Intuitive, mindful, emotional, external and regulatory eating behaviours and beliefs: An investigation of the core components

Jessica L. Kerin*, Haley J. Webb, Melanie J. Zimmer-Gembeck

School of Applied Psychology, Griffith University, Gold Coast, Australia

ABSTRACT

The aim of this study was to identify the interrelations between, and the core components of, adaptive and maladaptive measures of eating behaviours. Participants were 2018 females (M_{age} = 23.14 years) who completed measures of intuitive eating, mindful eating, overeating regulation, dietary restraint, emotional eating, external eating, and overeating dysregulation in contexts of leisure and discomfort. Most associations between eating measures were significant, with the largest association between eating for physical rather than emotional reasons (intuitive eating) and emotional eating, and the smallest and nonsignificant associations usually involving the mindful eating subscales. Principle component analysis of the composite scores for all measured eating subscales revealed a 4-component structure. Component 1, labelled attuned eating, reflected positive loadings for eating for physical rather than emotional reasons (intuitive eating); act with awareness, present eating, and non-reactivity (mindful eating); and overeating regulation. Attuned eating also had negative loadings for emotional eating, external eating, and leisure and discomfort overeating dysregulation. Component 2, labelled unrestrained eating, reflected positive loadings for unconditional permission to eat (intuitive eating) and acceptance (mindful eating), but also a negative loading for dietary restraint. Component 3, labelled eating and hunger awareness, had positive loadings for reliance on hunger/satiety cues (intuitive eating) and awareness (mindful eating). Component 4, labelled casual eating attitudes, was represented by positive loadings for non-reactivity and flexibility (mindful eating). These findings highlight the complexity of eating behaviour by revealing that although many adaptive and maladaptive eating concepts appear to tap opposite ends of a continuum of attuned versus disinhibited eating, several other adaptive and maladaptive eating concepts are better described as tapping somewhat unique attitudes, beliefs, motivations, and behaviours regarding food and eating.

Many different eating behaviours, as well as beliefs, attitudes, and motivations regarding food and eating, have been investigated by health and social scientists (Damiano & Paxton, 2018). Of these, some of the most commonly studied have been emotional eating and external eating, as well as dietary restraint, with all shown to be associated with problems with weight, disordered eating symptomology, and other negative health or social outcomes (Neumark-Sztainer, Wall, Story, & Standish, 2012; Ouwens, van Strien, & van Leeuwe, 2009). Emotional and external eating involve initiating eating in response to either internal emotional signals (e.g., psychological distress), or external, environmental cues (e.g., easily accessible desirable food, food advertising, or time of day; van Strien, Frijters, Bergers, & Defares, 1986), whereas dietary restraint refers to restrictive eating practices for weight loss or maintenance purposes, and involves the use of rigid cognitive and behavioural controls over eating (Polivy & Herman, 1985).

In contrast to the focus on eating problems or rigid restriction of eating, other research has focused on intuitive and mindful eating. In this research, intuitive eating is defined as eating according to internal physiological cues of hunger and satiety rather than external or emotional cues (Tribole & Resch, 1995), and mindful eating is defined as intentional and "non-judgemental awareness of physical and emotional sensations while eating or in a food-related environment" (Framson

et al., 2009, p. 2). Both intuitive and mindful eating have been found to be associated with less dieting and disordered eating and more positive emotional functioning and body image, leading researchers to refer to them as adaptive and positive eating patterns (Bruce & Ricciardelli, 2016; Dalen et al., 2010). Even more recently, the focus has been on the ability to regulate eating and overeating to maintain better health, with a recent study showing the capacity for overeating regulation to be associated with greater emotional functioning and mindfulness, and less binge eating (Kerin, Webb, & Zimmer-Gembeck, 2017). Overeating regulation differs from dietary restraint in that it involves refraining from eating to excess, which is considered to be a positive approach to weight management and maintaining good health, rather than a tendency to restrict eating more generally, which is considered to potentially reflect an unhealthy diet and other unhealthy behaviours (Kerin et al., 2017).

Despite evidence of positive intercorrelations between emotional and external eating and dietary restraint (Ouwens et al., 2009; van Strien et al., 1986), only a handful of studies have examined their relationships with intuitive or mindful eating, and no studies have examined their relationship with overeating regulation. Further, although the promotion of intuitive and mindful eating (Framson et al., 2009; Tylka, 2006), as well as overeating regulation (Herman, van Strien, &

Polivy, 2008; Kerin et al., 2017), has received attention in recent years as a way to intervene and improve the maintenance of a healthy weight and better physical health, it remains an area about which little is known. In fact, most research attention has been directed to only maladaptive eating patterns and disordered eating. Consequently, it remains unclear as to how intuitive eating, mindful eating, and overeating regulation relate to emotional and external eating and dietary restraint. Accordingly, the purpose of the present study was to move towards a greater synthesis of empirical evidence across previously insulated areas of research by investigating the interrelations and core components of these measures.

