

2020年度 青森県立保健大学大学院博士論文

Mindful Eating Proficiency and Healthy Eating Literacy in Japanese Mothers:
Associations with Their Own and Their Children's Eating Behavior

分野名 保健・医療・福祉政策
システム領域

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Abstract

Mindfulness is a psychological process that can be developed using meditation and other training to mentally focus on the present moment. Applying the concept of mindfulness to eating (i.e., mindful eating; ME) is known to be associated with regulating eating behavior especially in overweight or obese people. Sustaining healthy eating behavior requires both healthy eating literacy (HEL) and proficiency in ME; however, ME proficiency in Japanese people has not been investigated. Additionally, women may be more susceptible to emotional dietary problems with ME proficiency than men and a healthy diet represents a sizable challenge for nursery school children. Therefore, we conducted a survey of mothers with 4- to 5-year-old children in City A, Japan, to investigate their ME proficiency and HEL level, and examine eating behavior and self-reported body mass index in both the mothers and their children. This study was the first to describe ME proficiency in Japanese mothers. ME proficiency in mothers was positively correlated with both their eating behavior and their children's eating behavior, suggesting a potential relationship, while strong relationships were not observed between HEL level and eating behaviors of mothers and children. Improving ME skills rather than HEL may be an effective way to sustain healthier eating behavior in mothers and their children.

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I. Introduction

Mindfulness is the psychological process of focusing attention on the experience in the present moment (Creswell, 2017; Kabat-Zinn, 2013; Slagter, Davidson, & Lutz, 2011), which can be developed through meditation and other training (Kabat-Zinn, 2013; Pagnini & Philips, 2015; Slagter et al., 2011). In the East, mindfulness has been practiced for 3,000 years in the form of Buddhist meditation (Kitagawa & Muto, 2013). However, a major characteristic of Buddhist meditation is that it is not practiced to achieve a specific goal (Fujii, 2017). Practicing mindfulness to achieve a specific goal was first organized into a clinical technique by Jon Kabat-Zinn et al. (1979) by combining it with psychological theory (Kitagawa & Muto, 2013). Recent application of the mindfulness concept to eating has developed into a personal approach for improving eating behavior referred to as “mindful eating” (ME) (Warren, Smith, & Ashwell, 2017).

There has been considerable discussion regarding the concept of ME and its practice. Previous research has suggested that ME includes being aware of the internal and external cues influencing the desire to eat, food choices, the amount of food eaten, and the manner in which it is eaten (Hanh & Cheung, 2010). ME also includes making conscious meal choices and learning to be more aware of cues indicating that one is full (Dalen et al., 2010). Paying attention to these two factors

has been shown to lead to healthier eating (Miller, Kristeller, Headings, & Nagaraja, 2014). Further, ME includes being aware of hunger and satiety, not focusing on other things while eating, knowing the consequences of eating inattentively, choosing properly nutritious, delicious things to eat and judging how much to eat (Lofgren, 2015). In other words, ME guides opinions on what, why, how, and how much to eat (Fung, Long, Hung, & Cheung, 2016). Fung et al. also asserted that as ME practice improves, one becomes more aware of the relationships between food and 1) one's body, 2) one's feelings, 3) one's mind, and 4) the interconnectedness of human and environmental health. Therefore, if everyone practiced eating better quality food in more appropriate amounts, it would contribute to better maintenance of both individuals' health and the health of our planetary environment. In 2019, the Canadian government introduced proposals to facilitate ME practice for consumers (Government of Canada), defining ME as being aware of how, why, what, when, where, and how much one eats (Webster, 2019).

Studies have demonstrated ME's effectiveness for treating eating disorders in obese women (J. L. Kristeller & Hallett, 1999), and in treating overweight or obese women who are susceptible to emotional eating (Fung et al., 2016). ME has also been shown to effectively manage binge eating (Ruth A. Baer, Fischer, & Huss, 2005; Boutelle et al., 2011; Dalen et al., 2010; J. Kristeller, Wolever, & Sheets, 2014;

Bruce W. Smith, Shelley, Leahigh, & Vanleit, 2006; Tapper et al., 2009), emotional eating (Alberts, Thewissen, & Raes, 2012; Corsica, Hood, Katterman, Kleinman, & Ivan, 2014), external eating (Alberts et al., 2012; Daubenmier et al., 2011), cravings (Alberts, Mulkens, Smeets, & Thewissen, 2010; Dunn et al., 2018), hunger awareness (Boutelle et al., 2014), food intake (Boutelle et al., 2014; Mantzios & Wilson, 2015; Miller et al., 2014; Timmerman & Brown, 2012), and food choice (Mantzios & Wilson, 2015; Stites et al., 2015). Numerous studies have also shown an association between ME and weight loss (Boutelle et al., 2014; Corsica et al., 2014; Dalen et al., 2010; Daubenmier et al., 2011; Dunn et al., 2018; J. Kristeller et al., 2014; Mantzios & Wilson, 2015; Tapper et al., 2009; Timmerman & Brown, 2012). A meta-analysis (Fuentes Artiles et al., 2019) also suggested that ME could offer a practical approach to losing weight.

To date, most studies have focused on ME's potential for preventing or treating obesity. However, ME's potential for managing other food-related issues has also been studied, including controlling binge eating (B. W. Smith et al., 2008), improving food intake (Healy, 2015), and improving food choice (Higgs & Donohoe, 2011; Jenkins & Tapper, 2014; Jordan, Wang, Donatoni, & Meier, 2014; Kidwell, Hasford, & Hardesty, 2015). Although, there has been one Japanese study showing that appreciation for food plays an important role in children's health (Kawasaki &

Akamatsu, 2019), few studies have investigated ME in Japan.

