THE INFLUENCE OF SELF-COMPASSION ON BINGE EATING AND INTERNALIZED WEIGHT BIAS IN MEN: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

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ABSTRACT

THE INFLUENCE OF SELF-COMPASSION ON BINGE EATING AND INTERNALIZED WEIGHT BIAS IN MEN: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

NATALIE M. PAPINI

Prior research has identified self-compassion as a mechanism that may improve disordered eating, alleviate binge eating, and improve an individual's ability to regulate emotions during challenges and adversity. Despite evidence supporting self-compassion as a skill that can improve disordered eating, few studies have adequately sampled men and examined this trend among men who binge eat. This project had two primary objectives: 1) examine between and within-subject self-compassion and how it influences momentary binge eating and internalized weight bias; 2) elucidate the relationship between binge eating behaviors, self-compassion, and internalized weight bias in men who binge eat. This project aimed to achieve these objectives by assessing self-compassion and its influence on binge eating behaviors and internalized weight bias (IWB) using a 1-week, single-wave, ecological momentary assessment (EMA) design: study 1) assess the impact of momentary self-compassion (IV) on binge eating behaviors at the following prompt (DV) with adverse childhood experiences and drive for muscularity as moderators while controlling for BMI, age, race, and ethnicity; study 2) examine the between and within-subject effects of self-compassion on IWB controlling for BMI, age, race, and ethnicity, with adverse childhood experiences and drive for muscularity as moderators; and study 3) to examine the indirect effects of the relationships among self-compassion, internalized weight bias, and binge eating. More specifically, we assessed if self-compassion moderates the relationship between internalized weight bias and binge eating. Generalized estimating equations were

used to determine the impact of momentary self-compassion on binge eating behaviors and internalized weight bias. To examine if self-compassion moderates internalized weight bias and binge eating, the third and final study utilized IWB (IV) and self-compassion (moderator) at time 1 and binge eating (DV) at time 2 (at a prompt where it is next reported) in the model. Time 1 (IWB as IV and self-compassion as moderator) indicated the most proximal momentary assessment preceding a report of binge eating. Time 2 was a prompt where binge eating was reported. Across three studies, self-compassion appears to play a crucial role in reducing momentary binge eating and internalized weight bias in men.

ACKNOWLEDGEMENTS

My first acknowledgement is to my doctoral mentor, Gigi Lopez. If I am one day half the mentor and scientist that you are, I will consider that a huge success. Thank you for being a friend and support to me throughout this process. Thank you for sharing your time, effort, and expertise. I could not imagine having a better role model throughout my PhD program than you. Thank you to my dissertation committee: Dr. Lynda Ransdell, Dr. Tyler Mason, and Dr. Laura Noll. I learned so much from each of you and appreciate the time and care you put into my development as a researcher and this project.

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And finally, to quote Snoop Dogg:

"Last but not least: I want to thank me. I want to thank me for believing in me, I want to thank me for doing all this hard work. I want to thank me for having no days off. I want to thank me for never quitting. I want to thank me for always being a giver and trying to give more than I receive. I want to thank me for trying to do more right than wrong. I want to thank me for just being me at all times."

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DEDICATION

I would like to dedicate this dissertation to my parents, Dennis and Karen Papini. Both encouraged me throughout my life to work hard and persevere through challenges. These life skills have helped me throughout my education and dissertation work, and I know that my ability to successfully finish my doctoral program has much to do with their influence and unconditional love and support. Thank you both for being incredible parents.

PREFACE

Chapters 3, 4, and 5 of this dissertation were written to appear as articles in peer-reviewed scientific journals. As a result, some redundancy may result from combining these articles within the university formatting requirements. The first chapter includes a general review of the literature on self-compassion, binge eating, and internalized weight bias to inform the reader of the context in which these three studies were conducted. The second chapter offers the reader a general overview of specific study methods and the analytic plans for each study to provide the necessary detail that will not be included in the manuscripts sent to the scientific journals.

Chapters 3, 4, and 5 have not been submitted for publication at the time of the dissertation defense.

CHAPTER 1

Overall Introduction and Comprehensive Literature Review

Eating disorders (EDs) are complex conditions characterized by persistent disturbances of eating or eating behaviors that impose negative consequences on physical health and psychosocial functioning (APA, 2013). EDs affect a wide range of individuals across the lifespan, despite stereotypes that these disorders occur primarily in skinny, white, affluent girls "SWAG" (Arnow et al., 2017; Sonneville et al., 2018). In addition to physical and psychosocial harms to the individual, EDs also have economic repercussions. It is estimated that the 1-year total economic costs of EDs are $64.7 billion in the U.S., which translates to $11,808 per affected individual (Streatfeild et al., 2021). Eating disorders confer serious adverse health risks, and are on the rise (Da Luz et al., 2018; Giel et al., 2021; Schlegl et al., 2020). The SARS-COV-2 pandemic saw increases in EDs, likely the result of many factors, including but not limited to increased social isolation, reduced opportunities for exercise, major stress events, and stigmatizing public health messages focused on weight (Bristow et al., 2022; Cooper et al., 2022). Given the negative health outcomes, economic costs, and increased rates of EDs, it is critical for research to elucidate psychosocial constructs that may influence ED pathology.

