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1 **Development and validation of the mindful eating scale (Mind-Eat Scale) in a general**  
2 **population**

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34 **Abbreviations:** TLI, Tucker-Lewis Index; TFEQ-R21, Three-Factor Eating Questionnaire; SWLS,  
35 Satisfaction with Life Scale; SRMR, Root Mean Square Residual; STAI, State Trait Anxiety  
36 Inventory; SCOFF, Sick Control One Fat Food questionnaire; RSES, Rosenberg Self-Esteem Scale;  
37 RMSEA, Root Mean Square Error of Approximation; PNNS-GS, Programme national nutrition  
38 santé-Guideline Score; Mind-eat scale, Mindful Eating scale; MES, Mindful Eating Scale; MEQ-  
39 short, Mindful Eating Questionnaire Short; MEQ, Mindful Eating Questionnaire; MEI, Mindful  
40 Eating Inventory; MEBS, Mindful Eating Behavior Questionnaire; MBSR, Mindfulness-Based Stress  
41 Reduction; LOT-R, Life Orientation Test Revised; KMO, Kaiser-Meyer-Olkin Test; IRB,  
42 Institutional Review Board of the French Institute for Health and Medical Research; IES-2, Intuitive  
43 eating Scale-2; ICC, Intraclass Correlation Coefficient; GQ-6, Gratitude Questionnaire; FMI,  
44 Freiburg Mindfulness Inventory; FFMQ, Five Facets Mindfulness Questionnaire; FFaMES, Four  
45 Facet Mindful Eating Scale; EFA, Exploratory Factor Analysis; CNIL, Commission Nationale  
46 Informatique et Libertés; CFI, Comparative Fit Index; CFA, Confirmatory Factor Analysis; CES-D,  
47 Center for Epidemiologic Studies-Depression; BRS, Brief Resilience Scale; BMI, Body Mass Index.

48

49 No reprints requested.

**Abstract**

*Background:* Mindful eating is a concept that is increasingly being used to promote healthy eating. Observational studies have suggested associations with healthier eating behaviors, lower weight status, and favorable cardiovascular biomarkers. However, existing scales assessing mindful eating have some limitations. Our study aimed to develop and validate a scale assessing the level of mindful eating in a general population. *Methods:* The Mind-Eat Scale was developed in four main steps: 1. Generating an initial item pool covering all aspects of mindful eating; 2. Reviewing items with experts and naive individuals; 3. Administering the scale to a large and representative sample from the NutriNet-Santé cohort (N=3102); 4. Conducting psychometric analyses. Construct validity was assessed using exploratory (EFA) (N<sub>1</sub>=1302) and confirmatory (CFA) (N<sub>2</sub>=1302, N<sub>3</sub>=498) factor analyses. Content, discriminant, convergent, and divergent validity, internal consistency, and test-retest reliability were examined. *Results:* The initial pool of 95 items was refined to 24 items using EFA. The EFA highlighted six dimensions: Awareness, Non-reactivity, Openness, Gratitude, Non-judgement, and Hunger/Satiety, consisting of four items per dimension. CFAs showed a good fit for first and second-order models. Adequate content validity was confirmed. Discriminant, convergent, and divergent validity were supported by significant differences between subgroups of individuals, and correlations with eating behaviors and psychological well-being scales. The Mind-Eat Scale showed good reliability for all six dimensions, with high McDonald's  $\omega$  and adequate intraclass correlation coefficients (ICC). *Conclusions:* This study validated the first tool assessing a total mindful eating score and its sub-dimensions in a general population. This scale can be an asset for clinical and epidemiological research on dietary behavior and related chronic diseases.

73

**Keywords:** Mindful Eating, Mindfulness, Eating Behavior, Questionnaire, Validation

## 75 1. INTRODUCTION

76 Mindfulness has been defined as “*The awareness that emerges through paying attention on*  
77 *purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment*  
78 *by moment.*” (Kabat-Zinn, 2003). Mindfulness is an innate disposition, reflected in a general  
79 tendency to be mindful in daily life, but can also be acquired through the practice of meditation  
80 (Kabat-Zinn, 2003). Mindfulness meditation has been introduced into medicine and healthcare  
81 as an adjunct to medical treatment to help patients cope with stress, pain, and disability (Kabat-  
82 Zinn, 2003). Since then, many systematic reviews and meta-analyses have confirmed the  
83 positive impacts of mindfulness on mental and physical health (Dossett et al., 2020; Lee et al.,  
84 2020; Scott-Sheldon et al., 2020), leading the American Heart Association (AHA) to  
85 recommend it as an adjunct to other methods of reducing cardiovascular risk (Levine et al.,  
86 2021). More recently, mindfulness-based interventions have been used for the treatment of  
87 obesity-related eating behaviors showing promising results (O’Reilly et al., 2014), while  
88 dispositional mindfulness has been associated with weight status (Camilleri, Méjean, Bellisle,  
89 Hercberg, et al., 2015). However, it is worth considering mindfulness in the context of eating  
90 as its effects may vary depending on the specific situation, and will allow for a better  
91 understanding of the specific mechanisms of action of mindfulness on eating behavior (Oliveira  
92 et al., 2023).

93 Despite the growing body of literature on mindful eating, no universally accepted definition of  
94 mindful eating has emerged, leading to the creation of a non-exhaustive list of common key  
95 features of mindful eating practices (Tapper, 2022). These key principles include present-  
96 moment awareness of the sensory properties of food, internal bodily sensations, and cues that  
97 elicit eating or the urge to eat, but also, acceptance of cravings, acceptance and/or decentering  
98 from food-related thoughts, and decentering from cravings (Tapper, 2022). A recent narrative  
99 review recommended narrowing the concept by distinguishing mindful eating behavior from

100 mindful decision-making around eating (Mantzios, 2023b). By contrast, other authors have  
101 expanded this concept to include other principles such as an awareness of the  
102 interconnectedness of all living beings and the earth (Altman et al., 2013; Fung et al., 2016;  
103 Peitz et al., 2021).

104 Given the relative novelty of the concept of mindful eating, the literature examining  
105 associations between dispositional mindful eating and nutrition, or health is still limited. Data  
106 have already shown associations between mindful eating and healthier eating behavior  
107 (Kawasaki et al., 2021; Salvo et al., 2022), weight status (Spadaro et al., 2018; Timmerman &  
108 Brown, 2012), and negative affect (Oliveira et al., 2023; Pintado-Cucarella & Rodríguez-  
109 Salgado, 2016). However, further research, particularly in population-based samples, is needed  
110 to improve knowledge of mindful eating. Appropriate instruments to assess mindful eating are  
111 therefore needed (Tapper, 2017). Over the past decade, seven multidimensional mindful eating  
112 questionnaires have been developed, as it is generally accepted that mindfulness is a  
113 multifaceted construct (Baer et al., 2006). These questionnaires ranged from two (Clementi et  
114 al., 2017; Mantzios, 2023a) to seven (Peitz et al., 2021) dimensions, corresponding to different  
115 definitions of mindful eating. These questionnaires have made important contributions to the  
116 field, but they also have specificities and limitations. Some of the scales omit important  
117 dimensions that are generally accepted as part of the concept of mindful eating, such as non-  
118 judgment or acceptance (Clementi et al., 2017; Framson et al., 2009; Winkens et al., 2018).  
119 Furthermore, the majority of existing questionnaires are not based on the experience of  
120 individuals who practice mindful eating in their daily lives. Developing an instrument that  
121 considers both theory and practice would therefore be useful. Another limitation of these scales  
122 is that they do not allow for the calculation of a comprehensive total score for mindful eating  
123 that has been validated by confirmatory factor analysis (CFA). A total score would be useful in  
124 clinical and epidemiological research to facilitate comparisons between individuals or groups

