating without Distraction) showed good fit (comparative fit index=0.97, Tucker-Lewis index=0.96, and root mean square error of approximation=0.04). Measurement invariance was found for sex, age, and body mass index. Cronbach's α values were medium to high (.70 to .89). Most correlations were in the expected directions, which indicated good preliminary convergent validity.

Conclusions The MEBS was successfully developed consisting of 17 items and four domains. Because of low interfactor correlations, a total score combining the four domains should not be computed. The MEBS showed good internal consistency and preliminary convergent validity in a sample of Dutch adults aged 55 years and older.
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MINDFULNESS INTERVENTIONS HAVE BEEN SUGgested for a range of health issues. Reviews show that mindfulness-based therapies and interventions are among others effective in treating eating disorders,[1] reducing symptoms of depression and/or anxiety in clinical populations,[2,3] reducing emotional reactivity,[4] and increasing subjective well-being and behavior regulation.[4]

Interventions that are based on the concept of mindfulness can be applied to various aspects of life. One of the areas being explored in relation to health is the area of nutrition and food-related behavior. Mindful awareness toward eating may minimize automatic reactions and impulsive reactions, thereby fostering self-regulation.[5,6] Reviews of mindfulness-based interventions specifically focused on eating behavior showed improvements in binge eating,[7,8] emotional and external eating,[7] restrained eating and interoceptive awareness,[9] weight management,[5] mental well-being,[9] and dietary intake.[9]

Studies of mindfulness-based interventions that did not have content related to eating behavior reported smaller effect sizes[8] or no effect on these outcomes.[7] These results

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indicate that domain-specific mindfulness related to eating behavior may play an important role in the prevention and treatment of health issues related to overweight and disordered eating. Mindfulness is a difficult state to fully achieve, so focusing strictly on eating can make it easier to adapt to and more relevant for eating-related behavior.[5]

Mindfulness that is related to eating behavior can be termed mindful eating. At present there are two mindful eating scales: the Mindful Eating Questionnaire (MEQ)[10] and the Mindful Eating Scale (MES).[11] Recently an abbreviated version of the MEQ[12] was developed. For the development of the MEQ[10] six constructs were selected to construct subscales on, including the three constructs emotional eating, external eating, and disinhibition. The MES[11] was developed with the aim of including a subscale to measure nonjudgment—which the MEQ was lacking— and was inspired by two existing general scales for mindfulness. The abbreviated version of the MEQ was developed with the aim of obtaining a shorter tool that would be suitable in health contexts where time constraints are at play.[12] Although these scales make it possible to measure mindfulness specifically targeted at eating behavior, some issues arise that need to be addressed.

Because the MEQ[10] was developed based on existing eating behavior constructs, overlap between these different constructs may exist. For example, the MEQ contains the items "I recognize when food advertisements make me want to eat" and, "When I'm sad I eat to feel better," which assess external and emotional eating (eating in response to food-related cues or to negative mood). Furthermore, some items from the MEQ ask about very specific situations (ie, restaurant, parties, and all-you-can-eat buffets), which makes it difficult to measure general mindful eating in common situations.

The abbreviated version of the MEQ already deals with some of these issues by deleting items that were evaluated by experts as poorly representative of the construct of mindful eating.[12] Although this shortened version of the MEQ thus measures mindful eating conceptually better, it still contains items on external eating (eg, "I notice when I'm eating from a dish or candy just because it's there"), items that ask about specific situations (eg, party or all-you-can-eat buffet), and two items with cross-loadings above 0.20. The test–retest validity and convergent validity were adequate. However, participants from specific settings such as yoga centers or weight-loss centers were overrepresented in the sample. This strategy is useful for allowing comparisons between different groups, although it leads to a composition of the sample that is not representative of the general population.

The MES was developed to be more in line with standard definitions of mindfulness, but a limitation is that the factor analysis was conducted on 127 predominantly female students, and a confirmatory factor analysis in a nonstudent sample was not conducted.[11] Cronbach's α for the unstructured eating factor was only .60,[11] and the items "I snack when I'm bored" and, "I eat between meals" from this factor do not seem to measure mindful eating. The factor nonreactivity is more likely an outcome of having learned mindfulness skills as opposed to being implicit in the construct.[13]

For these reasons, the aim was to develop a new instrument to measure mindful eating that does not contain items on emotional and external eating—to open up the possibility to assess the independent effects of mindful eating, asks about general situations, and is evaluated in a large sample that includes people with different socioeconomic backgrounds.

RESEARCH SNAPSHOT

Research Question: What is the internal structure, reliability, and convergent validity of the Mindful Eating Behavior Scale, a new instrument to measure mindful eating?

Key Findings: The final confirmatory factor analysis model with 17 items and four domains (Focused Eating, Hunger and Satiety Cues, Eating with Awareness, and Eating without Distraction) showed good fit (comparative fit index=0.97, Tucker-Lewis index=0.96, and root mean square error of approximation=0.04) in a cross-sectional study in a sample of 1,227 Dutch adults aged 55 years and older. Cronbach's α values were medium to high (.70 to .89) and most correlations were in the expected directions, which indicated good preliminary convergent validity.

The definition of mindful eating that was used for this new scale is: Eating with attention and awareness. This was based on the definition of mindfulness by Brown and Ryan:[14] "An enhanced attention to and awareness of current experience or present reality." Mindfulness is most often divided into two separate elements: self-regulation of attention in the present moment (the attention element) and paying attention nonjudgmentally (the acceptance element). The focus of this scale is on the attention part because this element is essential: Present moment awareness is needed to be able to pay attention nonjudgmentally.[15] In some earlier studies on the development of mindfulness instruments, an acceptance factor was not found[16] or provided no extra exploratory advantage in the prediction of criterion measures.[17] A recent review showed that there is no conclusive evidence that acceptance could promote changes in eating behavior.[18]

The aim of this study was to develop a new scale to measure the attention element of mindful eating, the Mindful Eating Behavior Scale (MEBS), and test the internal structure and reliabilities. Correlations with relevant variables were computed to establish convergent validity. Because the MEBS should be able to measure mindful eating separately from the eating styles emotional, external, and restrained eating, it was tested whether mindful eating was metrically distinguishable from these eating styles.

METHODS

Participants and Procedure

All data were collected within the Longitudinal Aging Study Amsterdam (LASA).[19,20] The LASA sample consists of a representative sample of older adults aged 55 years and older, living in three geographic regions in the Netherlands: Amsterdam, Zwolle, Oss, and the suburbs of these regions. The LASA study started in 1991 with the primary aim to follow physical, cognitive, emotional, and social functioning in relation to ageing.[20] The first cohort of participants participated in 1992-1993 and consisted of 3,107 participants aged 55 to 85 years. The second cohort in 2002-2003 included 1,002 participants aged 55 to 65 years and the third cohort started in 2012-2013 with 1,023 participants aged 55 to 65 years. Follow-up measurements by a main interview,

medical interview, and self-reported questionnaire take place every 3 years.[20]

Data on the Mindful Eating Behavior Scale items collected in the LASA Nutrition and Food-Related Behavior study—an ancillary study conducted in between fall 2014 and spring 2015—were used. The ancillary study consisted of a questionnaire that people were asked to fill out either online or on paper. The questionnaire included questions on food-related behavior, body weight, and mental well-being. Ethical approval for the LASA study and the ancillary study was given by the Medical Ethics Committee of the VU University Medical Center Amsterdam and all participants provided written informed consent. See the flow chart in Figure 1 for information about the selection procedure and response rate of this study.

Selection of Potential Scale Items of the MEBS

To develop the MEBS, a selection of 20 items from existing instruments was used as a starting point. These 20 items were selected because they reflect the attention and awareness part of mindful eating, ask about mindful eating in general (instead of asking about specific situations), and do not measure the tendency toward external or emotional eating.

From the MEQ,[10] two out of three items from the domain Distraction were selected. From the MES,[11] the five-item domain Awareness was selected, three out of four items from the Act with Awareness domain, and two out of four items from the Unstructured Eating domain were selected. From the Intuitive Eating Scale-2,[21] the 6-item domain Reliance on Hunger and Satiety Cues was selected. Two items were newly constructed: "I watch TV while eating" and "I read while eating" because these are types of distraction that occur often during eating across generations.[22] A more detailed description of the development of the MEBS and the selected items can be found in Figure 2 (available at www.jandonline.org).

