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ORIGINAL PAPER

Initial Validation of the Mindful Eating Scale

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[Running Head: Mindful Eating Scale]

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Abstract

Self-report scales for mindfulness are now widely used in applied settings, and have made a contribution to research, for instance in demonstrating mediation effects. To date there are no convincing data as to whether mindfulness skills generalise fully across life domains, and so some researchers have developed mindfulness scales for particular domains of behaviour. We present the development of a self-report scale to measure mindfulness with respect to eating behaviours. A previous measure, the Mindful Eating Questionnaire, whilst possessing good psychometric properties, does not agree well with standard definitions of mindfulness or possess a factor structure similar to well-researched generic mindfulness scales. We developed an item pool based on items drawn from popular generic measures of mindfulness and the resultant questionnaire was completed by 127 university students (77.2% female, M age 25.65 years, SD age 8.89 years). An exploratory factor analysis yielded six factors: acceptance, awareness, non-reactivity, act with awareness, routine, and unstructured eating. The factors correlated in the expected direction with existing measures of mindfulness ($.113 < r < .522$), acceptance ($.052 < r < .325$), and eating disorder symptoms ($-.629 < r < -.056$). We anticipate that this measure will be of use in the further development of mindfulness-based interventions for eating disorders and obesity.

Keywords: mindfulness, acceptance, non-judgement, non-reactivity, eating, scale

The Mindful Eating Scale: Initial Validation

Introduction

A person's relationship with food is central to a good deal of health psychology, clinical psychology, medicine, and allied disciplines. Given the steady increase in obesity (WHO, 2000), and concomitant reduction in life expectancy (Peeters, et al., 2003) and quality of life (Fontaine & Barofsky, 2001), there is great pressure to develop weight loss interventions that work. Standard weight loss advice is to reduce calorie consumption, to increase the relative proportion of fruit and vegetables consumed, and to increase physical activity (e.g. NICE, 2006). Whilst these approaches have excellent efficacy, extremely poor adherence to such lifestyle changes result in poor real-world effectiveness, leading some researchers (e.g. Mann, et al., 2007) to claim that dieting simply doesn't work and others (e.g. Stice, Cameron, Killen, Hayward, & Taylor, 1999) to claim that dieting can paradoxically lead to weight gain. These approaches do not fail in biological terms, but perhaps they fail because psychological considerations, such as the power of food as a reward, and as a tool for emotional regulation, are not taken adequately into account.

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The considerable and stable prevalence of other eating-related psychological problems, including bulimia nervosa and binge eating disorder (Hoek, & Van Hoeken, 2003) are also considerable clinical challenges. Whilst treatments such as Cognitive Behavior Therapy are somewhat effective (e.g. Pike, Walsh, Vitousek, Wilson, & Bauer, 2003), there remains some room for improvement. Recently, a number of mindfulness-based interventions for eating-related psychological problems, and for weight loss, have been developed and tested. We review these briefly below.

Mindfulness, as we have come to know it in Western academic psychology, has its roots in Eastern contemplative traditions such as Buddhism (Williams & Kabat-Zinn, 2011). It is usually defined as being a particular mode of consciousness (Brown & Ryan, 2003), or less contentiously, as the self-regulation of attention in order to direct it towards present-moment experience, accompanied by a curious, open, non-judgemental and accepting stance (Bishop et al., 2004). Mindfulness is distinct from other constructs such as self-knowledge, not least because it is present-focussed (Brown, Ryan, & Creswell, 2007a). Since mindfulness is variously construed as naturally occurring trait or characteristic, or as a set of learned skills, we will use here a broad and atheoretical phrase to encompass the whole: mindfulness behaviours.

Traditional mindfulness practices from Eastern religions such as zazen meditation have been demonstrated to result in improvements in mindfulness behaviours

(Brown & Ryan, 2003), and wellbeing (Brown, Ryan, & Creswell, 2007a). However, these are generally of less interest to Western psychologists than the psychotherapeutic models that have been developed to take advantage of mindfulness processes, such as mindfulness-based stress reduction (MBSR) (Kabat-Zinn, 1990), mindfulness-based cognitive therapy (Kuyken et al., 2010; Ma & Teasdale, 2004), acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 2011), and dialectical behaviour therapy (DBT; Linehan et al., 1999). Traditional and modern mindfulness training practices share common principles with these third-wave cognitive behavioural therapies; indeed leading proponents of ACT and DBT have made the parallels explicit e.g. (Hayes, 2002). Mindfulness- and acceptance-based approaches lay great importance on the context of, rather than the content of, mental phenomena (Brown, Ryan, & Creswell, 2007b). This is their major distinction by comparison with mainstream cognitive behaviour therapy models, which usually emphasise the need to challenge the content of unhelpful thoughts (Longmore & Worrell, 2007). There is promising evidence of the effectiveness of mindfulness-based psychological interventions across a range of outcome measures, including depression, anxiety (e.g. Hoffman et al, 2010), perceptions of pain and stress (Baer, 2003); effect sizes are usually moderate.