125 and to monitor changes over time. Some questionnaires also include items that are not  
126 universally applicable to all individuals, such as items about snacking (Clementi et al., 2017;  
127 Framson et al., 2009; Hulbert-Williams et al., 2014; Winkens et al., 2018), or items that involve  
128 complex concepts, such as metacognition (Carrière et al., 2022). Finally, some scales have been  
129 validated on samples that are small (Carrière et al., 2022; Framson et al., 2009; Hulbert-  
130 Williams et al., 2014; Mantzios, 2023a) or not representative of the general adult population  
131 (Hulbert-Williams et al., 2014), and validation methods lack robustness in some cases, such as  
132 the lack of CFA to support the factor model (Framson et al., 2009).

133 The objective of this study was therefore to develop and validate a comprehensive mindful  
134 eating scale, that covers all aspects of the concept and allows the computation of an overall  
135 score. The content validity, reproducibility, construct validity, discriminant validity, and  
136 reliability of our questionnaire were assessed, and internal validity was determined using  
137 exploratory and confirmatory factor analyses.

138

## 139 **2. METHODS**

140 To develop and validate the Mind-Eat Scale, the COSMIN Risk of Bias Checklist (Mokkink et  
141 al., 2018) and Boateng (Boateng et al., 2018) recommendations for validating a questionnaire  
142 were followed as reference methods. Four steps were implemented (Figure 1).

143

### 144 ***Step 1: Item generation***

145 The first step was to create a pool of items representing all aspects of mindful eating. Items  
146 were selected and adapted from existing mindful eating and mindfulness questionnaires.

147 Additional items were created based on a thorough literature review, supplemented by semi-  
148 structured interviews and think-aloud sessions (further details provided below). The entire  
149 process was coordinated by a group of six mindful eating experts from various disciplines

150 (psychology, nutrition, epidemiology). The focus was on the development of a diverse set of  
151 potential items, aiming to encompass essential aspects emphasized in recent reviews (Mantzios,  
152 2023b; Tapper, 2022), be comparable to generic mindfulness assessments (such as the FFMQ  
153 (Baer et al., 2006) or CHIME- $\beta$  (Bergomi et al., 2013)), and reflect as closely as possible how  
154 mindful eating users and experts practice mindful eating. This approach is expected to result in  
155 an instrument with broader and more practice-oriented dimensions, compared to instruments  
156 based on more theory-based definitions, such as the recent Trait and State Mindful Eating  
157 Behaviour Scale (Mantzios, 2023a). Items had to be concise, clear, and relevant to all  
158 populations. Special care was taken to create items that individuals could connect with in their  
159 daily lives, enhancing the reliability of responses. Both positively and negatively worded items  
160 were included, with the latter representing less than 25% of the questionnaire. In addition, two  
161 different five-point response scales were designed: a Likert scale and a frequency scale.

162

### 163 *Translation of existing mindful eating questionnaires*

164 The six mindful eating questionnaires available at the time of the study (Carrière et al., 2022;  
165 Clementi et al., 2017; Framson et al., 2009; Hulbert-Williams et al., 2014; Peitz et al., 2021;  
166 Winkens et al., 2018) were translated from English into French by three individuals who  
167 collaborated to produce the best translation, and then two English speakers independently  
168 provided back-translations to ensure accuracy.

169

### 170 *Semi-structured interviews*

171 Semi-structured interviews were conducted with 14 mindfulness professionals (71.4% of  
172 women, mean age  $46.0 \pm 8.8$ ) including teachers of yoga, meditation, or Mindfulness-Based  
173 Stress Reduction (MBSR) (Kabat-Zinn, 1982), and 12 individuals practicing mindfulness for  
174 at least two years (58% of women, mean age  $41.6 \pm 10.3$ ), recruited through word of mouth or



175 social networks, and varied in age and sex. The interviews aimed to create new items using  
176 easy-to-understand language suitable for non-experts in mindfulness.

177

### 178 *Think-aloud*

179 An initial Mind-Eat Scale of 138 items was developed and later refined using think-aloud  
180 interviews with 10 adults who were unfamiliar with mindful eating and nutrition (60% females,  
181 mean age  $34.4 \pm 14.1$ ). Participants, recruited by word of mouth and representing a wide range  
182 of ages, sexes, and educational levels, were instructed to read each item orally and explain their  
183 understanding. Their feedback led to modifying or removing items that were not easily  
184 understood, resulting in a final pool of 126 items suitable for people new to mindfulness  
185 concepts.

186

### 187 ***Step 2: Evaluation by experts and naive individuals***

188 The 126-item Mind-Eat Scale was reviewed by experts and naive individuals to ensure clarity,  
189 content and face validity, and even response distribution. The two response scales were also  
190 tested.

191

### 192 *Evaluation by experts in mindful eating and mindfulness*

193 Sixteen mindfulness and mindful eating experts, including mindfulness teachers, meditators,  
194 psychiatrists, nutritionists, and dieticians, participated in a two-round Delphi method. They  
195 each used a 7-point scale ranging from "totally irrelevant" to "totally relevant" to rate the  
196 relevance of dimensions and items to the concept of mindful eating. Dimensions and items  
197 scoring less than 50% above 5 were removed, 51-60% were revised or removed and at least  
198 61% were retained. In general, unclear, redundant, imprecise, or irrelevant items were adjusted  
199 or removed, and the balance of items between dimensions was assessed. Experts also assessed

200 the most appropriate five-point response scale. In the final step of this process, all experts  
201 provided an assessment of whether the scale measured the construct it was intended to measure,  
202 thereby confirming the adequate content validity of the scale.

203

#### 204 *Evaluation by experts in scale development and eating behavior*

205 Ten experts in eating behavior and scale development from different disciplines (epidemiology,  
206 psychology, nutrition) provided their input on item composition, length, language, and the  
207 balance of positive and negative items. They also voted on the most appropriate five-point  
208 response scale.

209

#### 210 *Evaluation by naive individuals*

211 Twenty participants, diverse in age, sex, and level of education or socio-professional status,  
212 completed the scale (75% females, mean age  $39.7 \pm 19.0$ ). Item responses were analyzed to  
213 ensure heterogeneity and items with a limited range of responses were adjusted or removed.  
214 Participants also rated the clarity and comprehensibility of the scale and reported difficulties in  
215 answering or understanding items, leading to necessary modifications.

216

217 This step resulted in the reduction of the Mind-Eat Scale to 95 items.

218

#### 219 ***Step 3: Survey administration***

220 The 95-item Mind-Eat Scale was further administered to a large sample of individuals  
221 representative of the French population.

