Association Between Mindful Eating and Weight Cycling

in Middle Age Women

by

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A Thesis Presented in Partial Fulfillment
Of the Requirements for the Degree
Master of Science

Approved April 2016 by the
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ARIZONA STATE UNIVERSITY

May 2016

ABSTRACT

Introduction: Weight cycling is defined as happening when an individual intentionally loses weight and then subsequently regaining the weight over time. Weight cycling has been associated with a number of adverse health consequences and is a risk factor for cardiovascular disease. The large majority of behaviorally based weight loss interventions typically result in full weight regain often with additional weight gained over time with each repeated bout of weight cycling. Mindful eating, which is defined as a non-judgmental awareness of meal related factors, has been found to influence negative behaviors related to weight cycling. **Purpose:** The purpose of this study was to examine the association between mindful eating and weight cycling in middle aged women. **Methods:** This study used an observational design to explore the relationships and characterize responses to the Mindfulness Eating Questionnaire (MEQ) in 75 overweight women (BMI > 25) who self-reported a history of weight cycling using a weight cycling index (WCI). The participants were divided into three groups: non-cyclers (NC) less than three cycles of 10 lbs; moderate cyclers (MC) at least three weight cycles of 10lbs; and severe cyclers (SC) at least three weight cycles of at least 20lbs. **Results:** NC were significantly ($p < 0.05$) younger and had lower BMI than the MC and SC groups. There were no significant differences in any of the MEQ subscores based on WCI groups. There were no significant relationships between WCI and any of the MEQ subscores. **Conclusion:** The Mindful Eating Questionnaire (MEQ), was an insufficient

discriminatory measure for use in an observational study on a complex behavior such as weight cycling. Further research to understand eating behavior domains, mindful awareness skills, and risk of weight cycling is needed.

To my patient and nearly perfect wife who supported me countless sleepless

nights and cranky days! To my children who give life new meaning!

ACKNOWLEDGMENTS

I want to give out a lot of thanks to a lot of people. First and foremost thank you Dr. Pamela Swan for the energy and time I drained from you especially as time marched on and we realized we needed to change directions. Thank you Dr. Ann Sebren for helping me learn to cope with stress as well as finding the right opportunity with which to do an amazing thesis project! Thank you Dr. Jack Chisum for the countless hours you spent teaching me to be not only a better student but a better person. Thank you Dr. Kathy Campbell for bringing me into the master's degree program to begin with and trusting that I would step up to the challenge. Thank you Karen Moreno for going beyond the call of duty and being a wonderful peer mentor and leader. Finally, thanks to my father for being an exercise physiologist and bringing me into this field through example and interest!

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INTRODUCTION

Weight cycling is defined as when an individual intentionally loses weight through some sort of behavioral change intervention, including energy restriction, which then results in gaining the weight back over time (Field et al., 1999). In more popular vernacular, repeated cycles of losing weight and gaining it back called "yo-yo dieting" would be the same as weight cycling (Atkins et al., 1994). Elfhag and Rossner (2005) suggest that 80% of patients who undergo weight loss interventions will regain their weight. A person does not have to have to be considered overweight or obese in order to weight cycle (Montani, Viecelli, Prevot, & Dulloo, 2006). Women appear to be at greater risk of weight cycling than men (Montani, Schults, & Dulloo, 2015).

Weight cycling has been correlated with major health issues and is considered a risk factor for cardiovascular disease (CVD) (Graci, Izzo, Savino, Cattani, Lezzi, & Berselli, 2004). There are several factors that increase CVD risk in weight cyclers including a larger waist-to-hip ratio (WHR) (Cereda et al., 2011), enhanced weight gain, hypertension (Montani, Viecelli, Prevot, & Dulloo, 2006), and decreased overall bone density (Lee et al., 2011). In addition to other casual health consequences of weight cycling is the harmful effects found as part of the "overshoot theory." Overshoot theory specifically describes how the fluctuations in blood pressure, heart rate, kidney filtration, and blood sugar and fat levels that exceed normal values during weight regain can place additional load on the cardiovascular system and contribute to risk of CVD (Montani, Viecelli, Prevot, & Dulloo, 2006).

Underlying physiological factors that may be causal in weight cycling include

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intensity of felt hunger (Pasman, Westerterp-Plantenga, 1999), endocrine balance of the body including levels of leptin, insulin, and ghrelin (Strohacker, McCaffery, MacLean, & Wing, 2014; Crujeiras, Goyenchechea, Abete, Lage, Carreira, & Martinez, 2010; Hooper, Foster-Schubert, Weigle, Sorensen, Ulrich, & McTieman, 2010), adjustments in thermogenesis in order to go into "catch up" mode (Dulloo, Jacquet, Seydoux, & Montani, 2006), and location of adipose tissue on the body including levels of visceral adipose tissue (VAT) and subcutaneous adipose tissue (SAT) (Marquez-Quinones, Mutch, Debard, Wang, Combes, & Roussel, 2010; Viguerie, Poitou, Cancello, Stich, Clement, & Langin, 2005). Weight cycling is also associated with a variety of psycho-social and behavioral factors which may include losing weight without including an increase in physical activity (Field, Manson, Taylor, Willet, & Colditz, 2004), level of self-efficacy (Clark & King, 2000), intense levels of chronic stress and inability to cope (Bryne, 2002), ability to set realistic goals and reach them (Bryne, Cooper, & Fairburn, 2004), and personal health history such as smoking, taking hormones, diabetes, and alcohol consumption (Clark & King, 2000).

One psycho-behavioral factor that may also play a role in weight cycling is mindful eating. Mindful eating is the "non-judgmental awareness of physical and emotional sensations while eating or in a food-related environment" (Framson et al, 2009, p. 1439).   Mindful eating has been found to reduce emotional eating, binge eating, overall body weight, calories consumed per meal, dichotomous thinking related to food, cravings, and has been found to increase amount of weekly exercise (Taper et al., 2009; Timmerman, & Brown, 2012; Alberts, & Raes, 2012).   Trait mindfulness has been found

to be associated with reduced uncontrolled eating, reduced calorie consumption, dietary self-efficacy, lower fat intake, and increased fruit and vegetable intake (Gilbert and Waltz, 2010; Jordan et al, 2014). One component of mindfulness which may play a contributing role in these outcomes is increased self-regulation (Gilbert and Waltz, 2010). Jordan et al (2014) suggest that eating-specific mindful awareness may play an important role in weight management. While there is a great deal of literature on the role of mindful eating in eating disorders and obesity, there is a dearth of studies in the published literature on the association between mindful eating and instances of weight cycling and this study is an attempt to address that gap.

PURPOSE OF THE STUDY

The purpose of this research study was to examine the association between mindful eating and weight cycling in middle aged women.

HYPOTHESES

1) A significant negative relationship will be found between a higher overall mindful eating (MEQ) score and a weight cycling index (WCI) score.

2) A significant negative relationship will be found between the MEQ subdomain of external cues and the WCI score.

3) A significant negative relationship will be found between the MEQ subdomain of disinhibited eating and the WCI score.

4)   A significant negative relationship will be found between the MEQ subdomain of emotional eating and the WCI score.

5)   A significant negative relationship will be found between the MEQ subdomain of awareness and the WCI score.

6)   A significant negative relationship will be found between the MEQ subdomain of distraction and the WCI score.

DEFINITION OF TERMS

Weight Cycling Index (WCI) – A method of quantifying the amount of weight cycling a person has experienced over the course of their lifetime by multiplying the average amount of weight lost by how the number of weight cycles experienced.

Mindful Eating Questionnaire (MEQ) – A questionnaire specifically developed to measure how well an individual utilizes the principles of mindfulness with the consumption of food.

Weight Cycling – A phenomenon associated with the intentional loss of weight and the subsequent regaining of the weight over time.

Moderate Weight Cycler (MC) – Individuals who lost and regained a minimum of 10 pounds at least 3 times in their history.

Severe Weight Cycler (SC) – Individuals who lost and regained a minimum of 20 pounds at least 3 times in their history

Body Mass Index (BMI) – A globally used measurement tool incorporating a person's body weight divided by height squared.

