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Eating well and being well: adaptive eating behaviors and their measurement

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1. Introduction

An individual's physical and mental well-being is determined by the practiced health behaviors to a great degree, which, amongst other things, include the eating behaviors[1] applied (Kärkkäinen et al., 2018; Ogden, 2010). Individual differences in eating behavior have long been studied. However, to date, research has predominantly focused on eating behaviors that have negative consequences for mental or physical health. This is due, at least in part, to the increasing prevalence of obesity and eating disorders at population level – particularly in developed countries of the world –, a trend that is essentially an indicator of unfavorable changes in attitudes towards food, eating and the body (Galmiche et al., 2019; OECD, 2023). For this reason, it is particularly important to empirically study not only problematic eating behaviors but also types of eating behaviors that may help prevent the development of so-called maladaptive eating patterns (see below) and eating disorder symptoms. There has been great progress in the scientific literature in this regard over the last two decades, but the research on protective or adaptive eating behaviors has been less nuanced in empirical studies compared to maladaptive eating behaviors. The primary aim of this PhD dissertation was to investigate three previously identified adaptive eating behaviors and their relationship with other eating behaviors, physical and mental well-being indicators, and self-attitudes.

Maladaptive eating behaviors are defined as eating practices given in response to stimuli other than physical hunger, or deliberate and unjustified avoidance of eating in the presence of physical hunger. For example, emotional, restrictive, disinhibited or uncontrolled, and external eating behaviors, as well as chronic dieting, extreme dieting practices, and loss of control in eating are considered to be maladaptive eating behaviors (Dakin et al., 2023; de Lauzon et al., 2004; Nightingale & Cassin, 2019). The maladaptive nature of these eating patterns is usually manifested in their consequences too (e.g. having excess weight or experiencing negative emotional response to eating, such as guilt or shame; Dakin et al., 2023; de Witt Huberts et al.,

[1] In the context of health psychology, research on eating behaviors generally does not focus on the diet (i.e., the nutritional value of the food consumed) itself. According to LaCaille (2020) "*Eating behavior is a broad term that encompasses food choice and motives, feeding practices, dieting, and eating-related problems such as obesity, eating disorders, and feeding disorders.*" (p. 641.)

2013). Contrarily, practicing adaptive eating behaviors means relying primarily on the body's internal hunger and satiety cues to regulate the timing, quantity and quality of food intake. Adaptive forms of eating behaviors also promote the conscious and flexible self-regulation of eating, as well as paying aware attention to the process of eating and increasing mental well-being by reducing the level of negative attitudes and concerns about food, eating, and body image (Tylka, 2006). Intuitive eating, mindful eating, autonomous forms of eating regulation, and eating competence are the types of eating behaviors that are most often labelled as adaptive (Bégin et al., 2019; Kerin et al., 2019; Lohse et al., 2007; Verstuyf et al., 2012). Adaptive eating behaviors have been associated with higher levels of mental well-being, the absence of eating disorders, a more positive body image, and a greater likelihood of developing a healthy diet and maintaining a healthy weight (Anderson et al., 2016; Bruce & Ricciardelli, 2016; Mason, Epel, Kristeller, et al., 2016; Taylor et al., 2015; Tylka et al., 2020).

1.1. Adaptive eating behaviors

A consistent description of adaptive eating behaviors is not yet available in the scientific literature. In the words of Tylka and colleagues (2013), "*In the field of eating behavior, scholars have emphasized the need to define adaptive eating as more than the absence of disordered eating symptoms because its dimensions, benefits, and protective ability cannot be inferred by conceptualizing it as the lack of pathology"* (p. 58). The adaptive eating behaviors that are briefly presented below are mindful eating, autonomous self-regulation of healthy eating behavior, and intuitive eating. These constructs are discussed in detail in the doctoral dissertation.

1.1.1. Mindful eating

The term '*mindful eating'* generally refers to the application of mindfulness in the food environment, but researchers still do not agree on the universal and exact definition of mindful eating (Mantzios, 2021). The most common elements of the construct of mindful eating that are included in the different definitions are: focusing attention and awareness on the process of eating (including taste, smell, texture and sight of the meal); the use of mindfulness in eating-related decisions and actions; being aware of the consequences of mindless eating; encouraging a non-judgmental acceptance of food, its environment, and one's physical and emotional reactions to them; the recognition of internal and external cues of hunger and satiety that have an impact on food choices and portion sizes; slow eating rate; and minimizing distractions while eating (Mantzios, 2021; Monroe, 2015; Tapper, 2022).

Cross-sectional studies investigating the construct of mindful eating have reported mixed results regarding its association with body mass index (BMI; Clementi et al., 2017; Hulbert-Williams et al., 2014; Mantzios et al., 2018). Nevertheless, mindful eaters report fewer eating disorder-related symptoms (e.g., food-related anxiety), more positive attitudes towards their bodies and its functioning, and fewer depressive symptoms (Taylor et al., 2015; Webb et al., 2018; Winkens et al., 2018, 2019). Furthermore, there is supportive evidence for a positive association between mindful eating practices and a healthy diet (Beshara et al., 2013; Mantzios et al., 2018). Intervention research has also found that practicing mindful eating leads to moderate weight loss (Carrière et al., 2018; Fuentes Artiles et al., 2019; Rogers et al., 2017), reduced emotional, external, and restrained eating, and lessened eating disorder symptoms (Carrière et al., 2018; Godfrey et al., 2015; Rogers et al., 2017). Mindful eating interventions can significantly decrease food cravings, body image concerns, symptoms of anxiety and depression, and perceived stress levels as well (Alberts et al., 2012; Daubenmier et al., 2011; Mason, Epel, Aschbacher, et al., 2016; Rogers et al., 2017).

Mindful eating may thus hold promise for rethinking our relationship with food and eating, but clarifying the conceptualization and operationalization of the construct requires more significant research efforts.