1. Adaptive eating constructs

Although there is debate about whether intuitive or mindful eating is or is not the superordinate construct (Van Dyke & Drinkwater, 2014), the conceptualisation of one seems to share some core ideas with the other. In particular, intuitive and mindful eating each stand opposed to the diet mentality, and collectively they reflect processes of eating that are based on mind-body connection and non-judgemental self-awareness. As such, they are offered as healthful alternatives for eating and weight regulation. Three core features of intuitive eating have been identified. The first, reliance on internal hunger and satiety cues to determine when and how much to eat, reflects both an awareness and trust in one's signals of hunger and fullness to guide eating behaviour. The second, eating for physical rather than emotional reasons, reflects eating food to satisfy physical hunger drives rather than to alleviate or avoid emotional distress. The third component, unconditional permission to eat desired food when hungry, reflects a willingness to eat the food that is desired in response to hunger cues. In other words, hunger signals are not ignored, foods are not labelled as "good" or "bad", and there are no attempts made to avoid eating foods often deemed unacceptable (Tribole & Resch, 2003). Mindful eaters are said to use all of their senses while eating (e.g., they notice the presentation, sound, taste, texture, and smell of foods they eat), recognise their responses to certain foods (e.g., likes and dislikes) without evaluation, decrease their pace of eating, and avoid distractions and multi-tasking whilst eating (e.g., watching television or using computers; Mathieu, 2009).

Only one study could be located that has directly examined the relationship between intuitive and mindful eating. In this study, Anderson, Reilly, Schaumberg, Dmochowski, and Anderson (2016) examined the associations between intuitive eating, mindful eating, and dietary restraint. Although they found a moderate inverse correlation between intuitive eating and dietary restraint, mindful eating was not significantly associated with either intuitive eating or restraint. Although this provides some evidence that intuitive and mindful eating may tap different eating patterns, the lack of association between them could have been due to the way in which mindful eating was measured. The Mindful Eating Questionnaire (MEQ; Framson et al., 2009) was used and, despite its adequate reliability, this measure has been criticised as lacking validity (e.g., Hulbert-Williams, Nicholls, Joy, & Hulbert-Williams, 2014), because the MEQ was not aligned with accepted definitions of mindfulness (e.g., Bishop et al., 2004; Kabat-Zinn, 1994). In particular, it omits the core mindfulness components (e.g., acceptance, non-judgement, and non-reactivity), and has produced a factor structure that greatly differs from those found for generic (i.e., not eating-specific) mindfulness measures (see Framson et al., 2009). The Mindful Eating Scale (MES; Hulbert-Williams et al., 2014) was developed to remedy the limitations of the MEQ by incorporating items that are central to accepted definitions of mindfulness, such as acceptance and non-reactivity. Consequently, the MES has greater face validity, because it better aligns with standard definitions of general mindfulness. The MES also has produced a factor structure similar to extant mindfulness measures (see Hulbert-Williams et al., 2014). However, no study has used the MES to examine the relationship between intuitive and mindful eating.

Items on the intuitive and mindful eating measures seem to partly reflect a greater ability to self-regulate eating when needed. Using a new measure, one study was located that investigated the association of overeating regulation with general (not eating-specific) mindfulness (Kerin et al., 2017), finding a positive association. Consequently, the question of whether overeating regulation may positively covary with intuitive and mindful eating remains unanswered. Drawing from research on intuitive eating suggesting inverse associations with emotional and binge eating (considered a specific type and an extreme form of overeating behaviour, respectively; Hawks, Madanat, Smith, & De La Cruz, 2008; Tylka, Calogero, & Daníelsdóttir, 2015), and research on mindful eating showing links with smaller serving sizes of energy-dense foods, lower total energy and fat consumption, and less emotional, external, and binge eating (Anderson, 2014; Beshara, Hutchinson, & Wilson, 2013; Fung, Long, Hung, & Lilian, 2016; O'Reilly, Cook, Spruijt-Metz, & Black, 2014), it seems likely that overeating regulation will be positively associated with both intuitive and mindful eating.

2. A search for the emergent structure of eating measures

Adaptive eating patterns have been conceptualised as separable from maladaptive eating patterns, such that they are expected to represent more than merely the absence or low levels of maladaptive eating (Tylka, 2006). However, this notion has not been sufficiently examined. A systematic review on the psychosocial correlates of intuitive eating found that only eight studies examined the relationship between intuitive eating and various maladaptive eating attitudes and behaviours, including disordered eating symptomology, restrained and controlled eating, and dieting, with moderate to large inverse correlations reported (Bruce & Ricciardelli, 2016). For the most part, similar associations emerged when the individual subscales of intuitive eating were examined in relation to disordered eating, however correlations tended to be larger for the unconditional permission to eat subscale (moderate to large in magnitude) compared to the eating for physical rather than emotional reasons and reliance on hunger/satiety cues subscales (small to moderate in magnitude). For Bruce and Ricciardelli (2016), these results suggest that higher levels of unconditional permission to eat are analogous to lower levels of disordered eating, whereas the remaining two subscales of intuitive eating are more conceptually distinct from disordered eating.