LIMITATIONS AND DELIMITATIONS

The limitations of the study include the use of two mutually independent questionnaires used a single time in an observational study. The very nature of an observational study disqualifies any casual findings from the data and leaves a large amount of room for human error in self reporting techniques. The delimitations of this study are specifically geared towards middle aged women who are considered overweight by their BMI score. Participants were self selected, were not compensated, and were required to physically be present in a lab with a time consuming list of baseline measurements.

METHODS

This study was a secondary analysis of data obtained from a larger study focused on variations in blood pressure in middle aged and overweight women who weight cycle. The study protocol was approved by the Institutional Review Board for Human Subjects at Arizona State University and each subject signed a written informed consent before participation in the study.

Subjects

Seventy-five women, aged 20-60 yr with a BMI > 25 kg/M2 were recruited through electronic and paper "flyers" and announcements. Women were excluded if they answered positively (i.e., yes) on The Physical Activity Readiness Questionnaire (PAR-Q) which indicated that they needed a physician approval prior to participating. Women with known cardiovascular, pulmonary, renal, peripheral vascular disease, Reynaud's

disease or metabolic disease, or having symptoms suggestive of these diseases were also excluded from the study. Women who were current smokers or women with contraindications to exercise were also excluded from the study. Lastly women who were currently pregnant, nursing or were within 12 months of childbirth were excluded.

Procedures

This study was conducted as part of a larger research study examining measures of health in women with a history of body weight cycling. No monetary compensation was awarded to subjects. Women were asked to come to the laboratory on the Arizona State University Downtown campus at the ABC1 building for testing. Upon arrival at the laboratory, the study procedures were explained and consent was solicited. Those who were not excluded were asked to participate in a series of resting and exercise tests that ended with them receiving a packet of questionnaires to complete at home designed to assess their eating behaviors and weight history. Two of the questionnaires was the Weight and Lifestyle Inventory (Wadden and Foster, 1992) and the Mindfulness Eating Questionnaire (Framson,2009).

Measurements

The Weight and Lifestyle Inventory (WALI)

The WALI was used to assess history of body weight cycling. The WALI has been shown to be a reliable representation of subjects reporting their number of diets (test-retest reliability $r = 0.077$) and the total amount of weight lost (Wadden, & Foster, 1992) (test-retest reliability $r=.87$ both P values <0.001). The questionnaire asks questions related to subjects weight history, family weight history, pregnancy history, tobacco (current smokers will be excluded from the study) and alcohol use, eating

habits/patterns, physical activity behaviors, and medical history. Additionally, subjects were asked to complete a grid that asked subjects to indicate the number of pounds lost on one axis and the frequency or number of times they had experienced this level of change on the other axis. Thus for each weight loss episode, e.g. 1-5 lbs, 6-10 lbs, 11-15lbs they were to report the number of times they had experienced this (i.e., 1x , 3x 5x etc). An example of this grid is located in Appendix A. The weight cycling index (WCI) was computed by determining the mean weight loss per cycle by the mean number of times the individual weight cycled (Rodin, 1990).

Weight Cycling Classification

In addition to a total WCI, three weight cycling groups were computed based on definitions from the Nurses' Health Study II (Field, Manson, Taylor, Willet, & Colditz, 2004). Classifications included: <u>non-cyclers</u> were defined as those who reported less than three cycles of 10 lbs or those who had no distinct pattern of weight cycling; <u>moderate cyclers</u> were classified as those who reported at least three weight cycles with a loss of at least 10lbs; and <u>severe cyclers</u> were classified as those who reported at least three weight cycles with a loss of at least 20lbs.

Mindful Eating Questionnaire (MEQ)

The MEQ was developed by Framson et al. (2009) in 2007 with n=303 and a majority of participants being middle aged (42+/-14.4) white women (90%). Items were rated on a 4-point Likert-type scale ranging from 1 "never/rarely" to 4 "usually/always." It has 28 self-report items assessing five domains of mindful eating including:, external cues, awareness, emotional response, disinhibition, and distraction. The mean score for

the instrument in development was 2.92 +/- 0.37, with reliability (Chronbach's) of .64.

The end resulting scores were inversely associated with BMI with those under a BMI of

25 scoring a average of 3.02 and those above or 30 scoring an average of 2.54.

Statistical Approach

Descriptive statistics were computed for the demographics and weight cycling

groups. Pairwise comparisons between weight cycling groups for each variable and

MEQ subscale were explored using Univariate Analysis of Variance (ANOVA). Pearson

Correlations were used to examine the associations between WCI scores and the five

subscales within the MEQ. The relationship between WCI to each MEQ subscale were

plotted and separate trend lines were generated indicating the R^2 between for each weight

cycling groups All data was analyzed using SPSS, v23. P values were calculated

assuming two-tailed hypothesis; $P < 0.05$ was considered statistically significant.

RESULTS

Table 1 presents the basic demographics of age and body mass for the participants

in this study. There were 75 women who volunteered for the study. To be eligible for

the study women were to have a BMI $\geq$ 25 kg/m^2. Participants were on average roughly

40 years old (39.29 +/- 11.01) spanning from 20 to 60 years old. The average body mass

was roughly 87 kg (87.26 +/-21.66) with a minimum mass of 54.2 kg and a maximum

mass of 173.2 kg. The overall mean BMI was 31 kg/m^2 (31+/- 6.8).

Table 1. Basic demographics of subjects

	N	Minimum	Maximum	Mean	SD
Age (yrs)	75	20.00	60.00	39.29	11.01
BMI (kg/M^2)	75	21.30	51.70	31.46	6.83
Body Mass (kg)	75	54.20	173.20	87.26	21.66

As shown in Table 2, of the 75 participants, only 67 completed the MEQ questionnaire appropriately. The MEQ has a score range of 1-4 with five subcategories: disinhibition, external cues, awareness, emotional response and distraction. The mean overall score of the MEQ was 2.68 +/- 0.38. The mean score for the different subcategories for disinhibition was 2.91 +/-0.62; for external cues 2.48 +/- 0.48; for awareness 2.43 +/- 0.62; for emotional response 2.84 +/- 0.78; and for distraction 2.76 +/- 0.72.

Table 2. **Descriptive** statistics related to the subcategories of the MEQ.

	N	Minimum	Maximum	Mean	SD
Awareness	67	1.14	4.00	2.43	0.62
Distraction	67	0.33	4.00	2.76	0.72
Disinhibition	67	1.50	4.13	2.91	0.62
Emotional	67	1.25	4.00	2.84	0.78
External	67	1.00	3.50	2.48	0.48
Mean MEQ	67	1.82	3.45	2.68	0.38

Table 3 provides the mean values of MEQ subcategories by weight cycling classifications. There were significant differences (P< 0.05) in WCI between all the

weight cycling groups such that Non-Cyclers mean score was 35.2 ± 34.8; Moderate

Cyclers the mean score was 69.4 ± 35.2; and for the Severe Cyclers the mean score was

127.0 ± 54.4. The Non-Cyclers were also significantly ($p < 0.05$) younger than both the

moderate and severe cycler groups. Additionally the Non Cycler's body weight and BMI

were smaller than both the Moderate and Severe Cycler groups. There were no

significant differences in any of the MEQ subscores based on WCI groups. However,

there was a possible indication or trend ($P < 0.08$) that Distraction score may be different

between the Moderate and the Severe Cycler groups.

Table 3. Mean values of each MEQ subscale by weight cycling classification. Values are
mean ± (SD).