There are sound theoretical reasons to expect a fit between eating-related clinical issues and the developing mindfulness-based approaches. For example, it is uncontroversial that psychological disorders such as binge eating disorder and bulimia nervosa often include an element of emotional eating (Mauler, Hamm,

Weike, Tuschen-Caffier, 2006) and ICD-10 includes a special diagnostic category for those who overeat in response to a stressful or traumatic event (F50.4; World Health Organization, 1993). Like most psychological traits, emotional eating can be considered as a continuum such that individuals tend to eat for emotional reasons either often, or infrequently, according to personal history. To date, it has been impossible to quantify the extent to which emotional eating might also contribute to the obesity epidemic.

There are sound theoretical reasons to expect mindfulness-based interventions to be effective with eating-related clinical issues (see Wilson, 1996 for a review) and indeed, there is now tentative evidence of efficacy. Simple case studies (e.g. Baer, Fischer, & Huss, 2005) and pre-post trial designs (e.g. Baer, Fischer, & Huss, 2005; Kristeller & Hallett, 1999) have gradually given way to more advanced methods, including controlled trials.

Tapper and colleagues (2009) report on a medium-sized trial ($N=62$) of a four-session mindfulness-based weight loss intervention. They report a medium sized effect (Cohen's d of .68, current authors' calculation) on body mass index (BMI) amongst the 70% of participants who self-reported engagement with the intervention. Within binge-eating disorder populations, Kristeller and Hallett (1999) report significant reductions in self-reported binge eating behaviour ($t = 9.86, p < .001$) and significant increases in satiety awareness ($t = 7.21, p < .001$) in their 21 participants. Anxiety and depression scores were also improved.

There are also successful trial reports of acceptance-based interventions for weight loss, mostly utilising ACT, and thus also employing mindfulness-based techniques. In a sample of 29 participants, Forman, Butryn, Hoffman, & Herbert (2009) reported an average weight loss of 6.6% of pretreatment body weight at completion, with further losses at 6-month follow-up and a statistically significant dose-response relationship ($r=.65, p < .01$). Similarly, Lillis, Hayes, Bunting, & Masuda, (2009) found that a one-day ACT-based weight loss intervention ($n=43$) resulted in statistically significant weight loss when compared with wait list controls ($n=41$) [Cohen's $d = .05, F(1, 83) = 9.80, p < .01$].

Juarascio and colleagues (2010) reanalysed a subsample of participants from an earlier trial (Forman, Herbert, Moitra, Yeomans, & Geller, 2007a) comparing cognitive therapy and ACT, selecting only those participants who the authors deemed to show subclinical eating pathology at recruitment. Eating pathology symptoms were shown to decrease more rapidly in the ACT treatment group [$F(1, 53) = 4.71, p=.03, \text{partial } \eta^2 = .08$].

In light of these hopeful developments, researchers and clinicians will need better tools to measure those variables pertinent to desired clinical change, in order to improve interventions, and ensure client progress.

The need for a measure of mindfulness specific to eating

There is a curious mismatch between the way mindfulness is currently being taught and how it is measured. Treatment protocols and self-help books indicate that both traditional and modern teachers of mindfulness assume that learned mindfulness behaviours do not generalise across domains of life. For example, treatment protocols often start with mindfulness of breath, but progress to include practice relating to other bodily sensations, such as eating a raisin, or yoga. Those who would develop an attitude of mindfulness are explicitly encouraged to put effort into generalising these behaviours learned on the zabuton and applying them to day-to-day activities.

“Try to use ordinary, repetitive occasions in your own house as invitations to practice mindfulness. Going to the front door, answering the telephone, seeking out someone else in the house to speak with, going to the bathroom ... all can be occasions to slow down and be more in touch with each present moment.”

(Kabat-Zinn, 1994, p. 202)

However, the psychometric measures of mindfulness we have at present do not in any sense attempt to detect whether or not these skills and tendencies have been generalised. Extant measures ask a number of questions relating to different domains of behavior, such as, “*When I am startled, I notice what is going on inside my body*” (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008), “*I tend not to notice*

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feelings of physical tension or discomfort until they really grab my attention" (Brown & Ryan, 2003), *"I forget a person's name almost as soon as I've been told it for the first time"* and *"When I take a shower or bath, I stay alert to the sensations of water on my body"* (Baer et al., 2006). Whilst these psychometric scales clearly have sufficient scope, with items referring to a range of different day-to-day experiences, their scoring algorithms make no allowance for the possibility that participants may be mindful across some domains of life but not others; that they may not have generalised their mindfulness behaviours. Should a respondent tend to be mindful of various types of experiences, but to avoid experiences relating to food (perhaps because of a psychological problem), these measures would not be able to pick up on such a nuance.