More recently, a handful of studies have examined the overlap of intuitive eating subscales with dietary restraint, emotional eating, and external eating (e.g., Barrada, Cativiela, van Strien, & Cebolla, 2018; Ruzanska & Warschburger, 2017; Van Dyck, Herbert, Happ, Kleveman, & Vögele, 2016). Overall, all three intuitive eating subscales correlated inversely with each of these maladaptive eating patterns, however strong inverse correlations were found between unconditional permission to eat and dietary restraint, as well as between eating for physical rather than emotional reasons and emotional eating. Eating for physical rather than emotional reasons and reliance on hunger/satiety cues showed moderate inverse correlations with external eating. Intuitive eating subscales showed only very small correlations with positive and negative affect, life satisfaction, body dissatisfaction, and weight control behaviour after controlling for maladaptive eating practices in the analysis (Barrada et al., 2018). These findings call into question the novelty of intuitive eating, as at least two core facets of intuitive eating (unconditional permission to eat and eating for physical rather than emotional reasons) appear to represent the respective opposite poles of the longstanding maladaptive eating practices of dietary restraint and emotional eating. Moreover, the diverging results for each intuitive eating subscale highlight the importance of using the intuitive eating subscales and not relying solely on the total score (Bruce & Ricciardelli, 2016).

Compared to the research on intuitive eating, there has been less attention on mindful eating and maladaptive eating patterns, with some studies reporting negative associations (e.g., O'Reilly, Cook, Spruijt-

Metz, & Black, 2014) and others finding no significant associations (Anderson et al., 2016; Taylor, Daiss, & Krietsch, 2015). Although not a direct test of covariation between measures, a review of mindfulness-based interventions for obesity-related eating behaviours suggests that mindfulness training can result in reductions in maladaptive eating, suggesting that mindful eating and maladaptive eating patterns may be inversely associated (O'Reilly et al., 2014). However, contrary to expectations, mindful eating was not associated with disordered eating or dietary restraint in two studies (Anderson et al., 2016; Taylor et al., 2015), though one of these studies reported a small significant inverse correlation between mindful eating and bulimia and food preoccupation (Taylor et al., 2015). Of note, however, was that both of these studies utilised the MEQ (Framson et al., 2009). In one study using the MES, a moderate significant inverse correlation was reported between the total score of mindful eating and disordered eating (Hulbert-Williams et al., 2014). However, notably, only three of the six mindful eating subscales were significantly and inversely associated with eating disorder symptomology, with effect sizes ranging from small to large.

3. The current study

There has been an increasing focus on intuitive and mindful eating practices, each of which are described as healthy eating behaviours that could also relate to regulation of overeating. In addition, intuitive and mindful eating, as well as overeating regulation, have been found to be related to better weight management, as well as physical and mental health (Bruce & Ricciardelli, 2016; Dalen et al., 2010; Hulbert-Williams et al., 2014; Kerin et al., 2017). Yet, the question remains whether adaptive patterns of eating are generally the inverse of emotional eating, external eating, and dietary restraint, with all these conceptualisations of eating representing a single core component that reflects adaptive versus maladaptive eating behaviour. On the other hand, it is possible that adaptive and maladaptive measures of eating reflect a range of eating behaviours that are better represented by a set of core components. In either case, it seems relevant for future research to identify the core components that may emerge from the assessment and analysis of all composite measures of both adaptive and maladaptive eating behaviours. Identifying the core components of adaptive and maladaptive measures of eating behaviours, in the composite forms used in most research, is the aim of this study. Given the predominant focus on females in past research (Bruce & Ricciardelli, 2016), only females were included in the present study to facilitate integration of the findings with those from past investigations.

4. Method

4.1. Participants and procedure

Participants were 2018 females aged between 16 and 81 years (M_{age} = 23.14 years, SD = 8.71), with the majority (86.7%) between the ages of 16 and 30 years. Participants were mostly university students (87%), with the remainder being staff at the university or individuals from the community recruited online (13%). Most participants lived in Australia (96.5%), with the remainder (0.9%) living in Asia-Pacific, Africa, and America. A small proportion (2.6%) of participants did not indicate a country of residence. Most reported being Australian/European/white (73.5%), followed by Asian (14.1%), African/Middle Eastern (2.9%), Pacific Islander/Polynesian (2.5%), Aboriginal/Torres Strait Islander/South Sea Islander (2.0%), South American (0.9%), and African American/Native American/Caribbean (0.3%). The remainder (3.7%) did not indicate their ethnicity.

Approval for this study was obtained from the university Human Research Ethics Committee. Participants were recruited face-to-face on three university campuses in Southeast Queensland, Australia, or online via university networks (i.e., first-year psychology research participation scheme and staff and student newsletter) or Facebook.

Participation was voluntary and involved the completion of a 45-min hardcopy or online survey. Participants who completed hardcopy surveys on campus were offered a small chocolate, and first-year psychology students received course credit. All participants had the opportunity to enter a prize draw to win 1 of 15 gift vouchers (5 x AUD $25, 10 x AUD $50).

4.2. Measures

4.2.1. Intuitive eating

The 21-item Intuitive Eating Scale (IES; Tylka, 2006) was used to assess intuitive eating. The IES comprises three subscales: unconditional permission to eat (9 items; e.g., "I try to avoid foods high in fat, carbohydrates, or calories", reverse-scored); eating for physical rather than emotional reasons (6 items; e.g., "I stop eating when I feel full [not overstuffed]"); and reliance on internal hunger/satiety cues (6 items; e.g., "I can tell when I'm slightly full"). Participants rated each item from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were averaged to create subscale scores, with higher scores reflecting higher levels of each facet of intuitive eating. Reliability and validity has been established for the IES across different age groups. Convergent validity for the IES is supported by its inverse correlations with eating disorder symptomology and body dissatisfaction, and positive correlations with positive affect, well-being, and life satisfaction (Augustus-Horvath & Tylka, 2011; Dockendorff, Petrie, Greenleaf, & Martin, 2012). Discriminant validity for the IES has been demonstrated by a nonsignificant association with impression management (Tylka, 2006). In the present study, Cronbach's α was .79, .82, and .73 for unconditional permission to eat, eating for physical rather than emotional reasons, and reliance on internal hunger/satiety cues, respectively.