The first scale developed to measure ME proficiency was the Mindful Eating Questionnaire (MEQ) (Framson et al., 2009). Building on previous eating-related scales (Arnou, Kenardy, & Agras, 1995; Stunkard & Messick, 1985; van Strien, Frijters, Bergers, & Defares, 1986) as well as other mindfulness-related scales, such as the Mindful Attention Awareness Scale (Carlson & Brown, 2005), the Freiburg Mindfulness Inventory (R. A. Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), and the Kentucky Inventory of Mindfulness Skills (R. A. Baer, Smith, & Allen, 2004), the MEQ consists of 28 items measuring five factors: 1) disinhibition, 2) awareness, 3) external cues, 4) emotional response, and 5) distraction. This scale has been translated and validated in many languages and populations (Abbaspoor, Javadifar, Miryan, & Abedi, 2018; Apolzan et al., 2016; Casu, Gremigni, & Masheb, 2019; Durukan & Gül, 2019; Garaulet et al., 2012; Hart, Pierson, Goto, & Giampaoli, 2018; Winkens et al., 2018), including an abbreviated version for use with Italian adults, the 20-item Italian MEQ (Clementi, Casu, & Gremigni, 2017). However, to date, no studies have examined ME proficiency in Japanese people.

Healthy eating literacy (HEL) is another approach for managing eating behavior. In contrast to ME, which is characterized by dietary awareness and mindfulness, *literacy* is the ability to use one's cognitive skills to understand,

organize, and apply a descriptive system to enact change. HEL has been found to be associated with the behavioral transformation stage that includes practicing healthier eating behavior (Takaizumi, Harada, Shibata, & Nakamura, 2012). Although learning and practicing healthier eating behavior requires improvement in both HEL and ME proficiency, no studies have been published on the relationship between ME practice and HEL or on how they may interact to influence eating behavior.

In addition to improving ME proficiency and HEL level to adopt healthier eating behavior, it is important that healthy eating behaviors be passed onto children. Although many believe that a mother's eating behavior is passed onto her children (Larsen et al., 2015), no studies have yet shown the possible effects of a mother's ME proficiency and HEL on her children's eating behavior. Therefore, the purpose of this study was to investigate 1) how proficient Japanese mothers are at practicing ME, 2) how their ME proficiency and HEL level relate to their eating behavior, and 3) how those factors may relate to their children's eating behavior.

II. Methods

2.1. Design and participants

Twenty nursery schools from about 54 school in City A in Aomori Prefecture to tackle health and nutrition issues in "Health Aomori 21", were randomly selected

for the sample, of which 18 agreed to participate. From August through September 2019, an anonymous self-administered questionnaire was given to all the mothers with 4- to 5-year-old children who attended one of those nursery schools. They were selected as the sample population for this study because: 1) ME proficiency had not previously been measured in Japanese people; 2) women have been shown to be more susceptible than men to problems with emotional eating (Tanofsky, Wilfley, Spurrell, Welch, & Brownell, 1997); 3) children in this age group were considered unlikely to be significantly influenced by an external environment (e.g., outside their family) and their eating behaviors were likely established. and, 4) children attending nursery school as opposed to kindergarten were chosen because healthy eating habits is a larger problem for nursery school children (Odani et al., 2018).

2.2. Data collection

The questionnaires were to be completed at home and collected through the nursery schools. The survey consisted of 77 items: 8 demographic items, a Japanese translation of the 20-item Italian MEQ (Clementi et al., 2017), the 5-item HEL (Takaizumi et al., 2012) and two 22-item Eating Behavior Scales (Utsumi et al., 2015), one for the mother to complete about herself and the other to complete about her child. After a written explanation of the purpose of the study, the methodology,

information on protecting personal information, study result publication, the voluntary nature of participation in that choosing not to participate would not result in any disadvantage, and that the data would only be reported at the group level, informed consent was obtained by the participants on the questionnaire.

2.3. Japanese version of the 20-item Italian MEQ

To assess ME proficiency, we used a Japanese version of the 20-item Italian MEQ, for which the validity and reliability had been confirmed using a sample of 1,067 Italian adults (mean age: 34.1, 64.1% female) (Clementi et al., 2017). The scale consists of 20 items measuring four factors: 1) disinhibition (7 items), 2) awareness (7 items), 3) external cues (5 items) and 4) emotional response (1 item). The instrument uses a 4-point scale, where responses are “never,” “rarely,” “sometimes,” or “almost always.” Six of the seven items measuring disinhibition were reverse-scored.: “If there’s good food at a party, I’ll continue eating even after I’m full,” “If there are leftovers that I like, I take a second helping even though I’m full,” “When I eat at ‘all you can eat’ buffets, I tend to overeat,” “When I’m eating one of my favorite foods, I don’t recognize when I’ve had enough,” “If it doesn’t cost much more, I get the larger size food or drink regardless of how hungry I feel,” and “I snack without noticing that I’m eating.” After creating a Japanese version, it

was back translated into English, and the equivalence of the original version and the back translated version was examined by the authors. The authors confirmed that it matched the concept that Clementi et al. had proposed. Although the items were developed for Italian adults, Japanese people could respond to the items without feeling that they did not apply to the way Japanese eat, indicating that the translated instrument was a valid measure of ME proficiency in Japanese people.

2.4. The Healthy Eating Literacy (HEL) Scale

The Healthy Eating Literacy (HEL) Scale (Takaizumi et al., 2012) was used to measure HEL. This scale was developed from the Health Literacy Scale validated by Ishikawa et al. (Ishikawa, Nomura, Sato, & Yano, 2008). The validity and reliability of the instrument was confirmed in a sample of 1,252 Japanese (mean age: 40.3). The scale includes five items, three measuring interactive literacy and two measuring critical literacy. The instrument uses a 5-point scale where 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, and 5 = strongly agree. The items are: 1) “I am able to gather diet-related information from various sources, including newspapers, books, TV, and the Internet”; 2) “I am able to pick out the diet-related information I need from the large amount of data available”; 3) “I am able to determine how reliable that diet-related information is”; 4) “I am

able to understand and communicate that diet-related information to other people”; and 5) “I am able to make plans and decide what I am going to do in order to eat more healthily based on that diet-related information.” Items 1, 2, and 4 measured interactive literacy and items 3 and 5 measured critical literacy.