Binge eating disorder (BED) remains the most common eating disorder in the U.S. and globally (Dahlgreen-Lindvall, Davis, Graham, & Wildes, 2020; Wisting, & Ro, 2017). According to the American Psychiatric Association (2013), a person with BED must recurrently consume an amount of food that is definitively larger than what others would eat under similar circumstances in a discrete period and experience feelings of loss of control of eating. In order to have BED, a person must experience at least three of the following symptoms at least once per week for the duration of three months: eating more rapidly than normal, eating to the point they

experience uncomfortable fullness, eating a large amount of food when not physically hungry, eating in solitude out of embarrassment or shame, and negative feelings (disgust, depression, or guilt) after a binge episode (APA, 2013). Finally, an individual with BED must not engage in any compensatory behaviors (such as self-induced vomiting, laxative use, compensatory exercise, and fasting). BED is associated with significant health problems, including an increased risk of diabetes mellitus and psychopathology (McCuen-Wurst, Ruggieri, & Allison, 2018). In men, binge eating is associated with greater mental health quality of life impairment than in females (Mitchison et al., 2014). Although an estimated 40% of all BED cases are men (Westerberg & Waitz, 2013), compared to women, men with BED are less likely to seek treatment for an eating disorder (Coffino, Udo, & Grilo, 2019). When men do receive psychological treatment for eating disorders, they are at higher risk for attrition than women (Aguera et al., 2017). Men may be hesitant to seek treatment for binge eating due to various factors, including implicit beliefs that associate binge eating with higher weight status and femininity (Cruz Garcia et al., 2023). It has been shown that men who binge eat are more likely to seek treatment for weight loss than seek treatment for an eating disorder (Ibqal & Rehman, 2019; Westerberg & Waitz, 2013). As such, this makes programs that promote weight loss an ideal setting from which to address binge eating in men.

Furthermore, adults who experience weight stigma (discriminatory experiences due to weight and size) are prone to develop internalized weight bias (IWB), defined as the internalization of negative stereotypes and self-defeating ideas regarding higher-weight people (Durso & Latner, 2008). Treatment-seeking individuals with comorbid obesity and BED report higher levels of internalized weight bias (IWB) compared to a community sample of adults with overweight (Durso, Latner, White, Masheb, Blomquist, Morgan, & Grilo, 2012), which occurs

when an individual adopts and internalizes negative stereotypes about people with overweight and obesity (Durso & Latner, 2008). IWB is prevalent in males and females and across BMI categories (Puhl & Quinn, 2018). However, individuals in larger bodies (those with overweight or obesity (OW/OB)) who seek treatment and report higher IWB suffer from poorer mental and physical health (Pearl, White, & Grilo, 2014). Weight stigmatization and subsequent IWB are risk factors for maladaptive eating behaviors (such as binge eating) in higher-weight people (Almeida, Savoy, & Boxer, 2011; Krug, Villlarejo, Jimenez-Murcia, Perpina, Vilarrasa, & Granero, 2013; Olvera, Dempsey, Gonzalez, & Abrahamson, 2013; Sutin & Terracciano, 2013).

Self-compassion (SC) could be a plausible mechanism through which individuals can regulate emotions, reduce disordered eating, and counteract IWB (Braun et al., 2021; Ferreira, Pinto-Gouveia, & Duarte, 2013). SC is the recognition that suffering, failure, and inadequacies are part of being human and that the self, as well as others, deserve compassion. SC contains three components: 1) self-kindness (acting in a kind and understanding way toward self), 2) common humanity (the ability to recognize feelings of inadequacy or periods of struggle as part of the shared human experience), and 3) mindfulness (willingness to experience thoughts and feelings accurately without becoming absorbed by them or evading them) (Neff, 2003). SC has been shown to modify negative emotions and engender more positive emotions (Berking & Whitley, 2014; Neff, Kirkpatrick, & Rude, 2007). Further, individuals who report higher self-compassion score higher on measures of physical health because they tend to engage in more positive health behaviors (Ramsey et al., 2023).

The emotion-regulation function provided by SC could be integrated into treatments for binge eating. Previous SC interventions for individuals with BED and standalone interventions have shown reductions in eating disorder pathology, eating concerns, body image concerns, and

weight concerns (Kelly & Carter, 2015; Turk & Waller, 2020). Furthermore, negative self-directed style (such as self-blame) and emotion dysregulation (using unhealthy strategies to manage negative affect) are critical targets of binge eating treatment since reductions in both negative self-directed style and emotion dysregulation predict reductions in binge eating frequency in adults with BED (Hazzard et al., 2020). Further examination of the link between SC and binge eating behaviors in daily living could provide valuable insight into the utility of SC integration into treatment.

Young adults who experience weight stigma report low levels of SC, though little is known about the nature or patterning of the relationship between SC and weight stigma (Puhl et al., 2020). In a SC intervention aimed at improving IWB, self-compassion and IWB improved from pre to post, and participants supported the program's acceptability (Haley et al., 2022). Limitations of this study included a small sample size, limited generalizability (only female participants), and an intervention offered in a group setting where participants may not have felt as comfortable sharing weight and body image concerns. The program focused on SC education that included applied exercises. Furthermore, participants listed that an improvement of the program would be to incorporate more SC exercises that addressed specific weight-related concerns (Haley et al., 2022).

To date, SC research that examines self-regulation of behaviors (such as binge eating) has primarily relied on methodologies that do not consider within-person variation or time-varying explanatory factors that vary across treatment (Biber & Ellis, 2019). Even less is known regarding fluctuations in state SC in real-time, as most existing research utilizes pre-post designs and cross-sectional designs using the trait self-compassion scale (SCS-T) (Biber & Ellis, 2019; Neff, 2003). Time-intensive methods such as Ecological Momentary Assessment (EMA), where

participants use smartphones to gather real-time self-reports of behaviors, environments, and perceptions in the natural environment, permit the study of time and within-person varying factors better than traditional methods. Additionally, EMA has several advantages over traditional approaches in that it 1) minimizes recall bias inherent in retrospective self-report and 2) enhances ecological validity by gathering real-time self-reports of behaviors, mood, beliefs, attitudes, and perceptions within the natural environment (Dunton, 2017; Shiffman & Stone, 1998). Though some EMA studies have incorporated self-compassion to elucidate its role in dietary lapses (Thogersen-Ntoumani et al., 2021), bulimia nervosa symptoms (Katan & Kelly, 2021), loss of control of eating (Bicaker et al., 2022), and well-being in daily life (Mey et al., 2023), more research is needed to understand how it can influence binge eating symptoms and internalized weight bias in men.