WCI Classification	Age (Yrs)	BMI (Kg/M²)	Body Mass (kg)	WCI	Awar	Distr	Disin	Emot	Exter
Non-cycler n = 28	35.3 [a] (11.4)	27.9 [a] (4.9)	78.5[a] (21.6)	35.2* (34.8)	2.4 (0.7)	2.8 (0.6)	3.0 (0.7)	2.9 (0.7)	2.5 (0.4)
Moderate cycler n = 16	42.9 (10.4)	31.9 (6.1)	86.5 (18.5)	69.4* (35.2)	2.4 (0.6)	2.5 (0.9)	2.7 (0.7)	2.8 (0.8)	2.6 (0.5)
Severe cycler (n= 19)	41.9 (10.1)	35.4 (6.9)	98.4 (18.3)	127.0* (54.4)	2.4 (0.6)	2.9[b] (0.7)	2.8 (0.4)	2.7 (0.8)	2.4 (0.6)
Total (n=63)	39.2 (11.2)	31.2 (6.6)	86.5 (21.4)	72.1 (56.8)	2.4 (0.6)	2.8 (0.7)	2.9 (0.6)	2.8 (0.8)	2.5 (0.5)

* $P < 0.05$ between all groups. Non cycler < Moderate Cycler < Severe Cycler

[a] $P < 0.05$ between Non Cycler < Moderate Cycler & Severe Cycler

[b] $P = 0.08$ between Moderate Cycler < Severe Cycler

WCI: Weight Cycling Index; Awar: MEQ Awareness; Distr: MEQ Distraction;

Disin: MEQ Disinhibition; Emot: MEQ Emotional Response; Exter: MEQ External Cues;

Table 4 provides a correlation matrix of all relationships between WCI scores and the MEQ subscores. WCI was significantly ($P < 0.05$) correlated with age ($r = .27$) and body weight ($r = .38$). However, there were no significant statistical correlations found between the WCI and any of the MEQ subscales. In fact the correlations were <u>very low</u> ranging from < 0.1 to -0.19.

Table 4
Correlation statistics comparing body weight, age and WCI with MEQ. * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Pearson Correlations									
		Age	bodywt	WCI	Awareness	Distraction	Disinhibition	Emotional	External
Body Wt	Correlation	0.131							
	Sig.	0.263							
	N	75							
WCI	Correlation	**.269***	**.378****						
	Sig.	0.022	0.001						
	N	72	72						
Awareness	Correlation	-0.049	-0.083	-0.176					
	Sig.	0.694	0.506	0.165					
	N	67	67	64					
Distraction	Correlation	0.184	-0.019	0.005	-0.069				
	Sig.	0.135	0.879	0.972	0.578				
	N	67	67	64	67				
Disinhibition	Correlation	-0.021	-0.014	-0.194	.281*	.378**			
	Sig.	0.864	0.908	0.124	0.021	0.002			
	N	67	67	64	67	67			
Emotional	Correlation	-0.015	0.013	-0.058	0.109	0.233	.607**		
	Sig.	0.906	0.918	0.651	0.378	0.057	0		
	N	67	67	64	67	67	67		
External	Correlation	-0.102	-0.099	-0.14	0.229	-0.135	0.023	-0.035	
	Sig.	0.41	0.426	0.271	0.062	0.276	0.851	0.78	
	N	67	67	64	67	67	67	67	
MeanMEQ	Correlation	0.014	-0.06	-0.177	.495**	.540**	.818**	.725**	.272*
	Sig.	0.909	0.632	0.161	0	0	0	0	0.026
	N	67	67	64	67	67	67	67	67

Figure 1 indicates the scatterplot of the relationship between WCI and the mean MEQ. As can be seen from this graph the overall R^2 was extremely low (< 0.03). However, when each weight cycling sub group are separately shown, there is a slight trend (R^2 = - 0.117) that in severe cyclers the lower their WCI the higher their MEQ score. Thus in ONLY those who are severe cyclers about 12% of the variance in mean MEQ score can be predicted from their weight cycling level.

Figure 1 Scatter plot of the relationship between the mean MEQ scores and the WCI separated by WCI classifications.
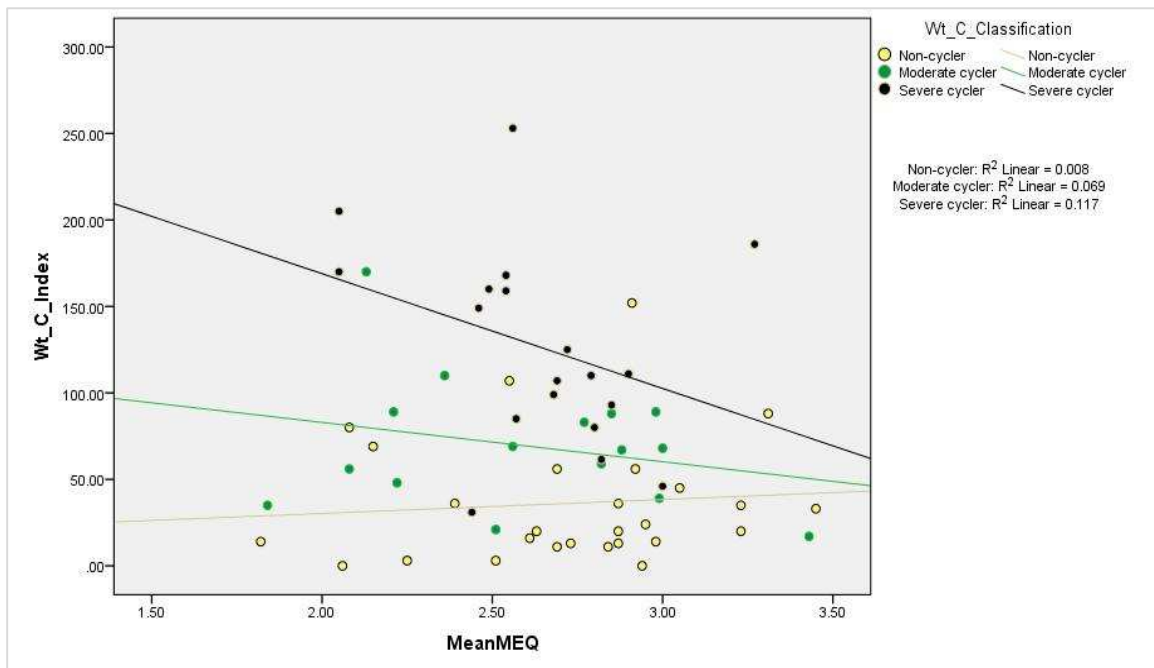
DISCUSSION

The purpose of this study was to explore any relationships that may exist between women who self-report weight cycling and their self-reported levels of mindful eating. It was hypothesized that the WCI score would be negatively related to the overall and

domain MEQ scores. None of the six hypotheses were supported as no significant

relationships were found between the WCI score and any of the MEQ domain scores or

between the WCI score and the overall MEQ score.

The women in this study were middle aged and on-average obese (BMI > 30

kg/M^2). However those in the NC group were significantly younger and weighed less

than those in the MC and SC group. When a partial correlation was conducted correcting

for the influence of age and body weight, the correlations between the variables improved

but were still not statistically significant.

Weight cycling is a complex phenomenon. It is not simply a result of an eating

behavior. The MEQ is a measure of eating behavior. Thus it is likely that the MEQ is not

able to capture any of the behaviors underlying weight cycling behaviors. Alternatively,

it is likely that the Mindful Eating Questionnaire (MEQ) is an insufficiently robust

measure of mindful eating behavior for the purposes of this study. The MEQ has five

subdomains, three of which measure eating behavior (emotional response, disinhibition,

and external cues) and two of which measure eating specific mindfulness (awareness and

distraction). The eating behavior domains in the MEQ were based on similar domains

adapted from the Three Factor Eating Questionnaire (TFEQ)(Stunkard, & Mossick,

1985), the Dutch Eating Behavior Questionnaire (van Strion, Frijtors, Borgors, &

Defanros, 1986), and the Emotional Eating Scale (Arnow, Kenardy, & Agras, 1995;

Framson et al., 2009). The development of the MEQ mindfulness subdomains were based

on a review of established and valid mindfulness measures such as the Mindful Attention

and Awareness Scale (MAAS) (Carlson, & Brown, 2005), the Freiburg Mindfulness Inventory (FMI) (Baer et al., 2006), the Kentucky Inventory of Mindfulness Skills (KIMS) (Baur, Smith, & Allen, 2004), the Cognitive Affective and Mindfulness Scale (CAMS) (Baer et al., 2006), and the Five Factor Mindfulness Questionnaire (FFMQ) (Baer et al., 2006). Mindfulness domains related to observing and noticing sensations, thoughts, and feelings and acting were awareness were adapted to create items specifically related to observing and acting with awareness in relation to eating.