4.2.2. Mindful eating

The 28-item Mindful Eating Scale (MES; Hulbert-Williams et al., 2014) was used to assess mindful eating. The MES has six subscales: acceptance (6 items; e.g., "I criticise myself for the way I eat", reverse-scored); awareness (5 items; e.g., "I notice flavours and textures when I'm eating my food"); non-reactivity (5 items; e.g., "I can tolerate being hungry for a while"); act with awareness (4 items; e.g., "I snack without being aware that I'm eating", reverse-scored); routine (4 items; e.g., "I have a routine for what I eat", reverse-scored); and unstructured eating (4 items; e.g., "I multi-task whilst eating", reverse-scored). Given that all items on routine and unstructured eating are reverse-scored, these subscales are henceforth referred to as "flexibility" and "present eating" respectively, to aide interpretation. Participants rated each statement from 1 (*never/almost never*) to 5 (*very often/always*). Items were averaged to create subscale scores, with higher scores reflecting higher levels of each mindful eating facet. Initial validation of the MES indicated acceptable reliability, and convergent validity for the MES was demonstrated by positive associations with mindfulness and acceptance (Hulbert-Williams et al., 2014). In the current study, Cronbach's αs were as follows: acceptance = .90, awareness = .79, non-reactivity = .76, act with awareness = .89, flexibility = .81, and present eating = .72.

4.2.3. Overeating regulation and dysregulation

Overeating regulation and dysregulation was assessed with the Overeating Regulation Scale (ORS; Kerin et al., 2017). This 15-item measure includes three subscales, one that reflects regulation of overeating and two that reflect dysregulation: general overeating regulation (6 items; e.g., "I CAN resist over-eating when I feel it's impolite to refuse a second helping"); overeating dysregulation when experiencing discomfort (5 items; e.g., "I CAN'T resist over-eating when I am angry or irritable"); and overeating dysregulation in leisure contexts (4 items; e.g., "I CAN'T resist over-eating when high calorie foods ['junk foods'] are available"). Participants rated each statement from 1 (*not at all true of me*) to 5 (*very true of me*). Items were averaged to create subscale scores, with higher scores indicating more overeating regulation, and

more discomfort and leisure overeating dysregulation, respectively. Initial validation of the ORS indicated acceptable reliability (Cronbach's αs ≥ .75), and convergent validity was demonstrated by positive correlations between the overeating regulation subscale and both mindfulness and emotion regulation, and negative correlations between overeating regulation and binge eating. The opposite pattern of results was found for the overeating dysregulation subscales (Kerin et al., 2017). In the present study, Cronbach's α was .68 for general overeating regulation, .77 for discomfort overeating dysregulation, and .71 for leisure overeating dysregulation. As Cronbach's α was < .70 for general overeating regulation, the inter-item correlations were also explored for the ORS. The average inter-item correlations for each subscale fell within the recommended range of .20–.40, suggesting that the items are reasonably homogeneous whilst also containing sufficiently unique variance (Piedmont, 2014, pp. 3303–3304).

4.2.4. Dietary restraint, emotional eating, and external eating

The 33-item Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986) was used to assess dietary restraint, emotional eating, and external eating. This measure includes three subscales assessing each of these eating patterns: restrained eating (10 items; e.g., "Do you try to eat less at mealtimes than you would like to eat?"); emotional eating (13 items; e.g., "Do you get the desire to eat when you are anxious, worried, or tense?"); and external eating (10 items; e.g., "If food tastes good to you, do you eat more than usual?"). Participants rated each statement from 1 (*never/almost never*) to 5 (*very often/always*). Items were averaged to create subscale scores, with higher scores indicating higher levels of dietary restraint, emotional eating, and external eating. Reliability and validity has been established for the DEBQ across different age and cultural groups (Bailly, Maitre, Amanda, Hervé, & Alaphilippe, 2012; Bozan, Bas, & Asci, 2011). For example, the DEBQ correlates positively with other measures of eating behaviours (Garner & Garfinkel, 1979; Maloney, McGuire, & Daniels, 1988), as well as BMI (Bailly et al., 2012). In the present study, Cronbach's α = .91 for dietary restraint, .95 for emotional eating, and .85 for external eating.

4.3. Overview of data analytic strategy

Estimation maximisation was used to estimate the small amount of missing data (i.e., < 0.5%). Means, *SD*s, and Pearson's correlations were calculated for all variables. Cohen's (1988) criteria was used to interpret the magnitude of correlations (i.e., small: $r = .1$, moderate: $r = .3$, large: $r = .5$). Principle component analysis with oblimin rotation was used to identify the core components from the composite scores for the 15 eating subscales. Given the debate over the use of principle component analysis versus factor analysis (Beavers et al., 2013; Field, 2009), the analyses were repeated using factor analysis. The same structure was found using both methods, so only results from the principle component analysis are reported. The number of components extracted was based on an eigenvalue ≥1.0 and interpretability of the solution. Analyses were conducted using SPSS version 25.