222

223

224

225 *Population*

226 Participants were adult volunteers (age  $\geq$  18 years) recruited from the general French population  
227 and included in the NutriNet-Santé study. This study is a large, ongoing, web-based prospective  
228 cohort launched in France in May 2009. Its design and methods have been described previously  
229 (Herberg et al., 2010). It aims to explore the relationships between diet and health and between  
230 the determinants of dietary behavior and nutritional status. Participants are asked to fill in  
231 monthly web-based questionnaires on various nutrition-related topics (e.g., dietary behavior,  
232 physical activity, anthropometric characteristics, lifestyle, socioeconomic conditions, and  
233 health status). The 95-item Mind-Eat Scale was sent to a sub-sample of 9790 participants. This  
234 sample of individuals was randomly selected within the NutriNet-Santé cohort to be  
235 representative of the French population in terms of age, sex, BMI, and educational level (French  
236 National Institute of Statistics and of Economic Studies (INSEE), 2022). The NutriNet-Santé  
237 study is conducted in accordance with the guidelines of the Declaration of Helsinki, and all  
238 study procedures were approved by the Institutional Review Board of the French Institute for  
239 Health and Medical Research (IRB Inserm n° 0000388FWA00005831) and by the Commission  
240 Nationale Informatique et Libertés (CNIL n° 908450 and n° 909216). Electronic informed  
241 consent was obtained from all participants. The NutriNet-Santé study is registered in  
242 ClinicalTrials (N°NCT03335644).

243

244 *Mindful eating*

245 The 95-item Mind-Eat Scale was administered in April 2022 to the 9790 participants initially  
246 selected. A total of 3,102 individuals completed the questionnaire. Their characteristics are  
247 shown in Table 1. Among these 3102 participants, 2363 individuals completed the  
248 questionnaire a second time with a mean test-retest interval of 48.6 days (SD = 9.5, range = 21-  
249 79 days). See Supplemental Table S1 for their characteristics. Given the length of the

250 questionnaire, four versions were created with different orderings between items to avoid the  
251 fatigue effect affecting the same items. Responses were rated on a 5-point frequency scale  
252 ranging from 1 "never or almost" to 5 "always or almost", with each point on the scale  
253 represented by a word anchor. The final score was divided by the number of items, resulting in  
254 a final total score ranging from 1 (low level of mindful eating) to 5 (high level of mindful  
255 eating).

256

### 257 *Socio-demographic, anthropometric, and lifestyle*

258 Socio-demographic, anthropometric, and lifestyle data were collected at inclusion and annually.  
259 The latest available data up to the date of completion of the Mind-Eat Scale were used with a  
260 mean ( $\pm$  SD) difference between mindful eating and covariate scores of  $8.16 \pm 9.13$  months.  
261 Data collected included: sex (male, female), age (years), self-reported height and weight,  
262 educational level (primary, secondary, university), employment status (unemployed, student,  
263 self-employed or farmer, employee or manual worker, intermediate professions, managerial  
264 staff or intellectual profession, and retired), children in the household (yes, no), history of diet  
265 (past/current, never), physical activity level (low, moderate, high), and meditation practice  
266 (current, former, never). BMI was calculated as the ratio of self-reported weight to height  
267 ( $\text{kg}/\text{m}^2$ ). Physical activity was assessed using the short form of the French version of the  
268 International Physical Activity Questionnaire (Craig et al., 2003). Weekly sitting time and  
269 various levels of physical activity were assessed and quantified into Metabolic Equivalent Task  
270 (MET) values to determine physical activity in METs per minute per week (MET.min.week-  
271 1). It categorizes individuals into three levels of physical activity (low, moderate, or high).

272

273

274

275 *Nutritional quality and eating behavior*

276 At inclusion and every six months thereafter, participants in the NutriNet-Santé study are asked  
277 to complete a set of three validated nonconsecutive web-based 24h-dietary records. Participants  
278 reported all foods and beverages consumed at each eating occasion, and estimated consumed  
279 portion sizes using validated photographs (Nutrinet Santé, 2013). Adherence to the French  
280 food-based dietary guidelines (FBDG) was assessed with the modified French National  
281 Nutrition and Health Program Guideline Score (PNNS-GS2), an *a priori* nutritional diet quality  
282 (Chaltiel et al., 2019). Higher scores indicate better nutritional quality. Participants completed  
283 the French version of the revised 21-item Three-Factor Eating Questionnaire (TFEQ-R21)  
284 (Tholin et al., 2005) (March to November 2017), which covers three dimensions of eating  
285 behavior: cognitive restraint (6 items), emotional eating (6 items), and uncontrolled eating (9  
286 items). Items are scored on 4-point scales and raw scores for each dimension were transformed  
287 to a 0-100 scale (a higher score indicates greater cognitive restraint, emotional eating, and  
288 uncontrolled eating). Intuitive eating was assessed using the French version of the Intuitive  
289 Eating Scale-2 (IES-2) (Camilleri, Méjean, Bellisle, Andreeva, et al., 2015) (December 2013  
290 to June 2014), which covers three dimensions of eating behavior: eating for physical rather than  
291 emotional reasons (8 items), reliance on hunger and satiety cues (6 items), and unconditional  
292 permission to eat (4 items). Items are rated on a 5-point Likert scale. The IES-2 total score and  
293 subscale scores range from 1 (low intuitive eating) to 5 (high intuitive eating).

294

295 *Psychological well-being*

296 Mindfulness was assessed using the 39-item Five Facets Mindfulness Questionnaire (FFMQ)  
297 (Baer et al., 2006) (January to June 2013). Items are scored on a 5-point scale. The FFMQ total  
298 score ranges from 1 (low mindfulness) to 5 (high mindfulness). Global self-esteem was assessed  
299 using the French version of the 10-item Rosenberg Self-Esteem Scale (RSES) (Vallieres &

300 Vallerand, 1990) (October to December 2016). Items are scored on 4-point scales. The RSES  
301 total score ranges from 10 (low self-esteem) to 40 (high self-esteem). Satisfaction with life was  
302 assessed using the French version of the 5-item Satisfaction with Life Scale (SWLS) (Blais et  
303 al., 1989) (October to December 2016). Items are scored on 7-point scales. The SWLS total  
304 score ranges from 5 (low satisfaction with life) to 35 (high satisfaction with life). Optimism  
305 was evaluated with the French version of the 6-item Life Orientation Test-Revised (LOT-R)  
306 (Trottier et al., 2008) (October to December 2016). Items are rated on a 5-point scale. The LOT-  
307 R total score ranges from 0 (low optimism) to 24 (high optimism). Resilience was evaluated  
308 with the 6-item Brief Resilience Scale (BRS) (Smith et al., 2008) (January to July 2017). Items  
309 are rated on a 5-point scale. The BRS total score ranges from 1 (low resilience) to 5 (high  
310 resilience). Gratitude was assessed using the 6-item Gratitude Questionnaire (GQ-6)  
311 (McCullough et al., 2002) (January to July 2017). Items are scored on 7-point scales. The GQ-  
312 6 total score ranges from 6 (low gratitude) to 42 (high gratitude). Depressive symptomatology  
313 was assessed using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D)  
314 (Radloff, 1977) (November 2021 to May 2022). Items are scored on 4-point scales. The CES-  
315 D total score ranges from 0 (lower depressive symptomatology) to 60 (higher depressive  
316 symptomatology). Anxiety was assessed with the French version of the subscale of the 20-item  
317 State-Trait Anxiety Inventory (STAI-T) (Langevin et al., 2012) (March to September 2020).  
318 Items are scored on 4-point scales. The STAI-T total score ranges from 20 (lower anxiety) to  
319 80 (higher anxiety).

