

The Relationship between Neuroticism, Self-Esteem, and Disordered Eating Attitudes:
Examining the Health at Every Size Theory

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Abstract

Background. In the modern day treatment of overweight/obesity, conflicting recommendations regarding treatment have been released by the Academy of Nutrition and Dietetics (AND) and advocates of the Health at Every Size (HAES) movement. While the AND have indicated their support for self-monitoring practices, such as keeping a food diary or tracking calories, HAES advocates have claimed that these restrictive practices may result in increased disordered eating tendencies and poor self-esteem.

Subjects. The participants for this study included 410 students at Grand Valley State University. Almost 80% of participants were female, and just over 85% of participants identified as white.

Methods. Participants completed three self-report measures through the online survey system Qualtrics: the Rosenberg Self-esteem Scale (RSES), which evaluates self-esteem; the EAT-26, which is a measure of characteristics of eating disorders, and eight items from the Big Five Inventory that measures an individual's level of neuroticism. These data were analyzed using regression models, correlation, and Mann-Whitney U tests conducted with SPSS v.20 software.

Results. Diet tracking was significantly correlated with increased disordered eating attitudes and behaviors, as well as lower self-esteem. Self-esteem was found to be a significant negative predictor of scores on a measure of disordered eating attitudes and behaviors. Individuals who diet tracked scored higher on a measure of disordered eating. Finally, lower scores on a measure of neuroticism significantly predicted greater frequency of meeting dietary goals.

Conclusion. This study confirmed previous research findings on the correlative links between self-esteem, diet tracking, and disordered eating attitudes and behaviors. The recommendations provided by the AND and HAES proponents each have some value in health management, as demonstrated by the work of previous studies. However, the limitations of the available research

and lack of data on this topic in more diverse populations suggest that additional research is required to comprehend the most optimal integration of treatment methodologies. Findings from this study support a multi-modal approach to weight management that combines mental health screening with traditional diet tracking approaches.

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Definition of Terms and Abbreviations

Body Mass Index (BMI): a weight-to-height ratio, calculated by dividing an individual's weight in kilograms by the square of their height in meters. BMI acts as a screening tool for weight or body fatness, categorizing an individual as underweight, normal or healthy, overweight, or obese. BMI does not directly measure body fat, but has been shown to be correlated with more direct measurement tools (such as skinfold calipers), as well as various metabolic and disease outcomes related to body fatness (such as type II diabetes mellitus or hypertension).¹

Disordered eating attitudes and behaviors: Behaviors and attitudes that are prevalent among a population of individuals with an eating disorder. This means that the presence of some amount of these attitudes/behaviors are necessary, but not sufficient for an ED diagnosis.

Diet tracking: Behaviors such as keeping a food log or journal, monitoring or limiting intake of a food or food group, or counting calories.

Eating Disorder: or ED; anorexia nervosa or bulimia nervosa

Health At Every Size (HAES): Trans-disciplinary movement that shifts the focus of health recommendations from weight management to overall health promotion. The primary intent is “to support improved health behaviors for people of all sizes without using weight as a mediator,” with the understanding that weight loss may or may not be a side effect of adopting these non-weight-focused health promoting behaviors.²

Self-esteem: Confidence in one's own abilities and value/worth²

Introduction

In recent years, an increasing number of health professionals have begun to adapt a new perspective in providing treatment that originates from the “Health at Every Size” (HAES) movement. This theory proposes that the weight-focused nature of health treatments may be potentially detrimental to the self-esteem and mental health of patients clinically categorized as overweight or obese.² There is often stigma associated with failure to achieve weight-related goals. As a result, proponents of the HAES movement claim that overweight and obese individuals face a higher risk of developing disordered eating behaviors and weight discrimination in their personal lives, work environment, and in the healthcare system.² In the practice of dietetics, many proponents of HAES have shifted towards a “non-diet,” intuitive eating approach to nutritional counseling for weight management, where focus is placed upon the size-acceptance perspective and less on behaviors that emphasize any cognitively-imposed dietary restrictions.² This practice aims to reduce the amount of physical, emotional, and spiritual distress that might occur when the individual “fails” to lose weight, despite attempts to follow the frequently-advised “eat less, move more” recommendation.³ However, a division seems to have formed between dietetic practitioners who advise for or against “dieting” behaviors as part of nutrition therapy, with no clear answer as to whether any sort of restrictive behaviors can be beneficial to weight management.

The size-acceptance practices that the HAES movement endorses contradict certain accountability and self-regulating behaviors that have been recommended by the Academy of Nutrition and Dietetics (AND) and other healthcare providers in the treatment of overweight or obesity.^{4,5} These resources recommend practices such as keeping a food diary, monitoring or limiting intake of calories or specific foods (such as energy-dense foods or sugar-sweetened

beverages), and obtaining regular weight checks to achieve and maintain weight loss.^{5,6} Specifically, proponents of the HAES movement have associated these self-monitoring practices with an increased risk for disordered eating attitudes and behaviors by claiming that they contribute to reduced self-esteem and an unhealthy fixation on weight-related outcomes.^{2,7} Long-term sustainability of most weight loss interventions appears relatively poor, with participants regaining on average up to 30-40% of their lost weight within a year, and a gradual return to baseline weight levels (or above) within 2-5 years.⁸ HAES advocates have cited research indicating that a non-diet approach to obesity treatment resulted in improved physiological, behavioral, and psychosocial outcomes, and that weight losses in HAES-practicing individuals were more long-lasting than those in conventional dieting groups.²