5. Results

Table 1 presents the means, standard deviations, and correlations of study variables.

5.1. Correlations between eating constructs

5.1.1. Adaptive eating

The three subscales of intuitive eating and the six subscales of mindful eating had small to moderate positive correlations. In addition, 15 of the possible 18 correlations between the intuitive eating subscales and mindful eating subscales were significant, with significant effect sizes ranging from small to large (rs = .07 to .59). Of all the mindfulness subscales, acceptance showed the greatest and most consistent overlap with all three subscales of intuitive eating. The strongest associations were for unconditional permission to eat with acceptance, as well as for eating for physical rather than emotional reasons with present eating, acceptance, and act with awareness. Also, small to large positive associations were found between both intuitive and mindful eating and overeating regulation (rs = .06 to .53). The strongest association was between overeating regulation and eating for physical rather than emotional reasons, and the weakest association was between overeating regulation and unconditional permission to eat and flexibility.

5.1.2. Maladaptive eating

Emotional and external eating were most strongly associated with each other ($r = .51$), and the associations of emotional eating and external eating with leisure overeating dysregulation were moderate (rs = .35 and .38). Discomfort overeating dysregulation was moderately associated with emotional eating ($r = .41$) and leisure overeating dysregulation ($r = .35$), but showed a small association with external eating ($r = .24$). Dietary restraint showed the weakest associations with other maladaptive eating measures, including a small positive association with emotional eating, external eating, and discomfort (but not leisure) overeating dysregulation (rs ranged from .07 to .22).

5.1.3. Adaptive related to maladaptive eating

Almost all adaptive eating measures were significantly and inversely correlated with maladaptive eating measures, with effect sizes ranging from small to large (rs = −.05 to −.80). Most notable were the findings for intuitive eating, with a large inverse association between unconditional permission to eat and dietary restraint ($r = -.68$). Also, eating for physical rather than emotional reasons had large inverse associations with emotional eating ($r = -.80$) and external eating ($r = -.51$); other associations were usually significant, but smaller in magnitude.

For the mindful eating subscales, mostly small inverse associations with each maladaptive eating pattern were found, with few non-significant associations found. Yet, there was a strong inverse association between mindful acceptance and dietary restraint ($r = -.61$), as well as between act with awareness and emotional eating ($r = -.50$). Moderate inverse associations were found for mindful acceptance with emotional ($r = -.47$) and external eating ($r = -.31$); non-reactivity with emotional eating ($r = -.39$); act with awareness with external eating ($r = -.38$); and present eating with emotional eating ($r = -.45$), external eating ($r = -.48$), and leisure overeating dysregulation ($r = -.35$).

Finally, overeating regulation showed moderate inverse associations with all maladaptive eating patterns. The only exception was dietary restraint, which had a small inverse association with overeating regulation ($r = -.11$).

5.2. Principle component analysis of all eating measures

When scores for all 15 eating subscales were subjected to principle component analysis with oblimin rotation, four components had an eigenvalue over 1.0 and accounted for 61.75% of the total item variance. All 15 eating subscales, with the exception of mindful non-reactivity, loaded highly only on a single component (see Table 2).

As shown in Table 2, the first component was labelled *attuned eating* (Eigenvalue = 4.83, 32.16% of item variance). Attuned eating had moderate to high positive loadings (.40–.76) for five composite scores: the eating for physical rather than emotional reasons subscale from the intuitive eating measure; the mindful eating subscales act with awareness, present eating, and non-reactivity; and overeating regulation. It also had moderate to high negative loadings for four composite scores: emotional eating, external eating, leisure overeating dysregulation, and discomfort overeating dysregulation (−.35 to −.71). This component was labelled attuned eating because the items on the contributing

Table 1
Correlations between eating constructs (N = 2018).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. IE- UPE	–														
2. IE- EPR	.24**	–													
3. IE- RHSC	.12**	.31**	–												
4. ME- Accept	.59**	.49**	.35**	–											
5. ME- Aware	−.02	.07**	.22**	.03	–										
6. ME- Nonreact	.15**	.34**	.12**	.23**	−.01	–									
7. ME- Flex	.33**	.06*	−.02	.11**	−.03	.33**	–								
8. ME- ActAware	.07**	.45**	.28**	.36**	.25**	.30**	.07**	–							
9. ME- Present	.02	.51**	.17**	.30**	.01	.24**	−.06*	.45**	–						
10. OER	.14**	.53**	.30**	.31**	.13**	.31**	.06**	.32**	.27**	–					
11. Restraint	−.68**	−.18**	−.17**	−.61**	.02	−.10**	−.25**	−.12**	−.02	−.11**	–				
12. EmotEat	−.22**	−.80**	−.29**	−.47**	−.08**	−.39**	−.14**	−.50**	−.45**	−.49**	.22**	–			
13. ExtEat	−.06*	−.51**	−.23**	−.31**	.06**	−.40**	−.01	−.38**	−.48**	−.43**	.07**	.51**	–		
14. OED- L	−.06*	−.39**	−.20**	−.24**	−.05*	−.20**	.06**	−.27**	−.35**	−.33**	.03	.35**	.38**	–	
15. OED- D	−.13**	−.38**	−.19**	−.23**	−.11**	−.20**	−.09**	−.26**	−.15**	−.37**	.12**	.41**	.24**	.35**	–
M	3.01	2.95	3.55	3.03	3.78	3.23	3.86	3.83	2.48	3.40	2.67	2.55	3.22	2.75	2.11
SD	.72	.83	.63	1.00	.70	.81	.88	.93	.77	.77	.89	.93	.66	.90	.91