320

#### 321 ***Step 4: Psychometric analyses and item reduction***

322 Individuals who completed the 95-item Mind-Eat Scale in the NutriNet-Santé study (N = 3102)  
323 were separated into three non-overlapping datasets to avoid performing both exploratory factor  
324 analysis (EFA) and confirmatory factor analysis (CFA) on the same dataset. First, a subsample

325 of participants (Sample 3, N=498) was drawn to represent the French population in terms of  
326 age, sex, BMI, and educational level (French National Institute of Statistics and of Economic  
327 Studies (INSEE), 2022). The remaining sample of 2,604 participants was randomly divided into  
328 two datasets of 1302 participants each to conduct an EFA and a CFA respectively (Sample 1  
329 and Sample 2). A final CFA was performed in sample 3. See Supplemental Table S1 for the  
330 characteristics of the participants in these three samples.

331

### 332 *Exploratory factor analysis*

333 An initial EFA was conducted on the first subsample of participants (Sample 1, N=1302) to  
334 identify latent variables. EFA with maximum likelihood estimation and oblique rotation  
335 (oblimin) was performed on the 95 items. The purpose of this step is to determine the underlying  
336 factorial structure and to eliminate items that do not clearly measure one of the latent factors.  
337 Before the EFA, the common variance adequacy of the items for factor analysis was verified:  
338 Bartlett's test which indicates the probability of the absence of correlations must be significant  
339 (Hair et al., 2010), and the Kaiser-Meyer-Olkin (KMO) test, which indicates the coherence of  
340 the set formed by the items, must have a KMO per item greater than 0.50 (Hair et al., 2010).  
341 Following this check, the number of factors to be extracted was based on the scree plot (Cattell,  
342 1966), the proportion of variance explained globally (> 60%) (Carricano et al., 2010), and for  
343 each factor (>5–10%) (Hatcher & O'Rourke, 2014) and parallel analysis (Horn, 1965). In  
344 interpreting the rotated factor pattern, items with a factor loading of 0.40 or greater were  
345 considered to represent a given factor. If an item showed a negligible loading (<0.30) on two  
346 or more factors, it was deleted.

347

348

349

350 *Confirmatory factor analysis*

351 A first CFA using maximum likelihood estimation was carried out on the second sample of  
352 participants (Sample 2, N=1302) to test the existence of the latent factors identified in the EFA  
353 on a first-order multifactor model. Modification indices were processed to identify correlations  
354 between disturbances of items within the same factor that needed to be estimated. A second  
355 CFA was then performed to test a second-order one-factor model on the same subsample of  
356 1,302 participants. Finally, a last CFA was performed on the representative sample of 498  
357 participants (Sample 3), to confirm our second-order one-factor model. It is recommended to  
358 use multiple fit indices to assess model fit (Kline, 2015). Five main indices were assessed for  
359 the goodness of fit: the chi-square by degrees of freedom index ( $\chi^2/df$ ) ( $< 5$ ) (Hair et al., 2010),  
360 the Comparative Fit Index (CFI  $\geq 0.95$  good,  $\geq 0.90$  acceptable), the Tucker-Lewis Index (TLI  
361  $\geq 0.95$  good,  $\geq 0.90$  acceptable), the Standardized Root Mean Square Residual (SRMR  $\leq 0.08$   
362 good), and the Root Mean Square Error of Approximation (RMSEA  $\leq 0.05$  good,  $\leq 0.08$   
363 acceptable) (Boateng et al., 2018). The  $\chi^2/df$  tests on the covariance matrix derived from the  
364 model represent the population covariance (Alavi et al., 2020). The CFI and TLI compare the  
365 fit of a hypothesized model with that of a baseline model (i.e., a model with the worst fit) (Xia  
366 & Yang, 2019). The SRMR summarizes the differences between the observed and implied  
367 covariance matrices of the model (Alhija, 2010). The RMSEA assesses how far a hypothesized  
368 model is from a perfect model. Configural, metric, and scalar invariance were tested.

369 To assess model invariance, sensitivity analyses were conducted on two subgroups. A first CFA  
370 was conducted on meditation practitioners (N=471) given the potential differences between  
371 meditators and non-meditators in response patterns related to conscious attention (Van Dam et  
372 al., 2009). A second CFA was conducted in individuals with overweight or obesity (N=1540)  
373 to ensure the relevance and validity of the questionnaire for those with weight-related concerns.  
374 See Supplemental Table S1 for the characteristics of the participants in these samples.



375 *Hypothesis testing*

376 Convergent and divergent validity of the Mind-Eat Scale were assessed by evaluating  
377 correlations between mindful eating and other scales on nutritional quality and eating behavior  
378 (PNNS-GS2, TFEQ-R21, IES-S2) and psychological well-being (FFMQ, RSES, SWLS, LOT-  
379 R, BRS, GQ-6, CES-D, STAI-T) using Spearman's correlation. Discriminant validity was  
380 assessed by comparing mindful eating scores between subgroups of individuals with different  
381 sexes, ages, BMI, educational level, employment status, presence of children in the household,  
382 history of diet, physical activity level, and meditation practice, by using Student's t-test or  
383 ANOVA's test, as appropriate.

384

385 *Reliability*

386 The reliability of the scale was assessed using McDonald's omega ( $\omega$ ) coefficient ( $\omega > 0.80$   
387 indicates good reliability). Test-retest analyses were performed on the participants who  
388 completed the questionnaire twice (N=2363). The level of consistency between the successive  
389 measurements was estimated using the intraclass correlation coefficient (ICC), calculated as  
390 the ratio of the subject variance by the sum of the subject variance and the residual variance.  
391 An ICC greater than 0.75 indicates good reliability, i.e. the questionnaire is reproducible (Koo  
392 & Li, 2016).

393

394 *Softwares*

395 All tests of significance were two-sided, and a p-value  $< 0.05$  was considered significant. EFA  
396 was performed using Jamovi version 2.3.19.0. CFA and the other statistical analyses were  
397 performed using R version 4.2.1 (Chambers, Murray Hill, NJ, USA).

398

399

400 *Content validity*

401 The content validity of the final 24-item version of the scale was assessed by eight experts in  
402 mindful eating from a variety of disciplines (psychology, nutrition, epidemiology, medicine,  
403 statistics, and social marketing). The experts confirmed that the scale measured the construct it  
404 was intended to measure and that there were no omissions.