However, convergent validity of the MEQ was not established in relation to the established eating behavior or mindfulness questionnaires used for initial scale development (Framson et al, 2009). Apolzan et al (2016) subsequently found significant relationships between the MEQ subdomains of disinhibition and emotional response and the three subdomains of the TFEQ; the overall MEQ score and the disinhibition subdomain of the TFEQ; the MEQ subdomain of distraction and the MAAS; and the overall MEQ score and the MAAS. While these authors conclude that there is support for convergent validity of the MEQ, this study was conducted on only 40 overweight or obese pregnant women between 18-40 years of age. Hulbert-Williams et al (2014) suggests that although the MEQ possesses good psychometric properties, it does not strongly align with standard definitions of mindfulness or possess a factor structure similar to validated mindfulness scales. Although MEQ constructs were based on a review of domains found in established and validated mindfulness scales, face validity of the item pool was established through review by food and nutrition professionals rather than mindfulness experts. Further research on the convergent validity of the MEQ is

warranted.

Additionally, the MEQ was originally validated primarily on the basis of its association with number of minutes of practice per week and number of years of yoga practice (Framson et al, 2009). The authors suggest that the association of the MEQ score with yoga practice was attributable to mindfulness training and used that association as the basis for supporting the construct validity of the MEQ. The argument that these domains have construct validity based on their association with yoga practice suggests that this measure may be valid as a measure of mindfulness intervention rather than trait or dispositional mindfulness (Quaglia et al., 2015). If so, it is likely that the use of the MEQ in an observational study such as this one would not provide adequate discrimination. One indicator that supports this analysis is that the mean MEQ scores of each of the weight cycling classifications yields scores almost consistently in the middle of the point spread (roughly 2.5). Questions may be constructed such that extreme answers are not selected over moderate answers making it less useful. With the average response in the middle of the scoring range, the instrument fails to predict who would be a non-weight cycler and who would be a severe weight cycler.

Mindful eating has in previous studies been found to be associated with emotional and disinhibited eating. Dalen et al., (2006) found that mindful eating decreased disinhibited eating and Katterman et al., (2014) found in a meta-analysis that mindful eating improved emotional eating. Further evidence of potential problems with MEQ validity can be found in the work of Kidd, Graor, & Murrock (2013). In an 8 week

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mindful eating intervention mixed-methods study with obese participants, these authors found no significant improvement in participants MEQ scores but did find significant changes in measures of eating habit self-efficacy. Additionally, this study included focus group analysis that provided thematic support for changes in eating specific mindful awareness. The authors conclude that the MEQ may not be a reliable measure of mindful eating in an obese population.

On the other hand, Beshara, Hutchinson, and Wilson (2013) found that mindful eating, as measured by the MEQ, fully mediated the relationship between every day, dispositional mindfulness and serving size. The MEQ domains most relevant to moderating serving size were emotional response and disinhibition. The authors conclude that the MEQ may be useful in helping health care professional understand client's psychological and behavioral barriers to healthy eating and serving size control. This study sought to analyze the association between dispositional mindfulness, mindful eating, and serving size selection over a 7 day recall. Perhaps the MEQ is best utilized in studies focused on more recent, acute behavioral characteristics. Given the complexity involved with longer term variables such as weight cycling over the lifespan it is not surprising that the MEQ might lack the discriminatory power needed to determine whether self-report mindful eating is associated with instances of weight cycling.

While to date few studies have utilized the MEQ, as the study and practice of mindful eating becomes more prevalent, more research in the future may be conducted using this instrument. Additional research is necessary to establish the convergent

validity of the MEQ and to determine whether the MEQ is more appropriately used as a measure of eating specific mindful awareness training or a measure of dispositional eating specific mindful awareness.

This study was unable to answer whether eating specific mindful awareness has an association with instances of weight cycling. To date there have been no studies focused on the relationship of mindful eating and weight cycling and this study was a first step in addressing this gap in the literature. Given that eating behavior factors such as disinhibition have been found to be associated with weight cycling and mindful eating has been found to be associated with eating behavior factors such as disinhibition and emotional eating, future research in this area is warranted. Recommendations for future research include the study of the association between mindfulness and instances of weight cycling using established measures of trait or dispositional mindfulness or mindfulness skill. Additionally, research on the effects of mindful eating interventions on instances of weight cycling is needed.

CONCLUSION

In conclusion, no significant relationships were found between the overall or subdomain MEQ scores and the WCI score. It is likely that the primary measure in this study, the Mindful Eating Questionnaire (MEQ), was an insufficiently discriminatory measure for use in an observational study on long term, complex variables such as weight cycling over the lifespan. Further research on the associations among eating behavior domains, mindful awareness skills, and risk of weight cycling is needed.

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APPENDIX A

A REVIEW OF LITERATURE

REVIEW OF LITERATURE

Weight Cycling

In 1994 the Journal of the American Medical Association published a lengthy review article produced by the National Task Force on the Prevention and Treatment of Obesity which declared that the evidence of the harmful effects of weight cycling (WC) do not override the harmful effects of being obese. This report stressed the importance of overlooking the health hazards of weight cycling in favor of the benefits with a disclaimer that weight loss should be a lifelong pursuit with full lifestyle changes (Atkinson et al., 1994). Since that time, evidence has emerged that is counter to this position.

Weight cycling is defined as when an individual intentionally loses weight and then subsequently regains the weight back over time (Field et al., 1999).   Individual attempts to intentionally lose weight as well as professional attempts to help patients or clients lose weight are both common in the US. Evidence suggests that when pharmacological or behavioral treatment interventions are used for weight loss, there is typically a significant amount of weight lost but there is also a high expectation that between 80 and 85% of weight losers will make a full regain of their initial weight over time. (Bryne, 2002; Bryne, Cooper, & Fairburn, 2004; Comieer, 2011) The international definition of a successful weight maintainer is someone who intentionally loses over 10% of his or her body weight and is able to maintain the weight loss for a minimum of 1 year (Marquez-Quinones, Mutch, Debard, Wang, Combes, & Roussel, 2010).

There is some disagreement in the literature on how much has to be gained back from the total weight lost in order to be considered a weight cycler. Some studies use a

percentage of weight as their criteria specifically classifying a level such as 50% of their weight as the cutoff. This means a person would have to regain more than 50% of the weight they originally lost to qualify for the classification of a weight cycler. Other studies have utilized absolute pounds regained as their criteria; some considering a regain of as little as 5 pounds from the lowest weight the participant reached as a weight regain or WC (Bryne, 2002). Variability also exists in the literature in the amount of time between weight loss and weight regain in terms of what can be considered a weight cycle ranging from weight maintenance from 6 months to as long as 2 years (Bryne, 2002).

Weight Cycling's Classification and Measurement

There is variability in the scientific literature on exactly how weight cycling is classified. One classification, termed "severe WC," as presented in the Nurses' Health Study II which ran from 1989 to 1993, is when participants had intentionally lost at least 20lbs at least 3 times in that 4 year time period and repeatedly gained the weight back. Mild WC was classified as those who intentionally lost at least 10lbs at least 3 times in the studies running time and also gained the weight back (Field et al., 1999). For most studies, a single bout of losing weight and gaining a significant portion of the weight back over time is enough to be considered a weight cycle or weight cycler (Bryne, 2002). Other studies have included women who have had up to 12 rounds of WC (Bryne, Cooper, & Fairburn, 2004).

There are two basic research designs used to study variables related to weight cycling: prospective and retrospective. A prospective study is when participants are in intervention that takes place over time and in which researchers follow the participant

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and monitor different factors related to either weight maintenance or weight regain. A retrospective study is where individuals who have lost weight are interviewed to discuss specific factors related to their weight loss, weight maintenance, or weight regain. Both forms of data collection limitations. Prospective studies are often being conducted in a university lab setting resulting in more artificial conditions. Retrospective studies rely on self report measures which can substantially increase error (Bryne, 2002).

Factors Related to Weight Regain and Weight Cycling

The homeostatic regulation of weight, which occurs primarily in the hypothalamus, appears to protect against weight loss more than from weight gain (Sumithran & Proietto, 2013). However, homeostatic hypothalamic regulation is also influenced by a number of psychosocial factors involved in the hedontic pathways such as motivation, reward, cognitive factors, learned behaviors, habits, social context, availability of food, and external visual, olfactory, and taste sensory cues (Comier, 2011, Sumithran & Proietto, 2013).   Kristeller & Epel (2014) point out that among the bio-behavioral processes that can be self-regulated, eating is the most flexible and most easily taken to extremes in both overeating and undereating. In their view, eating regulation is a process of allostasis rather than homeostasis that when dysregulated results in many ups and downs in caloric intake.   Compensatory changes in the biological pathways involved in the utilization and storage of energy predispose individuals to weight regain (Sumithran & Prietto, 2013).

