

## Mindful Eating Behavior Scale (MEBS)

Handbook of Assessment in Mindfulness Research

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## Abstract

The Mindful Eating Behavior Scale (MEBS) (Winkens et al., 2018) is a 17-item self-report scale to assess the attention element of mindful eating. The MEBS was developed to make it possible to measure mindful eating in common situations and independent from emotional or external eating. The MEBS consists of four domains: Focused Eating (5 items), Eating in response to Hunger and Satiety Cues (5 items), Eating with Awareness (3 items), and Eating Without Distraction (4 items). The MEBS was validated in a representative sample of 1,227 Dutch adults aged 55 years and older. The final confirmatory factor analysis model

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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  $\alpha$  values were medium to high (0.70–0.89). Most correlations were in the expected directions, which indicated good preliminary convergent validity. It is recommended to calculate scores on the separate domains rather than a total score combining the four domains due to low inter-factor correlations between these domains. In contrast to previous mindful eating scales, the MEBS makes it possible to disentangle mindful eating from other eating behaviors. This offers the possibility to advance the research into mindful eating, as it then becomes possible to study mechanisms. This is also useful for applied settings as it makes it possible to better match the treatment to the needs of the individual.

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**Keywords**

Mindful eating · Questionnaire · Validation · Awareness · Attention

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**Introduction**

The Mindful Eating Behavior Scale (MEBS) (Winkens et al., 2018a) was developed to make it possible to assess mindful eating in common situations and independent from emotional or external eating. This chapter describes the theoretical foundations, development, validation, psychometric properties, and instructions of the MEBS.

**Theoretical Foundations**

Mindful eating is a domain-specific type of mindfulness. Compared to interventions without a mindful eating component, mindfulness-based interventions with an eating component were much more effective in reducing binge eating (Mantzios & Wilson, 2015), and other maladaptive eating behaviors (Papies et al., 2012; O’Reilly et al., 2014). These results 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 (Mantzios & Wilson, 2015).

There is very limited knowledge on mechanisms of action for the associations between attentive mindful eating and eating behaviors, but some potential explanations can be given. Mindful awareness toward eating may minimize automatic reactions and impulsive reactions, thereby fostering self-regulation (Mantzios & Wilson, 2015; Papies et al., 2012; Kristeller & Wolever, 2010). A reduction in eating automaticity and a prioritization of the amount of pleasure obtained from food instead of reaching satiation could explain the associations between mindful eating and decreased energy intake (Tapper, 2017). Another potential explanation is that

mindful eating reduces cravings to food (Tapper, 2018; Paolini et al., 2012), which is associated with higher intake of unhealthy food products (Chao et al., 2014). Increased interoceptive awareness – the ability to recognize and respond to internal states such as emotions, hunger, and satiety – was associated with higher reliance on hunger and satiety cues (Herbert et al., 2013; Herbert & Pollatos, 2014), and mediated the association between reliance on hunger and satiety cues and BMI (Herbert et al., 2013). This suggests that mindful eating might influence habitual food intake through an increase in interoceptive awareness.

A limitation of previous research into mindful eating is that the instruments used to measure mindful eating have limitations; they show overlap with other eating behavior constructs and suffer from psychometric issues. The aim was therefore to develop a new instrument to measure mindful eating that 1) does not contain items on emotional and external eating to open up the possibility of assessing the independent effects of mindful eating, 2) asks about general situations, and 3) is evaluated in a larger sample of people from different socioeconomic backgrounds.

The definition of mindful eating that was used for this new scale is: “eating with attention and awareness.” This is based on the definition of mindfulness by Brown and Ryan (Brown & Ryan, 2003), which is “an enhanced attention to and awareness of current experience or present reality.” There is a variety of definitions for generic mindfulness, some containing only an attention element (Brown & Ryan, 2003, 2004; Mikulas, 2011; Grabovac et al., 2011), others also incorporating a second element, namely acceptance (Bishop et al., 2004; Baer et al., 2006; Kabat-Zinn & Hanh, 2009). Attention is the self-regulation of attention in the present moment, whereas paying attention nonjudgmentally can be defined as acceptance. Some studies suggest that paying attention is needed first to be able to pay attention nonjudgmentally (Brown et al., 2007; Chiesa, 2013). The focus of the scale is on the attention part, because this element is essential: present moment awareness is needed to be able to pay attention nonjudgmentally (Shapiro et al., 2006). In some earlier studies on the development of mindfulness instruments, an acceptance factor was not found (Baer et al., 2006), or provided no extra explanatory advantage in the prediction of criterion measures (Brown & Ryan, 2004). A recent review showed that there is no conclusive evidence that acceptance could promote changes in eating behavior (Tapper, 2017).