405

### 406 **3. RESULTS**

407

#### 408 *Exploratory Factor Analysis (EFA)*

409 Bartlett 's test performed on the 95-item Mind-Eat Scale indicated a strong relationship between  
410 the variables ( $P < 0.001$ ) while the KMO test indicated good sampling adequacy (ranging from  
411 0.78 to 0.93). Using a scree plot and parallel analysis, the EFA resulted in a solution with a  
412 maximum of 13 factors. Items with primary factor loadings  $< 0.40$  and no clear assignment to a  
413 factor were excluded. Only the 24 items with factor loadings between 0.40 and  $> 0.70$  were  
414 retained. As a result, six factors emerged from the EFA which accounted for 61.55% of the total  
415 variance (Table 2). The following factors emerged: Awareness (11.16%), Non-reactivity  
416 (11.01% of the variance), Openness (10.26%), Gratitude (9.93%), Non-judgment (9.55%), and  
417 Hunger/Satiety (9.64%). Each factor consisted of four items resulting in a 24-item Mind-Eat  
418 Scale. The final version of the Mind-Eat Scale is presented in Supplemental Table S2.

419

#### 420 *Confirmatory Factor Analysis (CFA)*

421 The CFAs conducted on the 24-item Mind-Eat Scale suggested an adequate fit for all five  
422 indices ( $\chi^2/df$ , CFI, TLI, SRMR, RMSEA) to a first-order six-factor model in Sample 2 and to  
423 a second-order one-factor model in Samples 2 and 3 (Table 3) (see Supplemental Table S3).

424 Configural, metric, and scalar invariance models were applied, and showed identical results.  
425 These results validate that it is possible to calculate a total score of mindful eating.

426

427 The sensitivity analyses, performed on a subgroup of meditation practitioners (N=471) and  
428 another subgroup of individuals with overweight/obesity (N=1540) indicated that both the first-  
429 and second-order models showed a satisfactory fit for all five indices (see Table 4). These  
430 results confirm the validity of the Mind-Eat Scale in these specific populations.

431

### 432 *Hypothesis testing*

433 Convergent and divergent validity were confirmed by associations with other scales assessing  
434 nutritional quality, eating behavior, and psychological well-being (Table 5). Mindful eating was  
435 positively associated with higher nutritional quality, intuitive eating subscale “Reliance on  
436 hunger and satiety cues”, mindfulness and its subscales, self-esteem, satisfaction with life,  
437 optimism, resilience, and gratitude ( $P<0.001$ ). Mindful eating was negatively correlated with  
438 the three subscales of eating behavior (cognitive restraint, emotional eating, uncontrolled  
439 eating), with depressive symptomatology and anxiety ( $P<0.001$ ). No associations were found  
440 with the intuitive eating subscales “Eating for physical rather than emotional reasons” and  
441 “Unconditional permission to eat”.

442 The discriminant validity of the Mind-Eat Scale was confirmed (Table 1). The total mindful  
443 eating score was significantly higher in males, those who were older, had a lower BMI, were  
444 retired and self-employed or farmers, had children in the household, had never dieted, had  
445 higher levels of physical activity, and those who currently practiced meditation ( $P<0.001$ )  
446 (Table 1). Mindful eating scores were also lower in students ( $P<0.001$ ), although no significant  
447 differences were observed according to educational level.

448

#### 449 **Reliability**

450 McDonald's  $\omega$  indicated good internal consistency for the six dimensions: Awareness ( $\omega =$   
451 0.88), Non-reactivity ( $\omega = 0.88$ ), Openness ( $\omega = 0.86$ ), Gratitude ( $\omega = 0.84$ ), Non-judgment ( $\omega$   
452 = 0.84), and Hunger/Satiety ( $\omega = 0.84$ ).

453 Overall, interdimensional robust correlation coefficients were observed between Awareness,  
454 Openness, Gratitude, and Hunger/Satiety, and between Non-judgment, Non-reactivity, and  
455 Hunger/Satiety (Table 6). Non-judgment was weakly associated with Awareness, and  
456 Gratitude, and showed no association with Openness. In addition, non-reactivity was not  
457 significantly associated with Openness and Gratitude.

458 Test-retest over a 51-day period revealed high reliability with good ICCs for all dimensions:  
459 Awareness (0.82 95% CI [0.80; 0.83]), Non-reactivity (0.74 95% CI [0.72; 0.76]), Openness  
460 (0.81 95% CI [0.80; 0.83]), Gratitude (0.79 95% CI [0.77; 0.80]), Non-judgment (0.78 95% CI  
461 [0.77; 0.80]), and Hunger/Satiety (0.79 95% CI [0.78; 0.81]).

462

#### 463 **4. DISCUSSION**

464 In this study, we aimed at developing and validating a questionnaire to assess the level of  
465 mindful eating in a general population. The developed Mind-Eat Scale consists of 24 items  
466 divided into six dimensions: Non-reactivity, Awareness, Openness, Gratitude, Non-judgment,  
467 and Hunger/Satiety. Unlike existing mindful eating scales, ours introduces two new  
468 dimensions: Openness and Gratitude. A second-order factor that includes all six dimensions  
469 allows us to calculate a total mindful eating score. All other scales developed in previous years  
470 have allowed for the calculation of scores by dimensions only (Carrière et al., 2022; Clementi  
471 et al., 2017; Framson et al., 2009; Hulbert-Williams et al., 2014; Peitz et al., 2021; Winkens et  
472 al., 2018). The scale showed good psychometric properties, adequate discriminant, convergent  
473 and divergent validity, satisfactory internal consistency, and reliable test-retest reliability. This

474 study validated the first tool to assess a total mindful eating score and its subdimensions in a  
475 general population.

476

477 *Exploring mindful eating dimensions*

478 The present study confirms the multidimensionality of the mindful eating construct as  
479 suggested by previous studies (Peitz & Warschburger, 2022). The dimensions identified in the  
480 Mind-Eat Scale cover a variety of attitudes and behaviors, that are generally accepted as part of  
481 the concept of mindful eating.

482 The *Awareness* dimension describes the ability to be fully present and attentive to the sensory  
483 experiences, thoughts, and emotions that arise during food experiences. Awareness is a core  
484 aspect of mindful eating and this dimension has been included in all mindful eating scales  
485 (Carrière et al., 2022; Clementi et al., 2017; Framson et al., 2009; Hulbert-Williams et al., 2014;  
486 Mantzios, 2023a; Peitz et al., 2021; Winkens et al., 2018). This heightened awareness allows  
487 individuals to make conscious and intentional choices, savor the flavors and textures of food,  
488 and develop a healthier relationship with food (Bays & Kabat-Zinn, 2009). It is important to  
489 note that our awareness subscale differs slightly from other mindful eating scales in that it  
490 includes aspects of slower eating. Research has shown that slower eating is associated with  
491 healthier eating (Robinson et al., 2014). Slowing down the rate of eating can be a practical way  
492 for individuals to increase their sensory exposure (Tapper, 2022) and, consequently, their  
493 awareness. Our scale was developed based on mindful eating practice rather than theory, which  
494 may explain why this aspect emerged in our scale.