The selected English items were translated to Dutch and back-translated to US English by a US native speaker. The 20-item initial version of the MEBS was pilot tested for understandability (18 people in total; seven on paper of whom 2 people read out loud and 11 answered online). Answer categories for these 20 items ranged from 1=never to 5=very often.

Four domains in the MEBS were expected: Eating while Focusing on the Food, Eating while Paying Attention to Hunger and Satiety Cues, Being Aware of One's Eating, and Eating while not being Distracted/Doing other Things. In Figure 3 (available at www.jandonline.org) the initial 20-item version of the MEBS with all used items and their origin can be found, as well as the expected structure of the MEBS.

Description of the Sample: Sociodemographic and Lifestyle Characteristics

The study sample was described in terms of sociodemographic and lifestyle characteristics. Sex, age, and education

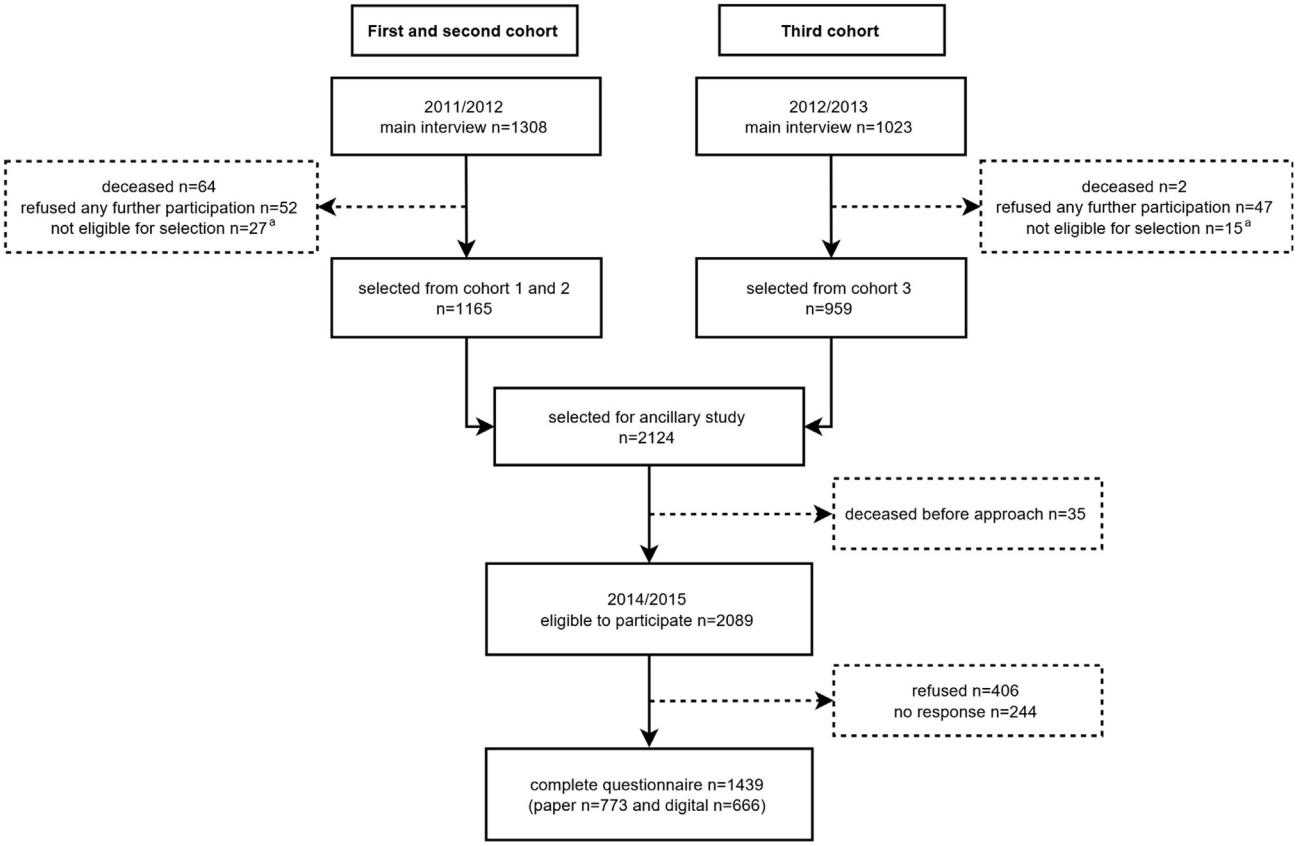

Figure 1. Flow chart of selection and response to the ancillary Nutrition and Food-Related Behavior Study of Dutch adults aged 55 years and older from the Longitudinal Aging Study Amsterdam. [a]For example: Respondent has indicated willingness to participate at regular waves only or has severe vision problems.

level were self-reported and measured at the baseline measurement of LASA. Smoking status (never, former, or current), weight, height, and physical activity were measured in the last LASA cycle conducted before the Nutrition and Food-Related Behavior Study (time lag is between 1 and 3.5 years). Alcohol consumption was measured in the Nutrition and Food-Related Behavior study.

Education level was categorized into low (none or elementary school), middle (secondary education, lower, and intermediate vocational training), and high (higher vocational training, college, and university education).

Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters^2. Weight was measured to the nearest 0.1 kg using a calibrated bathroom scale (Seca, model 100). Corrections have been made to adjust the measured body weight for clothing, shoes, or a corset (−1 kg for one of those elements and −2 kg for more than one) when people did not wear underclothing only. Height was measured to the nearest 0.001 m using a stadiometer. Corrections have been made to adjust the measured height for shoes (−1 cm) when people did not take their shoes off.

Physical activity was measured using the validated LASA Physical Activity Questionnaire.[24] Frequency and duration of walking outdoors, bicycling, light and heavy household activities, and sports during the past 2 weeks was asked. Total time in minutes per day spent on these activities was calculated.

Alcohol consumption was assessed by asking participants about the number of days per week they drank alcohol and the number of alcoholic drinks on these days.[25] The number of drinks per day was calculated and categorized into no drinking, moderate drinking (on average maximum 2 drinks per day and never more than 6 drinks per occasion), and excessive drinking (on average more than 2 drinks per day or more than 6 drinks in one occasion).

Factor Analysis Dutch Eating Behaviour Questionnaire Items

The psychological eating styles emotional eating (α=.93), external eating (α=.77), and restrained eating (α=.87) were measured with the 20-item version of the Dutch Eating Behaviour Questionnaire (DEBQ-20),[26,27] which is the brief version of the original 33-item DEBQ.[28]

Convergent Validity: Correlations with Relevant Variables

The psychological eating styles, alexithymia, and satisfaction with weight were measured in the Nutrition and Food-Related Behavior Study. The other variables that are described below were measured in the last LASA cycle conducted before the Nutrition and Food-Related Behavior Study.

Satisfaction with life (α=.64) was measured using 2 questions:[29] one about current life, the other about life as a whole. Both scores were summed.

Perceived stress (α=.86) was measured with the 10-item version of the Perceived Stress Scale,[30] which is a shortened version of the 14-item Perceived Stress Scale.[31]

Depressive symptoms (α=.85) during the past week was measured with the 20-item Center for Epidemiological Studies Depression Scale.[32,33]

Alexithymia was measured with the scales Difficulty Identifying Feelings (α=.87) and Difficulty Describing Feelings (α=.74) from the Toronto Alexithymia Scale-20.[34,35]

Satisfaction with weight was measured with one question asking about how satisfied people were. Answers ranged from 1=very dissatisfied to 5=very satisfied.

General self-regulation (α=.92) was measured with a 14-item questionnaire that was based on a German questionnaire focussing on physical activity.[36] This focused questionnaire was a shortened version of the original 48-item questionnaire on goals in general.[37] For LASA, the narrow focus of the shortened questionnaire was broadened again from goals related to physical activity to goals in general.