Hormonal Regulation.

Following weight loss there are a number of compensatory changes in circulating

hormones involved in appetite regulation (Hooper, Foster-Schubert, Sumithran & Prietto, 2013; Weigle, Sorensen, Ulrich, & McTieman, 2010). Leptin normally acts in the hypothalamus to reduce food intake and increase energy expenditure; however, leptin levels have been found to decrease significantly following dietary restriction and during weight loss. The reduction of both leptin and insulin as a result of weight and fat mass loss results in increased hunger, reduced satiety signaling to the brain, as well as reduced energy expenditure. These changes have been predictive of weight regain (Comier, 2011; Sumithran & Proietto, 2013). There is evidence that those who have lower baseline as well as post intervention levels of leptin are more likely to WC (Strohacker, McCaffery, MacLean, & Wing, 2014). Crujeiras et al. (2010) found specifically that when research participants experienced small decreases in leptin greater than 5% during intentional weight loss, those individuals had a significantly higher level of WC.

Changes in Metabolism.

Diet-induced reduction of 10% of body weight has been found to result in a reduction of total energy expenditure (TEE) to a level below which can be explained by changes in body mass and body composition (Sumithran & Proietto, 2013). This could result in reductions in resting metabolic rate (RMR) and an increase in cravings for substrates typically higher in caloric density (Comier, 2012; Sumithran & Proietto, 2013).

Sympathetic Nervous System Activity.

One critical factor that appears to play a role in the effects of leptin and metabolism is sympathetic nervous system (SNS) overactivity (Sumithran & Proietto, 2013). Chronic SNS activity results in down-regulation of adrenoreceptors which can

impair energy expenditure. Additionally, reductions in food intake have been found to result in increased circulating cortisol which inhibits the suppressive activity of leptin (Sumithran & Prietto, 2013).

Maximum Lifetime Weight.

Maximum lifetime weight at baseline for an individual attempting to intentionally lose weight has a strong positive association with WC. Those who became obese earlier in life have been found to be more likely to weight cycle than those who became obese later in life and this is also true of those who have previously reported having an eating disorder (Bryne, Cooper, & Fairburn, 2004).

Personal Health History.

Weight cyclers tend to be former smokers, have a history of diabetes in the family, are less likely to be current smokers, have higher energy intake, drink less alcohol and are former postmenopausal hormone users as opposed to being currently on the hormones (Clark & King, 2000).

Health Issues Related to Weight Cycling

Overshoot Theory

Overshoot theory specifically describes how the fluctuations in blood pressure, heart rate, kidney filtration, and blood sugar and fat levels that exceed normal values during weight regain can place additional load on the cardiovascular system and contribute to risk of CVD (Montani, Viecelli, Prevot, & Dulloo, 2006). Fluctuations in food intake contributes to fluctuations in sympathetic nervous system activity which affects blood pressure.   Variability in blood pressure is an independent cardiovascular

risk factor. Additionally, plasma glucose, insulin, triglycerides, and total cholesterol have all been found to overshoot with refeeding and can play a role in increasing vulnerability of the kidneys (Montani et al, 2006).

Total Body Fat and Visceral Fat Accumulation

Initially studies on rats have shown that when given significant caloric restrictions and then allowed to eat whatever they want whenever they want, rats would regain more body fat than the other rats that were always given a choice to eat whatever they wanted whenever they wanted (Montani, Viecelli, Prevot, & Dulloo, 2006). It is theorized that the body enhances its production of lipogenic enzymes during the period of restriction which then can distort the uptake of fat in the refeeding period. On a more long term basis, the genetic or DNA level becomes altered to continue to produce more of the key lipogenic enzymes (Montani, Viecelli, Prevot, & Dulloo, 2006).

Retrospective studies have found that women with a more androgenic body type as opposed to gynoid type were much more likely to have a history of weight cycling which has been linked as a risk factor of cardiovascular disease. In other terms, in obese women, those with a higher hip-to-waist ratio will be more likely to have a history of WC than those with a lower ratio (Montani, Viecelli, Prevot, & Dulloo, 2006).

Cereda et al. (2011) conducted a cross sectional analysis of a large database of Italian citizens specifically created to heighten awareness of obesity and its health risks. They were able to look at the BMI and hip-to-waist ratio over a large population of people and the associated physical activity reports and dieting attempts along with other anthropomorphic measurements. The results of this study conclusively found that WC is

strongly correlated with the accumulation of abdominal fat deposits and overall weight gain. These researchers specifically recommend weight maintenance as a more critical function of a weight intervention than the weight loss aspect of the same application.

Wallner et al. (2004) selected 30 overweight women who had been found to have a history of weight cycling and specifically measured subcutaneous fat from 15 different sites on the body. They found that only in WC was there a significant correlation between BMI and waist-to-hip ratio (WHR). Specifically, the results of this study, although unclearly explained by the authors, found that WC could be identified by specific subcutaneous adipose tissue buildup locations on the body such as the neck.

Enhanced Weight Gain

There is increasing evidence that each round of WC is linked to an increase in a person's weight beyond that which they originally started. (Montani, Viecelli, Prevot, & Dulloo, 2006).

Hypertension

Linking hypertension with WC seems to be a population specific risk factor. In obese women with a history of weight cycling compared to non-obese women, WC was a strong predictor of hypertension. In other populations such as Japanese men who were not obese, dynamic weight history was an indicator of hypertension. Although the mechanism is unknown WC may play a role in disrupting the normality of the body's day and night blood pressure routine which may have other health consequences (Montani, Viecelli, Prevot, & Dulloo, 2006).

In a 2 year cross sectional investigation of a large cohort of middle-aged Germans

(n = 12362), the researchers identified 180 had become hypertensive when they previously were not considered hypertensive and of these cases, controlling for BMI, they found that weight cycling was strongly positively associated with incidence of hypertension compared to other obese individuals who had been able to maintain weight. The finding was strong enough to support the hypothesis that weight cycling is a risk factor for hypertension (Schulz et al., 2005).

Guagnano et al (2000) studied obese women between the age of 25 and 64 years old without a history of hypertension, who did not smoke, who had normal levels of cholesterol and who were not diabetic. When these participants were screened for the previous 5 year history of WC they also had their WHR measured and it was found that the participants who WC had greater WCR and that there was a strong increase in the risk of hypertension.

Type 2 Diabetes and Insulin Resistance

While WC may not directly influence insulin resistance, studies have found that WC plays a moderating role on insulin sensitivity. For example, one study found that obese participants had a greater history of WC than non-obese participants and that the obese participants had a higher level of insulin resistance (Anastosiou et al., 2010).

Zhang et al. (2005), was able to follow a large cohort of Japanese men numbering in the 600's for a longer period of time and found that of this population, those who had a number of reported WC did in fact have a significantly higher level of blood plasma fasting glucose classifying WC as a possible risk factor for increased insulin resistance.

Dyslipidemia

In a cross sectional study of 485 women of which nearly 30% reported well established WC; defined specifically as intentionally losing more than 4.5 kg of weight at least three times, had on average 7% less HDL-C levels in their blood than the non-cyclers and demonstrated a dose response with the greater classification of WC resulting in lower HDL-C blood lipid profile (Olson et al., 2000).

Cardiovascular Disease (CVD)

A retrospective study conducted by Craci et al. (2004) involving 340 females and 119 males up to age 65 and with a minimum BMI of 30 were interviewed as well as subjected to baseline blood and health tests to specifically looking at the different risk factors for CVD. Some of the questions asked in the interview included an investigation into the quantity of previous diet episodes, the highest amount they had ever lost in an cycle, what was the highest amount of weight that was regained in a cycle, the total amount of weight lost in all of their cycles, what the total percentage of their body weight they had lost all together in their life and the total amount of weight regained as a percentage. Many of the risk factors related to CVD such as the waist-to-hip ratio were found to increase in association to the subject's history of WC. This lead to the conclusion that WC can play a significant role CVD.