EMA methods go beyond a single measurement point and allow for examination of within-subject effects that can occur over time and space (Dunton, 2017). The ability to study intra-individual effects in eating disorder research can shed light on changes that occur throughout a person's day that may precede or follow disordered eating occurrences. For example, one diagnostic criteria of binge eating disorder is to eat alone out of embarrassment over the amount of food consumed (APA, 2013). EMA is a preferred data collection method that would allow for examination to determine if binge eating occurs most often in certain social and physical environments. Similarly, individuals may not be able to adequately recall loss of control of eating after a binge eating episode if surveyed well after the episode or in an artificial setting (Dunton, 2017; Goldschmidt et al, 2012). As such, EMA would allow for assessment of loss of control immediately following a binge eating episode.

SC has been proposed as an intervention strategy using novel ecological momentary

intervention methods to disrupt self-critical thoughts and provide a supportive coping strategy to women with binge eating pathology (Mason et al., 2021). To our knowledge, no research exists using real-time EMA methods to examine the role of SC on binge eating and IWB in adult men with moderate-to-severe binge eating symptoms. It is imperative to understand the relationship between SC and binge eating in men using real-time methods, such as EMA.

Theoretical Support for Self-Compassion and Binge Eating

Most research using theoretical approaches to examine eating disorders (EDs) includes samples primarily comprising women and therefore, may not generalize to men (Forrest et al., 2019). However, there are some notable exceptions. Forrest and colleagues (2019) conducted an eating disorder network analysis with only adolescent and adult men admitted to an ED hospitalization program to address this gap in the literature. The following ED symptoms (including BED) were shown to be central in men: 1) body dissatisfaction (shape overvaluation, desiring weight loss, and fearing weight gain), 2) muscularity (desire for more enhanced musculature exhibited through guilt after missing a weight-training session, and supplement use), and 3) fear and avoidance (including fear of losing control of eating, fear of weight gain, and avoidance of social eating occasions (Forrest et al., 2019). Notably, these main ED symptoms observed in Forrest and colleagues' (2019) network analysis are aligned with the hierarchical taxonomy of internalizing dimensions for ED (Hi-TIDE model) (Forbush et al., 2017; Forbush et al., 2018). The Hi-TIDE model posits that three subfactors unite ED syndromes (including binge eating disorder): distress, body dissatisfaction, and fear/avoidance (Forbush et al., 2017). The Hi-TIDE model does not assert that an individual has a specific motivation to avoid food or that the only way an individual can experience body dissatisfaction is from pursuing the thin ideal, which is a typical motivator for women. As such, the Hi-TIDE model may be the most appropriate

theory for the present study, given the empirical support from Forrest and colleagues paired with differences in sociocultural body ideals between men and women in which men often report muscularity-related body dissatisfaction while women report thinness-oriented body dissatisfaction (Lavender et al., 2015; Murray et al., 2017). The Hi-TIDE model is particularly applicable to men because it allows for muscularity-related body dissatisfaction as a motivator for disordered eating.

Because roughly 80% of people with an ED have a comorbid internalizing disorder (such as anxiety, depression, or substance use), it is the first overarching factor of the Hi-Tide model (Forbush et al., 2018; Keski-Rahkonen & Mustelin, 2016). The inclusion of this internalizing factor illustrates the critical role of negative affect in predicting ED onset and maintenance (Forbush et al., 2018). From there, the internalizing factor is subdivided into distress and fear avoidance. The Hi-TIDE model was selected to inform the current study because SC is an affect-regulation strategy that may work to minimize distress and fear avoidance.

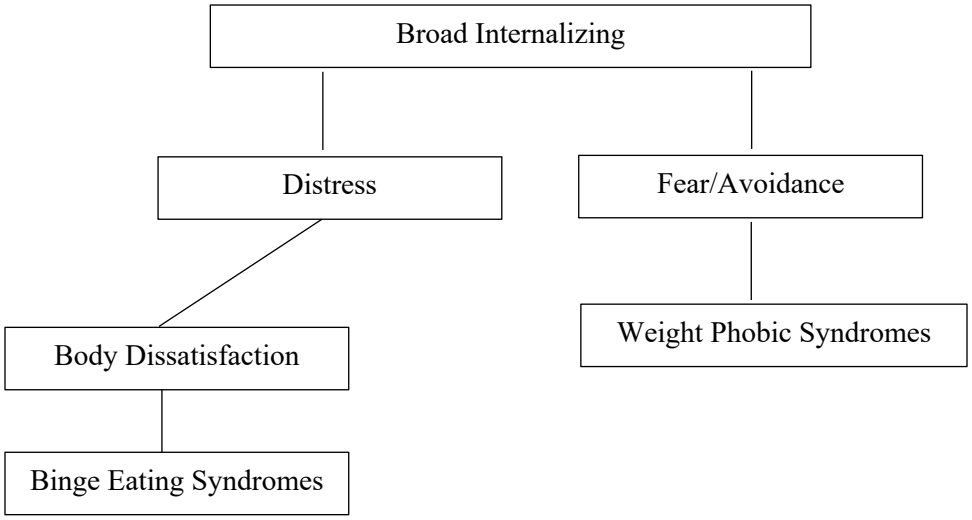

Figure 1.

A segment of the Hierarchical Taxonomy of Internalizing Dimensions for EDs (Hi-TIDE) Model (Forbush et al., 2018).

Note. The top part of this model is most relevant to the present work since self-compassion may work to reduce distress, fear/avoidance, and body dissatisfaction implicated in binge eating syndromes and weight phobic syndromes.