495 The *Non-reactivity* dimension refers to the ability to observe thoughts, emotions, and cravings  
496 related to food without immediately acting upon them or being driven by them. This dimension  
497 is included in three mindful eating questionnaires (Carrière et al., 2022; Hulbert-Williams et

498 al., 2014; Peitz et al., 2021) and in the FFMQ (Baer et al., 2006). A higher level of non-reactivity  
499 allows for a pause between the stimulus (e.g. craving) and the response (e.g. eating) and creates  
500 space for a more mindful decision about whether to act on the craving. This can be described  
501 as an improvement in cognitive flexibility (Zou et al., 2020). This dimension overlaps with the  
502 “External eating” dimension of the DEBQ, which refers to eating in response to external cues  
503 such as environmental or situational triggers (van Strien et al., 1986).

504 The *Openness* dimension involves adopting an open and curious mindset towards food,  
505 embracing the present moment with curiosity instead of seeking rigid control over overeating  
506 experiences (Albers, 2009). Mindfulness requires that individuals approach their moment-by-  
507 moment experiences with openness (Barner & Barner, 2011; Bishop et al., 2004; Kabat-Zinn,  
508 2005). However, this aspect is not included in other assessments of mindfulness or mindful  
509 eating besides the Freiburg Mindfulness Inventory (FMI) (Walach et al., 2006). Increased  
510 openness is expected to help individuals let go of biases, making it easier to discover new foods  
511 and flavors with a more flexible and receptive approach. The relevance of this subscale within  
512 the mindful eating concept needs further confirmation.

513 The *Gratitude* dimension expresses an awareness and a sense of recognition for those  
514 contributing to meals. Gratitude is an important form of mindfulness and a tenet of Buddhist  
515 psychology (Rosenzweig, 2013). Some mindfulness-based interventions now incorporate  
516 teachings and practices around gratitude (Kabat-Zinn, 2013). However, this dimension has not  
517 been included in other scales except for the MEI which integrates some aspects of it in the  
518 “Connectedness” dimension (Peitz et al., 2021) and its relevance should be further assessed.  
519 Gratitude may hold an important role in mindful eating by acknowledging a broader awareness  
520 of the origin of the food that consumers have been increasingly concerned about in the last  
521 decades (Baudry et al., 2017). In addition, the inclusion of gratitude offers a more

522 comprehensive perspective, that addresses not only awareness of physical aspects but also  
523 emotional aspects of the eating experience (McCullough et al., 2002).

524 The *Non-judgment* dimension is defined by the ability to avoid negative self-judgment of  
525 ourselves and our food choices and eating behaviors. This refers to an attitude of acceptance,  
526 accepting things as they are in the present moment, including thoughts, emotions, and  
527 sensations, without resistance and without trying to change or control them. This dimension is  
528 a well-accepted aspect of mindfulness and has been included in all mindful eating  
529 questionnaires except for the MEQ (Framson et al., 2009), and MEQ-short (Clementi et al.,  
530 2017). A limit of this dimension is that like in most questionnaires on mindful eating (Carrière  
531 et al., 2022; Clementi et al., 2017; Framson et al., 2009; Hulbert-Williams et al., 2014; Peitz et  
532 al., 2021; Winkens et al., 2018) and mindfulness (Baer et al., 2006; Bergomi et al., 2013), it  
533 mainly consists of reverse items that assess self-judgment rather than non-judgment, which are  
534 not strict opposite constructs as has been shown with the concepts of mindfulness and  
535 mindlessness (Van Dam et al., 2009). Although the 95-item version of the scale included an  
536 adequate number of items related to non-judgment, none of them were retained in the final  
537 solution. Items related to judgment may be more relatable to individuals' daily experiences than  
538 those related to non-judgment.

539

540 The *Hunger/Satiety* dimension is defined by present-moment awareness and trust in internal  
541 bodily sensations. It contributes to a stronger connection with hunger and satiety signals.  
542 Increased awareness of these signals enables individuals to make more conscious dietary  
543 choices, potentially reducing overeating and mindless eating driven by emotions or external  
544 cues (Kristeller et al., 2014). This dimension aligns well with common mindful eating practices  
545 (Tapper, 2022) and is included in various mindful eating questionnaires (Clementi et al., 2017;  
546 Framson et al., 2009; Peitz et al., 2021; Winkens et al., 2018). However, the relevance of this

547 dimension with the concept of mindful eating was questioned (Mantzios, 2023a). Concerns  
548 included the fact that hunger and satiety necessarily involve judgment and reaction, the  
549 multiplicity of other motives that can lead to the initiation or end of consumption, and potential  
550 implications for overconsumption (Mantzios, 2023a). It must be noted that similar dimensions  
551 can be found in other measures of dietary behavior such as the “Reliance on hunger and satiety  
552 cues” dimension of the intuitive eating questionnaire (IES-2) (Tylka & Kroon Van Diest, 2013).  
553

554 Our data suggest a close relationship or shared measurement of mindful eating aspects within  
555 two groups of dimensions: Awareness, Openness, Gratitude, and Hunger/Satiety on one side,  
556 and Non-judgment, Non-reactivity, and Hunger/Satiety on the other side. However, most  
557 dimensions showed limited associations with each other confirming that they are relatively  
558 independent and measure distinct aspects of mindful eating.

559

#### 560 *Hypothesis testing and tool validity*

561 Our findings support our hypothesis by revealing positive correlations with nutritional quality,  
562 mindfulness, self-esteem, satisfaction with life, optimism, resilience, and gratitude. Only the  
563 'Reliance on hunger and satiety cues' dimension from the IES-2 questionnaire (Camilleri,  
564 Méjean, Bellisle, Andreeva, et al., 2015) exhibited a significant positive correlation with our  
565 Mind-Eat Scale, indicating that the intuitive eating concept differs from mindful eating.  
566 Negative correlations were observed with cognitive restraint, emotional eating, uncontrolled  
567 eating, depressive symptomatology, and anxiety. These findings are consistent with the core  
568 tenets of the mindful eating concept and highlight its role in promoting a healthier relationship  
569 with food (Jordan et al., 2014) and psychological well-being (Goyal et al., 2014).

570 Our study suggests that the Mind-Eat Scale is a valid tool to assess mindful eating in individuals  
571 who meditate or live with overweight/obesity. It identifies varying levels of mindful eating,



572 among diverse populations such as lower overall mindful eating scores in individuals with  
573 overweight or obesity. This research could enhance clinical nutrition practice, and promote  
574 well-being, given the positive impact of mindful eating on physical and mental health (Khan &  
575 Zadeh, 2014). It could be particularly beneficial for healthcare professionals' practice, as it  
576 supports patients in cultivating a healthier relationship with food. Assessing dietary patterns in  
577 this population is crucial for personalized recommendations and comprehensive care. Mindful  
578 eating assessment can also raise awareness of eating behavior, by fostering positive changes  
579 and improved weight management. Finally, the Mind-Eat Scale can aid in evaluating  
580 interventions for individuals with overweight or obesity, allowing tailored follow-up plans and  
581 progress monitoring.