Self-esteem (α=.71) was measured with four of the 10 items of the Rosenberg Self-Esteem Scale.[38]

Statistical Analysis

The study sample was described in terms of sociodemographic, lifestyle, and behavior characteristics.

The number of factors to retain was determined by parallel analysis and theoretical interpretability of the solution. Parallel analysis is a principal components analysis conducted on the actual data as well as multiple sets of random data.[39] The number of factors of which the eigenvalue of the real data is greater than the eigenvalue of the random data is retained. The idea behind this is that the factors underlying mindful eating should account for more variance than is expected by chance.

Concerning the validation of the questionnaire, the first step was to evaluate the internal structure of the scale. As modeling technique, an exploratory structural equation modeling approach (ESEM)[40] was used on all items to develop the final version of the scale. ESEM is a technique that, unlike confirmatory factor analysis (CFA), permits that all items load into all factors, and unlike exploratory factor analysis, permits the correlation between item uniqueness. The ESEM technique was used with a random half of the sample to determine theoretical meaning of the domains to be retained. Several models were tested until a final model with satisfactory fit was derived. The items to be retained in the final version were determined based on loadings over 0.40 in the primary factor and no cross-loading >0.20. With new questionnaires, it is common to have to drop some items of the initial version to derive a final version because their performance is not as expected when the instrument was constructed.

The second step was to cross-validate the internal structure of the final version proposed using ESEM with a CFA in the entire sample. In this way a compromise between the need to cross-validate the results and the need to keep a sample size as large as possible for the final model was achieved (eg, the study by Sánchez-Carracedo and colleagues[41]).

In both ESEM and CFA, models were analysed using robust maximum-likelihood (MLR estimator). Goodness-of-fit in all derived models was assessed with the common cut-off values for the fit indexes:[42] values >0.95 on the comparative fit index (CFI) and Tucker-Lewis index (TLI), and <0.06 on the root mean square error of approximation (RMSEA). Localized areas of strain were assessed with modification indexes.

In a third step a factor invariance study was carried out, splitting the sample by sex, age, and BMI. The groups for

these last two variables were constructed with a median split. For age in years, the younger sample included 615 participants (range=56.8 to 67.3 years), whereas the older sample included 612 participants (range=67.3 to 101.2 years). For BMI, the lower half (n=586) range was 17.4 to 26.6, whereas the higher half (n=586) range was 26.6 to 56.3. To test the invariance, the equality (or minimal difference) of the fit between consecutive and more restrictive models was evaluated. It was tested whether configural invariance (equal form), metric invariance (equal loadings), scalar invariance (equal loadings and intercepts), and strict invariance (equal loadings, intercepts, and error variances) between models could be justified. The Satorra-Bentler χ^2 difference test for model comparison was conducted. Given the large samples sizes used in the analysis, closer attention was paid to the change in model fit indexes for establishing measurement invariance. These parameter restrictions were considered to be satisfactorily met if the decrease in CFI was lower than 0.01 and RMSEA increased by <0.015.[43,44]

The fourth step was to compute the frequencies of scores, median scores, and interquartile ranges to check the distribution of these scores, and to compute the reliability of the sum of the different observed scores for each dimension with Cronbach's α.

A fifth additional step was to analyze the internal structure of the MEBS items and the DEBQ-20 items simultaneously. The aim was to test whether the mindful eating domains can be distinguished from the eating styles by showing whether the MEBS and DEBQ items would load into different domains; that is, Focused Eating, Hunger and Satiety Cues, Eating with Awareness, Eating without Distraction, Emotional Eating, External Eating, and Restrained Eating. By doing so the aim was to test whether the MEBS items were measuring mindful eating and not simultaneously also some other eating styles. For this purpose, an ESEM approach was used because the presence of relevant cross-loadings could not be reasonably discarded beforehand. The items were assigned to factors based on loadings over 0.40 in the theoretical factor and no cross-loading >0.20.

The sixth and final step was to assess the associations between the found domains and theoretically related variables. Correlations between the found domains and theoretically relevant variables were computed to check whether expected associations could be reproduced. Correlations were considered small in the case that they were below 0.20, medium-small in the case that they were 0.20 or greater and smaller than 0.30, moderate in the case that they were 0.30 or greater and smaller than 0.50, and large in the case that they were 0.50 or above.[45]

ESEM and CFA were performed with M*plus* 7.4[46] and R 3.3.2,[47] with packages *psych* version 1.6.12[48] and M*plus* Automation version 0.6-4.[49] The descriptives, Cronbach's α values, and correlations were computed with SPSS version 23.[50]

Convergent Validity

Positive correlations between the MEBS domains and satisfaction with life and negative correlations with perceived stress and depressive symptoms were expected. Earlier research with the Hunger and Satiety Cues domain found correlations with negative influence and life satisfaction.[21] Mindful eating as measured with the MEQ was correlated with a positive mental well-being scale.[51] Eating chocolate mindfully led to an increase in positive mood compared with eating chocolate nonmindfully.[52] A review of interventions that promote eating by internal cues found that participants showed improvements in depression, negative affect, and quality of life.[9]

Negative correlations between the MEBS domains and BMI and positive correlations with weight satisfaction were also expected. Although studies show mixed findings regarding associations between mindful eating and BMI or weight change,[18] the covariate-adjusted MEQ score was inversely associated with BMI, and the Awareness factor of the MES correlated negatively with BMI.[11] A recent review showed that two mindfulness interventions led to improvements in body dissatisfaction in overweight/obese populations.[53]

Negative correlations were expected with the psychological eating styles: emotional, external, and restrained eating. A literature review showed that five out of eight mindfulness-based interventions focused on emotional eating resulted in lower degrees of emotional eating and that four out of six interventions on external eating led to lower frequency of external eating.[7] Another review showed that participants in most studies decreased their dietary restraint.[9] Act with Awareness (MES domain) also correlated with the score on the Eating Disorder Examination Questionnaire,[11] indicating that this may be an important construct for eating pathology; for example, the eating styles emotional and external eating.

Negative correlations were expected between the MEBS domains and difficulty identifying feelings and difficulty describing feelings. Several interventions focused on eating by internal cues led to increased interoceptive awareness, the ability to recognize and respond to internal states such as emotions, hunger, and satiety.[9]

Positive correlations between the MEBS domains and self-regulation were expected. Findings that mindful attention prevents impulses toward attractive food suggests that "mindful attention to one's own mental experiences helps to control impulsive responses and thus suggest mindfulness as a potentially powerful method for facilitating self-regulation."[6]

Positive correlations were expected between MEBS domains and self-esteem. Earlier research did find correlations between reliance on hunger and satiety cues and self-esteem.[21] Interventions with a focus on eating by internal cues led to increases in self-esteem.[9]

Although there is some evidence to expect the above-mentioned correlations, due to the limited availability of previous research on mindful eating and because most of the research is conducted in small, predominantly female samples, overweight/obese samples, or university samples, it is difficult to establish convergent validity based on these findings.