## **Description of Development and Initial Validation of the Scale**

### **Item Generation Process**

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 (Framson et al., 2009), 2 out of 3 items from the domain “Distraction” were selected. From the MES (Hulbert-Williams et al., 2014), the

5-item domain “Awareness” was selected, 3 out of 4 items from the “Act with awareness” domain, and 2 out of 4 items from the “Unstructured eating” domain were selected. From the Intuitive Eating Scale-2 (Tylka & Kroon Van Diest, 2013), the 6-item domain “Reliance on hunger and satiety cues” was selected. Two items were newly constructed, i.e., “I watch TV while eating” and “I read while eating,” because these are types of distraction that occur often during eating across generations (Carrier et al., 2009). Answer categories for these 20 items ranged from 1 = *never* to 5 = *very often*.

The selected English items were translated to Dutch and back-translated to English (US) by a US native speaker. The 20-item initial version of the MEBS was pilot tested for understandability (18 people in total; 7 on paper, whereof 2 people out loud; 11 online). The respondents 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.

### Study Sample

All data for the development and the validation of the MEBS were collected within the Longitudinal Aging Study Amsterdam (LASA) (Huisman et al., 2011; Hoogendijk et al., 2016). The LASA sample consists of a representative sample of older adults aged 55 years and older. Data on the Mindful Eating Behavior Scale items were collected in an ancillary study in the LASA sample, the LASA Nutrition and Food-Related Behavior study, conducted between fall 2014 and spring 2015. The ancillary study consisted of a questionnaire that people could fill out either online or on paper and 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.

The ancillary study was completed by 1,439 people. Of these, 124 people were excluded because they did not fill out the questionnaire 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 years ( $SD = 8.10$ ) of which 51.8% was female. For the calculation of correlations (convergent validity), people with missing values on one of the variables in the analyses were additionally excluded ( $n = 192$ ), which resulted in an analytic sample of 1,035 people for these analyses.

### Item Selection Criteria

The number of factors to retain was determined by parallel analysis (principal components analysis; Garrido et al., 2013) and theoretical interpretability of the solution. The parallel analysis showed that for the first four factors the eigenvalues of the real data were greater than the eigenvalues of the random sample, which indicates that these four factors account for more variance that is expected by chance.

This led to testing an exploratory structural equation modeling approach (ESEM) (Asparouhov & Muthén, 2009) with four factors. ESEM is a technique that, unlike

confirmatory factor analysis (CFA), permits all items load into all factors, and unlike exploratory factor analysis (EFA), 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 greater than  $|0.20|$ . Three of the 20 items were deleted to arrive at a model in which the four factors had a clear theoretical interpretation and satisfactory fit.

In the final version of the MEBS (see [Appendix 1](#)): (a) Focused Eating consisted of five items (e.g., “I notice how my food looks”); (b) Eating in response to Hunger and Satiety Cues also comprised five items (e.g., “I trust my body to tell me how much to eat”); (c) Eating with Awareness was defined with three items (e.g., “I eat automatically without being aware of what I eat”); and (4) 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.

## EFA and CFA Validation

The internal structure of the final version proposed using ESEM was cross-validated with a CFA in the entire sample (see Sánchez-Carracedo et al. (2012)). In both ESEM and CFA, models were analyzed using robust maximum-likelihood (MLR estimator). Goodness-of-fit in all derived models was assessed with the common cut-off values for the fit indices (Hu & Bentler, 1999): values greater than 0.95 on the comparative fit index (CFI) and Tucker–Lewis index (TLI), and less than 0.06 on the root mean square error of approximation (RMSEA). Localized areas of strain were assessed with modification indices. The CFA model on the whole sample resulted in a good fit (comparative fit index = 0.97, Tucker–Lewis index = 0.96, and root mean square error of approximation = 0.04), 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 the item “I read while I am eating,” where the loading was 0.39.