Paired with other findings that indicate emotional regulation difficulties and dietary restraint mediate the effect of negative emotions on binge eating in men, the Hi-Tide Model is best suited to inform the role of SC on binge eating in adult men (Kukk & Akkermann, 2020). An EMA study examining the impact of positive affect, negative affect, guilt, fear, hostility, and sadness relative to binge eating episodes showed improvements in affect following binge eating episodes (Schaefer et al., 2020). These findings are aligned with the affect regulation model of eating pathology, which asserts that binge eating occurs when an individual is experiencing worse affect, and that affect improves following a binge eating episode (Schaefer et al., 2020; Heatherton & Baumeister, 1991). Since SC is an affect-regulation strategy that can be cultivated within individuals, it may influence the distress and fear/avoidance factors that come from broad internalizing.

Theoretical Support for Internalized Weight Bias and Self-Compassion

A preliminary model developed by Lee and colleagues (2019) illustrates the impact SC may have on IWB (see Figure 2). This model was proposed to create and assess hypothesized risks and outcomes of IWB in a sample of adult men and women (Lee et al., 2019). As it relates to IWB, findings from this study indicate that sociocultural pressures and stigmatizing experiences are significantly correlated with IWB, which in turn is significantly associated with binge eating. Lee and colleagues (2019) recommend this model for future research to direct efforts on the pressures themselves (e.g., sociocultural influences such as advocating for size

diversity in media depictions) or on an individual's perception of sociocultural pressures (e.g., extending compassion to oneself instead of experiencing guilt or shame in the face of not meeting sociocultural expectations of weight and size).

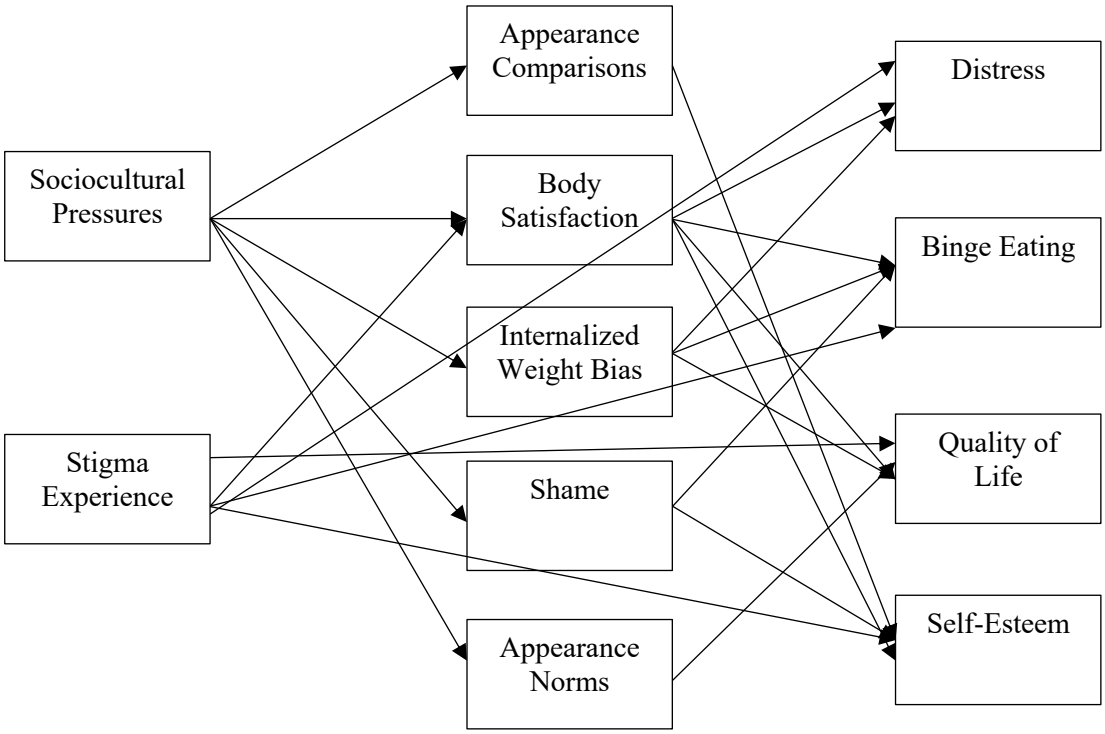

Figure 2.

Final Model of Internalized Weight Bias and Psychological Wellbeing (Lee et al., 2019).

Theoretical Support for Self-Compassion to Address BE and IWB

SC may serve as a buffer against disordered eating through three primary pathways: 1) SC decreases ED outcomes and improves ED treatment outcomes directly; 2) SC prevents initial risk factors for ED from occurring because of its association with protective factors (body appreciation, body image flexibility), 3) SC moderates associations between risk factors and ED-related outcomes (Braun, Park, & Gorin, 2016). For example, mediation cross-sectional work indicated SC could work indirectly through emotional tolerance and unconditional self-

acceptance to influence binge eating severity scores in college women (Webb & Forman, 2013). Additionally, in a systematic review examining 28 studies, higher levels of SC were consistently correlated with lower eating pathology and improved body image (Braun, Park, & Gorin, 2016).