Despite these findings, other scholars have pointed out that the HAES movement may not be the most optimal practice as a public health approach to addressing obesity.³ Besides the fact that innumerable research studies have linked the loss of excess body fat with an decreased risk for developing a range of detrimental health conditions, the available research on this non-diet perspective has demonstrated numerous limitations regarding items such as study size, design, generalizability, evaluation of psychological outcomes, and applicability to various personal and social influences.³ Even a modest weight loss of 5-10% of total body weight has been shown to produce health benefits, which can make a significant difference for individuals who are already overweight or obese.¹ Research has demonstrated that long-term, sustainable weight loss may be possible, but requires more significant and comprehensive therapy in both dietary and lifestyle changes.^{9,10} Therefore, promoting HAES as a reliable public health approach to obesity may be considered too hasty, until these limitations are adequately addressed.³

This study examines the contradictory recommendations given by HAES practitioners, and the guidelines provided by the Academy (AND), in regard to the implications of diet tracking practices on disordered eating risk. As registered dietitians, we are ethically bound to practice the principles of autonomy, non-maleficence, beneficence, and justice.¹¹ Practicing within these principles requires a strong grasp of the purpose of our practice and the rationale behind our recommendations. In order to provide dietary recommendations that are in the best interest of our clientele, we should seek to utilize evidence-based research and ethics to guide our decision-making and practice.¹² Additionally, we ought to continually improve our own knowledge base and remain up-to-date on current research, so that we may recognize how to refute inaccurate dietary recommendations and provide appropriate corrections. Research regarding emerging issues such as the HAES debate should be analyzed critically, to ensure its reliability and implications for positive patient outcomes and overall well-being.

Literature Review

Eating Disorders: Correlations with Self-Esteem, BMI, and Neuroticism

Anorexia nervosa (AN) and bulimia nervosa (BN) are the two most common eating disorders (EDs), with high morbidity and mortality rates.¹³ The *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) characterizes anorexia nervosa by the presence of excessive dieting and disordered body image, leading to severe weight loss with a pathological fear of becoming fat.¹⁴ Bulimia nervosa is defined by a similar desire to avoid weight gain, accompanied by frequent periods of binge eating and self-induced vomiting.¹⁴ While the individual's weight and outward physical symptoms may differ (i.e. severe caloric restriction or binge-purge cycles, respectively) between the two diagnoses, core symptoms- such as body dissatisfaction, low self-esteem, and preoccupation with food and weight- remain consistent between the two.¹⁵ Although eating disorders can affect both males and females, research has demonstrated that they are up to 10 times more prevalent among females.¹⁶

Most researchers agree that multiple factors may contribute to the development of disordered eating attitudes and behaviors.^{15,17} Efforts towards determining causative factors are impeded by difficulties in creating consistent and reliable research environments, as diagnosed cases may vary significantly and are difficult to control.¹⁵ For this reason, many studies focus on isolating correlates of eating disorders, with the hope of arguing that strong correlates are causative factors.¹⁵ Functionally, knowing the temporal order of two variables that are correlated allows a researcher to make an inference about a causative relationship.

An increasing amount of research over recent decades has focused on the role of psychological health in eating attitudes. Self-esteem has been well-researched and thoroughly documented as a risk factor for disordered eating attitudes, with studies demonstrating that low

self-esteem can predict disordered eating symptomatology.^{18, 19} Research comparing ethnic and gender differences regarding self-esteem and disordered eating attitudes among elite college athletes found that white female athletes reported significantly lower self-esteem, and were determined to be at greater risk for EDs.²⁰ A study performed on a sample of obese women found that self-esteem mediates the relationship between weight-related self-devaluation and restriction behaviors and weight concerns, suggesting that women with lower self-esteem may have greater diet-related problems and require more consideration in healthcare.²¹ Finally, in a sample of normal weight and obese adolescents, body shame was found to mediate the relationship between self-esteem and eating disorder risk.²² This result is not surprising, considering the increased emphasis that modern culture puts on individuals to maintain a healthy BMI and avoid excess weight gain, through mass advertising and media. In order to further explore the claims made by the HAES advocates in regard to dieting behaviors and ED risk, this study will further investigate the role of self-esteem as a mediating variable in this relationship.

The personality trait of neuroticism has also been strongly linked to an increased risk for developing ED attitudes or behaviors. The Five Factor Model (FFM) encompasses five broad categories of personality traits that have been studied by multiple researchers over the past few decades: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness/Intellect.^{23,24} Neuroticism describes the “tendency to experience negative emotion and related processes in response to perceived threat and punishment, which include anxiety, depression, self-consciousness, and emotional lability.”²⁴ Individuals who score high in this trait are more likely to demonstrate mood swings, high stress, irritability, or sadness, while those scoring low in this trait tend to demonstrate more emotional stability and resilience.²⁵ In both college-age and adult samples, women generally scored higher than men on a measure of

neuroticism.^{26, 27} Furthermore, women also tend to score higher on indices of anxiety or low self-esteem.^{28, 29} Studies show that neuroticism has been more strongly correlated with dysfunctional eating behaviors than traits such as anxiety or depression alone, in a population of morbidly obese patients.³⁰ Neuroticism was also found to be the largest contributor in predicting disordered eating in a population of female patients with eating disorders, while another study found a positive correlation between disordered eating and high scores on a measure of neuroticism in a population of female undergraduate students.^{31, 32} As a result, there is cause to further investigate the role of neuroticism in relationship to the variables of eating disorder risk and dieting behavior.