582

### 583 *Strengths and limitations*

584 A major strength of this study is its careful adherence to the recommended validation steps for  
585 scale development (Boateng et al., 2018) increasing its overall robustness. Another strength of  
586 this study is the representativeness of its population. Sample 3, used for the last CFA, had  
587 similar sex, BMI, and education distribution to the wider French population (French National  
588 Institute of Statistics and of Economic Studies (INSEE), 2022) and differed only in terms of  
589 age distribution. However, caution should be exercised in generalizing our results because the  
590 NutriNet-Santé study relies on voluntary, long-term, web-based recruitment. Hence, the study  
591 sample probably consists of health-conscious individuals interested in nutrition (Andreeva et  
592 al., 2016). This questionnaire possesses an added advantage as it incorporates both theoretical  
593 foundations and practical elements. Consequently, it becomes an instrument with more  
594 extensive and practice-oriented dimensions compared to the majority of other questionnaires.  
595 The relevance of some dimensions to the mindful eating concept such as gratitude,  
596 hunger/satiety, or openness dimensions should however be further assessed. Another limitation

597 is related to the bivariate correlations in hypothesis testing that may introduce bias (Bishara &  
598 Hittner, 2015). Finally, the temporality of the data can be a limit, as covariates and some of the  
599 dietary quality, dietary behavior, and psychological well-being questionnaires were collected  
600 several months, or in specific cases even years, earlier. As a result, they may not accurately  
601 reflect the current status or behavior of the participants. However, dietary behaviors (Mikkilä  
602 et al., 2005) and psychological traits (Johnson et al., 2005) tend to remain relatively stable over  
603 time.

604

## 605 **5. CONCLUSIONS**

606 In this study, the Mind-Eat Scale was developed and validated to assess the level of mindful  
607 eating in the general population. This work resulted in a 24-item scale distributed into six  
608 dimensions, which showed good psychometric properties. This tool is the first to calculate a  
609 CFA-validated total mindful eating score, in addition to a score by dimension. Mindful eating  
610 total score differed between sub-groups of individuals and was associated with favorable  
611 nutritional quality, eating behavior, and psychological well-being characteristics. This scale  
612 may prove useful to better understand the role of mindful eating in nutrition and associated  
613 health outcomes. It can also be useful for health professionals in managing patients, particularly  
614 in the context of overweight and obesity.

615

616

617

618

619

620 **DECLARATIONS**

621

622 **Ethics approval and consent to participate**

623 The NutriNet-Santé study is conducted according to the Declaration of Helsinki guidelines and  
624 was approved by the Institutional Review Board of the French Institute for Health and Medical  
625 Research (IRB Inserm n°0000388FWA00005831) and the “Commission Nationale de  
626 l’Informatique et des Libertés” (CNIL n°908450/n°909216). The study protocol is recorded at  
627 Clinicaltrials.gov under the number: NCT03335644. All subjects provided informed consent.

628

629 **Consent for publication**

630 Not applicable.

631

632 **Availability of data and materials**

633 **DATA AVAILABILITY STATEMENT**

634 Researchers from public institutions can submit a collaboration request to Dr. Mathilde Touvier  
635 via [collaboration@etude-nutrinet-sante.fr](mailto:collaboration@etude-nutrinet-sante.fr), including information on the institution and a brief  
636 description of the project. All requests will be reviewed by the steering committee of the  
637 NutriNet-Santé study. If the collaboration is accepted, a data access agreement will be  
638 necessary, and appropriate authorizations from competent administrative authorities may be  
639 needed. In accordance with existing regulations, no personal data will be accessible. The  
640 analysis code can be requested from the authors.

640

641

642 **Competing interests**

643 All authors report that they have no known competing financial interests or personal  
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656

657 **Authors' contributions**

658 MVB conducted the literature review and drafted the manuscript. MVB, CL, and SP performed  
659 the statistical analyses. SP, MVB, RS, AR, and CL were responsible for developing the design  
660 and protocol of the study. SP, MVB, RS, and AR were responsible for collecting the data. All  
661 authors participated in the editing and critical revision of the manuscript and approved the final  
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**Table 1**

Sample characteristics and differences in Mind-Eat Scale total scores across categories of individuals (N=3102, NutriNet-Santé)

	N (%)	Mind-Eat Scale total score (mean ± SD)	P-value <sup>1</sup>
<b>Sex</b>			<0.001
Male	1436 (46.3)	3.82 ± 0.54	
Female	1666 (53.7)	3.67 ± 0.62	
<b>Age</b>			<0.001
18-39y	458 (14.8)	3.64 ± 0.03	
40-59y	993 (32.0)	3.67 ± 0.02	
≥ 60y	1651 (53.2)	3.82 ± 0.01	
<b>Body mass index</b>			<0.001
Underweight (< 18.5 kg/m <sup>2</sup> )	108 (3.5)	3.91 ± 0.06	
Normal weight (≥ 18.5 and < 25 kg/m <sup>2</sup> )	1454 (46.9)	3.86 ± 0.02	
Overweight (≥ 25 and <30 kg/m <sup>2</sup> )	1070 (34.5)	3.67 ± 0.02	
Obese (≥ 30 kg/m <sup>2</sup> )	470 (15.2)	3.52 ± 0.03	
<b>Educational level</b>			0.36
Primary	1138 (36.7)	3.77 ± 0.02	
Secondary	895 (28.9)	3.73 ± 0.02	
University	1050 (33.8)	3.72 ± 0.02	
Missing data	19 (0.6)	-	
<b>Employment status</b>			<0.001
Unemployed	250 (8.1)	3.69 ± 0.04	
Student	47 (1.5)	3.51 ± 0.08	
Self-employed, farmer	88 (2.8)	3.78 ± 0.06	
Employee, manual worker	548 (17.7)	3.63 ± 0.02	
Intermediate professions	226 (7.3)	3.64 ± 0.04	
Managerial staff, intellectual profession	447 (14.4)	3.72 ± 0.03	
Retired	1495 (48.2)	3.82 ± 0.02	
Missing data	1 (0.0)		
<b>Children in the household</b>			<0.001
Yes	2327 (75.0)	3.77 ± 0.57	
No	775 (25.0)	3.67 ± 0.63	
<b>History of diet</b>			<0.001
Past/current dieter	1339 (43.2)	3.60 ± 0.60	
Never dieter	1624 (52.4)	3.86 ± 0.55	
Missing data	139 (4.4)	-	
<b>Physical activity level (IPAQ)</b>			<0.001
Low	554 (17.9)	3.65 ± 0.02	
Moderate	1119 (36.1)	3.70 ± 0.02	
High	1426 (45.9)	3.81 ± 0.02	
Missing data	3 (0.1)	-	
<b>Meditation practice (%)</b>			<0.001
Current	471 (15.2)	3.91 ± 0.03	
Former	342 (11.0)	3.70 ± 0.03	
Never	2289 (73.8)	3.72 ± 0.01	

<sup>1</sup> P value based on Student's t-test or ANOVA, as appropriate.