A significant limitation in the field is that men are underrepresented in research studies. As such, there are generalizability issues related to theoretical underpinnings of how SC may work to improve binge eating and IWB in adult men. Preliminary findings suggest SC may be a protective factor for IWB and emotional eating in individuals seeking bariatric surgery (81% female sample) (Braun et al., 2021). Previous work demonstrated that stigmatizing experiences predicted binge eating behavior and overall psychological distress in higher-weight adults enrolled in a weight loss program (Ashmore et al., 2008). However, Ashmore and colleagues did not examine IWB, only stigmatizing experiences (weight stigma). In another study that exclusively recruited women, SC was associated with lower levels of IWB, and the relationship between SC and emotional eating, as well as eating restraint was explained through IWB (Fekete, Herndier, & Sander, 2021). Gender differences in self-compassion have emerged, such that common humanity and mindfulness are facets of self-compassion employed by boys aged 13-18 years that protect against body image concerns that are not used by same-aged girls (Rodgers et al., 2017). Men are known to have slightly higher levels of self-compassion than women, and men with binge eating report modestly lower eating disorder psychopathology than women (Lydecker & Grilos, 2018; Yarnell et al., 2015). Differences in self-compassion between men and women are likely better accounted for by gender role orientation rather than biological sex, and male gender norms of entitlement may encourage men to focus on their needs during suffering more than female gender norms (Neff, 2023). Still, men who binge eat report substantially greater psychosocial impairment compared to men who do not binge eat (Striegel et

al., 2011). It is unknown if the previous research on self-compassion and internalized weight bias using female samples would hold up in a sample of men. Further, it is unclear how either of these constructs measured at the momentary level would influence binge eating in adult men.

Ecological Momentary Assessment Findings on Binge Eating

Studies employing EMA methodology to examine binge eating within individuals can investigate significant individual factors (e.g., affect) that may play a role in the initiation and maintenance of binge eating. EMA research has emphasized the significance of daily and momentary factors in binge eating (Engel et al., 2016). Schaefer and colleagues (2020) found that binge eating improved unpleasant emotional experiences in adult individuals with BED. The observed improvements in negative affect following a binge eating episode were most influenced by changes in guilt and suggest that targeting feelings of guilt could improve binge eating behaviors in this population (Schaefer et al., 2020).

Additionally, different types of shame are associated with binge eating, including internal shame (focusing on being lesser than others), external shame (focusing on personal flaws and shortcomings becoming apparent to others), body shame, and shame related to binge eating behaviors (O'Loghlen et al., 2021). EMA findings indicate that higher momentary negative affect is positively associated with binge eating on days where individuals experienced lower inhibitory control (i.e., a person's ability to control attention, behavior, thoughts, and emotions to control strong internal or external responses or inclinations) (Smith et al., 2020). In a systematic review of EMA studies on eating behaviors, Maugeri and Barchitta (2019) found binge eating was associated with lower pre-binge hunger, higher post-binge satiety, eating alone, and feelings of disgust, depression, and guilt after a binge episode. These EMA study findings support the continued examination of momentary affective and emotional responses that may influence

binge eating.

Positive psychology aims to nurture and expand an individual's strengths and protective factors instead of focusing on individual pathology or risk factors (Steck et al., 2004). Historically, disordered eating research focused on risk factors related to the development of eating disorders rather than examining protective factors (e.g., SC) (Tylka & Piran, 2019). EMA methods incorporating positive psychological constructs, such as SC, are helpful for understanding how momentary changes in these protective factors can influence specific eating disorders like BED.

Ecological Momentary Assessment Studies on Self-Compassion

Extant literature on SC using EMA comprises primarily female samples, with few studies focusing exclusively on how SC may influence binge eating behaviors. SC improves self-regulation during and after eating in women with bulimia nervosa or binge eating disorder (Serpell et al., 2020) and mediates decreases in binge eating in middle-aged women with overweight and obesity (Pinto-Gouveia et al., 2019). In a convenience sample of university undergraduates, SC was shown to reduce binge eating severity (Webb & Forman, 2013). Additionally, previous findings indicate that SC is inversely associated with IWB in higher-weight women (Fekete et al., 2021). Low levels of SC mediated the relationship between IWB and emotional eating in a sample of pre-bariatric surgery patients (82% of whom were female), indicating that SC could be an essential treatment modality to address IWB (Braun et al., 2021).

New knowledge of how SC influences eating behaviors has been generated through incorporating the construct into EMA studies. Baker and colleagues (2022) found that SC significantly reduced loss of control of eating through down-regulating negative affect in university students enrolled in an EMA study. In women who met DSM-5 criteria for bulimia

nervosa, SC varied as much within a person throughout the day (within-subject effects) as it did between participants (between-subject effects), and higher levels of daily SC were associated with reductions in binge eating episodes (Katan & Kelly, 2021). In a sample of adults with overweight and obesity attempting to lose weight via restriction, SC was positively associated with intent and self-efficacy to continue dieting and negatively associated with negative affective reactions to dietary lapses (Thogersen-Ntoumani et al., 2021). Thus, SC may be a viable resource to cultivate among dieters who experience lapses and setbacks in their attempts to lose weight.

Ecological Momentary Assessment of IWB and Weight Stigma

To date, few studies have incorporated EMA methods to examine IWB. In a study that involved higher-weight (BMI of 25 or greater) participants completing a daily diary at the end of each day, IWB was significantly inversely related to positive affect and body appreciation (Carels et al., 2018). Further, IWB was positively associated with maladaptive eating behaviors, and the desire to avoid exercise (Carels et al., 2018). Additionally, IWB was significantly positively associated with negative affect (Carels et al., 2018). Importantly, this work indicates that IWB fluctuates daily and is associated with crucial psychological well-being concepts, such as depression and binge eating (Carels et al., 2018). Other EMA work that explored experiences of weight stigma in adults seeking weight loss treatment found that individuals who experienced weight stigma (assessed repeatedly via EMA) reported higher levels of IWB (assessed one time at the study start) compared to those who did not report instances of weight stigma (Carels et al., 2019). There is a critical need for studies to address momentary and daily factors associated with IWB using real-time collection methods. SC could be one way to reduce IWB and maladaptive eating behaviors such as binge eating (Rahimi-Ardabili et al., 2018).