2.5. The Eating Behavior Scale (EBS)

The Eating Behavior Scale (EBS) was used to assess eating behavior healthiness for the mother and her child. The validity and reliability of the scale were confirmed in a sample of 307 Japanese (mean age: 49.0±20.6) (Utsumi et al., 2015). The scale consists of 22 items measuring four factors: binge eating (6 items), dietary balance (8 items), eating rhythm (5 items), and manner of eating (3 items), and is scored on a 5-point scale where 1 = not true of me, 2 = rarely true of me, 3 = occasionally true of me, 4 = sometimes true of me, and 5 = often true of me. The EBS of her child was answered by the mother. The scores are reversed before analysis, therefore, higher scores indicate healthier eating behavior.

2.6. Demographic items

Respondents were asked to indicate their age, highest level of education, employment status, household income, marital status, the child’s gender, number of

children (including the child in the study), and both the mother's and the child's self-reported height and weight to calculate BMI.

2.7. Sample size calculations and statistical analyses

To measure the mothers' ME proficiency, we created a Japanese version of the 20-item MEQ developed by Clementi et al. for Italian adults. Because the Japanese version of the MEQ had not yet been used in a sample of Japanese people, we used the scores from the 28-item MEQ (Framson et al., 2009) on which Clementi et al. based their scale to calculate the required sample size. Although Framson et al. found that the mean score for their sample of adults who practiced yoga was 2.92 ± 0.37 (Framson et al., 2009), we assumed that the scores for our sample of ordinary mothers would be lower and the range between individuals would be larger. Therefore, we assumed a mean between-group difference in average scores of 0.3 for the categorical data analysis, a standard deviation of 0.5, an alpha error of 0.05, and statistical power of 0.8, which indicated that 80 participants were needed to identify significant between-group score differences. With about 700 children ages 4 to 5 registered in City A's nursery schools, a sample size of about 80 would be sufficiently representative of City A (α -error 0.05, power (1 - 0.10)). Assuming a 60% response rate and a 50% valid response rate, we determined that 270

questionnaires would need to be distributed.

Descriptive statistics for the sample were reported using percentages for the categorical variable and means plus or minus standard deviations for the continuous variables. After confirming that ME proficiency and HEL scores were normally distributed using the Kolmogorov-Smirnov test, multiple regression was performed with ME proficiency and HEL as the response variables and participant characteristics as the explanatory variables. Multiple regression was similarly performed with EBS as response variables and ME, HEL, age, education level, employment status, household income, marital status, child's gender and total number of children in the family as explanatory variables. Pearson's correlation coefficient (r) was used to investigate correlations between mothers' EBS scores and their ME proficiency and HEL scores, between mother and child EBS scores, and between EBS scores and BMI for both the mothers and children. The Cronbach's alpha coefficient was used as the measure of the reliability and validity of the ME questionnaire. Using the median scores for ME proficiency and HEL, the sample was divided into four ME-HEL proficiency groups. The chi-squared test was used to identify significant between-group differences in categorical variables representing participant characteristics. For the continuous variables (ME, HEL, EBS scores, and BMI), two-way analysis of variance (ANOVA) was performed followed by post hoc

multiple comparisons using Tukey's Test. *R* ver.3.5.2 was used for the statistical analysis with the significance level set at $p < 0.05$ (2-tailed test).

III. Results

3.1. Response rate and participant characteristics

Of the 270 questionnaires distributed, 177 were returned, for a response rate of 65.6%. Of these, four participants did not include their informed consent; after eliminating surveys with missing data, the analysis sample included 128 participants. Participant characteristics are shown in Table 1.

3.2. Scores and BMI

For mothers, the mean scores were: ME, 2.85 ± 0.31 ; HEL, 3.60 ± 0.62 ; and EBS, 3.35 ± 0.55 . The mothers' mean BMI was 21.50 ± 3.39 kg/m². Table 2 shows the mean ME scores by item and subscale. The children's mean EBS score was 3.60 ± 0.47 and mean BMI was 15.45 ± 1.64 kg/m².

3.3. The reliability and validity of the ME questionnaire

The α reliability coefficient of the ME questionnaire was 0.7404. Cronbach's α for the items of ME questionnaire are shown in Table 3.

3.4. Estimating the effects of participant characteristics on ME, HEL and EBS

After confirming normal distributions for ME and HEL scores, multiple regression was performed on the entire sample using ME and HEL as response variables and age, education level, employment status, household income, marital status, child's gender and total number of children in the family as explanatory variables. Results showed that all most explanatory variables were not significant predictors of ME or HEL (Tables 4 and 5). Likewise, multiple regression was performed on the entire sample using EBS as response variables and ME, HEL, and demographic items as explanatory variables. EBS was significantly associated by ME (Table 6).

3.5. Maternal eating behavior by ME-HEL group

A positive correlation was found between ME proficiency and maternal eating behavior ($r=0.43$, $P<0.001$), while the correlation between maternal eating behavior and HEL was not strong ($r=0.17$, $P<0.05$). Given that the purpose of the study was to understand the effect of different levels of ME proficiency and HEL in Japanese mothers on their own eating behavior, as well as on their children's, we performed an ME-HEL category analysis. Using the median values for ME and HEL scores (2.80

and 3.60, respectively), the sample was divided into four groups: Group A ($ME \geq 2.80$, $HEL \geq 3.60$), Group B ($ME \geq 2.80$, $HEL < 3.60$), Group C ($ME < 2.80$, $HEL \geq 3.60$) and Group D ($ME < 2.80$, $HEL < 3.60$). Chi-squared test results showed no significant between-group differences in participant characteristics (Table 7). The results of two-way ANOVA (ME * HEL / EBS) showed that ME had a significantly greater effect on EBS than HEL (Figure 1) and there is no significant interaction between ME and HEL (Table 8). However, for the children, no significant between-group differences were found. For BMI, no significant between-group differences were found for either mothers or children.