1.1.2. Autonomous self-regulation of healthy eating

Self-determination theory (SDT; Deci & Ryan, 1985) provides a framework for studying the motivational background of behavior change and the associated self-regulation processes as they relate to goal pursuit. According to Deci and Ryan's theory, individuals can fulfill their innate aspirations for personal growth and health when three basic psychological needs – i.e., autonomy, competence, and relatedness – are met. Healthy eating behavior is part of the aspiration to be healthy. It follows from the theoretical basis of SDT that by supporting autonomous self-regulation processes, behavior change, and hence, the more frequent practice of adaptive eating behaviors, can be successfully promoted (Deci and Ryan, 2000). The extent to which internal causes (e.g., values and beliefs) play a role as drivers of a behavior alongside externally controlled factors (e.g., expectations) determines whether the self-regulation process of a behavior is autonomous (identified and integrated regulations or intrinsic motivation), or controlled (external and introjected regulations; Ryan & Deci, 2017).

The results of the few available studies investigating autonomous and controlled types of eating behavior regulation have found that autonomous self-regulation in eating has a weak to moderate, but significant positive association with more frequent consumption of healthy

foods, having a more balanced diet, and experiencing greater life satisfaction, higher self-esteem, and self-compassion. In contrast, controlled forms of eating regulation – in addition to showing an inverse association of moderate strength with the above mentioned constructs –, are significantly positively associated with dysfunctional eating behaviors (e.g. bulimia nervosa symptoms), BMI, internalizing the sociocultural attitudes toward thinness, body dissatisfaction, and the frequency of making negative comments about one's own body (i.e., negative body talk), and depressive symptom severity, with medium and high effect sizes (Carbonneau et al., 2021; Guertin et al., 2015; Kato et al., 2013; Leong et al., 2012; Pelletier et al., 2004; Pelletier & Dion, 2007). Thus, we can consider the result of the autonomous self-regulation processes of healthy eating as an adaptive eating behavior that is not associated with undesirable eating styles, mental health consequences, or types of food consumed, contrary to the controlled type of self-regulation in eating.

1.1.3. Intuitive eating

Tribole and Resch (2003) developed the concept of intuitive eating with the primary aim of restoring people's good relationship with food, eating, and the body, and counteracting the negative consequences of the restrictive approach of traditional dieting practices. The authors state that intuitive eaters eat only when they notice the cues of physical hunger, are less likely to start eating as a response to unpleasant emotional stimuli, fatigue, or boredom, and, by detecting more accurately the signals of fullness, stop eating when they have eaten just enough to meet their needs. In addition to these, extended principles of intuitive eating include the rejection of classifying foods as 'good' and 'bad' (and the so-called diet mentality); the unconditional permission to eat when one is hungry; honoring health by choosing nutritious foods that are also enjoyable; the acceptance of and respect for one's own and others' body shape; and the commitment to practice enjoyable physical activity (Tribole & Resch, 2003; Tylka, 2006).

Although cross-sectional studies consistently found significant negative correlations between BMI and intuitive eating practices with small effect sizes, intervention studies have shown more convincing evidence for the role of intuitive eating in weight maintenance rather than weight reduction (Tylka et al., 2020; Van Dyke & Drinkwater, 2014). The results of relevant research show that, on the one hand, people who practice intuitive eating have fewer eating disorder symptoms, are less anxious about meals, are less likely to be on a diet, to apply either rigid or flexible restrictions in eating, and to internalize thinness ideals (Anderson et al., 2016; Bruce & Ricciardelli, 2016; Tylka et al., 2015). On the other hand, intuitive eating is

positively associated with higher body esteem, positive body image, body acceptance, life satisfaction, positive affectivity, and lower levels of depressive symptoms (Bruce & Ricciardelli, 2016; J. T. Schaefer & Magnuson, 2014; Van Dyke & Drinkwater, 2014). In addition, compared to women, men typically score higher on scales measuring intuitive eating (Camilleri et al., 2015; Carbonneau et al., 2016; Duarte et al., 2016; Tylka & Kroon Van Diest, 2013).

1.2. Childhood determinants of eating behaviors

When discussing adult eating behaviors, it is crucial to draw attention to their early childhood determinants. Learning and broader environmental factors play a significant role in the development of children's eating habits, such as food preferences and eating behaviors (Faith, 2004; Scaglioni et al., 2011). Parents also significantly shape their children's eating habits through their parenting and feeding styles as well as through personal examples (Ventura & Birch, 2008; Vollmer & Mobley, 2013). Thus, it is important to take a look at the parental eating and feeding practices that can directly or indirectly contribute to developing either negative or positive eating behaviors and health outcomes in childhood. Research in this area should include adaptive parental eating behaviors in addition to maladaptive eating behaviors. Indeed, eating behaviors and their consequences that develop throughout childhood and adolescence persist over the long term and may exert protective or detrimental effects on health in adulthood as well (Munkholm et al., 2016; Reilly & Kelly, 2011).

In light of the above-mentioned research findings, it is therefore important to continue the empirical endeavor to conceptualize and operationalize mindful eating, intuitive eating, and the autonomous regulation of healthy eating, and to examine these in relation to other eating behaviors, thus carrying on with the rather scarce research effort to explore and gain deeper insights into adaptive eating behaviors that support the protection and promotion of health.

2. Aims of the dissertation

This PhD dissertation is an initial effort to bring adaptive eating behaviors and their research to the fore in Hungary. One of the first steps in this process needs to be the adaptation and validation of questionnaires measuring adaptive eating behaviors already available in foreign literature, which allows for a more in-depth understanding of the constructs discussed,

as well as the measurement and investigation of them in Hungarian. Thus, the first three studies included in the dissertation each had the goal of examining the psychometric properties of three widely used questionnaires, namely the Mindful Eating Questionnaire (MEQ; Framson et al., 2009), the Motivation for Healthy Eating Scale (MHES; Kato et al., 2021), and the Intuitive Eating Scale 2. (IES-2; Tylka & Kroon Van Diest, 2013), and the relationship between these constructs and other eating behaviors. The fourth study aimed to investigate how the eating behaviors of mothers of young children, including both autonomous and controlled types of healthy eating motivation, are related to their applied feeding practices, and to the child's eating styles. In the latter study, we also sought to identify variables that determine parental healthy eating motivations, which could potentially play a role in shaping children's future eating styles through the parents' adopted feeding practices.