Current Study

The current observational study aims to understand the momentary relationships between SC, IWB, and binge eating symptoms in adult men with moderate to severe binge eating symptoms through EMA methods. This project has two primary objectives: 1) to gain insight into between- and within-subject variations of SC and how it influences binge eating and IWB, and 2) to elucidate the relationship between binge eating symptoms, SC, and IWB in men who exhibit binge eating spectrum behaviors. Given the physical and mental health risks associated with BED and IWB, this study is expected to have important implications for programming clinical and public health interventions aimed at addressing binge eating among men with binge eating. These findings will expand current knowledge on IWB and SC and inform future interventions utilizing SC exclusively within an adult male population. Results may warrant future examination of how compassion-based interventions compare to other treatment paradigms for men.

The study objectives were achieved by an observational ecological momentary assessment study with data from adult men with binge eating. Study 1 assessed the impact of momentary SC (IV) on binge eating symptoms at the next prompt (DV) with adverse childhood experiences (ACEs) and drive for muscularity as moderators while controlling for BMI, age, race, and ethnicity. Study 2 examined the between and within-subject effects of SC on IWB controlling for BMI, age, race, and ethnicity with ACEs (total) and drive for muscularity as moderators. Lastly, study 3 examined if SC moderated the relationship between IWB and binge eating.

The first study aimed to assess between and within-subject effects of SC on binge eating in adult men. Originally, a mixed-effects model was proposed to determine the impact of momentary SC (independent variable) on binge eating symptoms at the next prompt (dependent

variable) while controlling for body mass index (BMI; kg/m2), age, race, and ethnicity. However, violations of assumptions required a change in analysis. Instead, a series of sgeneralized estimating equations were used to explore the between and within-subject effects of SC on binge eating symptoms in adult men. It was hypothesized that an inverse relationship between SC with binge eating exists, such that those with lower EMA-assessed SC will report increased EMA-assessed binge eating.

The second study aimed to examine the between and within-subject effects of SC on IWB in adult men with moderate to severe binge eating symptoms. Similar to the above, a mixed effects model was proposed to explore the relationship between SC and IWB. However, violations of assumptions and lack of improvements upon applying transformations resulted in generalized estimating equations to analyze data in the second study. It was hypothesized that those with lower daily SC would report increased IWB after controlling for BMI, age, race, and ethnicity, with ACEs and drive for muscularity as moderators.

The third and final study aim was to explore if self-compassion at time 2 moderated the relationship between internalized weight bias at time 1 and binge eating at time 3 in a sample of adult men. Little is known regarding how these constructs are related in adult men with moderate to severe binge eating. Understanding how momentary self-compassion may influence the strength of the relationship between internalized weight bias and binge eating could be important for future interventions aimed at reducing both constructs.

CHAPTER 2

Overall Methods and Materials

Procedures

Data Recruitment and Participants

Data from all three studies came from men who were either: 1) enrolled, 2) previous (expired) members, or 3) expressed interest but never joined a health coaching program (i.e., Profile by Sanford) with clinics throughout the U.S. focused on health behavior change and weight loss. Profile by Sanford is a personalized health coaching program that helps individuals reach health goals through one-on-one meetings that target nutrition, physical activity, and lifestyle behaviors (e.g., stress management). Profile by Sanford recommends a balanced, reduced-calorie meal plan using a combination of grocery foods and meal replacements to ensure a nutritionally complete diet that includes an adequate intake of vitamins and minerals. All participants had to indicate moderate or greater binge eating via a score of 18 or greater on the Binge Eating Scale, which indicates moderate to severe binge eating symptoms (BES; Gormally et al., 1982) (range: 0-32; moderate: 18-26; severe: 27-32) and had to indicate male sex at birth.

Participants were recruited through email, Facebook posts, physical fliers in store locations, and by word of mouth through their health coach. Study recruitment materials included study expectations, estimated time needed to complete the study, and the study incentive ($100 Profile by Sanford gift card). Prospective participants were directed to a link through Research Electronic Data Capture (REDCap), a secure web application for research study management, where they signed the informed consent and completed the screener. Those eligible to participate completed the remaining surveys in REDCap and received instructions with a unique ID number to download the ecological momentary assessment (EMA) app LifeData, a Smartphone app and study design system for conducting EMA studies. The unique

ID number was then entered into the EMA app upon download, which allowed for linking REDCap surveys to all EMA data.

Data were collected from April 20, 2022, through July 3, 2022. Each participant provided consent before completing baseline and EMA measures, and all procedures were approved by the institutional review board (IRB) at the academic institution affiliated with the principal investigator. Data were de-identified and stored adhering to university and IRB data security policies. Participants included for analysis completed the baseline assessments and at least 5 EMA prompts throughout the week of EMA. Data were cleaned to remove implausible values, and assumptions (e.g., linearity, heteroscedasticity, normality) were assessed before running the model. Because of violations in heteroscedasticity and no improvement after appropriate transformations, generalized estimating equations (GEEs) were run to examine the data.

Study 1

To evaluate the effects of self-compassion on binge eating, men with moderate to severe binge eating completed seven days of EMA prompts. Previous findings indicate that shorter study duration, fewer prompts per day, shorter prompt duration (in minutes), and higher compensation are associated with increased willingness and likelihood to participate in an EMA study (Smyth et al., 2021). As such, a single-wave design was implemented, which included both signal and interval-contingent prompts. Signal-contingent recordings were completed through five semi-random signals evenly distributed between 9 AM and 10 PM (see Table 1).

Table 1

Ecological Momentary Assessment Prompting Schedule

Day	9-11 AM	12-2 PM	3-5 PM	6-8 PM	9-10 PM
Monday	X	X	X	X	X
Tuesday	X	X	X	X	X
Wednesday	X	X	X	X	X
Thursday	X	X	X	X	X
Friday	X	X	X	X	X
Saturday	X	X	X	X	X
Sunday	X	X	X	X	X

Study 1 was an observational study that evaluated how SC prospectively predicted binge eating in adult men.