Furthermore, there are good reasons to expect greater sensitivity to relevant behaviours where measures are developed in a domain specific way. For example, the Food Craving Acceptance and Action Questionnaire (Juarascio et al., 2011;) may have better sensitivity to food-related thoughts than its generic sister scale the Acceptance and Action Questionnaire (AAQ: Hayes, 2002; Longmore & Worrell, 2007). It's noteworthy that the AAQ measures a construct closely affiliated with mindfulness.

To date, only one attempt has been made to develop an eating-specific mindfulness scale. With the development of the Mindful Eating Questionnaire, Framson and colleagues (2009) make a valuable contribution, however, their measure does not

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appear to agree closely with standard definitions of mindfulness, such as that of Kabat-Zinn (1994), and bares a factor structure quite different from those seen in generic mindfulness measures. For example, the Mindful Eating Questionnaire includes a behavioural disinhibition subscale (example item “When I eat at ‘all you can eat’ buffets, I tend to overeat”), but doesn’t include an acceptance or nonjudgement subscale. Further exploration of the structure of mindfulness in this domain-specific manner is especially important because of the recent tentative evidence that certain sub-components of mindfulness might be especially impactful with regard to certain types of eating behaviours and certain types of eating disorders (Adams, 2007; Forman et al., 2007b).

Developing a mindfulness measure

Mindfulness is a complex phenomenon, and the the extent to which it is measureable has caused considerable debate (e.g. Baer, 2011; Grossman, 2008). Central to this debate is the discussion concerning the delineation of the component parts of mindfulness. Kabat-Zinn (1994, p.4), described mindfulness as ‘paying attention in a particular way, on purpose, in the present moment, and nonjudgmentally’. Even this simple definition suggests sub-components that are usually considered as separate phenomena in Western psychology, such as attention and cognitive appraisal. There remains some disagreement about the best definition of mindfulness. For instance, (Bishop et al., 2004) refined Kabat-Zinn's definition in an attempt to operationalise it in Western psychological terms and argued that

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there are two key components: self-directed attention and openness to experience. Some researchers (e.g. Grabovac et al., 2011; Dreyfus, 2011) have traced mindfulness back to its Buddhist roots to better understand its structure and the mechanisms by which salutary effects are brought about, whilst others are working to delineate the processes of mindfulness in such a way as to facilitate neuropsychological research (Fletcher et al., 2010). It should be noted that all these mainstream definitions comprise at a minimum, attention to, and non-judgemental acceptance of present-moment experiences.

A number of psychometric measures of mindfulness have been developed, most measure psychological constructs closely aligned with these theoretical definitions of mindfulness. Many of these measures have been subjected to factor analysis, a procedure often used to discover latent structure in complex mental phenomena (see Mulaik, 1987), resulting in mindfulness measures with varying numbers of subcomponents. Despite the precise number of components, all include an attention/awareness component, and a non-judgement/acceptance component (excepting those like the MAAS which attempt to measure mindfulness as a unitary construct). Of course, a factor or sub-scale cannot emerge from the data if no items capable of measuring that factor were not included from the start. It is therefore worth considering the work of Baer and colleagues (2006) who have taken an especially inclusive stance in the development of the Five Factor Mindfulness Questionnaire (FFMQ), one of the most commonly used measures of generic mindfulness. The FFMQ was developed by pooling items from five extant measures

of mindfulness. Exploratory factor analysis and subsequent hierarchical confirmatory factor analysis (Baer et al., 2006) resulted in an easily interpretable factor structure that neatly combines factors measured in other mindfulness scales, such as the Mindful Attention and Awareness Scale, (MAAS; Brown & Ryan, 2003), the Philadelphia Mindfulness Scale (PhlMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008), and the Toronto Mindfulness Scale (TMS; Davis, Lau, & Cairns, 2009).