Bone Density

During a substantial bout of weight loss there is an estimated 3 to 6% loss in bone mineral density. Fogelholm et al. (1997) conducted a weight loss study involving 169 premenopausal women ages 29 to 46 that looked specifically at their BMD. Dietary

intake was closely monitored and the BMD was measured with DXA scans specifically on the lumbar spine, femoral neck and distal radius. The researchers found that there were negative associations between lower spine and distal radius BMD with decreasing weight.

When applying these principles to the elderly, a large study conducted in Norway looked at elderly men with a mean age of 71.6 from those who had been examined 28 years prior as part of a follow up study, researchers discovered that those who had weoght cycled a minimum of 4 times were 2.91 times more likely to have bone fractures on non-weight bearing bones than those who did not WC. Thus BMD loss of those who WC will compromise bone health later in life (Sogaard, Meyer, Tonstad, Haheim, & Holme, 2008).

Mindful Eating

One way to define mindful eating as an action is to first define its antithesis, mindless eating. Mindful eating is "eating [that] has been identified as a barrier to effective monitoring of serving size, and refers to unconscious overconsumption by cues other than physiological hunger" (Beshara , Hutchingson , &Wilson, 2013). Mindful eating is "eating while fully aware of the process, noticing both the pleasantness and internal and external states influencing hunger and satiety, and desire for food" (Kristeller & Epel, 2014, p. 913). Framson (2009) refers to mindful eating as the non-judgmental awareness of physical emotional sensations while eating or in an environment related to food.

Monroe (2015) suggested five principles that underlie the concept of mindful

eating including: an ability to reduce the rate of food consumption; the ability to assess

personal hunger and current state of satiety; an ability to reduce the amount of food per

portion, the removal of external stimuli or distractions; and finally the ability to sincerely

savor the food being consumed (Monroe, 2015).

Mindful Eating Questionnaire

The Mindful Eating Questionnaire (MEQ) was designed with the purpose of

"allowing nutrition researchers to investigate whether and how mindful eating skills are

acquired through different practices/interventions and also whether and how mindful

eating is associated with healthful dietary behavior and related health outcomes"

(Framson et al, 2009, p. 1440).   The MEQ has five subscales, three of which measure

eating behavior (emotional response, disinhibition, and external cues) and two of which

measure eating specific mindfulness (awareness and distraction). The eating behavior

subscales in the MEQ were based on similar domains adapted from the Three Factor

Eating Questionnaire (TFEQ), the Dutch Eating Behavior Questionnaire, and the

Emotional Eating Scale (Framson et al., 2009). The development of the MEQ

mindfulness subscales were based on a review of established and valid mindfulness

measures such as the Mindful Attention and Awareness Scale (MAAS) (REF), the

Freiburg Mindfulness Inventory (FMI) (REF), the Kentucky Inventory of Mindfulness

Skills (KIMS) (REF), the Cognitive Affective and Mindfulness Scale (CAMS), and the

Five Factor Mindfulness Questionnarie (FFMQ) REF). Mindfulness domains related to

observing and noticing sensations, thoughts, and feelings and acting with awareness were

adapted to create items specifically related to observing and acting with awareness in

relation to eating. Items were generated for each of the eating behavior and mindfulness domains resulting in 40 items based on a Lickert type scale of "never/rarely", "sometimes", "often", and "usually/always". Some items were given the option of "not apply". Items were clarified through in-person and phone interviews and reduced to thirty-seven. The 37 item scale was administered to nutrition professionals for face validity and further item refinement.

The MEQ was administered to seven convenience samples including participants from a yoga studio, a university fitness facility, a software development company, a nonprofit company, and teachers and administrators from a preparatory school with a final participant pool of 303. Of these categories, the study population was predominantly white females, age 18-80, who were well educated and who engaged in moderate exercise per week. Cronbach's alpha was used to measure internal consistency reliability which ranged from 0.64 to 0. 83. Reliability of the overall MEQ score was 0.64. Pearson correlations among subscales and between the subscales and summary score ranged from 0.51 to 0.71. Mean MEQ score was 2.9 ± 0.37.

Mean and all subscales MEQ had significant, strong, inverse relationship with BMI and regular yoga practice was associated with higher MEQ score. The authors suggest these findings provided support for construct validity of the MEQ in the study sample population. However, convergent validity of the MEQ was not established in relation to the established eating behavior or mindfulness questionnaires used for initial scale development (Framson et al, 2009). Apolzan et al (2016) subsequently found significant relationships between the MEQ subdomains of disinhibition and emotional

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response and the three subdomains of the TFEQ; the overall MEQ score and the

disinhibition subdomain of the TFEQ; the MEQ subdomain of distraction and the MAAS;

and the overall MEQ score and the MAAS in a sample population of obese, pregnant

women. These authors conclude that there is support for convergent validity of the MEQ.

However, Hulbert-Williams et al (2014) suggest that the MEQ does not possess a factor

structure similar to well-researched and validated mindfulness scales. Future research to

establish convergent validity of the MEQ is needed.

Eating Behavior, Mindful Eating and Weight Cycling

Eating Behavior and Weight Cycling

   Feelings of Hunger. Feelings of hunger, which can be measured by the Three

Factor Eating Questionnaire (TFEQ), have been found to have a relationship between

weight maintenance and WC.   Pasman et al. (1999) found that when a participant had a

higher baseline score related to the TFEQ hunger scale or to questions related to feelings

of hunger, there was a significant ability to predict weight regain within a 14 month

follow up.

   Stress Related Eating.   Life's stressors and an individual's coping skills have

been found to be negatively correlated to the ability to maintain weight especially for

those who have experienced major illnesses and relationship losses. In one study those

who had predetermined coping responses to life's stresses such as a dinner table

argument were more likely to have a negative relationship with WC **(**Bryne, 2002).

   The role perceived stress plays on WC is interesting because some, when stressed,

tmay be found to naturally lose weight while others, when stressed at the same levels,

may gain weight. Because of this fact, both cross-sectional and longitudinal studies report mixed results regarding the role stress plays on WC. Depending on where the stress is derived from, such as a job, and depending if a person can be considered an "emotional eater" will play a huge role in the level of weight a person gains. Over time, studying the connection between stress and weight required an interest in dynamic weight change in general. Limiting the research to this parameter, a longitudinal study found that those who were already overweight or obese were the ones who were most likely to experience the greatest change in weight related to stress (Block, He, Zaslavasky, Ding, & Ayanian, 2009).

Disinhibition. Disinhibition has been defined as the inability to stop eating when full (Framson, 2009). Carmody, Brunner, & Jeor (1994) found in a 5 year prospective study specifically looking at those with a number of known cardiovascular risk factors as well as a history of weight cycling that disinhibition was a significant factor found for those with a history of weight cycling and weight fluctuations especially in women.

Mindful Regulation of Eating Behavior

Kristeller & Epel (2014) remind us that eating is a model of allostasis in which caloric intake is influenced by internal signals interacting with the environment. Mindfulness has been found to play a role in eating behavior factors such as stress and emotional eating, disinhibition, hunger, and external cues. One factor that plays a role in the effects of mindfulness on eating behavior is interoceptive awareness.

Interoceptive Awareness. Interoceptive awareness is the awareness of body sensations such as those related to eating (e.g., hunger and satiety), other physical

experiences (e.g., fatigue and thirst), and relevant mental states (e.g., thoughts and emotions) (Kristeller & Epel, 2014). This type of interoceptive awareness is the basis for being able to become more aware of the appeal and flavor of food when eating, of decisions to initiate eating and when to stop, and of decisions about the psychological and physiological value of food.

Stress and Emotional Eating. Stress eating, or emotional eating, is eating in response to a specific stressor with implied negative affect. Several studies have found that mindfulness appears to play a role in reducing emotional eating. Elfhag, & Rossner (2005) found in a large review of literature that a significant risk factor for weight regaining is when individuals eat in response to negative emotions, when they feel stressed or when they are in a pattern of reacting to problems in a passive manner. A well designed analysis of the association between dispositional mindfulness and serving size found that mindful eating fully mediated the negative associate with serving size. The domains of mindful eating most influential on serving size selection were emotional and disinhibited eating (Beshara, Hutchingson, & Wilson, 2013).