RESULTS

Characteristics of the Study Sample

Of 1,439 people who completed the questionnaire (see Figure 1), 124 people were excluded because they did not fill out the questionnaire for themselves, and 88 people were excluded because they had one or more missing values on the 20 MEBS items. This resulted in an analytic sample of 1,227 people. The mean age of these participants was 68.8±8.1 years and 51.8% were women (see Table 1). For the calculation

Table 1. Characteristics of the study sample of 1,227 people aged 55 years and older from the Longitudinal Aging Study Amsterdam

Characteristic	n	Result
		mean±standard deviation
Age (y)	1,227	68.8±8.1
Body mass index[a]	1,099	27.2±4.6
Physical activity (min/d)[b]	1,180	156.7±101.4
		%
Women	1,227	51.8
Education[c]	1,227	
Low		11.7
Middle		56.6
High		31.6
Alcohol use (%)[d]	1,227	
Nondrinker		17.1
Moderate		53.3
Excessive		29.6
Smoking (%)	1,181	
Never		27.8
Former		60.4
Current		11.9
		mean±standard deviation
Psychologic eating style[e]		
Emotional eating	1,223	1.9±0.8
External eating	1,226	2.4±0.6
Restrained eating	1,226	2.7±0.8
Satisfaction with life[f]	1,184	7.9±1.1
Perceived stress[g]	1,181	10.7±5.5
Depressive symptoms[h]	1,180	9.0±6.5
Alexithymia[i]		
Difficulty identifying feelings	1,208	12.3±5.1
Difficulty describing feelings	1,217	11.4±3.9
Satisfaction with weight[j]	1,223	3.3±1.0
General self-regulation[k]	607	53.6±10.0
Self-esteem[l]	1,217	15.7±2.1

[a]Calculated by dividing weight in kilograms by measured height in meters[2].
[b]Measured with the validated Longitudinal Aging Study Amsterdam Physical Activity Questionnaire.[24]
[c]Low indicates none and elementary school; middle indicates secondary education, lower, and intermediate vocational training; and high is higher vocational training, college, and university education.
[d]Moderate drinking is on average maximum 2 drinks per day and never more than 6 drinks per occasion, whereas excessive drinking is on average more than 2 drinks per day or more than 6 drinks per occasion.
[e]Measured with the 20-item version of the Dutch Eating Behaviour Questionnaire.[26,27] Scores per eating style are calculated as the mean score on the items of that scale and range from one to five. Higher scores reflect more emotional, external, or restrained eating.
[f]Summed score of 2 questions (range=two to 10)[29]: one about current life, the other about life as a whole. Higher scores indicate higher satisfaction with life.
[g]Measured with the 10-item version of the Perceived Stress Scale.[30] The sum score ranges from zero to 40. Higher scores indicate higher levels of stress.
[h]Measured with the 20-item Center for Epidemiological Studies Depression Scale.[32,33] The sum score ranges from zero to 60. Higher scores indicate a higher level of depressive symptoms.
[i]Measured with the Toronto Alexithymia Scale-20.[34,35] Scores range from seven to 35 for difficulty identifying feelings and from five to 25 for difficulty describing feelings. Higher scores indicate more difficulty in identifying or describing emotions.
[j]Measured with one question asking about how satisfied people were (range=one to five). Higher scores indicate higher satisfaction with weight.
[k]Measured with a 14-item questionnaire based on a German questionnaire focussing on physical activity.[36] The focused questionnaire was a shortened version of the original 48-item questionnaire on goals in general.[37] The narrow focus of the shortened questionnaire was broadened again from goals related to physical activity to goals in general. The sum score ranges from 14 to 70. Higher scores indicate higher self-regulation.
[l]Measured with four of the 10 items of the Rosenberg Self-Esteem Scale.[38] The sum score ranges from four to 20. A higher rating indicates more self-esteem.

of correlations (convergent validity), people with missing values on one of the variables in the analyses were additionally excluded from these analyses (n=192).

Internal Structure of the MEBS

The parallel analysis, as can be seen in Figure 4, showed that the eigenvalues of the real data are greater than the eigenvalues of the random sample for the first four factors. This indicated the convenience of modeling the interitem correlations with four factors. An ESEM model with four factors was therefore tested. Results of model fit for this and the next models can be found in Table 2. This first model (M1) did not meet the common cut-off values for goodness-of-fit. The higher modification index, equal to 294.8, corresponded to correlated uniqueness between Item 10 and Item 11. Both items shared in their wordings "to tell me when to stop eating."

In model 2 (M2), the uniqueness of these two items to correlate was allowed. By doing so, all the fit statistics were considered as adequate. Item loadings are shown in Table 3. In this solution, Item 18 ("I eat at my desk or computer") and Item 19 ("I watch TV while I am eating") had low factor loadings (0.30 and 0.25) and were therefore deleted. The correlation between the uniqueness of Item 10 and 11 was equal to 0.66. This indicates that with removing one of these items nothing relevant in terms of content will be lost. Because both items presented similar loadings it was decided to keep item 10 (fullness) because it is a clear counterpart to item 9 (hunger signals) and because fullness signals is more concrete than body. The final ESEM model of the reduced and final version of the MEBS, Model 3, met all goodness-of-fit criteria.

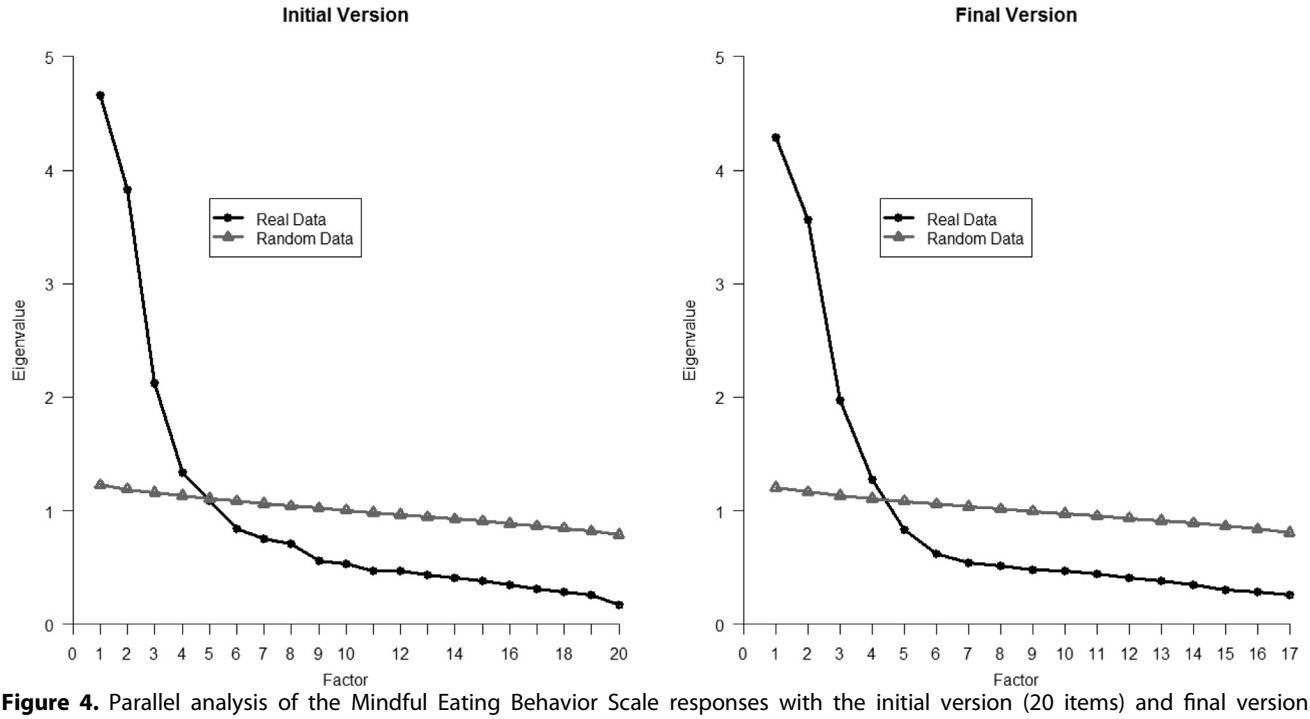

Figure 4. Parallel analysis of the Mindful Eating Behavior Scale responses with the initial version (20 items) and final version (17 items) in a Dutch sample of 1,227 adults aged 55 years and older.

The four factors had a clear theoretical interpretation. In the final version of the MEBS: Focused Eating consisted of five items (eg, "I notice how my food looks"), Hunger and Satiety Cues also comprised five items (eg, "I trust my body to tell me how much to eat"), Eating with Awareness was defined with three items (eg, "I eat automatically without being aware of what I eat"), and Eating without Distraction consisted of four items ("I think about things I need to do while I am eating"). The items of the last two factors are reverse scored, so that a higher score on each factor implies more mindful eating.

The CFA model, M4, on the whole sample also resulted in a good fit and differences in loadings between the final ESEM model and this model were trivial. All the item loadings were equal or higher than 0.65, with the exception of Item 20, where the loading was 0.39.