The present study

This paper presents the development of the Mindful Eating Scale. We used a method similar to that of Baer and colleagues (2006) in that we pooled items from three well-developed mindfulness scales, edited them with reference to eating behaviours, hunger, satiety and so on, and ran the resulting item pool through an exploratory factor analysis. We developed this alternative measure with two specific aims in mind: (a) the new scale ought to include subscales to measure at least the central features of mindfulness, those of attention and nonjudgement, (b) the new scale should be better aligned with subcomponents of generic mindfulness scales. Both of these features are important if the new scale is to facilitate the development of targeted intervention studies and manualised treatments with few redundant processes. Given the need to recruit a sample diverse with respect to a number of characteristics (e.g. class, geographical and ethnic background), we recruited from a two universities with strong widening participation agendas. University populations are viewed as highly suitable for studying eating attitudes and behaviours due to the

high levels of subclinical disordered eating amongst younger people (see Welch, Miller, Ghaderi & Vaillancourt, 2009).

Our aim was to create a multifaceted scale with sub-scales that overlap conceptually with other established trait measures. Given that these measures vary in regard of the number of factors, no particular predictions were made beforehand as to the number of factors likely to be identified (see Table 2, below). We made six *a priori* predictions: that any emerging *acceptance* factor would correlate positively with (1) the MAAS and (2) the AAQ, whilst correlating negatively with (3) the EDE-Q, (4) the FMPS, and the BAQ (5); that any emerging *awareness* factor would correlate positively with (6) the MAAS. We made no *a priori* predictions based on BMI, as we could find no robust extant evidence that would support the idea that eating-related mindfulness and BMI ought to be related.

Method

Participants

A sample of 127 university students was recruited, 101 participants from the study's primary centre, a small university, situated in the North West of England, and 26 participants from the secondary centre, a larger university comprising of four campuses across the West Midlands and Shropshire. Participants were predominantly female (77.2%) and averaged 25.65 years of age (SD = 8.89) with 85% of the sample reporting their ethnic identity to be White. Thirty-five point four

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percent of the sample already had a university degree and 34.6% reported A Levels (high school diploma) as their highest level of education, whilst the remainder reported lower qualifications. Thirty-one point five percent of the sample reported having at least one dependent under the age of 18, and 32.3% were living with a partner, reflecting the high number of mature students recruited to the two universities from which the sample was drawn. Self-reported height and current weight allowed us to calculate Body Mass Index. The sample mean was 23.59 (SD = 3.54) and the distribution was approximately normal.

Measures

The Mindful Eating Scale.

To develop the items for our self-report measure, we pooled the items from the Five Factor Mindfulness Questionnaire (Baer et al., 2006), and the Philadelphia Mindfulness Scale (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). Two authors [redacted for anonymity] edited each item to make more direct reference to eating-related behaviours whilst maintaining the original meaning of the item so far as possible. For instance, the FFMQ item, “I am easily distracted” became, “I am easily distracted whilst eating”. Contrariwise, the MAAS item “I snack without being aware that I’m eating” remained unchanged. This item pool was reviewed by three independent researchers and three clinicians specializing in eating behaviors and eating disorders. Minor textual improvements were suggested and implemented. Most authorities on exploratory factor analysis agree that at least three, and

preferably five measured variables ought to be included for each factor the researcher anticipates will emerge from the questionnaire (Fabrigar et al., 1999). To ensure sufficient over-determination of the model therefore, we included 74 items in the original pool. We asked participants to rate their own behaviour against these on a four-point Likert-type scale: never, rarely, sometimes, usually.

The Acceptance and Action Questionnaire II.

The Acceptance and Action Questionnaire II (AAQ-II; Bond, Hayes, Baer, Carpenter, Orkutt, Waltz et al., 2011) is a measure of psychological flexibility and comprises of 10 items, such as, "Emotions cause problems in my life" which are rated on a seven-point Likert type scale. High scores indicate greater psychological flexibility which consistently correlates with generic measures of mindfulness. Bond and colleagues have shown this measure to have good internal consistency ($\alpha = .84$), and test-retest reliability of (3-month .81, 12-month, .79).

The Mindfulness Attention Awareness Scale.

The Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003) was one of the earlier mindfulness scales to be developed and remains one of the most frequently used. It is a 15-item self-report instrument with Likert-type responses given to statements such as, "I do jobs or tasks automatically without being aware of what I'm doing". Its two subscales have good internal consistency ($.80 < \alpha < .87$ in range of samples; *ibid.*). We chose the MAAS for this study as it has the best evidence base of any mindfulness measure to date with respect to concurrent

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validity as measured by correlations with other psychometric instruments (Brown & Ryan, 2003; MacKillop & Anderson, 2007; van Dam, Earleywine, & Borders, 2010). Brown & Ryan (2003) have also demonstrated that the MAAS has sound discriminant validity in a comparison between students of Zen Buddhism and those with no history of meditation.

The Eating Disorder Examination Questionnaire.