3.6. EBS scores and BMI in mothers and children

There was a significant correlation between the mother's and child's EBS scores ($r=0.55$, $p<0.001$), but not between EBS scores and BMI in either the mothers ($r=-0.02$, $p=0.783$) or the children ($r=0.01$, $p=0.935$).

IV. Discussion

Data from 128 mothers of 4- to 5-year-old children attending 18 nursery schools in City A in Aomori Prefecture were analyzed to examine participant characteristics, mothers' ME proficiency and HEL scores, and mothers' and

children's EBS scores. To the best of our knowledge, this study is the first to measure ME proficiency in Japanese mothers. Maternal EBS scores were found to positively correlate with ME proficiency, while a strong correlation was not found between maternal EBS scores and HEL. Mother and child EBS scores were significantly related. These results suggested that maintaining healthy eating behavior in both mothers and their children may be associated with the mother's proficiency at practicing ME.

From the Cronbach's α coefficient of each ME questionnaire item (Table 3), it was considered that there was no major problem in the reliability and validity of the this ME scale used. Although a previous study found that ME proficiency increased with age (Durukan & Gül, 2019), participant ages ranged from 15–72 in that study. By contrast, participants in the present study were relatively young (in their 20s to 40s); therefore, the age range may have been too limited to show a relationship.

ME proficiency is frequently assessed using the original MEQ (Framson et al., 2009) or one of its revised versions. In the original study on a sample of 303 adults (mean age: 42 ± 14.4), the mean MEQ score was 2.92 ± 0.37 (Framson et al., 2009). Another study on a sample of 150 university students (mean age 19.23), reported a mean MEQ score of 2.86 ± 0.38 (Bruzas & Krietsch, 2015). A 2019 study of 300 University of Malaysia students (mean age: 21.94 ± 1.53) reported a mean MEQ

score of 2.68 ± 0.24 (Ahmad et al., 2019); and a study of 598 Turkish adults (age 15–72) completing a Turkish version of the MEQ reported a mean score of 3.44 ± 0.51 (Durukan & Gül, 2019). Although these studies were conducted in different countries, younger people's MEQ scores tend to be lower, perhaps because younger people may have more difficulty making conscious choices about their eating. The mean ME proficiency score of 2.85 ± 0.31 in the present study was similar to that found in previous studies even though the sample was comparatively young (73.3% of participants were in their 20s or 30s). This may indicate that ME proficiency in Japanese mothers is relatively higher than in other countries. In this study, the ME disinhibition and awareness subscales had the lowest mean score (Table 2). Lower scores in the disinhibition and awareness subscales indicate a lower ability to stop eating once one feels full and to be sensitive to food and changes that happen to yourself during meals, respectively, suggesting that these skills, in particular, may need improvement.

Research on identifying the mechanism by which ME practice improves eating behavior is progressing. Neuroscience research has shown that mindfulness may suppress activity in brain areas that subjectively and cognitively evaluate emotions (Ives-Deliperi, Solms, & Meintjes, 2011). Therefore, improving ME practice may result in increased spiritual strength that may enhance the ability to self-regulate

(Jean L Kristeller & Jordan, 2018). These factors may also be involved in improving food intake. However, the mechanism by which ME practice influences eating behavior remains under-studied, and future studies that examine this relationship are needed.

To measure HEL, this study used the HEL Scale developed by Takaizumi et al., a simple but effective tool that assesses the interactive and critical literacy needed to establish healthy eating habits. Three studies have used this instrument to measure HEL. In the first study, described earlier, the mean per item HEL score in a sample of 1,252 adults (mean age: 40.3) was 3.5 ± 0.7 (Takaizumi et al., 2012). In a second study, the mean total HEL score in a sample of 124 female university students (median age: 21.0) was 16.0 (Sato, Chiba, & Umegaki, 2018). In the third study, the mean total score in a sample of 150 parents of fifth and sixth graders was 18.3 (Iwabe & Yoshiike, 2019). Given that the scale contains five items, the mean scores per item for the second and third studies would have been around 3.20 and 3.66, respectively.

This suggests that, similar to MEQ scores, HEL scores may tend to be lower in younger people. The mean HEL score in the present study was 3.60 ± 0.62 (interactive literacy score 3.78 ± 0.95 and critical literacy score 3.33 ± 0.85), which largely matched the results of the previous studies. Although literacy for a healthy

diet was generally associated with dietary behavior, there was no strong relationship between HEL and EBS in this study. This may be due to the fact that the HEL scale is so simple that it may not include the comprehensive concept of interactive and critical literacy defined by Nutbeam (Nutbeam, 2000; Takaizumi et al., 2012).

In the analyses by ME-HEL group, no significant between-group differences were found in participant characteristics (Table 7). This shows that Both ME proficiency and HEL can be improved posteriorly regardless of socioeconomic status.

A Multiple regression analysis showed that EBS is affected by ME and unaffected by HEL (Table 6). The results of the two-way ANOVA also suggested that the maternal EBS score was more affected by ME than by HEL (Fig. 1). Further there was no interaction between ME and HEL (Table 8). These results suggest that maternal eating behavior may potentially be more influenced by ME than HEL.