Eating Disorders and Diet Tracking

Multiple research articles have demonstrated that the use of fitness trackers and food diaries (such as MyFitnessPal, a smartphone app designed to help individuals who are interested in tracking their dieting activity) have produced successful long-term weight loss in thousands of individuals, as these diet-tracking activities are considered part of the self-monitoring behaviors that are essential to long-term weight loss and maintenance.⁹ An article discussing the use of digital health trackers found weight loss to be significantly higher during periods of high adherence to food and weight tracking, along with activity tracking.³³ A systematic review of three components of self-monitoring (diet, exercise, and self-weighing) in behavioral weight loss studies found a consistent association between self-monitoring in weight loss, but recognized significant limitations to the findings related to homogenous samples and reliance on self-report data.⁴ A high frequency and consistency of dietary self-monitoring produced beneficial outcomes on weight loss in a study of 220 obese women; an association that was partially mediated by adherence to daily caloric intake goals.⁹ The authors also believe that maintenance

of these behaviors following the desired weight loss period may aid in reducing the commonly observed weight regain during the maintenance phase, indicating that the effectiveness of sustained dieting behaviors may be related to the length of time that they are sustained.⁹

However, these studies did not discuss any of the potential psychological or emotional changes that may have occurred in the participants during the study period, that could further illuminate the aftereffects of engaging in long-term diet behaviors.

Intersection of Diet Regulation, Disordered Eating, and Mental Health Traits

There is far less research examining whether weight loss achieved through dietary restraint also affects individuals' self-esteem or the development of disordered eating attitudes. Despite the multiple studies reporting successful weight-loss outcomes through diet tracking, there have been a few reports that may suggest an association with increased risk for disordered eating attitudes and behaviors.^{34,35} This self-regulation of eating behavior is a characteristic of typical dieting, as individuals are actively watching the types of food they consume and restricting specific foods with the intention of weight loss. Again, there appears to be a lack of data regarding whether practices emphasizing dietary restraint increase the risk for disordered eating behaviors.

Another study found that within a sample of women clinically diagnosed with eating disorders, approximately 75% utilized the MyFitnessPal application to track their calories and 73% of users perceived the app as contributing to their eating disorder.³⁵ This finding serves to support a relationship between diet tracking and disordered eating attitudes and behaviors, but may benefit further from exploring the effect that self-esteem and BMI may have in that relationship. Diet-tracking behaviors may both rely on and further perpetuate disordered eating attitudes and behaviors, so determining which variable came "first" or precipitated the

development of the other is not feasible with a correlational study. As discussed previously, other studies on individuals who were not diagnosed with eating disorders have identified a correlation between diet restraint and eating disorder symptomatology, but also did not discuss how the individual's BMI or self-esteem may have contributed. Another study found that poor mental health may cause binge eating, but any compensatory behaviors (in the cases of bulimia nervosa) were dependent on the individual's self-esteem and body image importance.³⁶ Taken together, these studies serve to highlight the need for further research investigating the complex relationship between the self-regulation of eating behaviors, self-esteem, and eating disorder risk.

HAES and Eating Disorders

In response to the increasing rates of both overweight/obesity and strict dieting, the HAES movement is campaigning a “holistic, health-centered approach emphasizing self-acceptance and well-being, rather than weight-loss.”² This approach, along with other “non-diet” methods to improving health and preventing disease risk, has been found to improve certain parameters such as eating behaviors, well-being, body image, and psychological health.³⁷ Proponents of the HAES movement generally follow the principles of intuitive eating, allowing their body's natural hunger cues to determine when, what, and how much to eat.³⁸ In contrast to strict dieting, diet “rules” do not exist within intuitive eating, which theoretically prevents intuitive eaters from having food cravings or falling to “temptation” that they might face while on a traditional diet. However, because intuitive eaters are able to eat anything in accordance with personal desires, researchers have discussed the potential negative consequences on the quality of these individuals' diets (particularly if the individual is under-resourced, uninformed about the importance or basics of maintaining a healthy diet, or unable to make responsible decisions).^{38,39} Insufficient research has been conducted to determine the effects of these non-

diet programs on diet quality and other health outcomes, with the limited available studies providing mixed results.⁴⁰

Various studies have discussed HAES' argument against weight-centric health recommendations, claiming that they demonstrate negative weight bias and are responsible for the development of disordered eating behaviors. One study reported that a government-mandated fitness program for overweight students resulted in the participants developing an aversion to physical activity, as well as initiating in eating disordered behaviors.⁴¹ Other literature has found that obese individuals who experience perceived weight stigma adopt behaviors characteristic of disordered eating, such as food restriction, extreme dieting, binge eating, and compulsive exercise, as a response to the emotional stress.⁴²⁻⁴⁴ Furthermore, individuals perceiving to experience weight bias may avoid participating in public activities such as physical activity, in fear of being shamed for their weight.^{45,46}

However, we have reason to hypothesize that the observed association between diet tracking and other dietary self-monitoring behavior with the risk of developing disordered eating attitudes and behaviors may be spurious. While these self-regulatory behaviors have indeed been shown to be correlated with disordered eating behaviors, factors such as self-esteem and neuroticism should also be taken into consideration as mediators of this relationship. As discussed previously, both of these factors may have considerable influence on the development of disordered eating attitudes and behaviors, and no studies to date have examined the mediating effect that they might exhibit.

Methodology

Design and Subject Selection

This research consisted of a quantitative, survey-based Qualtrics questionnaire distributed to a random sample of undergraduate students (N = 2 000) at Grand Valley State University. The survey included a demographics section that contains questions about the participants' age, ethnicity, gender, and academic major, along with two questions asking if the participant maintained a daily calorie/dietary goal, and how often they met this goal. The inclusion criteria for this study allowed only students from Grand Valley State University who were at least 18 years of age or older to participate. There was no exclusion regarding gender or ethnic background. Participants who monitored their dietary intake as part of nutrition therapy for any non-threatening chronic conditions, such as type I diabetes mellitus, were excluded from the study, as they likely had different intentions behind dieting or self-regulatory eating behaviors that differed from the general population. This screening measure also clarified that diets such as vegetarianism or veganism would not be considered diet-tracking or monitoring unless the participant is also using an application such as MyFitnessPal, to avoid further confusion regarding the intentions behind maintaining the diet.