**Table 2**  
Factor structure of the 24-item Mind-Eat Scale using EFA<sup>1</sup> (N = 1302)

	Factor loadings <sup>2</sup>					
	1	2	3	4	5	6
<b>F1. Awareness</b>						
14. When I eat, I take the time to appreciate the taste of food.	0.861					
1. When I eat, I take the time to savor the food.	0.830					
18. When I eat, I take the time to taste each food.	0.749					
23. I savor the food I'm eating, even if it's a food I eat often.	0.692					
<b>F2. Non-reactivity</b>						
20*. When I see a food I want, I can't help but eat it.		0.895				
2*. When I see foods I like, I find it hard not to eat them.		0.808				
5*. If I want a certain food, I can't help but eat it.		0.762				
8*. When I smell something tasty, I find it hard not to eat it.		0.734				
<b>F3. Openness</b>						
13. I try new foods without reluctance.			0.853			
21. I like to discover new foods.			0.847			
6. I try new foods, even if I have a preconceived negative opinion about them.			0.707			
9. I like to choose unfamiliar foods (meals at home or out).			0.691			
<b>F4. Gratitude</b>						
16. When I eat, I feel gratitude for the planet that has provided me with food.				0.837		
24. When I eat, I think of the people or elements that produced my food (farmers, rain, animals, etc.).				0.835		
11. When I eat, I feel gratitude to the people who made it possible for the food to reach my plate.				0.769		
3. I feel gratitude for the people who prepared the food I eat.				0.452		
<b>F5. Non-judgement</b>						
17*. I blame myself when I feel like I have eaten too much.					0.887	

	Factor loadings <sup>2</sup>					
	1	2	3	4	5	6
4*. I blame myself if I have eaten more than my body needs.					0.880	
22*. I feel guilty when I eat foods that I consider bad for my health.					0.662	
10*. I criticize myself for the way I eat.					0.497	
<b>F6. Hunger/Satiety</b>						
7. I trust my body to know how much to eat.						0.908
12. I trust my body to know when to stop eating.						0.867
19. I trust my body to know what foods to eat.						0.578
15. I stop eating when I'm no longer hungry, even when it's a food I like.						0.518

<sup>1</sup> EFA = Exploratory Factor analysis

<sup>2</sup> Maximum Likelihood<sup>1</sup> extraction method with an 'oblimin' rotation.

\* = inverted items

**Table 3**CFA<sup>1</sup> model fit statistics and reliability of the Mind-Eat Scale in two samples (N2=1,302, N3=498)

	<b>First-order six-factor model (Sample 2, N=1302)</b>	<b>Second-order one-factor model (Sample 2, N=1302)</b>	<b>Second-order one-factor model (Sample 3, N=498)<sup>2</sup></b>
<b><math>\chi^2/df</math></b>	3.13	4.29	2.43
<b>CFI</b>	0.97	0.95	0.94
<b>TLI</b>	0.96	0.94	0.94
<b>SRMR</b>	0.05	0.08	0.08
<b>RMSEA</b>	0.04	0.05	0.05
	90% CI [0.03; 0.04]	90% CI [0.04; 0.05]	90% CI [0.05; 0.06]

<sup>1</sup> CFA = Confirmatory Factor analysis<sup>2</sup> The CFA model is presented in Supplemental Table S1

$\chi^2/df$  = chi-square, CFI = comparative fit index, TLI = Tucker-Lewis Index, SRMR = standardized root mean square residual, RMSEA = root mean square error of approximation, 90% CI = 90% confidence interval.

**Table 4**CFA<sup>1</sup>s in individuals practicing meditation (N=471) and overweight/obese individuals (N=1,540)

	<b>Meditation practitioners (N=471)</b>		<b>Overweight/obese individuals (N=1540)</b>	
	<b>Six-factor model</b>	<b>One-factor model</b>	<b>Six-factor model</b>	<b>One-factor model</b>
<b><math>\chi^2/df</math></b>	2.20	2.45	3.63	4.53
<b>CFI</b>	0.95	0.94	0.95	0.93
<b>TLI</b>	0.95	0.93	0.94	0.92
<b>SRMR</b>	0.06	0.08	0.05	0.09
<b>RMSEA</b>	0.05	0.06	0.05	0.06
	90% CI [0.05; 0.06]	90% CI [0.05; 0.06]	90% CI [0.04; 0.05]	90% CI [0.05; 0.06]

<sup>1</sup> CFA = Confirmatory Factor analysis

$\chi^2/df$  = chi-square CFI = comparative fit index TLI = Tucker-Lewis Index SRMR = standardized root mean square residual RMSEA = root mean square error of approximation, 90% CI = 90% confidence interval.

**Table 5**

Correlation coefficients between the Mind-Eat Scale and nutritional quality, eating behavior, and psychological well-being scales

	<b>N</b>	<b>r<sup>1</sup></b>	<b>P-value</b>
<b>Nutritional quality (PNNS-GS2)</b>	2056	0.11	<0.001
<b>Three-Factor Eating Questionnaire (TFEQ-R21)</b>			
Cognitive restraint	2235	-0.20	<0.001
Emotional eating	2235	-0.38	<0.001
Uncontrolled eating	2235	-0.41	<0.001
<b>Intuitive eating (IES-2)</b>	2214	0.33	<0.001
Eating for physical rather than emotional reasons	2214	0.04	0.05
Reliance on hunger and satiety cues	2214	0.37	<0.001
Unconditional permission to eat	2214	-0.01	0.83
<b>Mindfulness (FFMQ)</b>	2355	0.38	<0.001
Observe	2355	0.32	<0.001
Description	2355	0.24	<0.001
Awareness	2355	0.21	<0.001
Non-judgement	2355	0.16	<0.001
Non-reactivity	2355	0.27	<0.001
<b>Self-esteem (RSES)</b>	2079	0.24	<0.001
<b>Satisfaction with life (SWLS)</b>	2084	0.22	<0.001
<b>Optimism (LOT-R)</b>	2075	0.17	<0.001
<b>Resilience (BRS)</b>	2179	0.25	<0.001
<b>Gratitude (GQ-6)</b>	2178	0.22	<0.001
<b>Depressive symptomatology (CES-D)</b>	2968	-0.29	<0.001
<b>Anxiety (STAI-T)</b>	2869	-0.32	<0.001

<sup>1</sup> r = Rho de Spearman

**Table 6**  
Interdimensional correlation coefficients between the six dimensions of the Mind-Eat Scale

		Awareness	Non-reactivity	Openness	Gratitude	Non-judgement	Hunger/Satiety
<b>Awareness</b>	$r^1$	—					
	<i>P</i> -value	—					
<b>Non-reactivity</b>	$r^1$	0.17 ***	—				
	<i>P</i> -value	< 0.001	—				
<b>Openness</b>	$r^1$	0.39 ***	0.00	—			
	<i>P</i> -value	< 0.001	0.99	—			
<b>Gratitude</b>	$r^1$	0.47 ***	0.02	0.26 ***	—		
	<i>P</i> -value	< 0.001	0.48	< 0.001	—		
<b>Non-judgement</b>	$r^1$	0.09 ***	0.37 ***	-0.05	-0.08 **	—	
	<i>P</i> -value	< 0.001	< 0.001	0.051	0.005	—	
<b>Hunger/Satiety</b>	$r^1$	0.52 ***	0.25 ***	0.14 ***	0.32 ***	0.27 ***	—
	<i>P</i> -value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	—

*Note.* \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

<sup>1</sup>  $r$  = Rho de Spearman



**Figure 1** Development and validation of the Mind-Eat Scale in four steps