The present study found a significant positive correlation between mother's and their child's EBS scores, which is consistent with the findings of another study (Balantekin, 2019). In addition, a conceptual model for the relationship between parents' and children's eating behaviors has also been developed (Larsen et al., 2015). The model proposes that the family eating environment and the child's personality are involved in determining parents' and children's eating behavior. Such factors could also have influenced the eating behavior of the children in the present

study, in addition to the influence of their mother's eating behavior. A child's eating behavior is also associated with their current health status, and their physical and emotional development (Wu et al., 2019). Given that it may affect their eating habits and health in the future, it is extremely important to establish healthy eating behavior from early childhood.

In this study, no relationship was found between eating behavior and BMI in either the mothers or the children. Because many factors outside of eating behavior can affect weight, such as exercise, sleep, and in adults, drinking and smoking (Egger, 2011), other factors could explain why BMI was not associated with eating behavior. Similar to previous studies, however, a simple linear regression analysis revealed a significant correlation between some EBS items and BMI in mothers. For example, Chiba showed that frequency of intaking fatty foods and regular meal time in women aged 20 to 34 (Chiba, Iwabe, & Yoshiike, 2019), similar to "I like food that is oily and rich" and "I eat at irregular times" in this study, were also related to their BMI.

This study had three important limitations. The first is the cross-sectional design. In spite of its observation that there may be a relationship between ME proficiency and eating behavior, because a questionnaire was used, the two factors were not measured independently, so a cause and effect relationship could not be

shown. A future intervention study is needed to investigate causality. The second limitation is the validity of using the ME scale. Clementi et al. developed the ME scale with Italian adults (Clementi et al., 2017). We adopted the scale to investigate Japanese mother's ME proficiency, but it may not accurately reflect Japanese culture and customs in spite of careful confirmation by the authors. Similar problems may exist in previous studies (Ahmad et al., 2019; Bruzas & Krietsch, 2015), so international standards are needed to properly assess and compare ME scores internationally. The final is that this study did not find any characteristic of participants which affect ME, HEL and EBS, though it is generally said that age, household income, educational background, etc. have an effect. In order to re-verify these results, a multivariate analysis was performed by adding samples including missing data, but the results were not clear. It may be necessary to increase the sample size or change the question items to verify them.

Because this was the first time a measure of ME proficiency was used in a study of Japanese people, the study provides a basis for future Japanese studies. In addition, the simultaneous investigation of the effects of ME and HEL on eating behavior suggested that ME had more of an effect. Based on this result, we speculated that improving ME skills, such as learning to manage disinhibition and awareness, may be an effective way to sustain healthier eating behavior in mothers

and their children.

V. Conclusion

Using a sample of mothers with 4- and 5-year-olds attending nursery schools in City A, Japan, this study examined ME proficiency and HEL in the mothers as well as eating behavior and BMI in both the mothers and their children. To the best of our knowledge, this was the first time ME was studied in Japanese mothers. In these mothers, ME proficiency appeared to influence eating behavior more than HEL and their eating behavior appeared to influence their children's eating behavior. Therefore, to sustain healthier eating behaviors in Japanese mothers and their children, it may be effective to help mothers eat more mindfully in addition to improving their HEL.

VI. Tables

Table 1 Participant characteristics

Age		n (%)
	20 s	15 (11.7)
	30 s	82 (64.1)
	40 s	31 (24.2)
Highest level of education		
	Middle school/High school	49 (38.3)
	Junior college/Vocational school	52 (40.6)
	University/Postgraduate degree	27 (21.1)
Employment status		
	Full-time	86 (67.2)
	Part-time	40 (31.3)
	Unemployed	2 (1.6)
Household income		
	<2 million yen	15 (11.7)
	2-4 million yen	48 (37.5)
	4-6 million yen	38 (29.7)
	6-8 million yen	11 (8.6)
	>8 million yen	16 (12.5)
Marital status		
	Married	108 (84.4)
	Widowed/Divorced	18 (14.1)
	Never married	2 (1.6)
Gender of child in the study		
	Male	72 (56.3)
	Female	56 (43.8)
Number of children (including the child in the study)		
	1	24 (18.8)
	2	73 (57.0)
	3	23 (18.0)
	4	7 (5.5)
	5	1 (0.8)

Table 2 ME scores by statement item and subscale

Subscale	Statement item	By item		By subscale		
		Mean	SD	Mean	SD	
Disinhibition	If there's good food at a party, I'll continue eating even after I'm full.	2.47	0.94			
	If there are leftovers that I like, I take a second helping even though I'm full.	2.73	0.83			
	When I eat at "all you can eat" buffets, I tend to overeat.	2.17	0.84			
	I stop eating when I'm full even when eating something I love.	2.77	0.76	2.70	0.88	
	When a restaurant portion is too large, I stop eating when I'm full.	2.69	0.79			
	When I'm eating one of my favorite foods, I don't recognize when I've had enough.	3.25	0.68			
	If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	2.81	0.91			
	Before I eat I take a moment to appreciate colors and smells of food.	2.37	0.72			
	I notice when the food I eat affects my emotional state.	2.25	0.77			
	I taste every bite of food I eat.	2.34	0.67			
Awareness	When eating a pleasant meal, I notice if it makes me feel relaxed.	2.88	0.71	2.69	0.81	
	I appreciate the way my food looks on my plate.	2.70	0.72			
	I notice subtle flavors in the foods I eat.	2.74	0.76			
External cues	I notice when foods and drinks are too sweet.	3.55	0.54			
	At a party with a lot of good food, I notice when it makes me want to eat more than I should.	2.98	0.72			
	I recognize when I'm eating and not hungry.	3.18	0.66			
	I recognize when food advertisements make me want to eat.	3.26	0.69	3.17	0.73	
	When I eat a big meal, I notice if it makes me feel heavy or sluggish.	3.47	0.65			
	I notice when I'm eating from a dish of candy just because it's there.	2.98	0.83			
	I snack without noticing that I'm eating.	3.43	0.72	3.43	0.72	
	Emotional response					