Interfactor correlations showed a moderate relation between Focused Eating and Eating with Awareness (r=0.39), medium-small relations between Focused Eating and Hunger and Satiety Cues (r=0.25) and Focused Eating and Eating without Distraction (r=0.20), a high relation between Eating with Awareness and Eating without Distraction (r=0.51), and small relations between Hunger and Satiety Cues and Eating with Awareness (r=0.03) and between Hunger and Satiety Cues and Eating without Distraction (r=0.14).

Measurement Invariance

Measurement invariance with respect to sex, age, and BMI was tested. For all the different groups, model fit was satisfactory (see Table 2). When imposing the different equality restrictions in the parameters, the changes in model fit were minimal, clearly below the threshold to reject invariance for eight out of nine comparisons. The only exception was strict invariance with respect to age, where change in CFI=−0.010; a value equal to the defined threshold. The change of RMSEA was lower than the defined threshold. Inspection of modification indexes showed that the problem was located in the error variance of Item 1 ("I notice flavors and textures when I'm eating my food.") When this parameter was allowed to differ between groups, the error variance was 0.346 for the younger sample and 0.759 for the older one. Freeing this parameter led to CFI=0.965 and change in CFI=−0.003.

Distribution of Scores and Internal Consistency Reliabilities

The frequencies of scores, median scores and interquartile ranges showed that all four domains of the MEBS show enough variation in scores (Figure 5).

The internal consistency reliabilities (Cronbach's α) were high for three of the domains: 0.85 for Focused Eating, 0.89 for Hunger and Satiety Cues, 0.81 for Eating with Awareness, and medium for the domain Eating without distraction, α=.70.

Factor Analysis with MEBS and DEBQ-20 Items

By simultaneously modeling the 17 items of the MEBS and the 20 items of the DEBQ it was tested whether, as expected, the items of the MEBS were not assessing the eating styles covered by the DEBQ (see Table 4, available at www.jandonline.org). Model fit for this analysis was adequate (CFI=0.956, TLI=0.932, and RMSEA=0.039). Although TLI was slightly below the intended threshold, it was considered satisfactory, considering the large number of items involved in the analysis. All items clearly loaded in their intended factors (loadings over 0.40, except for item 17 of the MEBS, for which loading was equal to the threshold of 0.40).

Table 2. Summary of goodness-of-fit statistics for exploratory structural equation modeling (ESEM), confirmatory factor analysis (CFA), and measurement invariance models of the Mindful Eating Behavior Scale items in a sample of 1,227 Dutch adults aged 55 years and older

Item	Model	*n*	χ^2[a]	*Df*	CFI[b]	TLI[c]	RMSEA[d]	χ^2_{diff}[e]	P_{SB}[f]	ΔCFI[g]	ΔRMSEA[h]
M1	ESEM	614	551.2	116	.895	.828	.078				
M2	ESEM correlated uniqueness	614	220.5	115	.975	.958	.039				
M3	ESEM deleted items[i]	614	126.3	74	0.984	0.971	0.034				
M4	CFA deleted items[i]	1227	321.4	113	0.970	0.964	0.039				
	Invariance by sex										
M5	Women	635	222.8	113	0.972	0.966	0.039				
M6	Men	592	212.7	113	0.969	0.963	0.039				
M7	Configural invariance	1227	435.3	226	0.970	0.964	0.039				
M8	Metric invariance	1227	462.0	239	0.968	0.964	0.039	26.6	0.014	−0.002	0.000
M9	Scalar invariance	1227	513.3	252	0.963	0.960	0.041	54.4	<0.001	−0.005	0.002
M10	Strict invariance	1227	539.9	269	0.962	0.961	0.041	30.3	0.025	−0.001	0.000
	Invariance by age (median split)										
M11	Younger participants	615	207.2	113	0.974	0.969	0.037				
M12	Older participants	612	205.2	113	0.972	0.967	0.037				
M13	Configural invariance	1227	412.5	226	0.973	0.968	0.037				
M14	Metric invariance	1227	419.4	239	0.974	0.971	0.035	7.8	0.856	0.001	−0.002
M15	Scalar invariance	1227	476.6	252	0.968	0.965	0.038	61.3	<0.001	−0.006	0.003
M16	Strict invariance	1227	565.1	269	0.958	0.957	0.042	63.8	<0.001	−0.010	0.004
	Invariance by BMI[j] (median split)										
M17	Lower BMI	586	199.2	113	0.973	0.968	0.036				
M18	Higher BMI	586	236.3	113	0.963	0.956	0.043				
M19	Configural invariance	1172	434.6	226	0.968	0.962	0.040				
M20	Metric invariance	1172	454.1	239	0.967	0.963	0.039	19.7	0.103	−0.001	−0.001
M21	Scalar invariance	1172	474.7	252	0.966	0.964	0.039	20.1	0.092	−0.001	0.000
M22	Strict invariance	1172	483.3	269	0.968	0.967	0.037	19.2	0.318	0.002	−0.002

[a]All *P* values for the χ^2 test were <0.001.
[b]CFI=comparative fit index.
[c]TLI=Tucker-Lewis Index.
[d]RMSEA=root mean square error of approximation.
[e]χ^2_{diff}=nested χ^2 difference.
[f]p_{SB}=*P* value of the Satorra-Bentler test.
[g]ΔCFI=comparative fit index difference.
[h]ΔRMSEA=root mean square error of approximation difference.
[i]Item 11 was deleted because of correlated error with Item 10. Item 18 and Item 19 were deleted because their primary loading was <0.30.
[j]BMI=body mass index.

Cross-loadings were very small (mean unsigned cross-loading=0.03 and range=0.00 to 0.18).

Convergence Validity: Correlations with External Variables

Correlations of the four subscales of the MEBS with some theoretically relevant variables are shown in Table 5. Although in general all the correlations were small (<0.2) or medium-small (0.2 to 0.3), most of the significant associations were in the expected directions, which indicated good preliminary convergent validity. For the domains Focused Eating, Eating With Awareness, and Eating without Distraction, positive correlations were found with self-esteem, life satisfaction and satisfaction with weight, and negative correlations were found with depressive symptoms, difficulty identifying feelings, difficulty describing feelings and perceived stress. The domain Hunger and Satiety Cues was positively correlated with satisfaction with weight and negatively correlated with difficulty describing feelings and BMI.

For Focused Eating, the maximum correlation $-max(|r|)-$ was −0.25 with Difficulty Identifying Feelings and Difficulty Describing Feelings; for Hunger and Satiety Cues, $max(|r|)$ was 0.12 with External Eating and −0.12 with BMI; for both

Table 3. Factor loadings of Mindful Eating Behavior Scale items: Exploratory structural equation modeling (ESEM) (Model 2) and confirmatory factor analysis (CFA) (Model 4) in 1,227 Dutch adults aged 55 years and older[a]

	ESEM				
Scale item	Focused Eating	Hunger and Satiety Cues	Eating with Awareness	Eating without Distraction	CFA
1. I notice flavors and textures when I'm eating my food	**0.71**	0.03	0.02	0.03	**0.67**
2. I stay aware of my food while eating	**0.72**	0.03	−0.02	−0.13	**0.76**
3. I notice how my food looks	**0.81**	−0.01	0.00	0.04	**0.79**
4. I notice the smells and aromas of food	**0.78**	0.00	−0.01	0.02	**0.74**
5. It is easy for me to concentrate on what I eat	**0.72**	−0.02	−0.03	−0.05	**0.73**
6. I trust my body to tell me when to eat	0.01	**0.83**	0.00	0.00	**0.82**
7. I trust my body to tell me what to eat	0.04	**0.78**	0.11	−0.10	**0.77**
8. I trust my body to tell me how much to eat	−0.02	**0.86**	0.00	−0.01	**0.84**
9. I rely on my hunger signals to tell me when to eat	−0.04	**0.84**	−0.04	0.04	**0.82**
10. I rely on my fullness signals to tell me when to stop eating	0.00	**0.72**	−0.02	0.04	**0.70**
11. I trust my body to tell me when to stop eating[b]	0.02	**0.72**	−0.02	0.04	—
12. I snack without being aware that I am eating[c]	0.06	0.02	**0.67**	0.03	**0.65**
13. I eat automatically without being aware of what I eat[c]	−0.02	−0.01	**0.84**	0.07	**0.88**
14. I eat something without really being aware of it[c]	−0.06	0.00	**0.79**	−0.04	**0.78**
15. My thoughts tend to wander while I am eating[c]	−0.03	0.02	0.07	**0.62**	**0.67**
16. I think about things I need to do while I am eating[c]	−0.02	0.02	−0.02	**0.70**	**0.70**
17. I multi−task while I am eating[c]	−0.01	−0.01	0.06	**0.63**	**0.69**
18. I eat at my desk or computer[bc]	0.12	0.05	0.03	0.30	—
19. I watch TV while I am eating[bc]	−0.02	0.04	−0.03	0.25	—
20. I read while I am eating[c]	0.06	−0.08	−0.01	**0.49**	0.39

[a]Boldface type indicates loadings, in absolute value, over 0.40.
[b]Item was removed from the final version.
[c]Item is reversed scored.