3. Studies

3.1. Study 1. Psychometric investigation of the Mindful Eating Questionnaire

The aim of the study

The aim Study 1. was to examine the factor structure of the Hungarian version of the Mindful Eating Questionnaire (MEQ, Framson et al, 2009), and to test the robustness of the construct validity of mindful eating by exploring the relationship between the MEQ subscales and the constructs of mindfulness, impulsivity, emotional eating, restrictive eating, and uncontrolled eating, as well as BMI and meditation practice, drawing on already available research findings in the scientific literature.

The questionnaire

Several questionnaires have been developed to measure the construct of mindful eating, the first and one of the most widely used being the Mindful Eating Questionnaire (Framson et al., 2009). Framson and colleagues (2009) proposed that mindful eating can be characterized by paying aware attention to the process of eating, consciously avoiding emotional, external and disinhibited eating as well as being aware of the stimuli that elicit these eating behaviors, and finally limiting distractions while eating. Thus, the questionnaire they developed aimed to measure mindful eating along five factors: Disinhibition (8 items, e.g., "*When I'm eating one of my favorite foods, I don't recognize when I've had enough."* – reversed item), Awareness (7 items, e.g., *"Before I eat I take a moment to appreciate the colors and smells of my food."*), External Cues (6 items, e.g., *"I notice when I'm eating from a dish of candy just because it's*

there."), Emotional Response (4 items, e.g., *"When I'm sad I eat to feel better.*" – reversed item) and Distraction (3 items, e.g., "*My thoughts tend to wander while I am eating."* – reversed item). Attaining higher scores on the subscales indicates practicing mindful eating more often, although the names of factors other than Awareness would suggest the opposite.

Methods

A cross-sectional survey design was used to assess the psychometric properties of the MEQ.

Participants

The convenience sample consisted of 323 university students (80.5% female) from the Faculty of Education and Psychology of Eötvös Loránd University, with a mean age of 21.2 years (standard deviation: 2.58 years) and a mean BMI of 21.9 (standard deviation: 3.2). Among the participants, 72.8% belonged to the normal BMI category, 9.3% to the underweight BMI category, and 17.9% to the overweight or obese BMI category. Of the participants, 10.2% practiced meditation regularly at least once a week.

Measures

- *Mindful Eating Questionnaire* (MEQ; Framson et al., 2009);
- *Mindful Attention and Awareness Scale* (MAAS; Brown & Ryan, 2003; Simor et al., 2013);
- *Three-factor Eating Questionnaire Revised 21-item* (TFEQ-R21; Czeglédi & Urbán, 2010; Tholin et al., 2005), all three factors: Uncontrolled Eating, Emotional Eating, and Cognitive Restraint;
- *Barratt Impulsiveness Scale 11* (BIS-11; Kapitány-Fövény et al., 2018; Patton et al., 1995);
- *Obesity status* based on BMI*:* overweight or obese vs. underweight or normal weight;
- *Meditation practice:* measured by the question *„Do you meditate on a regular basis (at least once a week, even as part of yoga class)?".*

Results and interpretation

After seeing the initial poor fit indices as the result of the applied confirmatory factor analysis (CFA), we examined the modification indices and freed the error covariance between two pairs of items that belong to the same subscale. This slightly improved the values of the fit indices ($\chi 2 = 548.0$, df = 312, $p < 0.001$; CFI = 0.886; TLI = 0.872; RMSEA [CI90%] = 0.048 [0.042 - 0.055]; SRMR = 0.066), however, the comparative fit index (CFI) and the Tucker-

Lewis fit index (TLI) remained in the unacceptable value range. This result cast doubt on whether the original factor structure would be an appropriate representation of the latent factor structure of the data collected in this study. Thus, as the next step, we used exploratory factor analysis (EFA) with principal axis factoring (PAF) and oblique rotation to explore the factor structure of the questionnaire. The number of factors was limited to five. This decision was supported when inspecting the eigenvalues and the scree plot, which indicated an inflection point at factors 4 and 5. These five factors accounted for 48.6% of the total variance. The five original factors with minor deviations could be identified. One item originally belonging to the Awareness subscale ("*I notice when foods and drinks are too sweet."*) did not load significantly on any of the factors and was, therefore, excluded from subsequent analyses. The item *"I eat so quickly that I don't taste what I'm eating."* loaded onto the Awareness subscale in the PAF-derived model instead of its original Distraction factor. Four subscales showed acceptable internal reliability, with Cronbach's α values being between .67 and .82. The Distraction factor with its two remaining items had a Cronbach's α value of only .53.

To establish the degree of convergent validity, we examined the correlations between the MEQ subscales using the slightly modified factors suggested by the results of the EFA. Pearson correlation coefficients ranging between -.36 and .52 indicated that some of the results contradicted the expected significant positive association. To better understand the pattern of associations between the subscales, a principal component analysis was performed using direct oblimin rotation. As a result of this analysis, two principal components were identified, which explained 64% of the total variance. Disinhibition, Emotional Response, and Distraction showed cohesion and were thus grouped into the first component, which we called Self-regulation. The other component includes Awareness and External Cues, which we labelled Awareness. The two principal components showed an inverse, weak association (r = -.17, p < .01). As the five subscales showed little unity, the factors and principal components of the MEQ were included separately in the remaining analyses.

Regarding the relationship between the MEQ subscales and the validating constructs, both correlation analysis and multivariate regression analysis using structural equation modelling (SEM) yielded mixed results. A significant negative association was hypothesized between the MEQ factor scores and BMI; however, only two of the five MEQ factors (External Cues and Awareness) showed a negative, but rather weak association with obesity status (β = -.19, p < .05, and β = -.15, p < .05). Contrary to our hypotheses, trait mindfulness was not positively associated with the Awareness subscale. However, confirming our assumption,

Disinhibition showed an inverse significant relationship with the variable Uncontrolled Eating, as measured by TFEQ-R21 (β = -.54, p < .05). As expected, there was an inverse relationship between the Emotional Eating and Emotional Response subscales (β = -.65, p < .05). The hypothesized negative relationship between impulsivity and the External Cues subscale was not confirmed. The construct validity of the External Cues factor could have also been supported by its negative association with Emotional Eating; however, this association was significantly positive between the two variables (β = .16, p < .05). Our results also showed that cognitive restraint significantly associated only with the Emotional Response subscale (β = .08, p < .05). Finally, the correlation analysis did not yield significant results for the relationship between regular meditation practice and the MEQ subscales. However, the results of the multivariate regression analysis showed that, contrary to the hypothesis, meditating at least on a weekly basis was a significant negative but weak predictor of the Distraction (β = -.12, p < .05) and Disinhibition (β = -.19, p < .05) subscales. The results of the multivariate regression analysis for the two principal components show the same trend as the betas of the related subscales and their validating factors. It is worth noting that, while trait mindfulness seemed to have a significant positive association with Self-Regulation (β = .13, p < .05), it was not a significant predictor of Awareness, although the Awareness subscale was part of the latter principal component.