The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Bèglin, 1994) asks the respondent for frequency data on key behavioural features of eating disorders. It comprises of 28 questions, for example “Have you had a definite fear that you might gain weight”, 23 of which are assessed using a 7-point or 5-point forced-choice rating scheme. Whilst it can be used to rate different typologies of behavior, we used the EDE-Q global score here as a general measure of eating pathology. The EDE-Q global score has good internal consistency ($\alpha = .90$; Peterson, Crosby, Wonderlich, Joiner, Crow, Mitchell et al., 2007).

The Frost Multidimensional Perfectionism Scale.

The Frost Multidimensional Perfectionism Scale (FMPS; Frost et al., 1990) is a 35-item self-report questionnaire designed to assess six dimensions of perfectionism: Concern over Mistakes, Personal Standards, Parental Expectations, Parental Criticisms, Doubts about Actions, and Organization. Perfectionism is important within this context, as it is known to be predictive of likelihood of eating disorder

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symptomatology (Welch, Miller, Ghaderi, & Vaillancourt, 2009). Participants rate their level of agreement on a five-point Likert scale (strongly disagree to strongly agree). The scale has sound internal reliability ($\alpha = .90$; Frost et al., 1990).

Body Attitude Questionnaire.

The Ben-Tovim Walker Body Attitude Questionnaire (BAQ; Ben-Tovim & Walker, 1991) is a 44 item questionnaire measuring the cognitive salience and disparaging nature of the respondent's cognitions about his own body. Items such as, "People avoid me because of my looks," and, "I feel fat when I wear clothes that are tight around the waist" are scored on five-point Likert scale. Ben-Tovim and Walker has shown the BAQ to have good internal consistency ($\alpha = 0.87$) and satisfactory test-retest reliability for the global score ($r = .83$).

Procedure

Participants were recruited from undergraduate populations in two British universities. The study was advertised during scheduled lectures, via the Student's Union and associated facilities. A formal process of informed consent was adopted and responses were anonymous. The study protocol was approved by the ethics committees of both universities and suitable procedures were put in place to make referrals to student counselling services and specialist eating disorder services should it become necessary. Participants were asked to complete the questionnaire packs "over the next few days" and to return them to the lead investigator. Trial runs indicated that the questionnaire pack would take approximately 20 minutes to

complete. Students received a debrief sheet in the questionnaire pack, stapled as the penultimate page, which they were encouraged to detach for their records.

Data analysis

All 74 items of the draft MES item pool were entered into an exploratory principle axis factoring analysis. With regard to factor retention, Catell's scree plot method, which tends to underestimate the number of factors, suggested 4 factors, whilst Kaiser's criterion of Eigenvalues greater than 1, which tends to overestimate the number of factors, suggested a 20-factor solution (see Costello & Osborne, 2005 for a discussion of these criticisms). In the face of such discrepancy we opted to conduct a Monte Carlo simulation for eigenvalues based on the parallel method (Horn, 1965). Following Hayton, Allen & Scarpello (2004), we ran 200 exploratory factor analyses with simulated pseudorandom data and took arithmetic means of eigenvalues across simulations. Based on this, we specified a six-factor solution for the exploratory factor analysis of the real data. There are good theoretical reasons and some empirical evidence (e.g. Brown & Ryan, 2003; Baer et al., 2008) to support the expectation that mindfulness factors might be correlated and so we chose an oblique method of rotation (direct oblimin) to enhance interpretability (see Ford, MacCallum & Tait, 1986). We calculated that for our sample size, factor loadings of .4 or greater could be deemed statistically significant, and so only these loadings were retained (see Stevens, 2004).

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It was our intention to create a parsimonious and brief instrument, and to that end, we conducted a process of item reduction wherein we attempted to reduce the number of items in each subscale whilst retaining the highest possible internal consistency. Whilst some colleagues (e.g. Anastasi & Urbina, 1997) recommend the use of Cronbach's alpha for this purpose, coefficient alpha is biased by the number of items in the scale and must be interpreted with caution (Cortina, 1993). We adopted mean inter-item correlations to overcome this problem. We also set a lower bound of three measure items per factor to ensure sufficient overdetermination in subsequent tests of the factor model (Fabrigar et al., 1999).

Published effect sizes for correlations between different trait mindfulness scales tend to be above $r = .4$ (e.g. Baer et al., 2006). An *a priori* power analysis using G*Power suggested, therefore, a sample of at least 59 participants to detect such effects with a power of .95. Total missing data was less than 1%. Missing data were addressed differently depending on the measure. Mean-score substitution was used where less than 10% of a participant's responses on an individual subscale were missing, unless the scoring instructions provided explicit guidance on the handling of missing data. For the MES, since no factors could be assumed *a priori*, cases with missing data (N=2) were simply excluded from analyses. These cases have also been excluded from the description of the participants above.