## Inter-Factor Correlations

Inter-factor correlations showed a moderate relation between Focused Eating and Eating with Awareness ( $r = 0.39$ ), medium-small relations between Focused Eating and Eating in response to 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 Eating in response to Hunger and Satiety Cues and Eating with Awareness ( $r = 0.03$ ) and between Eating in response to Hunger and Satiety Cues and Eating Without Distraction ( $r = 0.14$ ). Because of some low inter-factor correlations between these domains, the computation of a total score combining these four domains is not recommended.

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### Measurement Invariance

Measurement invariance was tested by splitting the sample by sex, age (median split), and BMI (median split) and evaluate the equality (or minimal difference) of the fit between consecutive and more restrictive models. For age in years, the younger sample included 615 participants, range [56.8, 67.3]; the older sample,  $n = 612$ , range [67.3, 101.2]. For BMI, the lower half,  $n = 586$ , range [17.4, 26.6]; the higher half,  $n = 586$ , range [26.6, 56.3]. For all the different groups, model fit was satisfactory as the decrease in CFI was lower than 0.01 and RMSEA increased by less than 0.015 (Chen, 2007; Cheung & Rensvold, 2002).

### Factor Analysis with MEBS and DEBQ-20 Items

To test whether the mindful eating domains can be distinguished from the eating styles (emotional eating, external eating, restrained eating), the internal structure of the MEBS items and the items of the 20-item Dutch Eating Behavior Questionnaire (DEBQ-20) (Van Strien et al., 2016; Paans et al., 2018) were analyzed simultaneously. For this purpose, an ESEM approach was used. The items were assigned to factors based on loadings over  $|0.40|$  in the theoretical factor and no cross-loading greater than  $|0.20|$ . By simultaneously modeling the 17 items of the MEBS and the 20 items of the DEBQ, it was tested if all items loaded in their intended factors. Model fit for this analysis was adequate (CFI = 0.956, TLI = 0.932, RMSEA = 0.039) and cross-loadings were very small (mean unsigned cross-loading = 0.03, range [0.00, 0.18]). This shows that the MEBS is able to measure the mindful eating domains independently from the psychological eating styles emotional, external, and restrained eating.

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### Reliability: Internal Consistency Reliabilities

The internal consistency reliabilities (Cronbach's alpha) were high for three of the domains: 0.85 for Focused Eating, 0.89 for Eating in response to Hunger and Satiety Cues, 0.81 for Eating with Awareness, and medium for the domain Eating Without distraction,  $\alpha = 0.70$ .

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### Convergent Validity: Correlations with External Variables

Correlations between the four domains of the MEBS and theoretically relevant variables are shown in Table 1. Although in general all the correlations were small ( $<0.20$ ) or medium-small (0.20–0.30), most of the significant associations were in the expected directions, which indicates good preliminary convergent validity. The domains Focused Eating, Eating with Awareness, and Eating Without Distraction were positively correlated with self-esteem, life satisfaction, and satisfaction with weight and negatively correlated with depressive symptoms, difficulty identifying feelings, difficulty describing feelings, and perceived stress. The domain Hunger

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

	Focused Eating	Hunger and Satiety Cues	Eating with Awareness	Eating Without Distraction
Life satisfaction	0.08**	-0.03	0.11**	0.10**
Perceived stress	-0.17**	-0.03	-0.18**	-0.19**
Depressive symptoms	-0.22**	0.05	-0.24**	-0.24**
Difficulty identifying feelings	-0.25**	0.02	-0.30**	-0.20**
Difficulty describing feelings	-0.25**	-0.05*	-0.28**	-0.19**
Satisfaction with weight	0.07*	0.10**	0.19**	0.13**
BMI	-0.10**	-0.12**	-0.17**	0.03
Emotional eating	-0.03	0.02	-0.32**	-0.28**
External eating	0.06	0.12**	-0.24**	-0.27**
Restrained eating	0.15**	0.06	-0.07*	-0.13**
General self-regulation <sup>a</sup>	0.13**	0.10*	0.04	0.02
Self-esteem	0.17**	-0.03	0.14**	0.17**

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\* $p < 0.05$ ; \*\* $p < 0.01$

<sup>a</sup> $n = 607$

and Satiety Cues was positively correlated with satisfaction with weight and negatively correlated with difficulty describing feelings and BMI.