Measures

The survey portion of the questionnaire was composed of three separate, self-reporting instruments, which included the Rosenberg Self-Esteem scale (RSES), which evaluates self-esteem by measuring both positive and negative feelings of self-worth; and the EAT-26, which is a measure of symptoms and concerns characteristics of eating disorders.^{47,48} The last component of the survey consisted of eight items from the Big Five Inventory that measures an individual's

level of neuroticism – a construct which is correlated with traits such as anxiety, irritability, depression, self-consciousness, impulsiveness, and vulnerability.⁴⁹

Both the EAT-26 and the Rosenberg Self-Esteem scale have been used widely in research, with high validity and reliability.^{48,50} The Eating Attitudes Test, also known as the EAT-26, is a widely used screening tool of symptoms and concerns characteristic of eating disorders.⁴⁸ While the EAT-26 was not designed to make a diagnosis of an eating disorder, it has been demonstrated to predict both anorexia nervosa and bulimia nervosa in clinical and non-clinical settings, and has been used often to research disordered eating behaviors in both North America and Europe.^{51,52} Twenty-six items describing behaviors or attitudes such as, “am terrified about being overweight,” or “avoid foods with sugar in them,” were rated on a scale ranging from “never” to “always.” Items were assigned scores between 0 and 3, with a potential maximum score of 78. Individuals who receive the EAT-26 cutoff score of 20 may have maladaptive eating attitudes and behaviors, but not necessarily a clinically diagnosable eating disorder.⁴⁸ Garner et al. remarked that, “while most individuals from these non-clinical groups who score highly on the EAT do not satisfy the diagnostic criteria for anorexia nervosa, the majority have been identified (in personal interviews) as experiencing abnormal eating patterns which interfere with normal psychological functioning.”⁴⁸ An alpha coefficient of 0.94 was reported by the authors of the EAT-26, demonstrating its internal consistency.⁵³ Although a test-retest reliability coefficient was not reported by the original authors, it has since been estimated by external researchers to be 0.81.^{54,55}

The Rosenberg Self-Esteem Scale (RSES) is a ten item questionnaire that evaluates self-esteem by measuring both positive and negative feelings of self-worth, by rating statements on a four-item Likert scale ranging from “strongly agree” to “strongly disagree”.⁵⁰ Scores can range

between 0 to 30 points, with 30 being the highest score possible and indicating high levels of self-esteem, while scores below 15 points may indicate potentially problematic low self-esteem.⁵⁰ Studies utilizing this scale have demonstrated its unidimensional structure with two factors, self-confidence and self-deprecation.⁵⁶ The scale has also shown high reliability, with test-retest correlations in the range of 0.82 to 0.88, and Cronbach's alpha for various samples being in the range of 0.77 to 0.88.^{50,56}

The trait of neuroticism, a component of the Five Factor Model, is a part of a widely accepted psychological theory of personality structure that has been in use since the mid-1980s.⁵⁷ Internal consistencies for neuroticism are high in adult samples, with coefficient alphas for this domain scored at 0.92.⁵⁷ The two-week test-retest reliability of the neuroticism trait has been measured at 0.86, and the two-year retest reliability coefficient was found to be 0.83.⁵⁸ Eight items from the Big Five Inventory are correlated with the trait of neuroticism, and are scored on a five-item Likert scale ranging from "disagree strongly" to "agree strongly." Scores can range between eight to 40 points, with higher scores indicating higher levels of neuroticism.

Subject Recruitment and Data Collection

After obtaining approval from the IRB regarding the proposed methodology, the study was distributed to a random sample of participants provided through the Grand Valley State University's Office of Institutional Analysis (OIA). Participants were contacted via email, which contained a link to take the survey online via Qualtrics. Entry into a raffle for one of three \$25 Visa gift cards were offered as incentive to participate in the survey. Upon completing the survey, participants were provided a link to a separate Qualtrics survey where they could enter their emails, separately from their survey response. In this way, their email could be collected

without being linked to their individual responses, and their personal identity could be further protected.

The OIA was fully responsible for distributing the survey and sending a follow-up reminder in the following week, so the researchers did not have access to any of the subject pool's identifying information. The first page of the Qualtrics form contained the consent form, and subjects needed to indicate their consent by checking the appropriate box before proceeding with the rest of the survey. Subjects who chose not to give consent by checking the alternate box were taken to the end of the survey, and their response recorded as such. The consent form explicitly stated that the subjects' participation in the study was completely voluntary, and that they were free to withdraw from the study at any time without consequence. The survey closed after 10 days, with a reminder email sent to participants after the first week.

Statistical Analyses and Data Management

The researcher performed statistical analyses of the de-identified data set with the help of the members of the research committee. Data were analyzed with SPSS 20, and descriptive statistics were obtained for all data collected. The full list of research questions, hypotheses, and statistical tests performed may be viewed in Table 1 of Appendix A.

Participant data and emails were stored primarily on Qualtrics, which was only accessible by the principal investigator, the supervising professor, and members of the research committee. Each participants' BMI was calculated by dividing their weight (in pounds) by height (in inches squared) and multiplying by a conversion factor of 703. The BMIs were categorized based on the Centers for Disease Control and Prevention (CDC) interpretation of BMI for adults, as follows:⁵⁹

- Underweight: <18.5

- Normal: 18.5 - 24.9
- Overweight/obese: 25+

A complete description of the collected data may be viewed in Table 2 of Appendix A.