Table 3 Cronbach's α for the items of ME questionnaire

Subscale	Statement item	Cronbach's α
Disinhibition	If there's good food at a party, I'll continue eating even after I'm full.	0.732
	If there are leftovers that I like, I take a second helping even though I'm full.	0.743
	When I eat at "all you can eat" buffets, I tend to overeat.	0.737
	I stop eating when I'm full even when eating something I love.	0.724
	When a restaurant portion is too large, I stop eating when I'm full.	0.725
	When I'm eating one of my favorite foods, I don't recognize when I've had enough.	0.726
	If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	0.742
	Before I eat I take a moment to appreciate colors and smells of food.	0.728
Awareness	I notice when the food I eat affects my emotional state.	0.735
	I taste every bite of food I eat.	0.726
	When eating a pleasant meal, I notice if it makes me feel relaxed.	0.729
	I appreciate the way my food looks on my plate.	0.728
	I notice subtle flavors in the foods I eat.	0.715
	I notice when foods and drinks are too sweet.	0.721
	At a party with a lot of good food, I notice when it makes me want to eat more than I should.	0.738
	I recognize when I'm eating and not hungry.	0.715
External cues	I recognize when food advertisements make me want to eat.	0.740
	When I eat a big meal, I notice if it makes me feel heavy or sluggish.	0.738
	I notice when I'm eating from a dish of candy just because it's there.	0.737
Emotional response	I snack without noticing that I'm eating.	0.726

Table 4 Estimated effects of participant characteristics on ME

Independent variable	Partial regression coefficient	p-value	95% CI ^a		
			Lower limit	Upper limit	
Age ^b	30 s	0.169	0.152	-0.063	0.401
	40 s	0.116	0.360	-0.134	0.367
Highest level of education ^c	Junior college/Vocational school	-0.044	0.549	-0.187	0.100
	University/Postgraduate degree	0.001	0.992	-0.164	0.166
Employment status ^d	Part-time	-0.015	0.823	-0.144	0.115
	Unemployed	0.105	0.644	-0.344	0.554
Household income ^e	2-4 million yen	0.163	0.139	-0.054	0.379
	4-6 million yen	0.156	0.220	-0.095	0.406
	6-8 million yen	0.217	0.123	-0.060	0.495
	>8 million yen	0.297	0.039	0.015	0.579
Marital status ^f	Widowed/Divorced	0.248	0.030	0.024	0.472
	Never married	-0.087	0.740	-0.608	0.434
Gender of child ^g	Female	-0.035	0.558	-0.151	0.082
Number of children ^h (including the child in the study)	2	-0.099	0.225	-0.259	0.062
	3	-0.184	0.063	-0.379	0.010
	4	0.079	0.573	-0.198	0.355
	5	-0.342	0.287	-0.976	0.292

Notes: ^a CI: confidence interval. Group of reference: ^b 20s, ^c Middle school/High school, ^d Full-time, ^e <2 million yen, ^f Married, ^g Male and ^h 1.

Table 5 Estimated effects of participant characteristics on HEL

	Independent variable	Partial regression coefficient	p-value	95% CI ^a	
				Lower limit	Upper limit
Age ^b	30 s	-0.318	0.181	-0.787	0.151
	40 s	-0.365	0.156	-0.872	0.141
Highest level of education ^c	Junior college/Vocational school	-0.134	0.361	-0.425	0.156
	University/Postgraduate degree	0.010	0.952	-0.323	0.344
Employment status ^d	Part-time	0.159	0.230	-0.102	0.420
	Unemployed	-0.037	0.935	-0.944	0.869
Household income ^e	2-4 million yen	-0.126	0.568	-0.564	0.311
	4-6 million yen	-0.219	0.392	-0.725	0.287
	6-8 million yen	0.186	0.513	-0.374	0.746
	>8 million yen	0.164	0.570	-0.406	0.734
Marital status ^f	Widowed/Divorced	-0.113	0.622	-0.565	0.339
	Never married	-0.994	0.064	-2.045	0.058
Gender of child ^g	Female	0.135	0.259	-0.101	0.370
Number of children ^h (including the child in the study)	2	-0.226	0.169	-0.550	0.098
	3	-0.172	0.387	-0.566	0.221
	4	-0.429	0.131	-0.986	0.129
	5	-0.228	0.725	-1.508	1.052

Notes: ^a CI: confidence interval. Group of reference: ^b 20s, ^c Middle school/High school, ^d Full-time, ^e <2 million yen, ^f Married, ^g Male and ^h 1.

Table 6 Estimated effects of participant characteristics on EBS

Independent variable	Model 1		Model 2 ^a		Model 3 ^b	
	Partial regression coefficient	p-value	Partial regression coefficient	p-value	Partial regression coefficient	p-value
ME	0.761	<0.001	0.752	<0.001	0.756	<0.001
HEL	-0.012	0.876				
Marital status ^c						
Widowed/Divorced	-0.093	0.581	-0.089	0.575	-0.252	0.040
Never married	0.897	0.031	0.877	0.029	0.549	0.107
Household income ^d						
2-4 million yen	0.166	0.323	0.138	0.370		
4-6 million yen	0.118	0.533	0.081	0.635		
6-8 million yen	0.128	0.559	0.096	0.638		
>8 million yen	0.389	0.082	0.364	0.072		
Age ^e						
30 s	0.227	0.211	0.193	0.256		
40 s	0.235	0.234	0.201	0.281		
Highest level of education ^f						
Junior college/Vocational school	-0.074	0.525				
University/Postgraduate degree	-0.030	0.819				
Employment status ^g						
Part-time	0.019	0.859				
Unemployed	-0.093	0.796				

Notes: ^a Adjusted for HEL, Highest level of education, and Employment status.