Note. IE = intuitive eating; UPE = unconditional permission to eat; EPR = eating for physical rather than emotional reasons; RHSC = reliance on hunger/satiety cues; ME = mindful eating; Accept = acceptance; Aware = awareness; Nonreact = non-reactivity; Flex = flexibility; ActAware = act with awareness; Present = present eating; OER = overeating regulation; Restraint = dietary restraint; EmotEat = emotional eating; ExtEat = external eating; OED- L = leisure overeating dysregulation; OED- D = discomfort overeating dysregulation.
*p < .05. **p < .01.

Table 2
Component loadings for eating constructs (N = 2018).

Subscales/Measures	Attuned Eating	Unrestrained Eating	Eating and Hunger Awareness	Casual Eating Attitudes
Intuitive Eating- EPR	.76			
ME- Act with Awareness	.51			
ME- Present	.79			
Overeating Regulation	.54			
Emotional Eating	−.71			
External Eating	−.80			
OED- Leisure	−.62			
OED- Discomfort	−.35			
Intuitive Eating - UPE		.88		
ME- Acceptance		.77		
Dietary Restraint		−.90		
Intuitive Eating - RHSC			.51	
ME- Awareness			.90	
ME- Nonreactivity	.40			.67
ME- Flexibility				.84

Note. Loadings < .35 are suppressed. EPR = eating for physical rather than emotional reasons; ME = mindful eating; Present = present eating; OED = overeating dysregulation; UPE = unconditional permission to eat; RHSC = reliance on hunger/satiety cues; UPE = unconditional permission to eat; RHSC = reliance on hunger/satiety cues.

subscales indicate an ability to be aware of when and what you are eating as well as being free from distraction and competing tasks when eating. In addition, items reflect an ability to refrain from impulsively or automatically responding to hunger cues but by the same token only eating when physically hungry and not in response to emotional or external cues, or when already full.

Component 2 was labelled *unrestrained eating* (Eigenvalue = 2.04, 13.59% of item variance) because it was represented by high positive loadings for unconditional permission to eat from the intuitive eating measure (.88) and mindful acceptance (.77), but also a very strong negative loading for dietary restraint (−.90). This component was labelled unrestrained eating because items for dietary restraint reflect rigid cognitive and behavioural control over eating for weight loss or maintenance purposes. Similarly, items on the unconditional permission to eat and acceptance subscales reflect flexible internal and external control over eating, non-rigid beliefs about what constitutes unacceptable foods and eating behaviours, and lack of self-criticism and negative feelings when unacceptable foods are consumed.

Component 3 was labelled *eating and hunger awareness*

(Eigenvalue = 1.27, 8.48% of item variance) because it had high positive loadings for reliance on hunger/satiety cues from the intuitive eating measure (.51) and mindful awareness (.90). This component was labelled eating and hunger awareness because the items on the subscales indicate an ability to notice the physical properties and sensations of food whilst eating as well as individual levels of hunger and fullness. Furthermore, three items within this component (specifically from the reliance on hunger/satiety cues subscale of intuitive eating) reflect the trust that an individual has for their body to indicate when, what, and how much to eat.

Component 4 was labelled *casual eating attitudes* (Eigenvalue = 1.13, 7.52% of item variance) because it was represented by strong positive loadings for mindful non-reactivity (.67) and mindful flexibility (.84). This component was labelled casual eating attitudes because items on the non-reactivity subscale reflect an ability to refrain from automatically eating or becoming irritable or pre-occupied with eating when hungry. Furthermore, items on the flexibility subscale reflect a lack of firm routine regarding what is eaten and at what time, and instead represent flexibility in regard to eating and

dietary diversity.

Small correlations were found between each eating component, and all were positively correlated with each other. The smallest correlation was between eating and hunger awareness and casual eating attitudes with a correlation of .06. The largest correlation was between attuned eating and eating and hunger awareness with a correlation of .25.

6. Discussion

The aim of this study was to simultaneously assess a number of key eating measures, in order to identify whether measures of adaptive eating represent more than merely the absence of, or a lower level of, maladaptive eating. The present findings point to the complexity of eating behaviour by revealing that although many adaptive and maladaptive eating concepts do appear to represent two sides of the same coin, several other adaptive and maladaptive eating concepts are better described as tapping somewhat unique attitudes, beliefs, motivations, and behaviours regarding food and eating. Although not all of the 15 eating measures that were included in the present study were significantly correlated with each other, most did significantly covary, some quite strongly. Thus, in general, participants who reported more adaptive eating on one measure tended to report more adaptive eating and less maladaptive eating on other measures.