Ethical Considerations

To ensure that the basic rights and welfare of the research participants are protected, the protocol for this study was submitted to the online Human Research Review Committee and Institutional Review Board of Grand Valley State University, for evaluation and approval. The Office of Research Compliance and Integrity/Human Research Review Committee completed the review of the study as stated in July of 2018 and granted approval to proceed under exempt status.

Results

Of the 2 000 participants who were provided the survey link, 450 responses were collected at the end of the 10 day period. Twenty-nine of these responses were excluded due to the participant reporting diet-tracking for medical reasons, and 11 more responses were discarded due to incompleteness. This left 410 surveys eligible for analysis, split into two groups: diet trackers (N=145) and non-diet trackers (N=265). The age of the participants was distributed fairly evenly among the five options (18, 19, 20, 21, and 22+), with a slight majority of participants (89, or 21.98%) being age 22 or above. Almost 80% of participants were female, and just over 85% of participants identified as white. Finally, the participants' BMIs ranged from 16.87 to 54.57, with a mean of 24.72.

Hypothesis 1: Diet tracking; EAT-26: disordered eating attitudes and behaviors

A histogram and boxplot were graphed to test the assumptions of normality for the diet-tracking and non-diet-tracking groups on a measure of disordered eating attitudes and behaviors. Both samples were right-skewed with many outliers and indicated a non-normal distribution. Therefore, a Mann-Whitney test was conducted to compare scores on the EAT-26 in diet-tracking and non-diet-tracking groups. EAT-26 scores in diet-trackers (Median = 10) were significantly higher than non-diet-trackers (Median = 4), $U = 8256.000$, $z = -8.674$, $p < .001$. This suggests that individuals who actively monitor their dietary intake score significantly higher on a measure of disordered eating attitudes and behaviors than those who do not diet track.

Hypothesis 2: Diet tracking; RSES: self-esteem

A histogram and boxplot were graphed to test the assumptions of normality for the diet-tracking and non-diet-tracking groups on a measure of self-esteem. The data showed symmetric and normally distributed samples with no outliers. Therefore, an independent-samples t-test was

conducted to compare mean scores on the RSES between diet-tracking and non-diet-tracking groups. Participants who tracked their diet (N= 142) scored significantly lower on a measure of self-esteem (M = 17.82, SD = 5.3) than participants who did not diet track (N=253, M = 19.1, SD 5.18); $t(393) = -2.349, p=.019$. This result indicates that individuals who actively monitor their dietary intake have poorer self-esteem than those who do not track their diet. However, since the instrument scoring method reports that scores below 15 are indicative of self-esteem, the statistically significant difference in mean scores for these two groups may not be clinically important.

Hypothesis 3A: RSES: self-esteem; Big Five: neuroticism

A logistic regression was performed to determine the level to which self-esteem and neuroticism could predict membership in the diet tracking group. Overall, the model indicated that these two variables contributed to the prediction of diet tracking membership ($\chi^2(2) = 6.897, p=.032, C\&S R^2=.018, Nagelkerke R^2=.024$). Overall, the model classified 63.6% of the cases correctly. Self-esteem was found to be a significant predictor of diet-tracking (OR = .941 [.892, .992]), while neuroticism was not a significant predictor (OR = .989 [.943, 1.037]). As discussed previously, the presence of diet tracking was correlated with lower scores on a measure of self-esteem.

Hypothesis 3B: Diet tracking, RSES: self-esteem; Big Five: neuroticism; EAT-26: disordered eating attitudes and behaviors

A linear regression was performed to determine the predictive strength of diet tracking, and self-esteem for EAT-26 scores. The assumptions for normality were confirmed with a P-P plot, collinearity diagnostics, and a homoscedasticity scatterplot. Neuroticism was excluded from this analysis due to its insignificant contribution to the prediction of diet tracking

membership, as demonstrated in the previous section. Diet tracking ($b = -.23.226, t(388) = 8.352, p < .001$) and self-esteem ($b = -.260, t(388) = -2.938, p = .003$) were both found to significantly predict EAT-26 scores. Individuals who diet tracked scored higher on the EAT-26, and self-esteem negatively predicted EAT-26 scores. The interaction between self-esteem and diet-tracking was found to be significant at ($b = -.870, t(388) = -5.930, p < .001$), indicating a much stronger negative relationship between self-esteem and EAT-26 scores for diet-trackers.

Hypothesis 4: Frequency of meeting dietary goals; EAT-26: disordered eating attitudes and behaviors.

A bivariate correlation was calculated to determine if the frequency of meeting dietary goals was associated with EAT-26 scores within the population of participants who reported diet tracking. A scatterplot was created to graph the relationship between frequency of meeting dietary goals and scores on the EAT-26. The scatterplot confirmed a linear relationship. Frequency of dietary goals met was not significantly correlated with EAT-26 scores ($r = -.004, p = .967, n = 139$), indicating that an individual's consistency at meeting their dietary goals is not significantly associated with their scores on a measure of disordered eating attitudes and behaviors. However, frequency of meeting dietary goals was significantly correlated with BMI ($r = -.291, p < .001$), indicating that meeting dietary goals more often was linked with lower BMIs.