^b Adjusted for HEL, Household income, Age, Highest level of education, and Employment status
Group of reference: ^c Married, ^d <2 million yen, ^e 20s, ^f Middle school/High school, and ^g Full-time

Table 7 Number of participants by characteristic and ME-HEL group

	Group A	Group B	Group C	Group D	p-value *
Age					
20 s	8	2	3	2	0.788
30 s	29	19	15	19	
40 s	8	9	7	7	
Highest level of education					
Middle school/High school	20	10	9	10	0.488
Junior college/Vocational school	14	16	9	13	
University/Postgraduate degree	11	4	7	5	
Employment status					
Full-time	29	19	17	20	0.950
Part-time	14	10	8	8	
Unemployed	1	1	0	0	
Household income					
<2 million yen	6	2	3	4	0.269
2-4 million yen	19	12	9	6	
4-6 million yen	7	8	7	16	
6-8 million yen	5	2	4	0	
>8 million yen	7	5	2	2	
Marital status					
Married	34	25	23	26	0.303
Widowed/Divorced	10	5	2	2	
Never married	1	0	0	1	
Gender of child in the study					
Male	25	17	12	18	0.794
Female	20	13	13	10	
Number of children (including the child in the study)					
1	13	4	3	4	0.253
2	21	20	17	15	
3	8	3	4	8	
4	3	3	0	1	
5	0	0	1	0	

Figure 1 Effects of ME and HEL on EBS

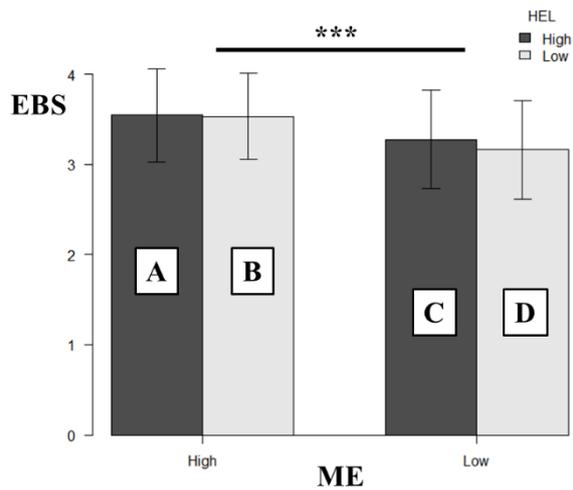


Figure 1 Effects of ME and HEL on EBS.
Data are shown as Mean \pm S.D. *** P<0.001

Table 8 Two-way ANOVA test for EBS by ME and HEL

Source	Sum Sq	Df	F value	P value
(Intercept)	1391.75	1	5135.4788	<0.001
ME	3.12	1	11.5135	<0.001
HEL	0.13	1	0.4624	0.498
ME * HEL	0.08	1	0.2952	0.588
Residuals	33.60	124		

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Ethics approval and consent to participate

The study was conducted with the approval of the Aomori University of Health and Welfare Research Ethics Committee (approval no. 19009, May 22, 2019).

Declaration of competing interest

The authors have no conflicts of interest directly relevant to the content of this article.

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Appendix

I. Questionnaire

年長児の保護者の皆さま

「食行動と食意識」に関するアンケート

.....

これは、お子様が通園される保育園様のご承諾のもと実施される「母親のマインドフルイーティングの実践及び健康的な食生活リテラシーと小児食習慣の関係」に係るアンケート調査です。質問は6ページまであり、お答えいただくのに必要な時間は10分程度です。回答が他の人に分かったりすることはありませんので、ありのままをお答えください。ご記入が終わりましたら、本状が入っております封筒にて、**9月13日（金）まで**にお子様が通園される保育園にご提出くださいますようお願いいたします。

お手数おかけしますが、ご協力のほどよろしくお願い申し上げます。

.....

本調査の趣旨を理解し、参加に同意いただける場合は、「同意する」にチェックをつけ、先に進んでください。

同意する

食行動と食意識に関するアンケート

記録日 _____ 年 月 日

(1) ご自身の食行動について

最も当てはまるものを1つ選んで、番号に○をつけてください。



		そんなことは ない	ほとんど ない	たまに ある	時々ある	よくある
Q1	満腹でも果物やお菓子を食べる	1	2	3	4	5
Q2	間食をする	1	2	3	4	5
Q3	食べることでストレスを解消する	1	2	3	4	5
Q4	他の人が食べているとつられて食べる	1	2	3	4	5
Q5	お正月等の長い休暇には食べ過ぎる	1	2	3	4	5
Q6	イライラすると沢山食べる	1	2	3	4	5
Q7	油っこいこってりした料理が好きだ	1	2	3	4	5
Q8	味の濃い料理を食べたくなる	1	2	3	4	5
Q9	野菜類をあまり食べない	1	2	3	4	5
Q10	きのこ、こんにゃく、海藻類等の繊維質を摂らない	1	2	3	4	5
Q11	肉料理をよく食べる	1	2	3	4	5
Q12	ファーストフードが好きだ	1	2	3	4	5
Q13	好きなものだけを食べる	1	2	3	4	5
Q14	食事内容などあまり意識せずに食べる	1	2	3	4	5
Q15	食事の時間は不規則である	1	2	3	4	5
Q16	夜の遅い時間に食事をする	1	2	3	4	5
Q17	1日3食食べない	1	2	3	4	5
Q18	ゆっくり食事をする時間がない	1	2	3	4	5
Q19	夜に1日分をまとめて食べる	1	2	3	4	5
Q20	早食いである	1	2	3	4	5
Q21	よく噛まないで食べる	1	2	3	4	5
Q22	食べ過ぎを他人に注意される	1	2	3	4	5