Results

The final factor structure of the Mindful Eating Scale can be seen in Table 1, including factor labels. We interpreted the factors by reference to extant generic mindfulness scales. Though the process of item reduction did lead to minor changes in Cronbach's alpha, five of the six subscales have good internal consistency with alphas of .75 or higher. The sixth factor, unstructured eating, has an alpha of .60 and is more difficult to interpret.

[INSERT TABLE 1 ABOUT HERE]

Our chief aim was to create an instrument with better agreement with standard definitions of mindfulness, as operationalized in other psychometric mindfulness measures. In Table 2, we compare the factor structures of the MES and MEQ with the structures of the most cited generic measures. Four of the MES's 6 factors map neatly onto the factors of the generic scales, compared with 2 of the 5 MEQ subscales. Unlike the MEQ, but in line with most other measures of mindfulness, the new MES retains a factor relating to acceptance (non-judgement of experiences). Like the Five Factor Mindfulness Scale, which we consider to be one of the most well developed scales to date, the MES also retains a factor of behavioural non-reactivity to emotional cues (equanimity).

[INSERT TABLE 2 ABOUT HERE]

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As expected, due to the nature of mindfulness subcomponents and the oblique rotation chosen for the present study, we found that several of the subscales of the MES intercorrelated. These results are shown in Table 3. It is noteworthy that two subscales emerged from the factor analysis which both appear to measure aspects of awareness. The first, which we have called simply *Awareness*, includes items that relate to noticing physical experiences and is conceptually similar to the *Observe* subscale from the FFMQ. The second, which we have called *Act with awareness* includes items on automaticity and becoming distracted and is conceptually very similar to the scale of the same name in the FFMQ. On the face of it, these two subscales seem to overlap conceptually, however, given that they have emerged as independent subscales in both our analysis and that conducted by Baer and colleagues (2006) it seems likely that they are measuring stable and independent constructs.

[INSERT TABLE 3 ABOUT HERE]

In order to provide initial data on convergent validity, we examined the correlations between the factors, and global score, of the MES, and the other measures described above. Table 4 shows the pattern of correlations, which was much as expected, though some relationships are larger than we might have hoped. Specifically, regarding the six *a priori* predictions made, all six were supported at the $p < .01$ level. Three participants failed to give either height or weight information, reducing the N in analyses involving BMI to 124.

[INSERT TABLE 4 ABOUT HERE]

Discussion

We have presented the ground-up development of a domain-specific psychometric measure of eating-related mindfulness. By drawing together items from a number of generic measures of mindfulness and editing them to be eating-related we were able to ensure a factor structure more closely associated to standard definitions of mindfulness. Crucially, we included items relating to acceptance and non-reactivity—two concepts central to most definitions of mindfulness (Bishop et al., 2004), but omitted from the previously developed Mindful Eating Questionnaire (Framson et al. 2009) —and these were retained as factors in the final model. The new measure, the Mindful Eating Scale (MES) might thus make a contribution to future basic and applied research as the subscales of this new measure are in greater agreement with standard definitions of mindfulness than comparable measures.

Several factors of the MES—*acceptance*, *awareness*, *act with awareness*, and *non-reactivity* overlap in terms of face validity with subscales on generic mindfulness instruments. Whilst factors 4, and 6—*routine*, and *unstructured eating*—are not conceptually contiguous with the factors of the Five Factor Mindfulness Scale, they correlate with other pertinent measures including the Mindful Attention and

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Awareness Scale. We are not therefore tempted to second-guess the parallel analysis and reduce the number of factors in the scale at this point.

Whilst university samples generally provide an excellent testing ground for theories on eating behaviours and body satisfaction, due to the high variability of these constructs in younger people (see Welch, Miller, Ghaderi & Vaillancourt, 2009), the factor structure presented here is in need of confirmation. We had no prior predictions as to the precise factor structure of the MES, but given that the emergent factor structure is extremely similar to the Five Factor Mindfulness Questionnaire, in future work we hope to cross-validate the MES against that questionnaire. For the present study it was necessary to choose brief measures to reduce participant burden given the length of the draft MES administered and the total number of questionnaires. It will also be interesting to examine any possible relationships between the MES and other eating-related constructs including the Power of Food Scale (Lowe et al., 2009), food enjoyment, and so on.