Hypothesis 5: RSES: self-esteem; Big Five: neuroticism; Frequency of dietary goals met

A linear regression was performed to determine the predictive strength of self-esteem and neuroticism for frequency of dietary goals met, within the population of participants who reported diet tracking. The assumptions for linear regression were confirmed with a P-P plot, collinearity diagnostics, and a homoscedasticity scatterplot. Self-esteem did not significantly

predict frequency of dietary goals met ($b = .007$, $t(138) = .428$, $p = .669$). However, frequency of meeting dietary goals was significantly predicted by neuroticism ($b = -0.42$, $t(138) = -2.933$, $p = .004$), indicating that lower scores on a measure of neuroticism significantly predicted greater frequency of meeting dietary goals.

Discussion

The purpose of this study was to examine some of the claims made by proponents of the HAES movement in regard to diet tracking behaviors and increased risk for disordered eating. While self-monitoring behaviors such as keeping a diet journal or tracking calories may help facilitate successful weight change or weight management, many of the reviewed research articles on the topic are limited in their discussion of how these behaviors may impact the individual's mental health. Because diet intake is one of the first items assessed in the nutrition aspect of weight management, dietetic practitioners should understand how their recommendations for self-monitoring behaviors may influence the patient's overall well-being.

The study's sample was composed of primarily women (79.3%), in comparison to the 58.5% female population of Grand Valley State University's undergraduates.⁶⁰ Out of the 145 participants who reported that they tracked their diet, 127 of them were female (87.5%) and 18 were male (11.7%). Because a majority of the data on diet trackers was collected from a primarily female population, extrapolation of the results may not be applicable to males. The results of this study indicated that diet tracking behaviors were associated with increased disordered eating attitudes and behaviors, as well as lower self-esteem. This finding supports the first hypothesis of the study, which predicted that scores on a measure of disordered eating attitudes and behaviors would be higher in the diet-tracking group than the non-diet tracking group. However, in light of previous research indicating that eating disorders are more prevalent among females,¹⁶ conclusions must be considered in light of the heavily female study sample.

Diet-tracking was also found to be a significant predictor of self-esteem, with self-esteem negatively predicting scores on a measure of disordered eating. This finding supports the second hypothesis of the study. The third hypothesis, which predicted that the characteristics of self-

esteem and neuroticism would affect the influence of diet tracking on its relationship to the presence of disordered eating attitudes and behaviors, was only partially supported. Self-esteem was found to be a significant predictor of diet tracking, while both diet tracking and self-esteem were significant predictors of disordered eating attitudes and behaviors.

The fourth hypothesis of the study, which predicted that an individual's frequency of meeting their dietary goals would predict the presence of disordered eating attitudes and behaviors, was not supported by the results of the study. However, the correlation used to test this hypothesis suggested that meeting dietary goals was linked with lower BMIs. Finally, the fifth hypothesis of the study was also unsupported by the results of the study. While self-esteem was not found to be a significant predictor in the frequency of meeting dietary goals, lower scores on a measure of neuroticism were found to predict greater frequency of meeting dietary goals.

Expected Findings

Unsurprisingly, multiple results of this study support certain aspects of previous studies, many of which also identified correlations between diet-tracking behaviors and disordered eating and/or low self-esteem.^{34,35} However, this research also uncovered some potentially significant influences that may explain the relationship between these variables, such as the individual's self-esteem, BMI, or level of neuroticism. The finding that diet-tracking was associated with increased disordered eating attitudes and behaviors and lower self-esteem seems reasonable, but we still do not fully understand the numerous other complexities that may drive an individual to develop an eating disorder (such as sociocultural or familial influences, or individual affect).¹⁵ For this particular finding, further study will be required to determine if the absence of diet tracking or presence high self-esteem may offset the risk of disordered eating for one another.

For example, an individual who diet tracks but still has high self-esteem may have a lower risk for developing disordered eating attitudes, and the fact that they are tracking their diet may be irrelevant to total eating disorder risk.

Unexpected Findings and Potential Explanations

One unexpected finding of this study was that low scores on neuroticism were found to predict greater frequency of meeting dietary goals. Because neuroticism has been found to be a significant contributor in predicting disordered eating, we anticipated that individuals with greater scores on a measure of neuroticism would be more likely to meet their dietary goals. However, this prediction was unsupported. Frequency of meeting dietary goals was ultimately found to be correlated with BMIs that were lower (but still within normal range), but the cause-and-effect nature of this relationship remains uncertain.

Hypothesis 3A predicted that self-esteem and neuroticism could be used to create a model that predicted an individual's likelihood to diet track, but the model only classified 63.6% of the cases correctly. Although the model demonstrated high specificity (predicting those who do not track), it also demonstrated low sensitivity (predicting those who do track). The reasons for this remain unclear, as self-esteem was found to be a significant predictor for diet tracking but neuroticism was not.

Statistical analyses testing hypothesis 3B found that disordered eating attitudes and behaviors were predicted by diet tracking and low self-esteem. Although not completely unexpected, this finding does support the idea that diet tracking may not be the healthiest way to support weight management. However, the US Preventative Services Task Force issued a recommendation in 2017 for clinicians to offer or refer obese clients to an intensive, multicomponent behavioral intervention (with dietitians included in the multidisciplinary

approach) in order to achieve clinically significant improvements in weight status and other health problems.⁶¹ This particular study also searched for evidence of potential harms of behavioral weight-loss interventions, including an increased risk for eating disorders, and generally found no significant difference in the rate of adverse effects between the intervention and control groups. The Task Force also found that the decisive factor in obesity care was how much attention and support the patients received during treatment, rather than the specific diet that the patient attempted.⁶² Together, these findings suggest that individuals desiring to manage their weight should be seeking out comprehensive behavior and nutrition therapy, as the individualized treatment may be the difference in achieving weight loss without negative psychological aftereffects.