In summary, the EFA of the Hungarian adaptation of the MEQ resulted in a five-factor model that was almost identical to the original factor structure. In contrast, the analyses performed to test the construct validity of mindful eating measured by the MEQ did not yield results that would uniformly confirm the coherence of the subscales and expectations regarding their relationships with the validating variables. This finding underlines the need for further empirical studies on the construct of mindful eating. It may be useful to apply a definition of mindful eating other than what Framson and colleagues (2009) suggested when operationalizing the concept (for example, one that includes both acceptance and non-judgement as proposed by other researchers as well, e.g. Hulbert-Williams et al., 2014), and to capture the construct using fewer reversed items in the questionnaire. In addition, our results raise the question of whether it is possible to capture the experience of mindful eating using questionnaires, especially in the case of people who have never practiced mindfulness by formal (i.e., meditation) or informal means.

3.2. Study 2. A cross-cultural psychometric study of the Motivations for Healthy Eating Scale

The aim of the study

One of the aims of the present study was to investigate the psychometric properties of the short version of the Motivation for Healthy Eating Scale (MHES; Kato et al., 2013, 2021) that measures self-regulatory styles of healthy eating and to test the cross-cultural applicability of the MHES. We also aimed to examine the associations of the different types of healthy eating motivation with BMI, skipping breakfast, obesogenic eating behaviors (restrictive, emotional, and external eating), and well-being, and thus, to test the construct validity of the questionnaire across the applied international samples.

The questionnaire

The 18-item Motivations for Healthy Eating Scale is a modified 18-item version of the Regulation of Eating Behavior Scale (REBS) developed by Pelletier and colleagues (2004), which is specific to healthy eating self-regulation. In the two previous studies that examined the psychometric properties of the MHES, the results of principal component analyses identified six subscales representing the six self-regulatory styles described by the SDT: Amotivation, External-, Introjected-, Identified- and Integrated Regulation, and Intrinsic Motivation (see Table 1; Kato et al., 2013, 2021). The questionnaire can be used only at the subscale level. The answers to its items can be marked on a six-point scale (1 – does not correspond at all, 6 – corresponds very well).

Methods

This research was conducted in the form of a cross-sectional survey study.

Participants

A total of 938 Hungarian (n = 381), Japanese (n = 264), and Norwegian (n = 293) university students participated in this study. 82% of the Hungarian sample (average age: 23.3 years, standard deviation: 4.1 years), 57% of the Japanese sample (average age: 19.8 years, standard deviation: 4.1 years), and 79% of the Norwegian sample (mean age: 24.4 years, standard deviation: 4.7 years) consisted of female participants. Of the Hungarian and Norwegian samples, 19% and 31%, respectively, had a BMI of 25 or above, while this proportion was 5% in the Japanese sample. The samples differed significantly according to sex distribution, average age, average BMI value, and the distribution of those with a BMI value higher than 25.

Measures

- *Motivation for Healthy Eating Scale* (MHES; Kato et al., 2013, 2021);
- *The Dutch Eating Behavior Questionnaire* (DEBQ; van Strien et al., 1986), short version (van Strien & Oosterveld, 2008) using all three subscales: External, Emotional, and Restrained eating – adapted to Hungarian as part of the present research;
- *WHO-5 Well-Being Index* (WBI-5; Awata et al., 2007; Bech et al., 1996; Inagaki et al., 2013; Kaiser & Kyrrestad, 2019; Susánszky et al., 2006);
- *BMI* and *BMI categories*: obesity or overweight, and normal weight or underweight;
- *Breakfast skipping* measured by the question *„Do you have breakfast every day?*" allowing us to group participants into breakfast consumers and breakfast skippers.

Table 1 *Conceptual framework of Self-determination Theory in the context of healthy eating using items from the Motivation for Healthy Eating Scale as examples.*

Levels of self-determination		Examples
	Amotivation Lack of regulatory efforts.	E.g. "Regulating eating habits is not so important."
Controlled self-regulation	**Extrinsic motivation** The source of self-regulatory control is an external factor (e.g., rewards or recognition).	
	• **External regulation**	E.g. "I am expected to eat healthily."
	• **Introjected regulation**	E.g. "I would feel ashamed of myself if I didn't eat healthily."
Autonomous self-regulation	• **Identified regulation**	E.g. "I think that healthy eating has a positive effect on body and soul."
	• **Integrated regulation**	E.g. "Eating healthy is an integral part of my life."
	Intrinsic motivation The source of self-regulation is the pleasure of engaging in the activity.	E.g. "I take pleasure in fixing healthy meals."

Results and interpretation

Confirmatory factor analysis was performed on the data gathered from the three samples separately. In accordance with our assumption, we obtained fit indices that confirmed the presence of the original factor structure using the Japanese and the Norwegian samples, as well as in the case of the Hungarian data after freeing the error covariance between two items belonging to the same subscale (see Table 2). Multigroup CFA was performed to estimate measurement invariance across the samples concerning the factor structure (configural

invariance), the factor loadings of the items of the questionnaire (metric invariance), and the equality of the intercepts (scalar invariance). According to the results, partial measurement invariance holds with regard to healthy eating motivation in the samples of Hungarian, Japanese, and Norwegian university students using the MHES.