Further, the eating subscales were meaningfully represented by four core components and suggest two conclusions. First, many eating subscales loaded highly on a component that was labelled attuned eating, suggesting that many adaptive (eating for physical rather than emotional reasons, act with awareness, present eating, non-reactivity, and overeating regulation) and maladaptive (emotional eating, external eating, leisure and discomfort overeating dysregulation) eating constructs tap opposite ends of a continuum of attuned versus disinhibited eating. Second, despite this strong component of attuned eating, other core components emerged indicating a more complex structure. These included components labelled unrestrained eating, eating and hunger awareness, and casual eating attitudes.

6.1. Correlations among eating constructs

First, small to large positive bivariate correlations were found between the adaptive eating subscales, with the greatest overlap being between unconditional permission to eat and acceptance, as well as between eating for physical rather than emotional reasons and present eating, acceptance, and act with awareness. The moderate to large statistical overlap found between many intuitive and mindful eating facets is congruent with the proposed conceptual intersection of these eating constructs (Tribole, 2010; Van Dyke & Drinkwater, 2014), but contradicts the only other empirical study that assessed and correlated intuitive and mindful eating, which showed no significant relationship (Anderson et al., 2016). This discrepancy, however, may be due to Anderson et al.'s (2016) use of the MEQ (Framson et al., 2009), which has faced criticism regarding construct validity (see Hulbert-Williams et al., 2014). Furthermore, Anderson et al. (2016) utilised only a total score of mindful eating rather than examining individual subscales, which could also account for the overall lack of association between intuitive and mindful eating. The present study is the first to directly compare subscales of intuitive and mindful eating utilising the MES (Hulbert-Williams et al., 2014), which better aligns with accepted definitions of mindfulness (e.g., Bishop et al., 2004; Kabat-Zinn, 1994). Notably, some associations in the present study were small or non-significant suggesting that there are some components of intuitive and mindful eating that have more in common than others. In addition, the present study is the first to examine the covariation of overeating regulation with intuitive and mindful eating, and bivariate correlations revealed that people who report they are better able to regulate their overeating are also more likely to feel that they eat intuitively and mindfully, and in particular that they are more likely to eat for physical rather than emotional reasons.

Positive correlations were also found among the maladaptive eating measures. Overall, moderate to strong relationships were found between emotional and external eating, and overeating dysregulation in contexts of leisure and discomfort. In contrast, the most distinct of these maladaptive eating measures was dietary restraint, as demonstrated by its small correlations with many other eating measures. These results support previous research showing positive intercorrelations between emotional and external eating, and to a lesser extent, dietary restraint (Ouwens et al., 2009; van Strien et al., 1986; van Strien & Oosterveld, 2008), and extend upon these findings by showing that these maladaptive eating constructs also show some overlap with the recently formulated measures of leisure and discomfort overeating dysregulation.

Finally, small to large inverse correlations were found between most adaptive and maladaptive eating subscales. Most of these associations had not previously been examined. Furthermore, although the relationship between a total score of mindful eating and both dietary restraint and dieting has been examined in two previous studies, no significant relationships were found (Anderson et al., 2016; Taylor et al., 2015). In contrast, small to large convergence between four of the six facets of mindful eating and dietary restraint (albeit inversely) was found in the present study. The disparity in findings may be due to former studies using total scores of the MEQ to assess mindful eating (Framson et al., 2009), whereas subscale scores of the MES were used in the present study (see Hulbert-Williams et al., 2014).

6.2. Principle components of all eating measures

6.2.1. General findings

Building on the results of the correlation analyses, principle component analysis of the composite scores for all measured eating constructs and their subscales revealed a 4-component structure. Over half of the eating composite scores had moderate to high loadings on the first component, which we labelled attuned eating. Attuned eating was represented by eating for physical rather than emotional reasons, mindful acting with awareness, present eating, non-reactivity, and overeating regulation with a lack of emotional eating, external eating, and leisure and discomfort overeating dysregulation. These results somewhat contradict claims that adaptive eating measures are not simply reflecting a lack of maladaptive eating behaviour (e.g., Tylka, 2006). Rather, the present findings suggest that many adaptive and maladaptive eating constructs do seem to tap an underlying core concept of attuned eating.

Attuned eating is a very salient eating behaviour component that emerged from the analysis. Yet, the complexity of eating behaviour composite scores was also demonstrated with other subscales loading on one of three additional components, whereby the four components were represented by high loadings from subscales drawn from measures described as assessing adaptive eating behaviours, whereas only two components had high loadings for maladaptive eating measures. Thus, the four eating components seem most useful for helping to conceptualise the different components that could describe a range of eating behaviours, with some (attuned eating and unrestrained eating) in opposition to unhealthy eating measures, but others (eating and hunger awareness, and casual eating attitudes) more divergent from unhealthy eating. In addition, it is useful that dietary restraint was the only maladaptive eating measure that did not load on attuned eating. This suggests that there is something inherently or qualitatively different about the purposeful restriction of intake compared to the other problematic eating behaviours, which collectively represent different types of dysregulated or disinhibited eating behaviours.