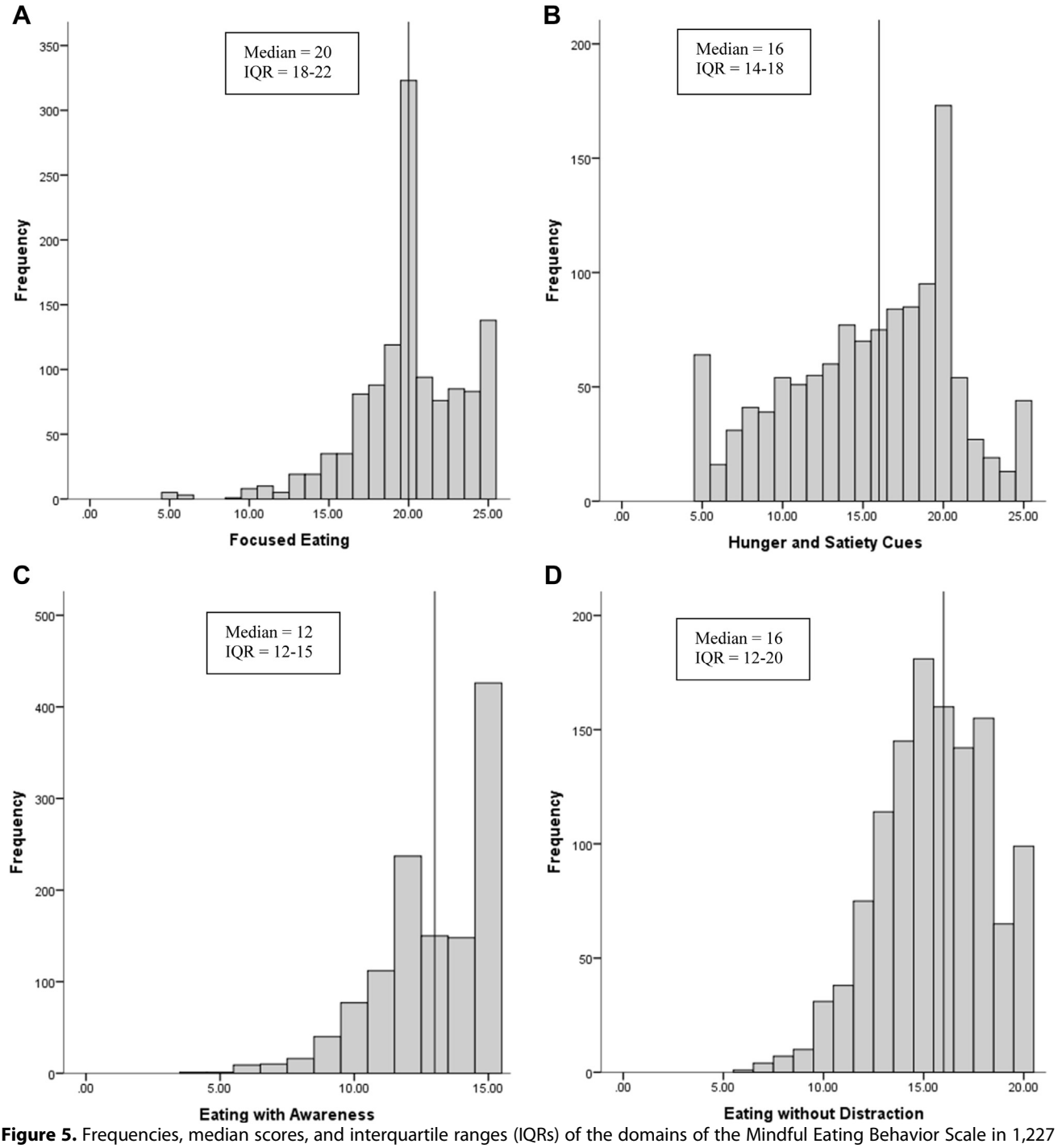

Figure 5. Frequencies, median scores, and interquartile ranges (IQRs) of the domains of the Mindful Eating Behavior Scale in 1,227 Dutch adults aged 55 years and older. (A) Focused Eating. (B) Hunger and Satiety Cues. (C) Eating with Awareness. (D) Eating without Distraction.

Eating with Awareness and Eating without Distraction, $max(|r|)$ was with Emotional Eating, $r=-0.32$ and $r=-0.28$, respectively.

Contrary to expectations, the domain Focused Eating was not correlated with emotional eating and external eating and was positively correlated with restrained eating. The domain Hunger and Satiety Cues was positively related to external eating. Eating without Distraction was not correlated with BMI.

DISCUSSION

In this study, the Mindful Eating Behaviour Scale was developed consisting of 17 items that make up four domains:

Table 5. Correlations between the four domains of the Mindful Eating Behavior Scale and theoretically relevant variables in 1,035 Dutch adults aged 55 years and older

	Focused Eating	Hunger and Satiety Cues	Eating with Awareness	Eating without Distraction
Life satisfaction[a]	0.08**	−0.03	0.11**	0.10**
Perceived stress[b]	−0.17**	−0.03	−0.18**	−0.19**
Depressive symptoms[c]	−0.22**	0.05	−0.24**	−0.24**
Difficulty identifying feelings[d]	−0.25**	0.02	−0.30**	−0.20**
Difficulty describing feelings[d]	−0.25**	−0.05*	−0.28**	−0.19**
Satisfaction with weight[e]	0.07*	0.10**	0.19**	0.13**
Body mass index[f]	−0.10**	−0.12**	−0.17**	0.03
Emotional eating[g]	−0.03	0.02	−0.32**	−0.28**
External eating[g]	0.06	0.12**	−0.24**	−0.27**
Restrained eating[g]	0.15**	0.06	−0.07*	−0.13**
General self-regulation[hi]	0.13**	0.10*	0.04	0.02
Self-esteem[j]	0.17**	−0.03	0.14**	0.17**

[a]Summed score of two questions,[29] one about current life, the other about life as a whole.
[b]Measured with the 10-item version of the Perceived Stress Scale.[30]
[c]Measured with the 20-item Center for Epidemiological Studies Depression Scale.[32,33]
[d]Measured with the Toronto Alexithymia Scale-20.[34,35]
[e]Measured with one question asking about how satisfied people were.
[f]Calculated by dividing measured weight in kilograms by measured height in meters^2.
[g]Measured with the 20-item version of the Dutch Eating Behaviour Questionnaire.[26,27]
[h]Measured with a 14-item questionnaire that was based on a German questionnaire focussing on physical activity.[36] This focused questionnaire was a shortened version of the original 48-item questionnaire on goals in general.[37] The narrow focus of the shortened questionnaire was broadened again from goals related to physical activity to goals in general.
[i]Sample size=607.
[j]Measured with four of the 10 items of the Rosenberg Self-Esteem Scale.[38]
*$P<0.05$.
**$P<0.01$.

Focused Eating, Hunger and Satiety Cues, Eating with Awareness, and Eating without Distraction. The computation of a total score combining these four domains is not recommended because of low interfactor correlations. The definition that was used for mindful eating was: Eating with attention and awareness. The MEBS shows good internal consistency reliability and preliminary convergent validity in a sample of Dutch adults aged 55 years and older.