Table 2 R*esults of the confirmatory factor analysis of the Motivation for Healthy Eating Scale by nationality.*

Model fit indices of the baseline confirmatory analysis						
Modell	χ^2	***df***	**TLI**	**CFI**	**RMSEA (90% CI)**	**SRMR**
Hungarian sample[a] (n = 381)	296.2	119	.929	.945	.063 (.053 – .071)	.048
Japanese sample (n = 264)	243.9	120	.923	.939	.063 (.051 – .074)	.058
Norwegian sample (n = 293)	249.9	120	.917	.935	.061 (.050 – .071)	.054

Note. *df* = degrees of freedom; *TLI* = Tucker-Lewis fit index*; CFI* = comparative fit index*; RMSEA* = root mean square error of approximation*; CI* = confidence interval*; SRMR* = standardized root mean square residual.

[a]Model allowing for the error covariance of two items of the Integrated regulation factor on the Hungarian data: "*Eating healthy is the basis of my life*" and "*Eating healthy is an integral part of my life*".

The Cronbach-α values of the MHES subscales in the three different samples ranged between .71 and .89. The pattern of Pearson correlation coefficients between the subscales of the MHES was similar in the three samples. While the subscales describing autonomous and controlled motivation typically showed a positive correlation with each other, amotivation was negatively related to the autonomous forms of healthy eating self-regulation.

To further test the convergent and discriminant validity of the self-regulatory styles of healthy eating, we identified their significant predictors using CFA with covariance analysis. Based on the results of previous studies, we expected that Intrinsic Motivation, Integrated Regulation, and Identified Regulation (together: autonomous self-regulatory processes), as well as Introjected Regulation and External Regulation (together: controlled self-regulatory processes) would show a significant positive relationship with well-being, and a negative association to overweight and obesity and skipping breakfast. In the case of Amotivation, we assumed the opposite of the aforementioned relationships. We also expected results that would confirm the discriminant validity of the MHES subscales regarding obesogenic eating behaviors.

Female participants scored slightly higher on autonomous self-regulation for healthy eating than male participants in all three samples. Overweight or obese participants in the Hungarian and Norwegian samples showed lower levels of autonomous motivation than normal weight and underweight individuals. Among Japanese students, controlled self-regulation showed a significant negative relationship with overweight and obesity. A weak, inverse relationship between autonomous motivation and skipping breakfast was identified in European students, while breakfast habits were not related to healthy eating motivation in Japanese participants. In all three samples, higher levels of well-being showed a positive association with autonomous forms of self-regulation and an inverse relationship with Amotivation. External Eating was not related to the different forms of healthy eating motivation. Emotional Eating showed a positive association with Amotivation in the case of Japanese and Norwegian students and with controlled motivation only in the case of Norwegian participants. Restrictive Eating showed a positive relationship with both autonomous and controlled forms of self-regulation, and a negative relationship with Amotivation in the European samples. Among Japanese university students, Amotivation was positively related to the restrictive eating style. All the relationships described above were significant with mostly weak effect sizes.

The results of the statistical analyses thus confirmed the original six-factor structure of the MHES and supported the construct validity of the subscales using the convenience samples of Hungarian, Japanese, and Norwegian university students. In addition, the participants of the three samples grasped the meaning of the factors similarly, and the strength of the item-factor relationships was also equivalent in the three culturally different samples. Furthermore, the presence of the self-determination continuum was also supported by our results. The results of the CFA with covariates analysis highlighted many similarities and some, presumably cultural differences between the samples. Overall, it can therefore be concluded that the MHES is a reliable and useful tool for assessing healthy eating motivations among university students.

3.3. Study 3. Measuring intuitive eating: the adaptation and validation of the Intuitive Eating Scale 2.

The aim of the study

The present study aims to contribute to the expansion of evidence-based knowledge about adaptive eating behaviors, their relationship to each other and some maladaptive eating practices, as well as their underlying motivations. First, we examined the psychometric properties of the Intuitive Eating Scale 2 (IES-2; Tylka & Kroon Van Diest, 2013) and tested the construct validity of intuitive eating by looking at the relationship between the factors of

the IES-2 with several validating variables: BMI, current and past year dieting, obesogenic eating behaviors (restrictive, emotional and uncontrolled eating), motivations for healthy eating, mindful eating, and internalization of the thin ideal. Then, as part of the current study, we also wanted to gain deeper insight into the relationship between the different adaptive eating behaviors.

The questionnaire

The most widely used tools to measure the concept of intuitive eating are the Intuitive Eating Scale (IES; Tylka, 2006) and its second version, the Intuitive Eating Scale 2 (Tylka & Kroon Van Diest, 2013). With its 23 items, the IES-2 covers four facets of intuitive eating: Unconditional Permission to Eat (UPE; e.g., *"I allow myself to eat what food I desire at the moment."*), Eating for Physical Rather than Emotional Reasons (EPR; e.g., "*I am able to cope with my negative emotions (e.g., anxiety, sadness) without turning to food for comfort."*), Reliance on Hunger and Satiety Cues (RHSC; e.g., "*I rely on my fullness (satiety) signals to tell me when to stop eating."*), Body-Food Choice Congruence (BFCC; e.g., *"I mostly eat foods that make my body perform efficiently (well)."*). Respondents can evaluate each statement of the questionnaire on a five-point Likert scale (1 - completely disagree, 5 - completely agree). Attaining higher scores on the scale indicates a greater degree of intuitive eating.

Methods

The present research applied a cross-sectional online questionnaire design.

Participants

A convenience sample of 732 Hungarian university students participated in the study (80.2% female; mean age = 22.7 years, standard deviation = 4.81 years). Thirteen percent of the sample belonged to the underweight, 69% to the normal weight, and 18% to the overweight or obese BMI categories. 172 participants (23.5%) stated that they were currently dieting, and 255 (34.8%) had dieted in the past year.