Though we must treat them with caution due to the MES being at an early stage of development, the current data suggest some interesting avenues for further research. As in studies using generic mindfulness scales (e.g. Baer et al., 2006), *awareness* and *acceptance* are not correlated. This suggests it may be worthwhile to conduct component breakdown intervention studies, to establish which aspects of mindful eating interventions are necessary and sufficient, and to examine how these

variables change in response to particular teaching exercises or interventions. Further, given the inherent difficulties in devising active control conditions that sufficiently blind participants (and ideally, therapists) to the nature of the intervention and to group membership, process (mediation) studies have proved helpful in studying clinical interventions. In these process studies (e.g. Lillis, Hayes & Levin, 2011), researchers are able to demonstrate that psychological variables inherent to the intervention model change as a result of the intervention, and further, that these changes are statistically capable of accounting for the outcome changes observed. We suggest that the MES may be a useful measure for this purpose within eating behaviour interventions.

Whilst the measurement of mindfulness can allow for important developments in understanding the mechanisms and processes of action within mindfulness based interventions (Bishop et al, 2004), we also acknowledge the debate concerning to what extent mindfulness is amenable to measurement (Grossman, 2008, Park, Reilly-Spong & Gross, 2013), and the implications this has for future work. It has been argued, for example, that individuals are unable to reliably report their tendency to be mindful, as they are not used to recognizing it in their day-to-day life. Baer (2011) has argued that this criticism can be circumvented by the use of ordinary language in questionnaire items, and argued that the ability of individuals to recognize 'mind wandering' (Smallwood et al., 2007) provided evidence that they have the ability to observe their own thoughts. Whilst we endeavor to use every day language in the development of the MES, future work on the comprehension of

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items (e.g., Belzer, Schmidt, Lucius-Hoene, Schneider, Orellana-Rios, & Sauer, 2012) would add to our understanding of the participants' experience.

A related concern is that attempts to measure mindfulness assume that this is an inherent human capacity, which occurs on a continuum, regardless of engagement in specialist training. Kabat-Zinn (2003 p.146) stated; "We are all mindful, to one degree or another, moment by moment." However individuals who are regular practitioners of meditation, or mindfulness exercises, tend to respond to, and interpret the content of, questionnaire items differently to those who are non-meditators (e.g., Belzer et al., 2012). This has been highlighted as a concern (e.g., Grossman, 2008), however Baer (2011) does not see this pattern as problematic. We would expect those who practice mindfulness regularly, to score more highly on a measure of mindfulness. This may be a result of their differential interpretation of items, or the heightened intensity of their experience. A final criticism of the literature attempting to measure mindfulness is the lack of research attempting to examine the association with external referents (Park et al., 2013). Therefore it is necessary for future research to extend the development of tools, such as the MES, to incorporate validation against actual behavior or clinician reports. The measurement of mindfulness cannot easily be achieved through observation, or physiological means, neither is it closely related to sustained attention (Baer, 2011). Advancing the techniques used in self-report measurement is therefore important if we are to develop and understand the mechanisms involved in mindfulness interventions.

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Following further work to confirm the psychometric properties of the MES, it may also become a useful measure for use in clinical practice and psychoeducational settings, to monitor the development of mindfulness skills in clients, and potentially to describe a relative profile of mindfulness skills for an individual, allowing the therapist or teacher to guide experiential work toward those areas where the client has not yet made substantial progress.

Tables

Table 1: Pattern matrix and Cronbach's alphas for the Mindful Eating Scale

| | Factor number | | | | | |
|--|---------------|-------|--------|-------|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Factor 1: Acceptance | | | | | | |
| I criticise myself for the way I eat. ^R | 0.736 | | | | | |
| I tell myself I shouldn't be eating what I'm eating. ^R | 0.722 | | | | | |
| I tend to evaluate whether my eating is right or wrong. ^R | 0.706 | | | | | |
| I wish I could control my eating more easily. ^R | 0.704 | | | | | |
| I tell myself I shouldn't be hungry. ^R | 0.652 | | | | | |
| I wish I could control my hunger. ^R | 0.617 | | | | | |
| Factor 2: Awareness | | | | | | |
| I notice flavours and textures when I'm eating my food. | | 0.729 | | | | |
| I stay aware of my food whilst I'm eating. | | 0.665 | | | | |
| I notice how my food looks. | | 0.642 | | | | |
| I notice the smells and aromas of food. | | 0.567 | | | | |
| It's easy for me to concentrate on what I'm eating. | | 0.465 | | | | |
| Factor 3: Non-reactivity | | | | | | |
| I can tolerate being hungry for a while. | | | -0.637 | | | |
| Once I've decided to eat, I have to eat straight away. ^R | | | 0.542 | | | |
| When I get hungry, I can't think about anything else. ^R | | | 0.506 | | | |
| I become very short tempered if I need to eat. ^R | | | 0.455 | | | |
| I need to eat like clockwork. ^R | | | 0.430 | | | |
| Factor 4: Routine | | | | | | |
| I have a routine for what I eat. ^R | | | | 0.628 | | |
| I have a routine for when I eat ^R | | | | 0.583 | | |
| I eat the same thing on the same day of each week. ^R | | | | 0.583 | | |
| I eat the same thing for lunch each day. ^R | | | | 0.441 | | |
| Factor 5: Act with awareness | | | | | | |
| I snack without being aware that I'm eating. ^R | | | | | 0.682 | |
| I don't pay attention to what I'm eating because I'm daydreaming, worrying or distracted. ^R | | | | | 0.675 | |
| I eat automatically without being aware of what I'm eating. ^R | | | | | 0.578 | |
| I eat something without really being aware of it. ^R | | | | | 0.486 | |