(2) お子様の食行動について

最も当てはまるものを1つ選んで、番号に○をつけてください。



		そんなことは ない	ほとんど ない	たまに ある	時々ある	よくある
Q1	満腹でも果物やお菓子を食べる	1	2	3	4	5
Q2	間食をする	1	2	3	4	5
Q3	食べることでストレスを解消する	1	2	3	4	5
Q4	他の人が食べているとつられて食べる	1	2	3	4	5
Q5	お正月等の長い休暇には食べ過ぎる	1	2	3	4	5
Q6	イライラすると沢山食べる	1	2	3	4	5
Q7	油っこいこってりした料理が好きだ	1	2	3	4	5
Q8	味の濃い料理を食べたくなる	1	2	3	4	5
Q9	野菜類をあまり食べない	1	2	3	4	5
Q10	きのこ、こんにやく、海藻類等の繊維質を摂らない	1	2	3	4	5
Q11	肉料理をよく食べる	1	2	3	4	5
Q12	ファーストフードが好きだ	1	2	3	4	5
Q13	好きなものだけを食べる	1	2	3	4	5
Q14	食事内容などあまり意識せずに食べる	1	2	3	4	5
Q15	食事の時間は不規則である	1	2	3	4	5
Q16	夜の遅い時間に食事をする	1	2	3	4	5
Q17	1日3食食べない	1	2	3	4	5
Q18	ゆっくり食事をする時間がない	1	2	3	4	5
Q19	夜に1日分をまとめて食べる	1	2	3	4	5
Q20	早食いである	1	2	3	4	5
Q21	よく噛まないで食べる	1	2	3	4	5
Q22	食べ過ぎを他人に注意される	1	2	3	4	5

(3) ご自身と食情報との関わりについて

最も当てはまるものを1つ選んで、番号に○をつけてください。



		全く そう思わ ない	あまり そう思わ ない	どちら でもない	まあ そう思う	強く そう思う
Q1	新聞、本、テレビ、インターネットなど、いろいろな情報源から食情報を集められる	1	2	3	4	5
Q2	たくさんある情報の中から、自分の求める食情報を選び出せる	1	2	3	4	5
Q3	食情報がどの程度信頼できるかを判断できる	1	2	3	4	5
Q4	食情報を理解し、人に伝えることができる	1	2	3	4	5
Q5	食情報をもとに健康改善のための計画や行動を決めることができる	1	2	3	4	5

(4) ご自身の食意識について

最も当てはまるものを1つ選んで、番号に○をつけてください。



		全く 当てはま らない	あまり 当てはま らない	やや 当てはまる	非常に 当てはまる
Q1	食べる前に、食べ物の色と匂いをしばし楽しむ	1	2	3	4
Q2	自分が口にする食べ物が自分の感情の状態に影響すると、それに気づく	1	2	3	4
Q3	自分が口にする食べ物を、一口毎に味わう	1	2	3	4
Q4	楽しい食事をする時、その食事のおかげでリラックスすれば、それに気づく	1	2	3	4
Q5	自分の皿にある食べ物の見ばえを楽しむ	1	2	3	4
Q6	自分が口にする食べ物の微妙な風味に気づく	1	2	3	4
Q7	食べていて、空腹でないときは、それが分かる	1	2	3	4
Q8	食べ物や飲み物が甘すぎる場合は、それに気づく	1	2	3	4
Q9	食べ物の宣伝のせいで何かを食べたくなる時は、それが分かる	1	2	3	4
Q10	お腹いっぱい食べた時、身体が重かったり、だるい感じがあれば、それに気づく	1	2	3	4
Q11	お皿にあるキャンディーがそこにあるからつい食べている時は、それに気づく	1	2	3	4
Q12	パーティーでごちそうがあれば、お腹がいっぱいになった後でもまだ食べる	1	2	3	4

		全く 当てはま らない	あまり 当てはま らない	やや 当てはまる	非常に 当てはまる
Q13	自分が好きな食べ物が残っていれば、お腹がいっぱいでもお代わりをもらう	1	2	3	4
Q14	「食べ放題」のバイキングで食べる時は、食べ過ぎる傾向にある	1	2	3	4
Q15	好きな物を食べていても、お腹がいっぱいになったら食べるのを止める	1	2	3	4
Q16	レストランで一人分の料理が多すぎる場合は、お腹がいっぱいになったら食べるのを止める	1	2	3	4
Q17	自分が好きな食べ物を食べている時は、もう十分食べた時でもそれが分からない	1	2	3	4
Q18	ごちそうがたくさんあるパーティーで、自分が食べるべき量以上に食べたくなる時、それに気づく	1	2	3	4
Q19	あまり値段が高くないのなら、空腹感にかかわらず、より大きなサイズの食べ物か飲み物を買う	1	2	3	4
Q20	食べているということに気づかずに間食をする	1	2	3	4

(5) ご自身について

最も当てはまるものを1つ選んで、○をつけてください。



Q1 年齢

(20代 ・ 30代 ・ 40代 ・ 50代 ・ 60歳以上)

Q2 最終学歴

(高等学校・中学校 ・ 短期大学・専門学校 ・ 4年制大学以上)

Q3 就業形態

(フルタイム ・ パート・アルバイト ・ 無職)

Q4 世帯年収

(~200万円 ・ 200~400万円 ・ 400~600万円 ・ 600~800万円 ・ 800万円~)

Q5 婚姻状況

(配偶者あり ・ 死別・離別)

Q6 年長のお子様の性別
(男子 ・ 女子)

Q7 年長のお子様の兄弟姉妹
お兄ちゃんまたはお姉ちゃんが、 () 人
弟または妹が、 () 人

⑧身長と体重

ご自身	身長 () cm	体重 () kg
年長のお子様	身長 () cm	体重 () kg

———— 調査は以上となります。ご協力ありがとうございました。 ————