Measures

- *Intuitive Eating Scale 2*. (IES-2; Tylka & Kroon Van Diest, 2013);
- *Motivation for Healthy Eating Scale* (MHES; Kato et al., 2013, 2021), with all three self-regulatory styles: autonomous and controlled self-regulation, and amotivation;
- *Mindful Eating Scale* (MES; Hulbert-Williams et al., 2014) – adapted to Hungarian as part of the present research;

- *Three-factor Eating Questionnaire-Revised 21-item* (TFEQ-R21; (Czeglédi & Urbán, 2010; Tholin et al., 2005), all three factors: Uncontrolled Eating, Emotional Eating, and Cognitive Restraint;
- *Sociocultural Attitudes Towards Appearance Questionnaire 4.* (SATAQ-4; L. M. Schaefer et al., 2015) using two subscales measuring the internalization of the thin and muscular/athletic body ideals;
- *BMI* and *BMI categories*: obesity or overweight, and normal weight or underweight;
- *Current and past-year dieting practices were* measured with the questions: *"Do you currently follow a diet (for body weight management)?"* and *"In the past year, did you follow any diet? (for body weight management)".*

Results and interpretation

Using CFA, we examined four possible measurement models, two of which allowed for error covariance between three pairs of items, and two of which tested the four-factor solution together with a general, second-order intuitive eating factor. Based on the fit indices, we found that the four first-order factor solution that allowed for the error covariance between the three pairs of items was the best representation of the collected data ($\chi 2 = 644.5$, df = 221, $p < .001$; CFI = 0.941; TLI = 0.933; RMSEA [CI90%] = 0.052 [0.047 - 0.056]; SRMR = 0.061).

The Cronbach-α values for the four subscales ranged from .84 to .89. Most of the intercorrelations of the IES-2 subscales showed significant positive relationships with weak or moderate effect sizes for both sexes ($r = .19 – .52$, $p < .05$). An exception was the relationship between the Unconditional Permission to Eat (UPE) and Body-Food Choice Congruence (BFCC) subscales, which were negatively correlated with each other (men: $r = -.33$, $p < .05$, women: $r = -.41$, $p < .05$), and the association of the Reliance on Hunger and Satiety Cues (RHSC) and the BFCC factors, which was not significant in the case of male participants ($r = .12$, $p \geq .05$).

The construct validity of the factors of the IES-2 was further examined with two CFA with covariance analyses separately for predictors representing different styles of eating behaviors and for those denoting motivational factors. We expected that male participants would achieve a significantly higher score in intuitive eating. However, sex showed a weak, inverse correlation only with the Eating for Physical rather than Emotional Reasons factor (EPR; $\beta = -.23$). Based on previous research results, a negative relationship could be expected between intuitive eating and dieting, cognitive restraint, uncontrolled eating, emotional eating, internalization of the thin ideal, and controlled regulation and amotivation for healthy eating,

while positive associations with autonomous motivation for healthy eating, and mindful eating were also hypothesized. According to the results, while current dieting was negatively associated with the UPE (β = -.21, p < .05) and positively with the BFCC (β = .20, p < .05) factors, uncontrolled eating was mostly uncorrelated to the IES-2 factors. Restrictive eating was moderately and inversely related to the UPE factor (β = -.62, p < .05) and positively to the BFCC items describing healthy eating practices (β = .40, p < .05). A weak, negative correlation between this latter validating variable and the RHSC subscale (β = -.16, p < .05) was also identified. Emotional Eating showed the strongest and inverse correlation with the EPR subscale (β = -.86, p < .05). Most of the factors measuring the different aspects of mindful eating were not related to intuitive eating. The autonomous and controlled type of regulatory processes underlying healthy eating motivation were both significant negative predictors of the Unconditional Permission to Eat subscale (β = -.27, p < .05 and β = -.11, p < .05, respectively). In addition, while autonomous motivation for healthy eating was positively related to Reliance on Hunger and Satiety Cues (β = .24, p < .05) and Body-Food Choice Congruence (β = .63, p < .05), controlled motivation showed a negative and weak relationship with the RHSC (β = -.10, p < .05). Amotivation showed a weak, positive correlation with the UPE subscale (β = .15, p < .05) and did not relate significantly to the other three factors. Participants who reported higher levels of internalization of the thin body ideal tended to have lower scores on all subscales of the IES-2 (β = -.18 – -.33, p < .05), as expected.

Regarding the relationship between body size determined by BMI and the facets of the IES-2, the different BMI groups differed significantly concerning the UPE, EPR, and RHSC subscales, with small to moderate effect sizes. In addition to participants with ever-decreasing BMI values proved to be more permissive regarding their selected meals, overweight and obese participants seemed to rely less on their body's signals of hunger and satiety when it comes to the timing of the meals, the amount eaten, and the way of eating, and are more likely to eat in response to uncomfortable emotions, compared to the underweight and normal weight BMI groups.

The results of the statistical analyses show that this adaptation of the IES-2 can be a well-suited tool for measuring intuitive eating among Hungarian university students, which did not have a global, second-order intuitive eating factor in the sample we examined. The results also show that people who deliberately pay attention to eating foods that are healthy and good for the body are generally more inclined to control their food intake, while people who follow diet rules are indeed less permissive about what foods they eat and rely less on their body's

signals of hunger and satiety in accordance with the concept of intuitive eating. In addition, a certain degree of control over food intake appeared to be desirable among all those who, whether for autonomous (e.g., good health or pleasure) or externally controlled (others' approval, avoiding shame) reasons, consider healthy eating important. Furthermore, based on our results, a permissive attitude towards eating does not necessarily mean overconsumption, which confirms the discriminant validity of the UPE factor. At the same time, the EPR subscale was not distinct from emotional eating in our sample. In addition to these, we also found results indicating that mindful eating and intuitive eating seem to be essentially separate constructs.

3.4. Study 4. The association of maternal adaptive eating and feeding behavior with eating styles of preschool-aged children

The aim of the study

In this research, we examined whether the different self-regulatory sources of healthy eating motivations of mothers of preschool-aged children show a significant association with the applied feeding styles, and investigated whether these forms of self-regulation in healthy eating are significantly associated with certain individual personal characteristics, such as self-compassion and the verbal expression of dissatisfaction with one's own body (i.e. negative body talk). According to our assumptions, these associations may be significant predictors of the child's eating style.

Methods

The research question was examined in a cross-sectional design, using convenience sampling.

Participants

The sample consisted of mothers of children between the ages of 3 and 7. Mothers who participated in the research had to be at least 18 years old, and they had to have at least one child between the ages of 3.0 and 6.9. The analyses were finally performed on data collected from a sample of 632 respondents. The average age of the mothers was 35.9 years (standard deviation: 4.97 years), and their average BMI value was 25.3 (standard deviation: 5.29). Of the mothers, 53.6% could be classified in the normal BMI category, while 3.6% were underweight and 42.7% belonged to the overweight or obese BMI group. 50.5% of the mothers provided their answers concerning their sons, and 49.5% of them responded to the questions about their daughters. The average age of the children was 4.8 years (standard deviation: 1.06). The children were classified to the relevant BMI categories based on their gender and age using six-

month age range limits, applying limit values previously established by researchers using a representative sample of Hungarian children (Zsákai et al., 2007). Of the children, 68.2% belonged to the normal, 20.3% to the underweight, and 11.5% to the overweight or obese BMI categories.