Study 2

The second study is similar to the first study, but with IWB as the outcome of interest. Covariates added to the model included age, race, BMI, and ethnicity. This study mirrors the description of the methods and procedures listed above. This study also used GEEs after violations of assumptions occurred, notably heteroscedasticity.

Study 3

Study 3 used moderation analyses to assess the relationships between SC, binge eating, and IWB. Participants, methods and procedures, and materials were all collected from the same design reported in the first study description. See Figure 3 for the proposed moderation model.

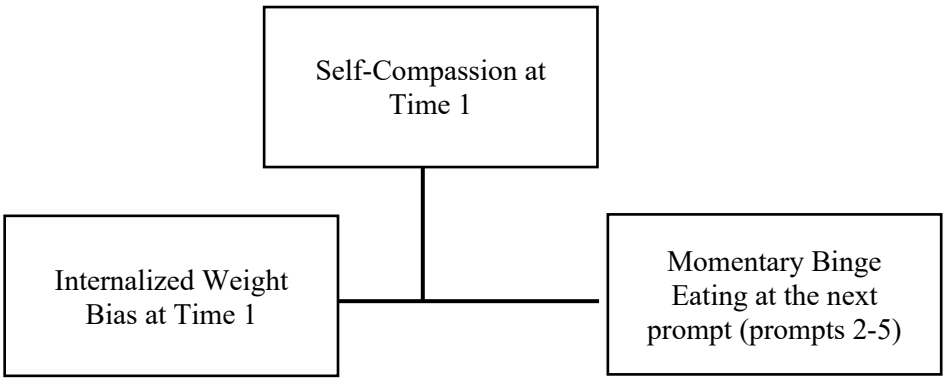

Figure 3.

Self-Compassion (time 1) Moderates the Relationship Between Internalized Weight Bias (time 1) and Binge Eating (at the next prompt where it is reported, prompts 2-5)

Measures

Measures used for each study are listed in their entirety in each chapter. Thus, to reduce redundancy, they will not be listed here.

Analytic Plan

The data used in all three studies were collected through EMA methods. Studies 1 and 2 aimed to examine between-subject and within-subject effects of SC on binge eating symptoms (study 1) and IWB (study 2). Originally, mixed effects models were going to be used to determine the influence of momentary SC (IV) on each respective dependent variable. However, after testing for violations of assumptions and applying square root, log, and natural log transformations without any notable improvement, our data plan was modified to use GEEs. In study 1, this analysis was used to evaluate momentary SC (IV) on binge eating symptoms at the next prompt (DV) with ACEs (total score) and drive for muscularity as moderators while controlling for BMI, age, ethnicity, and race. In study two, this involved using a GEE to assess momentary SC (IV), and IWB reported at the following prompt while controlling for BMI, age,

ethnicity, and race with ACEs (total score) and drive for muscularity as moderators. Age, race, and ethnicity were added to the models as covariates after the original data plan was solidified because of differences in participant compliance by demographic variables, namely age, race, and ethnicity.

We tested the following assumptions of the mixed effects model: 1) there must be a linear relationship between the outcome variable and independent variables, 2) residuals are normally distributed, and 3) absence of multicollinearity (independent variables are not highly correlated with each other). Graphs plotting model residuals was used to test the assumption of linearity. The absolute value of residuals and then squared was extracted from the model, and an ANOVA was run to determine between-subject residual differences to examine the assumption of homogeneity of variance. Finally, to test that the residuals in the model are normally distributed, QQ plots was used to estimate where standardized residuals are with respect to normal quantiles. Because violations of heteroscedasticity occurred, transformations were performed. None of the transformations resulted in improved error variance. As a result, GEEs were used for studies 1 and 2. GEEs are a type of statistical model appropriate for repeated measures data and are more robust than standard regression models. Further, they are appropriate to use when there are missing data.

Study 1

To accomplish study 1 aim, a GEE was used to determine the impact of momentary SC (IV) on binge eating symptoms at the next prompt (DV) with ACEs (total score) and drive for muscularity as moderators while controlling for BMI, age, race, and ethnicity. The nested model in this study involves analyzing two levels of data. In level one, there are repeated EMA observations of two variables, SC and binge eating. At level two, the data includes participant-level variables that do not vary over time, such as demographic factors. By utilizing this nested

model approach, the study aims to investigate the within-person changes in self-compassion and binge eating symptoms over time, while also accounting for the between-participant differences in this relationship. To test the primary hypothesis that binge eating symptoms vary by SC, a series of GEE analyses were conducted with binge eating as the response variable and SC as the predictor variable.

Study 2

A GEE was run to evaluate the variability of SC on IWB in men who binge eat. The study 2 nested model includes two levels of data: level 1) observations of EMA-assessed SC and IWB which are reported from level 2) participants. To test the primary hypothesis that IWB varies by SC, a GEE was fit with IWB as the response variable and SC as the predictor variable, with BMI, age, race, and ethnicity as covariates. Both drive for muscularity and ACEs were included as moderators. The same statistical assumptions from study 1 apply to study 2.

Study 3

Little is known regarding how SC, binge eating, and IWB are related in adult men with moderate to severe binge eating symptoms. We explored if SC moderates the relationship between IWB and binge eating. A generalized estimating equation (GEE) with a gamma link function and an autoregressive (AR1) serial autocorrelation correction was used to examine this hypothesis. The independent variable was internalized weight bias reported at time 1 of the day, self-compassion at time 1was the moderating variable, and the next eating occasion where binge eating items were completed (which could be any prompt between 2-5) was the dependent variable. Age, race, and ethnicity were included in the model as covariates.

CHAPTER 3

Associations among self-compassion and binge eating in men: An Ecological Momentary Assessment (EMA) Study.