## Subsequent Findings on Associations with the MEBS

After its publication, the MEBS has been used in a number of studies that assessed associations between mindful eating and depressive symptoms and underlying mechanisms of these associations. Studies showed among others that higher scores on Focused Eating, Eating with Awareness, and Eating Without Distraction were consistently associated with a lower level of depressive symptoms and a lower likelihood of having depression in three European countries (Winkens et al., 2018b). Higher baseline scores on Focused Eating, Eating with Awareness, and Eating Without Distraction were associated with a 3-year decrease in depressive symptoms in Dutch older adults, and these associations were mediated by external eating (Winkens et al., 2019). Diet quality did not mediate associations of any of the four mindful eating domains with change in

depressive symptoms, whereas total energy intake did mediate the associations with change in depressive symptoms for the mindful eating domains Eating with Awareness and Eating Without Distraction, but not for the other two domains (Winkens et al., 2020).

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## Scale Versions in Other Languages: Validation and Psychometric Properties

The selected English items were translated to Dutch and back-translated to English (US) by a US native speaker. The Dutch version of the MEBS can be requested by contacting Dr. Laura Winkens ([laura.winkens@wur.nl](mailto:laura.winkens@wur.nl)). The Dutch version is validated as described above. The English version is not validated, but has been used in previous research.

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## Citation and Copyright

The Mindful Eating Behavior Scale is free to use (English version in [Appendix 1](#)) and can be cited as: Winkens et al. (2018a).

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## Administration

The MEBS is validated as a self-report questionnaire in a sample of older Dutch adults of which 46.3% filled it out online and 53.7% filled it out on paper. The MEBS should be administered individually. The preliminary validation of the MEBS creates the possibility to use this scale in future research and applied settings, for example by dietitians and psychologists. Scores on the different domains could indicate on which elements treatment could be targeted, so that treatments can be matched to the needs of the individual.

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## Scoring of Data

It is recommended to calculate scores for the four domains of the MEBS separately instead of a total score, because of low inter-factor correlations between the four domains. The scores on the items of the domains Focused Eating and Eating in response to Hunger and Satiety Cues should be summed (item 1–10), whereas the scores on the items of the domains Eating with Awareness and Eating Without Distraction (items 11–17) should be recoded first (1 = 5; 2 = 4; 3 = 3; 4 = 2; 5 = 1) and then summed. Higher scores in each domain then indicate a higher level of mindful eating. See also [Appendix 2](#) for instructions on scoring and reverse scoring of the four domains.

## Considerations

Although the development of the MEBS is an important step in the valid measurement of mindful eating, independent from other eating styles, there are also considerations to take into account. The MEBS is validated in a Dutch sample of older adults and no test-retest reliability data is collected. This means that 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 18–54 years. The MEBS is a self-report questionnaire, which may suffer from biases. As meditators might answer items differently than nonmediators, the same score could therefore have a total different meaning (Bergomi et al., 2013). However, by using the scores on the different domains separately (some containing items on absent-mindedness and others on mindfulness), this problem should be less of an issue. Self-report measures of mindful eating could be complemented with neurocognitive measurements using fMRI or by biomarkers, as is also done when studying the effects of general mindfulness programs, for example cortisol as a marker of stress (Matousek et al., 2010) and changes in cerebral blood flow as a marker for stress and anxiety (Monti et al., 2012). This objective information might validate self-reported benefits or drawbacks attributed to interventions and can also be used to study mechanisms of change.

The MEBS only measures “attentive” mindful eating, and not the “acceptance” element of mindfulness. There are contrasting views on the relations between mindful attention and acceptance. Some argue that mindfulness consists of both elements separately (e.g., Bishop et al., 2004), while others argue that acceptance follows from paying attention and is therefore implicit in the attention element (Brown & Ryan, 2003). However, consensus is emerging suggesting that mindfulness is not unidimensional, but consists of both an attention and acceptance element (Sauer et al., 2013). Future research should investigate whether measuring acceptance as a separate element would add more predictive validity to the MEBS, or whether it is already incorporated in the domains on attentive mindful eating. The study by Keyte et al. (2020) suggests that the MEBS indirectly measures acceptance, but more research is needed.