Measures

- *Self-Compassion Scale* - short form (SCS-SF; Neff, 2003; Sági et al., 2013; Tóth-Király et al., 2017);
- *Motivation for Healthy Eating Scale* (MHES; Kato et al., 2013, 2021), with two self-regulatory styles: autonomous and controlled self-regulation;
- *Negative Body Talk Scale* (NBTS; Engeln-Maddox et al., 2012) – adapted to Hungarian as part of the present research;
- *Feeding Practices and Structure Questionnaire-28* (FPSQ-28; Jansen et al., 2016), using the Overt Restriction subscale – adapted to Hungarian as part of the present research;
- *Comprehensive Feeding Practices Questionnaire* (CFPQ; Musher-Eizenman & Holub, 2007) using the Modeling subscale – adapted to Hungarian as part of the present research;
- *Child Eating Behavior Questionnaire* (CEBQ*;* Wardle et al., 2001), using the Food Fussiness (representing undereating) and Food Responsiveness (representing the tendency to overeat) subscales – adapted to Hungarian as part of the present research.

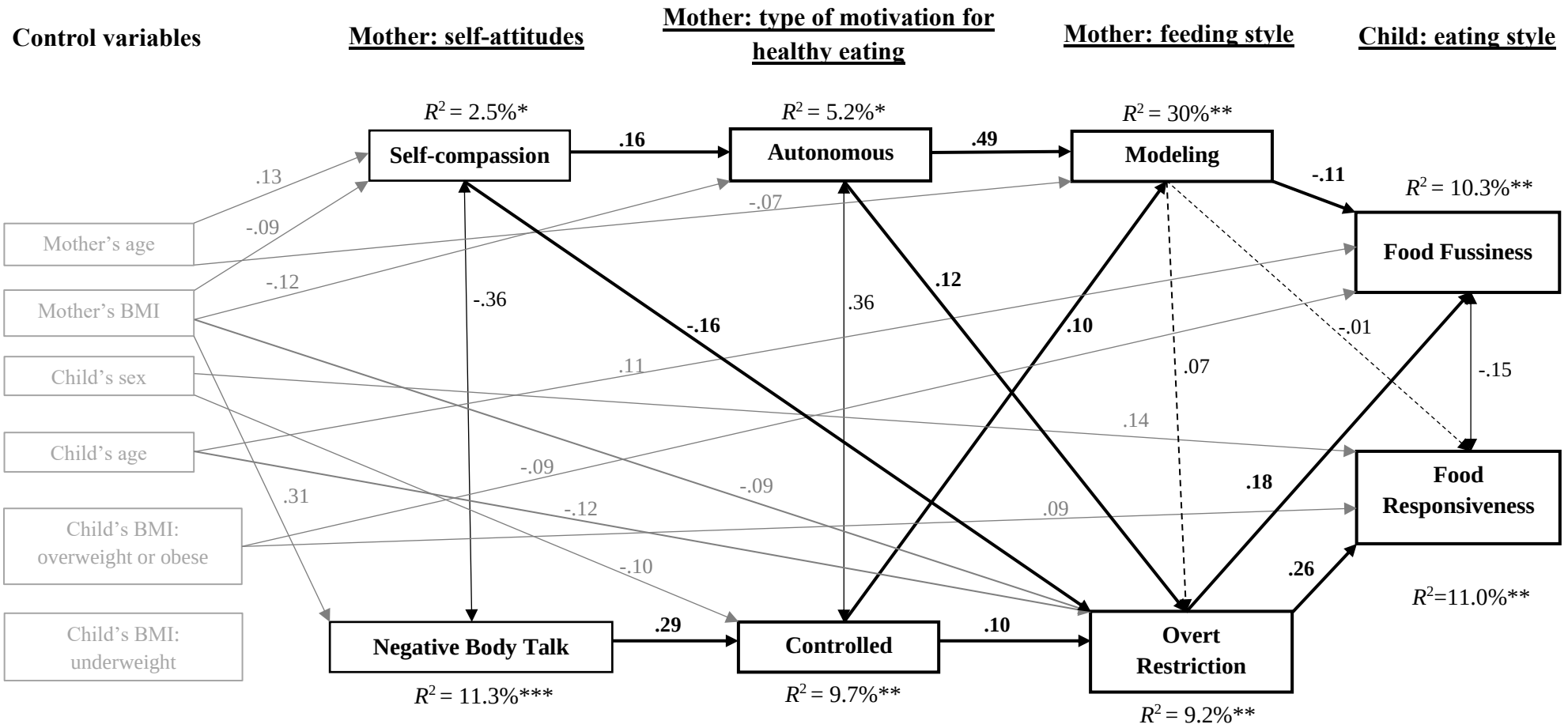
Results and interpretation

We hypothesized that the mother's level of self-compassion would be a positive predictor of her autonomous self-regulation processes for healthy eating, while the mother's autonomous healthy eating motivation would be positively correlated to Modeling (of healthy eating) feeding style. At the same time, controlled type of motivation for healthy eating would be positively predicted by the frequency of the mother’s negative body talk, which motivation type would show a significant positive association with a feeding style that is considered to be less desirable in terms of shaping the child’s eating behavior, that is Overt Restriction. In line with the results of previous research, we further hypothesized that Modeling healthy eating would be inversely, and Overt Restriction positively associated with children's Food Fussiness (undereating) and Food Responsiveness (overeating) eating styles.

The hypothesized net of the relationships between the studied variables was tested by using path analysis, with robust method of estimation (maximum likelihood – robust, MLR) using structural equation modeling. A fully saturated model was used for the path analysis. In addition to the main variables examined, the mother's age and BMI value, the child's gender, age, and body weight category were also entered into the analysis as control variables. The result of this analysis can be found in Figure 1.