Alberts, & Raes (2012) conducted an eight week randomized controlled mindfulness based intervention on adults between the ages of 18 and 65 with non-clinical eating disorder problems of emotional eating, consuming food without being aware, eating too much food, eating food in response to stress. There were 14 participants in the control group and 12 in the experimental group. Measurements were taken at baseline and conclusion and included weight, inventories including the Dutch Eating Behavior

Questionnaire, the Kentucky Inventory of Mindfulness Skills, the Dichotomous Thinking Scale, and food craving measurements. Sensitivity to emotional eating and external eating were significantly reduced in the mindfulness intervention group.

A meta-analysis found that mindfulness based interventions were effective in decreasing binge eating and emotional eating in individuals reporting elevated levels of these eating behaviors. There were two studies that examined emotional eating that demonstrated moderate to large effect sizes. The caveat is that this review looked at primarily short term interventions and lacks any long term data (Katterman et al., 2014).

Dalen et al., (2006) conducted a pilot study working with 10 obese patients in a six week two hour mindful meditation and mindful eating class. Significant reductions in eating behavior factors of cognitive restraint and disinhibition were found at 6 weeks and at 12 weeks of follow up with large to moderate effect sizes.

One major aspect of obesity is emotional eating which is a tendency to over eat in direct response to a negative stimulus or in response to a positive stimulus such as a good tasting food. Previous studies found that if techniques to control the emotional aspect of eating were in place, there was a strong possibility of maintaining weight up to 1 year.
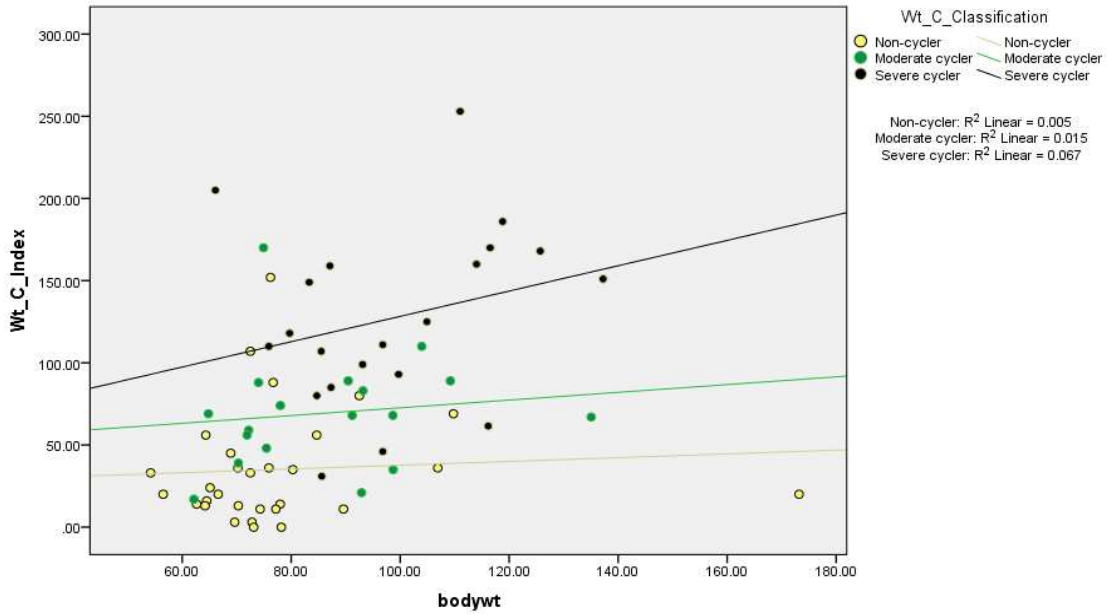
APPENDIX B

ADDITIONAL FIGURES

Figure 2

A scatter graph with fitted line comparing the positive relationship between a greater overall body weight (kg) and a higher score on the WCI. The different colors represent different classification of weight cyclers.
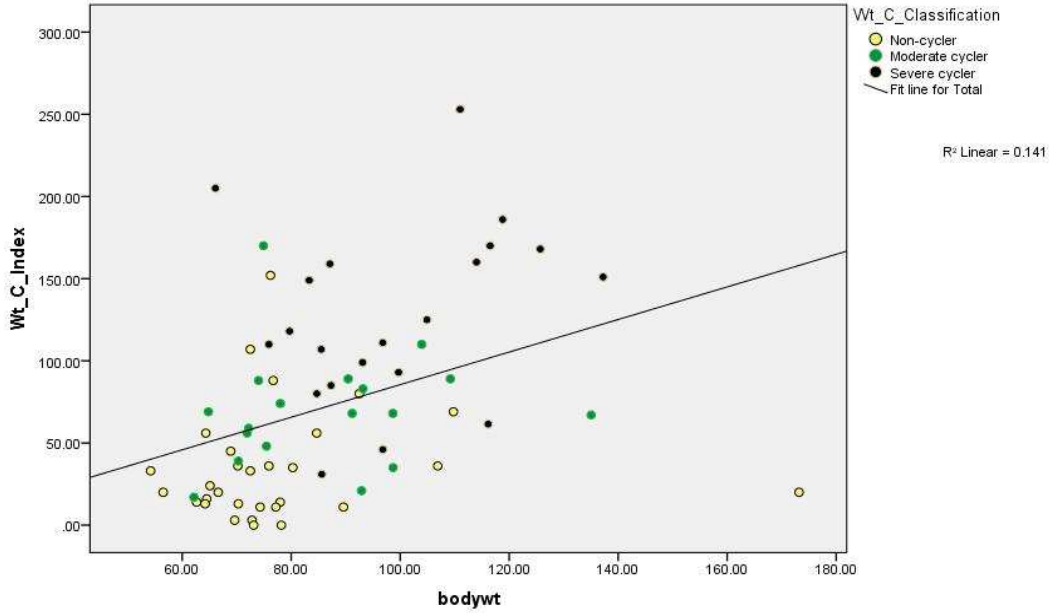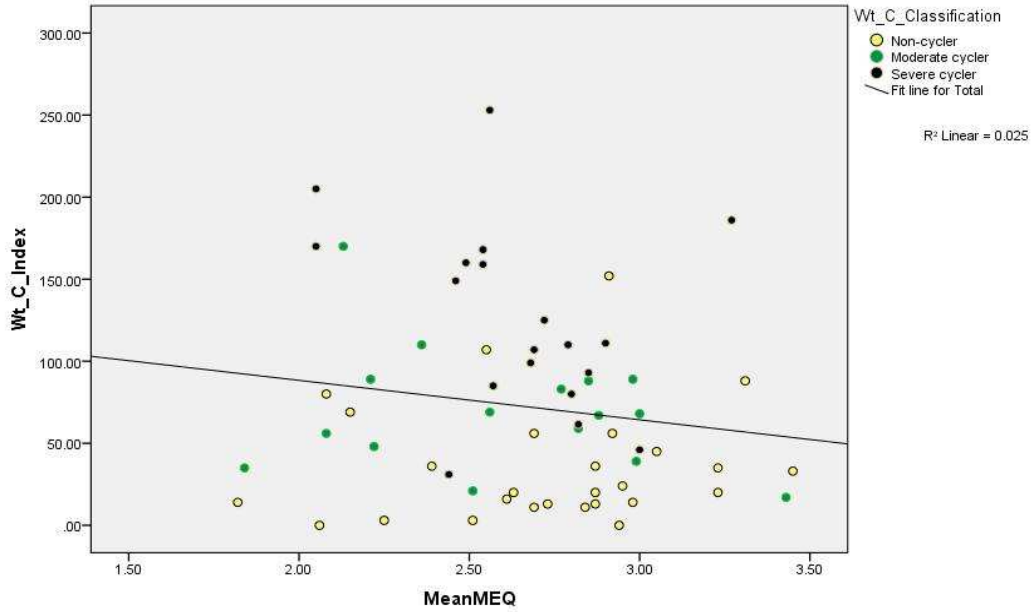