The domains of the final MEBS were mostly as expected (Figure 3, available at www.jandonline.org for expected domains). One item in the domain Hunger and Satiety Cues was deleted because of correlated uniqueness with another item. This correlated uniqueness was also found in the original and French-Canadian adaptation of the Intuitive Eating Scale-2.[21,54] The items "I watch TV while I am eating" (newly constructed) and, "I eat at my desk or computer" (MES) were deleted because they showed low loadings into the hypothesized domain Eating without Distraction. An explanation for this might be that the overarching question about multitasking while eating can better capture the concept of mindful eating, because multitasking already implies that no full attention is given to the act of eating. Watching television or using the computer while eating might not necessarily imply mindless eating: The focus might still be on the eating and not on the television or computer. This might be different for the item on reading while eating; reading is a complex task in which a lot of different brain regions are involved, which makes it difficult to focus on the eating simultaneously. It might also be that the people in our study multitasked or read while eating, but did not watch television or use the computer while eating.

In general, the interfactor correlations were low; ranging from small (r=0.03) to large (r=0.51). This leads to the recommendation of not computing a total score combining the four domains. The different domains seem to measure different aspects of mindful eating, which might have different influences on different health behaviors. The scores on these domains should therefore be used separately.

The scale has good internal consistency reliabilities above 0.80 for three of the subscales: Focused Eating, Hunger and Satiety Cues, and Eating with Awareness. For the Eating without Distraction subscale, the Cronbach's α was .70. This value of Cronbach's α might imply that the scores of this subscale can be used without problems for research purposes, but not for interpreting individual scores, due to their relevant measurement error.

Most of the significant associations between the subscales of the MEBS and theoretically related variables were in the expected directions, which indicated good preliminary convergent validity. However, there were also some unexpected findings. One unexpected finding was that Eating without Distraction was not related to BMI (r=0.03), although Eating with Distraction showed enough variation in scores

(Figure 4). Because distracted eating could interfere with cognitive processes such as paying attention to the food or reliance on hunger and satiety cues, this could lead to overeating and higher BMI. Earlier research found that listening to a story led to eating more pasta compared with a control condition and a focused attention condition.[55]

Another unexpected finding was that Focused Eating was not correlated with external (r=0.06) and emotional eating (r=−0.03). It was expected that mindful eating in general would be negatively correlated with external and emotional eating, but only the domains Eating with Awareness and Eating without Distraction were negatively correlated with these eating styles. In a longitudinal study[56] higher Observing—a domain of mindfulness that measures observing; noticing; and attending to sensations, thoughts, and feelings—predicted higher external and emotional eating over time, also contrary to expectations. However, in line with the current findings, the correlations between observing and emotional and external eating were nonsignificant in this study. Another study found that Observing was not uniquely associated with eating pathology in a hierarchical regression analysis.[57] In this study, paying attention to food while eating was measured, which might be unrelated to paying attention to food cues in general or to responding to emotions. More research into the associations between the different domains of mindful eating and these eating styles is needed.

The positive correlation between focused eating and restrained eating was unexpected, but is less controversial, because earlier research showed that restrained eaters have an attentional bias toward food.[58]

The domain Hunger and Satiety Cues was positively correlated with external eating, whereas you would expect that when people eat more according to their hunger and satiety cues, they are less susceptible to external food cues. However, the domain Hunger and Satiety Cues has overall very low correlations with the external variables in this study. Earlier research did find correlations between reliance on hunger and satiety cues and negative effect, life satisfaction, and self-esteem.[17] That these results were not replicated in the current study suggests that it did not measure what was intended to measure. However, this might also be due to the older age of the sample. In older age, hunger and appetite decrease and changes occur in the satiation and feeding systems,[59] which may make it more difficult to rely on these internal cues. More research into this domain is needed, preferably also in other age samples.

The factor analysis on the DEBQ and the MEBS items simultaneously showed that the mindful eating items are pure indicators of mindful eating and can be measured independently from the eating styles emotional, external, and restrained eating. Earlier scales incorporated all those constructs into the same questionnaire, which might lead to possible distortion of results. Because these constructs might be related to different health outcomes, the eating styles and mindful eating should be measured separately.

Strengths of this study are the large sample size, a representative sample of Dutch persons aged 55 years and older, and a univocal focus on mindful eating. Limitations are that no test−retest reliability data were collected and that not all variables that were used to calculate correlations were measured at the exact same time point as mindful eating. Nevertheless, this time separation between measurements can also be considered as an advantage, a method to reduce method bias.[60] A further limitation is that the current study did not include a measure for general mindfulness.

In contrast to earlier scales, the MEBS makes it possible to disentangle mindful eating from other eating behaviors that might have different effects on health outcomes. This is useful for research because it is then possible to study mechanisms. It is also useful for applied settings because it becomes possible to better match the treatment to the needs of the individual. The MEBS has—in contrast to the MES—no acceptance factor. Acceptance, or the combination of acceptance with the attention element, might be important for applied settings, although the evidence is not conclusive.[18] Because of general mindfulness scales not being able to detect an acceptance factor, the MEBS is only focused at measuring the attention element of mindful eating. The development of the MEBS is an important first step in better understanding how eating with attention and awareness regarding food can contribute to eating behaviors, weight, but also mental well-being and other health issues. Further tests of reliability and validity would be needed to ensure that the psychometric properties of the MEBS are robust for replication, also in adults aged 18 to 54 years. Although measurement invariance for different age groups was found, this is not enough evidence that the psychometric properties of the MEBS would hold when considering younger participants.

CONCLUSIONS

The successfully developed Mindful Eating Behavior Scale may be used in future research to measure four different domains of attentive mindful eating. The computation of a total score combining the four domains is not recommended due to low interfactor correlations. Advantages of the MEBS are that it only contains 17 items and that it is able to measure the domains of mindful eating separately from the eating styles emotional, external, and restrained eating.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

T. van Strien has a copyright and royalty interest in the Dutch Eating Behavior Questionnaire and manual. No potential conflict of interest was reported by the other authors.

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AUTHOR CONTRIBUTIONS

L. H. H. Winkens, M. Visser, I. A. Brouwer, and T. van Strien designed this study. L. H. H. Winkens collected the data. L. H. H. Winkens wrote the first draft with contributions from M. Visser, I. A. Brouwer, and T. van Strien. J. R. Barrada and L. H. H. Winkens conducted the statistical analyses. All authors reviewed and commented on subsequent drafts of the manuscript. All authors approved the final version.

First, a consultation with an expert of The Knowledge Center Measurement Instruments at the Vrije University Amsterdam Medical Center took place. The following advice was given:

- Define: What is core of mindful eating?
- Make sure to have no overlap with other constructs.
- Use existing subscales when possible.
- Make sure the items are translated well.
- Pilot: Think-aloud method.
- Do a factor analysis with a large enough number of people.

The development phase of the MEBS started with a search into the literature for information on mindful eating and definitions. The definition was created and a list of possible items based on this definition was drafted. The study authors discussed this list of items thoroughly during different meetings. Eventually, 20 items were selected/created that fit the earlier literature and the created definition.

The selected English items were translated to Dutch and back-translated to US English by a US native speaker.

The 20-item questionnaire was pilot tested with the think aloud method[23] (n=2) within the whole questionnaire of the Nutrition and Food-Related Behavior Study to check if people understood the items as they were intended. Other respondents (n=16) were asked to answer questions on clarity of the items, the sufficiency of the response options, and unpleasantness or difficulty of answering the items. No problems with any of the items of the MEBS occurred.

Figure 2. Detailed description of development of the initial version of the Mindful Eating Behavior Scale (MEBS).