Regarding the sample of children, our results indicated that the odds of being overweight or obese was significantly higher for boys (OR boys = 1.88; 95% CI = 1.20 – 3.09), while the odds of belonging to the underweight BMI category was significantly higher for girl preschoolers (OR boys = 0.59; 95 % CI = 0.42 – 0.79).

Figure 1 *The results of the path analysis.*



Note. N = 632. The results of the fully saturated path analysis using structural equation modelling. Standardized regression coefficients are shown next to the one-headed arrows, while Pearson correlation coefficients are shown next to the two-headed arrows.

BMI = body mass index. R^2 = explained variance. Child's sex: 0= boy, 1 = girl.

Continuous arrows present significant results at leas at $p < .05$. Dashed arrows represent nonsignificant results.

* $p < .05$.

** $p < .001$.

According to the results of the path analysis, the relationship between the variables corresponds to the hypothesized model. After controlling for mother's age, BMI, and the child's sex, age, and BMI category, self-compassion showed a significant positive relationship with autonomous motivation for healthy eating, and negative body talk was a significant positive predictor of controlled motivation for healthy eating. Those mothers who stated that healthy eating is an important value for them and that they enjoy preparing and eating healthy meals, also tended to consciously set an example for their children in this regard. Modeling healthy eating however was also used more often by mothers who scored higher on the Introjected and External Regulation subscales of MHES, although to a lesser degree. In addition to modeling healthy eating, both autonomous and controlled types of healthy eating motivation were weak but positive determinants of overt restrictive feeding practices. Overt Restriction in turn was positively related to Food Responsiveness and Food Fussiness in children, in accordance with our hypothesis. The study also found that the modeling feeding style inversely predicted Food Fussiness, but not Food Responsiveness.

4. Discussion

The studies included in the present dissertation aimed to provide insights into the different constructs of adaptive eating behaviors, their correlates, and measurement possibilities using quantitative research methodology. This has allowed us to make some initial steps to investigate additional potential predictors and protective factors of maladaptive eating styles in early childhood as well, through the eating and feeding practices of mothers.

In the course of our investigations, we found that the mentioned constructs are in very different positions, as far as the robustness of conceptualization and operationalization is concerned. Even though the results of our study examining the Mindful Eating Questionnaire (MEQ) pointed out some difficulties in replicating the original factor structure of the MEQ, more problematic questions were raised regarding its construct validity when the relationships between mindful eating and its validating variables were analyzed. The results of the psychometric analysis of the Motivations for Healthy Eating Scale (MHES) showed that the MHES was a reliable and valid tool to measure the different self-regulatory processes behind healthy eating in the case of all three culturally diverse samples used, which supported the assumption of cross-cultural validity of Self-Determination Theory (SDT) in the context of healthy eating. The third study confirmed the original factor structure of the Intuitive Eating

Scale 2 (IES-2). The construct of intuitive eating did not show strong negative associations with maladaptive eating behaviors except for emotional eating and was sufficiently distinct from mindful eating and autonomous self-regulation forms of healthy eating. Finally, the results of the fourth study pointed out that children's and mothers' eating behaviors might be indirectly interrelated through the mother's feeding practices, which could also be influenced by the self-attitudes of the mother, such as the level of self-compassion and the frequency of making negative comments about one's own body.

4.1. Limitations

The afore-presented studies have several limitations that must be taken into consideration when interpreting the results. Each research was carried out in a cross-sectional design, using convenience sampling. Thus, we cannot draw conclusions about causality in the relationship between the measured variables and we cannot generalize the results beyond the examined samples. Furthermore, BMI was calculated based on self-report information that can influence the reliability of the data. We also acknowledge that significant gender differences exist in eating behaviors and body image concerns, which we were only able to take into account to a limited degree in the studies. In the case of the second study, it is also necessary to keep in mind that even though there are significant cross-cultural differences in food consumption and eating traditions, it was not possible to determine to what extent the identified differences between the samples could be attributed to true cultural differences. In addition, the studies included several questionnaires that have yet to be psychometrically tested, and in some of these cases, the rather low internal reliability of the subscales makes it necessary for us to be cautious regarding drawing conclusions.

4.2. Conclusions

Future investigations need to continue the scientific endeavors to thoroughly map the relevant candidates of adaptive eating behaviors, to determine their appropriate common criteria and dimensions, and to establish a widely accepted definition for adaptive eating. Concerning mindful eating, there is a need to refine its conceptualization and base it on empirical grounds that can take place in parallel with the operationalization efforts. Based on the results of our study on intuitive eating, the question may arise as to whether it would be useful to completely abandon the restrictive approach to body weight control – as suggested by the concept of intuitive eating – taking into account the positive correlation coefficients found between the Body-Food Choice Congruence subscale and current dieting, as well as Cognitive Restraint, and the inverse relationship of the Unconditional Permission to Eat factor and the autonomous

form of self-regulation of healthy eating. Longitudinal interventional research could also shed light on whether the simultaneous practice of mindful eating and intuitive eating techniques would increase their beneficial effects, as they seem to be interrelated but sufficiently different adaptive eating behaviors. Furthermore, since the construct validity of the self-determined form of healthy eating regulation was also supported in our research, it would be useful in the future to identify the specific factors – such as skills – that can help the process of internalizing the motivation for healthy eating to move forward, and which can help people maintain their healthy eating habits in the long term. In addition, studying the applied parental feeding practices and the driving forces behind them – also taking into account the parents' eating behaviors and motivations and their significant determinants – applying a broader perspective and longitudinal design would be indispensable for developing effective early intervention strategies that promote healthy eating habits from the childhood on.

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6. List of publications in the topic of the dissertation

International publications as first author

Román, N., Rigó, A., Gajdos, P., Tóth-Király, I., & Urbán, R. (2021). Intuitive eating in light of other eating styles and motives: Experiences with construct validity and the Hungarian adaptation of the Intuitive Eating Scale-2. *Body Image, 39,* 30–39. https://doi.org/10.1016/j.bodyim.2021.05.012

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Gajdos, P., Román, N., Tóth-Király, I., & Rigó, A. (2022). Functional gastrointestinal symptoms and increased risk for orthorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *27*(3), 1113–1121. https://doi.org/10.1007/s40519-021-01242-0

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