As discussed previously, this research indicates that neuroticism negatively predicts frequency of dietary goals met, and that frequency of meeting dietary goals was correlated with lower BMIs. The correlation also indicated that frequency of meeting dietary goals was not associated with higher scores on the EAT-26, which means that consistently meeting dietary goals was not associated with increased disordered eating attitudes and behaviors. In a clinical application, clinicians who are interested in improving the frequency of dietary goals met should focus on diminishing the level of neuroticism that the client has. Multimodal intervention is likely ideal: behavior modification and psychotherapy may be valuable tools in this process, with nutrition therapy implemented to help the client establish realistic and achievable dietary goals.

In consideration of dietetic practice as contrasted with HAES recommendations, the present study does not give clear support for or against the self-monitoring practice of diet-tracking as part of nutrition therapy for weight management. Diet tracking may very well be a significant contributor in an individual's ability to lose weight, but it might only be associated

with increased risk for disordered eating if the client also is suffering from low self-esteem. For clients who desire more structure and guidance, tracking calories may be an effective means to weight management, and therapy to improve their own self-esteem may allow them to accomplish this in an even healthier manner. Practitioners should be mindful of each client's individual background, taking their needs and preferences into consideration when determining the most optimal methods for weight management.

Limitations and Implications for Research

While the present study succeeded in confirming and adding layers to previous research, it still carries with it a number of limitations. First, the sample calls for a greater proportion of male participants and perhaps more participants in total. Being that the sample population is primarily composed of white women (in comparison, the student body of GVSU is estimated to be about 58.5% female and 82.1% white) attending a public liberal arts university in the Midwest United States, the results may have limited external validity, especially amongst diverse populations.⁶⁰ While the ethnic demographics of the study sample are fairly consistent with the university's, the male versus female response rate indicated that a higher proportion of women participated in the survey than what would have been expected. Observing the response rate by gender indicated that females were drawn to the survey much more than men, which may have been due to an uneven population sample or a study topic that was perceived to be of greater interest for females. Future research regarding demographic differences in self-esteem, neuroticism, and disordered eating attitudes and behaviors would likely require a more diverse sample.

Self-report inventories are prone to specific bias, as participants are able to exaggerate or minimize their responses. Due to the cross-sectional nature of this study, the self-reported data

may also be affected by the participant's mood and feelings at the time the survey was taken, rather than being an accurate representation of their overall attitudes and perspective. The environment and location of the participant when the test is administered may also cause slight variations in response, due to any potential perceived social expectations.^{62,63} Because this study is focused on eating disordered behaviors characteristic of anorexia nervosa or bulimia nervosa, the findings may also not be generalizable to individuals with binge eating disorder or eating disorder not otherwise specified (EDNOS). Finally, since no longitudinal data was collected and no experiment variable was implemented, cause-and-effect relationships cannot be established. Altogether, these limitations suggest that further research is still necessary to examine more of the topics studied in this research in order to fully understand the complex interrelationship of the examined variables.

Findings from this research indicated that diet tracking and low self-esteem were significant predictors of disordered eating attitudes and behaviors in college students. This finding provides support for future research examining types of diet tracking, as this research did not thoroughly examine the specific guidelines that each participant adhered to in their self-reported diet tracking, which may be an important distinction in future work. Since some methods of diet tracking such as calorie or macro counting are more restrictive, they should be considered separately from diet tracking that merely involves keeping a food journal or focusing on portions and serving sizes. Because many individuals who desire to lose weight are simply looking for small and manageable lifestyle changes, less restrictive methods of diet tracking may be beneficial (and not at all harmful) to their physical and psychological health. Due to the relatively low number of males who participated in the present research, we were unable to distinguish whether there were significant differences in behavior or attitude between genders.

Additional research examining the potential benefits and drawbacks of varying levels of restrictiveness in dieting between males and females may shed further light on determining the most effective methods of weight management.

Furthermore, due to the study's limited external validity, we cannot know whether varying clinical populations may respond differently to the survey instruments. Future research in this field may benefit from studying the psychological response and overall health of overweight or obese populations who are attempting to manage their weight. Then, a determination may be made about whether the variables of self-esteem and neuroticism interact with disordered eating scores. Since previous research has shown that comprehensive behavioral and/or dietary weight loss interventions may successfully produce consistent significant improvements in psychological outcomes (including self-esteem), dietitians and other health practitioners should continue to encourage and support clients in their weight loss goals as part of managing their overall health.⁶⁴

Conclusion

In summary, the present study confirmed previous research findings on the correlative links between self-esteem, diet tracking, and disordered eating attitudes and behaviors. However, frequency of meeting dietary goals was found to be inversely predicted by neuroticism and correlated with lower BMIs, but not associated with increased disordered eating behaviors. While self-monitoring behaviors such as diet-tracking may be predictive of disordered eating attitudes and behaviors, there may still be other variables involved. A determination regarding the temporal occurrence of diet-tracking and disordered eating attitudes and behaviors is not possible with a cross-sectional research methodology. But, this research provides a greater understanding of the interaction that exists between this relationship, self-esteem, and neuroticism. Furthermore, it may aid in the development of more clinically applicable treatment protocols. The contradictory recommendations in the treatment of overweight or obesity provided by the Academy of Nutrition and Dietetics and the Health at Every Size movement each have some value in health management, as demonstrated by previous studies. Nevertheless, the lack of data on this topic in more diverse populations indicates that further research is necessary to fully understand the most optimal integration of treatment methodologies. Findings from this study and their implications are valuable in planning future research on weight management and determining appropriate weight loss techniques for diverse populations.