Figure 3

A second scatter graph related to table 7 but with broken out fitted lines corresponding with the different classes of weight cycling.
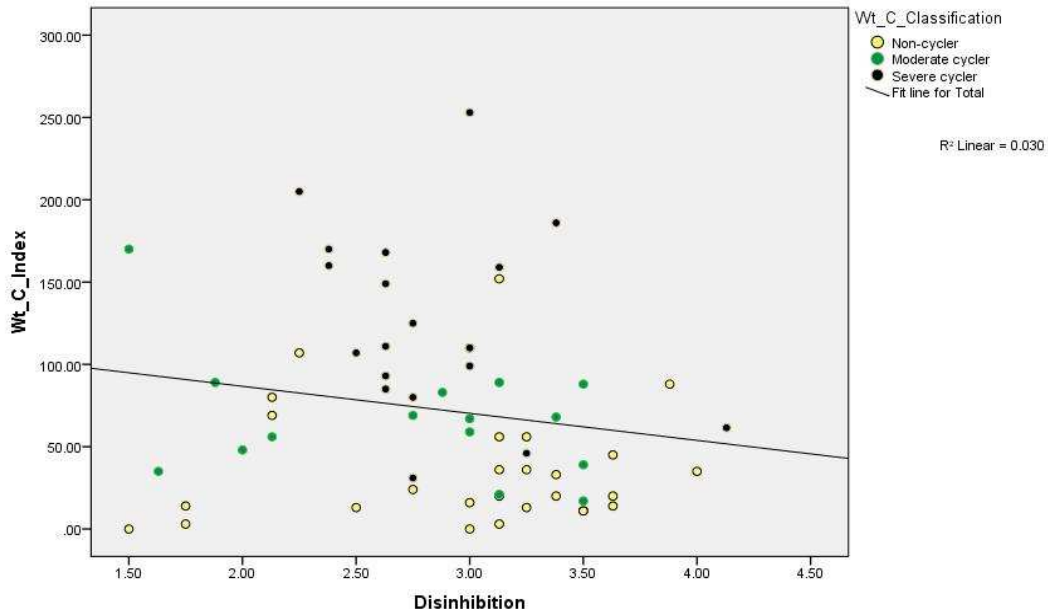
Figure 4

A scatter graph with fitted line comparing the negative overall relationship between a greater overall score on the WCI and a higher score on the MEQ.
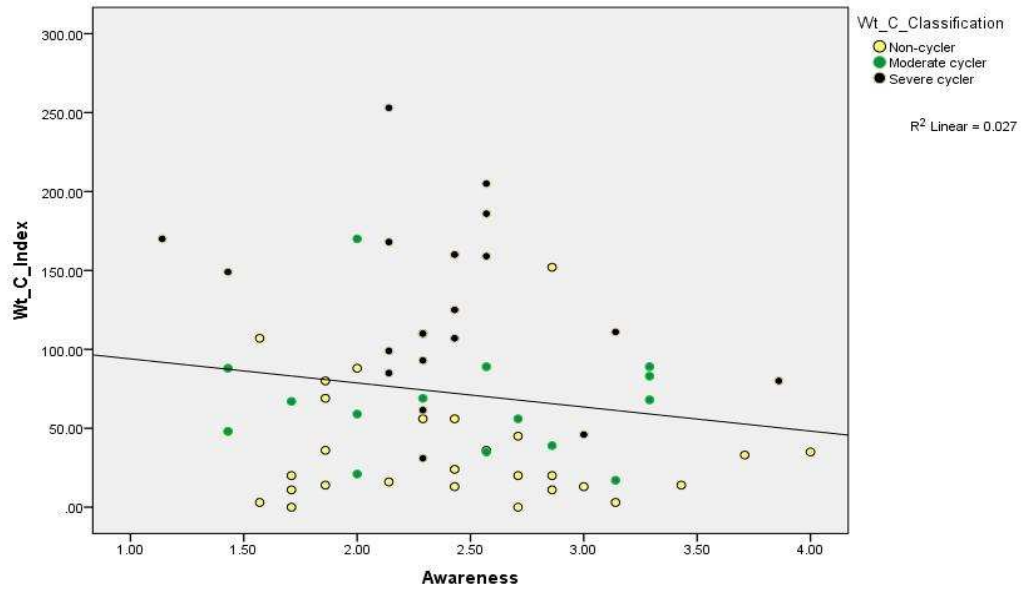

Figure 5

A scatter graph with fitted line comparing the negative overall relationship between a increasingly positive score of disinhibition and a higher score on the WCI.

Figure 6

A scatter graph with fitted line comparing the negative relationship between a greater overall level of awareness and a higher score on the WCI.

APPENDIX C

MINDFUL EATING QUESTIONNAIRE

Mindful Eating Questionnaire

Questions: (Never/Rarely; Sometimes; Often; or Usually/Always)

1. I eat so quickly that I don't taste what I'm eating.
2. When I eat at "all you can eat" buffets, I tend to overeat.*
3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.
4. I recognize when food advertisements make me want to eat.*
5. When a restaurant portion is too large, I stop eating when I'm full.
6. My thoughts tend to wander while I am eating.
7. When I'm eating one of my favorite foods, I don't recognize when I've had enough.
8. I notice when just going into a movie theater makes me want to eat candy or popcorn.*
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.
10. I notice when there are subtle flavors in the foods I eat.
11. If there are leftovers that I like, I take a second helping even though I'm full.
12. When eating a pleasant meal, I notice if it makes me feel relaxed.
13. I snack without noticing that I am eating.
14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.
15. I stop eating when I'm full even when eating something I love.
16. I appreciate the way my food looks on my plate.
17. When I'm feeling stressed at work, I'll go find something to eat.*
18. If there's good food at a party, I'll continue eating even after I'm full.
19. When I'm sad, I eat to feel better.
20. I notice when foods and drinks are too sweet.
21. Before I eat I take a moment to appreciate the colors and smells fo my food.
22. I taste every bite of food that I eat.
23. I recognize when I'm eating and not hungry.*
24. I notice when I'm eating from a dish of candy just because it's there.
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.
26. I notice when the food I eat affects my emotional state.
27. I have trouble not eating ice cream, cookies, or chips if they're around the house.
28. I think about things I need to do while I am eating.

*Included an n/a option

APPENDIX D

SECTION E: WEIGHT LOSS HISTORY (WALI)

Section E: Weight Loss History

(Taken from the WALI questionnaire)

SECTION E: WEIGHT LOSS HISTORY

1. Please record your major weight loss efforts, (i.e., diet, exercise, moderation, etc.) which resulted in a weight loss of 10 pounds or more. Take time to think over your previous efforts, starting with the first one, whether in childhood or adulthood. You may have difficulty remembering this information at first, but most people can if they take their time. Start with your first weight loss effort and proceed in order until you reach your most recent one.

	Age at time of effort	Weight at start of effort	# lbs. lost	Method used to lose weight
a.				
b.				
c.				
d.				
e.				
f.				
g.				
h.				
i.				
j.				

2. Please pick a number from 1 to 10 to indicate below how accurate you think you were in remembering and recording your weight loss history. Pick any number from 1 to 10: 1= not at all accurate and 10= completely accurate. Your number is _____

3. In the past year, how many times have you started a weight loss program on your own that lasted for more than 3 days? _____

4. In the past year, how many times have you started a weight loss program that lasted for 3 days or less? _____

5. Have you ever experienced any significant physical or emotional symptoms while attempting to lose weight or after losing weight? (circle one) Yes   No

If yes, please describe your symptoms, how long they lasted and the type of professional help that was sought, if any, Problem; Year; Duration; Type of Help

49

Weight cycling Index

Do not include weight gain or lose related to pregnancy or sickness

Pounds Lost					
20-50 lb's					
16-20 lb's					
11-15 lb's					
6-10 lb's					
1-5 lb's					
	0	1-5 times	6-10 times	11-15 times	>15 times
	Number of times you lost that amount of weight				
	1	2	3	4	5

BIOGRAPHICAL SKETCH

Jared McDonald Smith was born in Mesa, Arizona on February 16th, 1985. He attended elementary school at Harris Elementary in the Gilbert School District where he went on to attend Gilbert Jr. High and Gilbert High School. In high school he played the cello in the school symphony, was a 3 year varsity football player, 4 year varsity track & field athlete, as well as a committed Eagle Scout. After high school he attended Mesa Community College for a year before he set off and completed a two year LDS mission in Houston, Texas between May 2004 and June 2006. He received his Bachelors of Art in Economics with a minor in Business from Brigham Young University in April 2011. From there he spent several years as a financial consultant out of Scottsdale brokering and valuing businesses. While at Arizona State University he particularly became involved in understanding obesity with a greater depth and hopes to apply the learning as both a coach and teacher.