	Never	Seldom	Sometimes	Often	Very often
Expected domain 1: Eating while focusing on the food					
1. I notice flavors and textures when I'm eating my food[a]	☐	☐	☐	☐	☐
2. I stay aware of my food while eating[a]	☐	☐	☐	☐	☐
3. I notice how my food looks[a]	☐	☐	☐	☐	☐
4. I notice the smells and aromas of food[a]	☐	☐	☐	☐	☐
5. It is easy for me to concentrate on what I eat[a]	☐	☐	☐	☐	☐
Expected domain 2: Eating while paying attention to hunger and satiety cues					
6. I trust my body to tell me when to eat[b]	☐	☐	☐	☐	☐
7. I trust my body to tell me what to eat[b]	☐	☐	☐	☐	☐
8. I trust my body to tell me how much to eat[b]	☐	☐	☐	☐	☐
9. I rely on my hunger signals to tell me when to eat[b]	☐	☐	☐	☐	☐
10. I rely on my fullness signals to tell me when to stop eating[b]	☐	☐	☐	☐	☐
11. I trust my body to tell me when to stop eating[b]	☐	☐	☐	☐	☐
Expected domain 3: Being aware of eating					
12. I snack without being aware that I am eating[a]	☐	☐	☐	☐	☐
13. I eat automatically without being aware of what I eat[a]	☐	☐	☐	☐	☐
14. I eat something without really being aware of it[a]	☐	☐	☐	☐	☐
Expected domain 4: Eating while not being distracted					
15. My thoughts tend to wander while I am eating[c]	☐	☐	☐	☐	☐
16. I think about things I need to do while I am eating[c]	☐	☐	☐	☐	☐
17. I multi-task while I am eating[a]	☐	☐	☐	☐	☐
18. I eat at my desk or computer[a]	☐	☐	☐	☐	☐
19. I watch television while I am eating[d]	☐	☐	☐	☐	☐
20. I read while I am eating[d]	☐	☐	☐	☐	☐

[a]Derived from the Mindful Eating Scale.[11]

[b]Derived from the Intuitive Eating Scale-II.[21]

[c]Derived from the Mindful Eating Questionnaire.[10]

[d]Self-designed.

Figure 3. Initial 20-item Mindful Eating Behavior Questionnaire (English version): Origin of items and expected domains.

Table 4. Factor loadings of Mindful Eating Behavior Scale (MEBS) items and Dutch Eating Behaviour Questionnaire (DEBQ)-20[a] items: Exploratory structural equation modeling and confirmatory factor analysis in 1,227 Dutch adults aged 55 years and older

Question	Item description	FOC[b]	HSC[c]	AWA[d]	EMOC[e]	RES[f]	DIS[g]	EXT[h]
MEBS1	I notice flavors and textures when I'm eating my food	**0.70**[i]	0.01	0.07	0.03	0.04	−0.02	0.02
MEBS2	I stay aware of my food while eating	**0.71**	0.04	−0.06	0.02	0.01	−0.08	−0.02
MEBS3	I notice how my food looks	**0.80**	0.00	0.00	−0.01	0.03	0.04	−0.03
MEBS4	I notice the smells and aromas of food	**0.75**	−0.01	−0.02	−0.01	−0.03	0.03	0.05
MEBS5	It is easy for me to concentrate on what I eat	**0.71**	0.00	−0.04	−0.01	−0.02	−0.05	0.00
MEBS6	I trust my body to tell me when to eat	0.01	**0.81**	0.02	−0.04	−0.01	0.03	0.00
MEBS7	I trust my body to tell me what to eat	0.01	**0.78**	0.04	0.07	0.01	−0.04	−0.06
MEBS8	I trust my body to tell me how much to eat	0.00	**0.84**	−0.03	0.02	0.00	0.02	−0.02
MEBS9	I rely on my hunger signals to tell me when to eat	−0.02	**0.83**	−0.02	−0.01	0.00	0.00	0.04
MEBS10	I rely on my fullness signals to tell me when to stop eating	0.02	**0.68**	0.00	−0.07	0.00	0.03	0.06
MEBS11	I snack without being aware that I am eating	0.07	0.01	**0.67**	0.02	−0.03	−0.02	0.09
MEBS12	I eat automatically without being aware of what I eat	−0.02	−0.01	**0.87**	−0.04	0.00	0.03	0.02
MEBS13	I eat something without really being aware of it	−0.07	0.02	**0.75**	0.04	0.03	0.02	−0.06
MEBS14	My thoughts tend to wander while I am eating	−0.02	0.02	0.07	0.10	0.02	**0.60**	0.00
MEBS15	I think about things I need to do while I am eating	−0.05	0.01	−0.04	−0.01	−0.01	**0.74**	0.02
MEBS16	I multitask while I am eating	0.00	0.02	0.09	0.01	0.02	**0.60**	0.01
MEBS17	I read while I am eating	0.08	−0.01	0.00	0.03	0.00	0.40	0.00
DEBQ1	Eat more than usual when food is tasty…	0.04	−0.02	−0.01	−0.01	−0.05	0.13	**0.56**
DEBQ2	Desire to eat when feeling depressed…	−0.01	0.01	−0.03	**0.74**	−0.03	0.06	0.05
DEBQ3	Refuse food or drinks offered because of worry weight…	0.00	0.00	−0.01	0.02	**0.71**	0.04	−0.08
DEBQ4	Desire to eat when somebody lets you down…	−0.02	0.01	−0.02	**0.78**	0.00	0.01	0.04
DEBQ5	Eat more when food smells and looks good…	0.12	−0.04	0.06	−0.02	−0.06	0.10	**0.60**
DEBQ6	Desire to eat when cross…	0.02	0.00	0.03	**0.75**	−0.03	−0.04	0.04
DEBQ7	Watch what you eat…	0.08	0.00	0.00	0.01	**0.65**	0.00	−0.18
DEBQ8	Desire to eat when see or smell something delicious…	0.10	0.03	−0.08	−0.03	0.06	0.04	**0.52**
DEBQ9	Eat foods that are slimming…	0.06	0.02	−0.03	0.02	**0.70**	−0.03	0.03
DEBQ10	Desire to buy food when passing the baker…	0.00	0.02	0.00	0.03	0.05	−0.08	**0.50**
DEBQ11	Eat less after eating too much…	0.02	0.01	0.03	0.03	**0.43**	0.06	0.15
DEBQ12	Desire to eat when anxious, worried or tense…	0.01	−0.01	−0.01	**0.86**	0.00	0.07	−0.04
DEBQ13	Eat less not to become heavier…	−0.04	0.01	0.00	−0.02	**0.84**	0.03	0.07
DEBQ14	Desire to eat when seeing others eating…	−0.02	0.07	0.01	0.13	0.04	−0.03	**0.60**
DEBQ15	Desire to eat when things have gone wrong…	0.00	0.01	0.02	**0.87**	0.01	−0.01	0.02
DEBQ16	Desire to buy food when passing snack bar…	−0.08	0.03	0.00	0.05	−0.02	−0.08	**0.54**

(*continued on next page*)

Table 4. Factor loadings of Mindful Eating Behavior Scale (MEBS) items and Dutch Eating Behaviour Questionnaire (DEBQ)-20[a] items: Exploratory structural equation modeling and confirmatory factor analysis in 1,227 Dutch adults aged 55 years and older (*continued*)

Question	Item description	FOC[b]	HSC[c]	AWA[d]	EMOC[e]	RES[f]	DIS[g]	EXT[h]
DEBQ17	Try not to eat in the evening because watching weight…	−0.07	−0.03	0.04	0.02	**0.63**	−0.02	0.16
DEBQ18	Eat more when seeing others eating…	−0.04	−0.04	0.05	0.14	0.11	0.05	**0.47**
DEBQ19	Take account weight when eat…	0.02	0.00	−0.01	−0.04	**0.89**	−0.03	−0.03
DEBQ20	Desire to eat when disappointed…	0.02	−0.02	0.03	**0.88**	0.05	−0.02	−0.02

[a]The psychological eating styles emotional eating, external eating and restrained eating were measured with the 20-item version of the DEBQ,[26,27] which is the brief version of the original 33-item DEBQ.[28] Exact item wording of the DEBQ−20 items cannot be shown due to copyright restrictions.
[b]FOC=Focused Eating.
[c]HSC=Hunger and Satiety Cues.
[d]AWA=Eating with Awareness.
[e]DIS=Eating without Distraction.
[f]EMO=Emotional Eating.
[g]RES=Restrained Eating.
[h]EXT=External Eating.
[i]Boldface type indicates loadings, in absolute value, over 0.40.