Appendix A

Table 1: Research Questions, Hypotheses, and Statistical Tests

Research Question	Hypothesis	Statistical Test
1. Is there a difference in the extent of disordered eating attitudes and behaviors between individuals who diet track and individuals who do not?	Scores on a continuous measure of disordered eating attitudes and behaviors will be significantly higher in the diet tracking group than the non-diet tracking group	Mann-Whitney between diet tracking and non-diet tracking groups on EAT-26
2. Is there a difference in self-esteem between individuals who diet track and those who do not?	Scores on a continuous measure of self-esteem will be significantly lower in the diet tracking group than the non-diet tracking group	T-test between diet tracking and non-diet tracking groups on RSEQ
3. What relevant personal characteristics modify the relationship between diet tracking and risk of disordered eating attitudes/behaviors?	Self-esteem and neuroticism mediate the effect of diet tracking on disordered eating attitudes and behaviors.	<ul style="list-style-type: none"> a. Logistic regression using self-esteem and neuroticism to predict diet tracking. b. Linear regression using diet tracking, self-esteem and/or neuroticism to predict EAT-26 scores.
4. Are individuals who frequently meet their dieting goals more likely to be at risk for disordered eating attitudes and behaviors?	Frequency of meeting dietary goals predicts EAT-26 scores.	Correlation between frequency of dietary goals met and EAT-26 scores
5. What is the nature of the relationship between self-esteem, neuroticism and frequency of dieting goals met?	Self-esteem and neuroticism predict frequency of dietary goals met.	Regression analysis

Table 2: Data Descriptions (Requested Data)

Name of Variable	Unit of Variable	Type of Variable
Participant diet tracking	Yes or No	Categorical
How often does participant generally meet diet goals?	Never, Rarely, Sometimes, Most of the time, Always	Categorical
How long has the participant been engaging in diet tracking behaviors?	Less than 1 month, 1-3 months, 4-6 months, 6+ months	Categorical
Age	Years	Continuous
Gender	Male, Female, Other, Prefer not to respond	Categorical
Class rank	First year/ Sophomore/ Junior/ Senior/Graduate/Other	Categorical
Academic Major	Humanities, Social sciences, Natural sciences, Formal sciences, Applied sciences	Categorical
Ethnicity	White, Hispanic or Latino, Black or African American, Native American or American Indian, Asian or Pacific Islander, Other	Categorical
Height	Inches	Continuous
Weight	Pounds	Continuous
Body Mass Index	pounds/inches ² x 703	Continuous
Self-esteem score	Measure of self-esteem	Ordinal
EAT-26 Score	Measure of disordered eating attitudes and behaviors	Ordinal
Neuroticism score	Measure of anxiety, self-consciousness, etc.	Ordinal

Appendix B

From: Liana Cho, Graduate Student at GVSU

Subject: Complete the following survey for a chance to win a \$25 Visa gift card!

Hello GVSU students!

Welcome back to the start of a new school year! My name is Liana and I am a graduate student in GVSU's Clinical Dietetics program. I'd like to invite you to participate in a survey as part of my master's thesis research, on the topic of eating behaviors and disordered eating attitudes. The survey should take no longer than 7 minutes, and at the end, you'll have the opportunity to provide your email for a chance to be entered into a raffle for one of three \$25 Visa gift cards! All you need to do is click on the link below, and it will take you directly to the survey site. The survey link will be active until September 28th.

<https://tinyurl.com/cho12018>

We appreciate your honest responses to the questions in the survey. This research has been approved by GVSU's Institutional Review Board for Human Subjects. All responses are completely confidential. If you have any questions, please feel free to contact myself or my supervising professor, Dr. Elizabeth MacQuillan, at any time. Thank you so much!

Liana Cho
Grand Valley State University || 2018
Coordinated Graduate Program in Clinical Dietetics
lianacho895@gmail.com || (714) 858-1776

Figure 1: Text of Invitation Email Sent to Participants



DATE: July 03, 2018

TO: Elizabeth MacQuillan
FROM: HRRC
STUDY TITLE: The Relationship Between Self-Regulatory Eating Behaviors and Disordered Eating Attitudes
REFERENCE #: 18-312-H
SUBMISSION TYPE: HRRC Initial Submission

ACTION: Exempt Determination
EFFECTIVE DATE: July 03, 2018
REVIEW TYPE: Exempt Review

Thank you for your submission of materials for your planned scholarly activity. It has been determined that this project is human subjects research* according to current federal regulations and MEETS eligibility for exempt determination under Exempt Category 2, 45 CFR 46.101. You may now proceed with your research.

Exempt protocols do not require formal approval, renewal or closure by the Human Research Review Committee (HRRC). Any revision to exempt research that alters the risk/benefit ratio or affects eligibility for exempt review must be submitted to the HRRC using the *Change in Approved Protocol* form before changes are implemented.

Any research-related problem or event resulting in a fatality or hospitalization requires immediate notification to the Office of Research Compliance and Integrity (rci@gvsu.edu or 616-331-3197) and the Research Integrity Officer Jeffrey Potteiger at 616-331-7207. (See *HRRC policy 1020, Unanticipated problems and adverse events.*)

Exempt research studies are eligible for audits.

If you have any questions, please contact the Office of Research Compliance and Integrity at 616-331-3197 or rci@gvsu.edu. Please include your study title and protocol number in all correspondence with our office.

Sincerely,
Office of Research Compliance and Integrity

*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102 (d)).

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains data through intervention or interaction with the individual, or identifiable private information (45 CFR 46.102 (f)).

Office of Research Compliance and Integrity | 1 Campus Drive | 049 James H Zumberge Hall | Allendale, MI 49401
Ph 616.331.3197 | rci@gvsu.edu | www.gvsu.edu/rci

Figure 2: Copy of Exempt Determination Letter from Human Research Review Committee

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