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## Summary

The Mindful Eating Behavior Scale can be used to measure four different domains of attentive mindful eating: Focused Eating (5 items), Eating in response to Hunger and Satiety Cues (5 items), Eating with Awareness (3 items), and Eating Without Distraction (4 items). In contrast to earlier mindful eating scales, the MEBS makes it possible to disentangle mindful eating from other eating behaviors. The different domains seem to measure different aspects of mindful eating, and the scores on these domains should therefore be used separately. Further tests of reliability and validity are needed.

### Appendix 1 The Mindful Eating Behavior Scale (MEBS)

If you think about eating meals and snacks, how often do the following statements apply to you while eating those meals and snacks?

		Never	Seldom	Sometimes	Often	Very often
1	I notice flavors and textures when I'm eating my food	<input type="checkbox"/>				
2	I stay aware of my food while eating	<input type="checkbox"/>				
3	I notice how my food looks	<input type="checkbox"/>				
4	I notice the smells and aromas of food	<input type="checkbox"/>				
5	It is easy for me to concentrate on what I eat	<input type="checkbox"/>				
6	I trust my body to tell me when to eat	<input type="checkbox"/>				
7	I trust my body to tell me what to eat	<input type="checkbox"/>				
8	I trust my body to tell me how much to eat	<input type="checkbox"/>				
9	I rely on my hunger signals to tell me when to eat	<input type="checkbox"/>				
10	I rely on my fullness signals to tell me when to stop eating	<input type="checkbox"/>				
11	I snack without being aware that I am eating	<input type="checkbox"/>				
12	I eat automatically without being aware of what I eat	<input type="checkbox"/>				
13	I eat something without really being aware of it	<input type="checkbox"/>				
14	My thoughts tend to wander while I am eating	<input type="checkbox"/>				
15	I think about things I need to do while I am eating	<input type="checkbox"/>				
16	I multi-task while I am eating	<input type="checkbox"/>				
17	I read while I am eating	<input type="checkbox"/>				

### Appendix 2 Mindful Eating Behavior Questionnaire: Domains and Scoring

	Never	Seldom	Sometimes	Often	Very often
Domain 1: Focused Eating					
1. I notice flavors and textures when I'm eating my food	1	2	3	4	5
2. I stay aware of my food while eating	1	2	3	4	5

(continued)

	Never	Seldom	Sometimes	Often	Very often
3. I notice how my food looks	1	2	3	4	5
4. I notice the smells and aromas of food	1	2	3	4	5
5. It is easy for me to concentrate on what I eat	1	2	3	4	5
Domain 2: (Reliance on) Hunger and Satiety Cues					
6. I trust my body to tell me when to eat	1	2	3	4	5
7. I trust my body to tell me what to eat	1	2	3	4	5
8. I trust my body to tell me how much to eat	1	2	3	4	5
9. I rely on my hunger signals to tell me when to eat	1	2	3	4	5
10. I rely on my fullness signals to tell me when to stop eating	1	2	3	4	5
Domain 3: Eating with Awareness					
11. I snack without being aware that I am eating <sup>a</sup>	5	4	3	2	1
12. I eat automatically without being aware of what I eat <sup>a</sup>	5	4	3	2	1
13. I eat something without really being aware of it <sup>a</sup>	5	4	3	2	1
Domain 4: Eating Without Distraction					
14. My thoughts tend to wander while I am eating <sup>a</sup>	5	4	3	2	1
15. I think about things I need to do while I am eating <sup>a</sup>	5	4	3	2	1
16. I multi-task while I am eating <sup>a</sup>	5	4	3	2	1
17. I read while I am eating <sup>a</sup>	5	4	3	2	1

<sup>a</sup>These items need to be reverse coded: 1 = 5; 2 = 4; 3 = 3; 4 = 2; 5 = 1, such that a higher score on each domain indicates a higher level of mindful eating

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