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Factor 6: Unstructured eating

| | | | | | | |
|--|------------|------------|------------|------------|------------|------------|
| I multi-task whilst eating. ^R | | | | | | 0.491 |
| I snack when I'm bored. ^R | | | | | | 0.490 |
| I eat between meals. ^R | | | | | | 0.473 |
| I eat at my desk or computer. ^R | | | | | | 0.458 |
| Cronbach's alpha | .89 | .82 | .77 | .75 | .81 | .60 |

Note: ^R Item is reverse scored

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Table 2: Comparison of factor structures of the MES with other relevant scales.

| | Total number of factors | Awareness/Observe | Acceptance / non-judge. | Act with awareness | Describe | Non-reactivity | Disinhibition | External cues | Emotional response | Routine | Unstructured eating |
|--|-------------------------|-------------------|-------------------------|--------------------|----------------|----------------|---------------|---------------|--------------------|---------|---------------------|
| Philadelphia Mindfulness Scale | 2 | | | | | | | | | | |
| Mindful Attention and Awareness Scale | 4 | | | | — One factor — | | | | | | |
| Southampton Mindfulness Questionnaire | 4 | | | | — One factor — | | | | | | |
| Kentucky Inventory of Mindfulness Skills | 4 | | | | | | | | | | |
| Frieburg | 2 | † | | | | | | | | | |
| Five-Factor Mindfulness Questionnaire | 5 | | | | | | | | | | |
| Mindful Eating Scale (present study) | 6 | | | | | | | | | | |
| Mindful Eating Questionnaire | 5 | | | | | | | | | | |

† Presence in the Frieburg scale.

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Table 3: Means (sd) and Inter-factor correlations for the MES.

| | Acceptance | Awareness | Non-reactivity | Routine | Act with awareness | Unstructured eating |
|--------------------|------------|-----------|----------------|---------|--------------------|---------------------|
| Mean | 15.38 | 15.71 | 12.73 | 11.16 | 11.76 | 8.59 |
| (sd) | (4.79) | (3.25) | (3.41) | (2.85) | (2.65) | (2.26) |
| Acceptance | | .041 | .361** | .291** | .369** | .360** |
| Awareness | | | .036 | -.014 | .347** | -.090 |
| Non-reactivity | | | | .388** | .369** | .176* |
| Routine | | | | | .215* | .014 |
| Act with awareness | | | | | | .236** |

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Table 4: Correlations between the Mindful Eating Scale and other measures of mindfulness, acceptance, personality, and eating pathology symptoms.

| | MAAS | AAQ II | BMI | FMPS | BAQ | EDE-Q |
|-------------------------|---------|--------|--------|---------|---------|---------|
| Mean | 58.94 | 53.28 | 23.59 | 90.87 | 123.77 | 9.11 |
| (sd) | (13.69) | (6.25) | (3.55) | (24.75) | (21.35) | (9.24) |
| MES Acceptance | .369** | .243** | -.181* | -.239** | -.726** | -.629** |
| MES Awareness | .325** | .263** | .226* | -.151 | -.105 | -.056 |
| MES Non-reactivity | .216* | .179* | -.030 | -.172 | -.295** | -.173 |
| MES Routine | .113 | .052 | -.086 | -.027 | -.179* | -.236** |
| MES Act with awareness | .522** | .204* | .001 | -.245** | -.320** | -.190* |
| MES Unstructured eating | .181* | .185* | -.023 | -.075 | -.221* | -.146 |
| MES Total | .489** | .325** | -.054 | -.262** | -.581** | -.466** |

The scores used in generating these correlations were: Mindful Attention and Awareness Scale total, Acceptance and Action Questionnaire II total, Body Mass Index, Frost Multidimensional Perfectionism Scale global score, Body Attitude Questionnaire global score, and Eating Disorder Examination Questionnaire global score. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

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