6.2.2. Mindful eating

Some aspects of mindful eating loaded highly on attuned eating, while others loaded highly on each of the other three components of

unrestrained eating, eating and hunger awareness, and casual eating attitudes. Further research is needed to address the reliability, validity, and usefulness of the mindful eating measure for explaining health behaviours and outcomes apart from or in addition to other eating measures. Future research could help to clarify whether our findings suggest that the mindful eating measure has greater breadth of conceptual content and will be most informative about actual eating behaviour and health outcomes or whether the mindful eating measure may need further development. In particular, two of the four components had high loadings from more than one mindful eating component, and mindful non-reactivity was the only subscale that loaded highly on more than one component. Furthermore, the correlation analyses indicated that the mindful awareness subscale did not significantly correlate with any other mindful eating subscale except for act with awareness, suggesting potential problems with this subscale. Also, the initial validation of the MES indicated that the unstructured eating subscale (referred to here as present eating) had low reliability and was difficult to interpret, and that both unstructured eating and routine (referred to here as flexibility) did not neatly map onto measures of general mindfulness (Hubert-Williams et al., 2014).

6.2.3. Intuitive eating

Similar to mindful eating, each of the three intuitive eating subscales loaded highly on a different component in a way that paralleled subscales from the mindful eating measure. In particular, the eating for physical rather than emotional reasons subscale of intuitive eating loaded strongly on attuned eating along with the present eating and act with awareness subscales of mindful eating; the unconditional permission to eat subscale of intuitive eating loaded strongly on unrestrained eating along with the acceptance subscale of mindful eating; and the reliance on hunger/satiety cues subscale of intuitive eating loaded strongly on eating and hunger awareness along with the awareness subscale of mindful eating. Therefore, these results not only support the theorised convergence between intuitive and mindful eating (Van Dyke & Drinkwater, 2014), but they extend our understanding by showing that the facets of each construct share some similar content and together map onto superordinate eating styles.

6.3. Implications for research, theory, and clinical practice

The present findings have implications for research, theory, and clinical practice. For example, the emergence of four relatively distinct core components of eating behaviours suggests that there may be several aspects of, and therefore ways to promote, healthful and adaptive eating. However, it is not yet clear whether one, all, or a specific combination of eating styles is required to achieve optimal health. Understanding how these eating styles interrelate is particularly important for clinical intervention. For example, it may be that a restrained eating style is adaptive rather than maladaptive when paired with an attuned eating style. Alternatively, it may be that the development of eating and hunger awareness and/or casual eating attitudes are prerequisites for the successful treatment of eating problems such as excessive restriction or disinhibition. Irrespective of the relations between the eating styles, the subscale loadings within each style suggest ways in which to clinically intervene to improve different aspects of eating. For example, the results suggest that it may be particularly important for maintaining health and weight for individuals to resist eating according to external cues and instead practice being present while eating.

In a similar vein, knowledge of the four components that emerged from the 15 eating subscales included in the present study may facilitate more efficient empirical examination of eating constructs, whereby researchers could utilise a smaller number of measures to assess the same diversity of eating behaviours. Furthermore, knowledge of these four components may be informative for theory development

or refinement. Indeed, the emergence of an eating and hunger awareness component that reflects an awareness of physiological cues and physical sensations regarding eating aligns with most eating behaviour theories, which point to the critical role of homeostatic control in food and weight regulation (Stroebe, Papies, & Aarts, 2008). In comparison, the three remaining components (attuned eating, unrestrained eating, and casual eating attitudes) seem to be more behavioural, emotional, or socialised by context, reflecting different attitudes, motivations or drives to eat, as well as specific eating behaviours. These latter components resonate with the proposition made by some eating behaviour theorists (e.g., Herman & Polivy, 1984) that the regulation of eating extends beyond biological or physiological control to include psychological and social factors (Stroebe et al., 2008). Further investigation into these four components could help with the clarification and synthesis of existing eating behaviour theories.

6.4. Limitations and future directions

There are several study limitations to note. First, the sample in the present study comprised predominantly white Australian women, with most drawn from a university setting and aged 16–30 years. These sample characteristics may limit the generalisability of the study findings. Future research should endeavour to study a more heterogeneous sample, comprising greater numbers of older adults, members from the general community, and ethnic minorities. Moreover, the current widespread issue of overconsumption of energy-dense, nutrient-poor foods and overweight and obesity among both males and females (Ng et al., 2014; Pérez-Escamilla et al., 2012) highlights a need for future research to also examine these adaptive and maladaptive eating constructs among males.

Second, the aim was to identify the core components of various existing composite measures of adaptive and maladaptive eating, rather than to examine the structure of each measure at the item-level. Thus, we did not explore the structure of the individual items on each measure prior to using it in its composite form for our analyses. To build on these findings, it is recommended that future research incorporate multiple measures representing the four components found here to examine whether they uniquely predict various health indicators, such as weight, exercise, and dietary quality. Such an examination could involve the use of latent constructs, which could incorporate multiple subscales drawn from those that were found in the present study as indicators of attuned eating, unrestrained eating, eating and hunger awareness, and casual eating attitudes.

7. Conclusion

The present findings point to the covariation among many measures of adaptive and maladaptive eating behaviours, as well as a 4-component structure representing the covariation among sets of measures. It was found that many adaptive and maladaptive eating measures do appear to represent attuned versus disinhibited eating behaviour. Other components are better described as representing unrestrained eating, eating and hunger awareness, and casual eating attitudes. These four coherent components of eating behaviour offer guidance for how to select measures for future research and identify what may be critical targets of clinical intervention for reducing dysregulated or restrained eating and weight problems, and enhancing health-promoting eating patterns.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2018.10.011.

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