Abstract

Objective: Self-compassion is protective against disordered eating, though much of the existing literature includes white female samples. Questions remain on how self-compassion is associated with binge eating symptoms in men who binge eat. Thus, this study utilized ecological momentary assessment (EMA) methods to assess the between- and within-subjects effects of self-compassion on binge eating in adult men.
Method: Participants were 85 men (age_m=35.71±10.71 y; 43.5% White, 43.5% Black/African American; Binge Eating $Scale_m$=34.16±9.93, range 18-46) with binge eating symptoms who completed surveys on a smartphone using the LifeData app. Self-compassion and binge eating were assessed by 7 days of signal-contingent prompting through five semi-random signals evenly distributed between 8 AM and 10 PM. Generalized estimating equations (GEE) with a gamma function and autoregressive serial autocorrelation correction assessed the prospective associations between self-compassion and binge eating in the next two hours and trait drive for muscularity and adverse childhood experiences as potential moderators of this association. GEE models controlled for ethnicity, race, socioeconomic status, and age.
Results: One unit increase in between-subjects self-compassion was associated with a 0.19 decrease in binge eating in the next 2 hours ($p = .02$). Neither drive for muscularity nor adverse childhood experiences moderated the relationship between self-compassion and binge eating.
Discussion: Findings showed that momentary between-subjects self-compassion is a relevant protective factor for binge eating in adult males. Adult males with binge eating symptoms can benefit from interventions designed to increase self-compassion.

Introduction

Binge eating occurs when an individual consumes large quantities of food in a discrete period (such as 2 hours) while experiencing loss of control of eating (APA, 2013). Additionally, binge eating must occur in the absence of compensatory behaviors, such as self-induced vomiting, laxative use, or excessive exercise behaviors. Prevalence estimates of lifetime eating disorders in a nationally representative sample of U.S. adults indicate binge eating disorder (BED) is more prevalent than both anorexia nervosa and bulimia nervosa, with 63.5% of individuals with BED reporting their diagnosis persisted for 12 months and a mean self-reported age of onset of 24.5 years (Udo & Grilo, 2019).

BED is a significant health problem associated with overweight and obesity (OW/OB), increased risk of diabetes, and higher risk of psychopathology (McCuen-Wurst, Ruggieri, & Allison et al., 2018). It is estimated that roughly 40% of all BED cases are men (Hudson et al., 2007; Westerberg & Waitz, 2013). Compared to women, men with lifetime BED report earlier age of onset, longer duration of binge eating episodes, and later age of seeking help (Coffino et al., 2019). Binge eating has also been linked to metabolic syndrome, reduced cognitive flexibility, inhibitory control, attention, and planning (Iceta et al., 2021; Ndubuisi et al., 2022). An estimated 30% of all individuals enrolled in weight loss treatments show signs of BED, and most people with BED seek treatment for weight loss rather than binge eating (Ibqal & Rehman, 2019; Westerberg & Waitz, 2013).

Self-compassion (SC) has received increasing attention in eating disorder research, specifically as a mechanism to mitigate negative affect, which is thought to play a role in binge eating (Braun et al., 2016; Guan et al., 2021; Johnson & O'Brien, 2013). SC is defined as an individual's ability to extend compassion to themselves during periods of suffering or hardship

and involves three main components: 1) self-kindness versus self-judgment, 2) common humanity versus isolation, and 3) mindfulness versus over-identification (Neff, 2003). Self-kindness entails offering the same kindness and care to the self as one would to a close friend experiencing adversity. Common humanity requires the individual to recognize that imperfection and hardship are part of the broader human experience and foster feelings of connection to others instead of isolation. Finally, mindfulness involves recognizing and acknowledging suffering in a balanced and nonjudgmental way instead of becoming absorbed by it or minimizing it. SC interventions have resulted in improvements across 11 different psychosocial outcomes (e.g., stress, mindfulness, and depression) compared to controls, with large effect sizes observed for improved eating behaviors and rumination (Ferrari et al., 2019). Specifically, SC may be a helpful construct to target eating difficulties, including binge eating disorder (Ferrari et al., 2019; Kelly & Carter, 2015; Kelly et al., 2017).

SC has been proposed as an effective approach for reducing binge eating and weight concerns in adults with binge eating disorder (Kelly & Carter, 2015). SC is negatively associated with disordered eating in adolescents and adults from both clinical and non-clinical populations (Braun et al., 2016). Further, self-responses or self-talk that lack compassion may lead to increased negative affect and lead individuals to engage in binge eating to alleviate negative feelings (Bicaker & Racine, 2022). Bicaker and Racine (2022) observed that compared to compassionate self-responding, uncompassionate self-responding in men was strongly related to binge eating. This suggests that individuals who treat themselves harshly or critically may experience heightened binge eating, whereas individuals who respond to themselves with kindness and compassion while experiencing personal difficulties may be protected against binge eating. In an ecological momentary assessment (EMA) study examining the impact of positive

affect, negative affect, guilt, fear, hostility, and sadness relative to binge eating episodes, improvements in affect were observed following binge eating episodes (Schaefer et al., 2020). Since SC is a skill to regulate emotions when facing adversity or personal shortcomings, it may influence the occurrence and intensity of binge eating symptoms. A significant limitation in both the binge eating and self-compassion literature involves samples comprising mostly non-Hispanic White women. Thus, the inability to generalize existing findings to men is an important limitation of previous studies (Egbert et al., 2022; Ferrari et al., 2019).

Drive for muscularity is a prominent feature of body image among men. The drive to become more muscular can increase due to an individual's feelings of inadequacy in regard to their muscularity, leading to behaviors intended to close the gap between the ideal and actual body and physique (Bergeron & Tylka, 2007; McCreary & Sasse, 2000). Because male disordered eating often stems from muscularity ideals that contribute to male body image concerns (DeBlaere & Brewster, 2017; Kinasz, Accurso, Kass, & LeGrange, 2016), it is important to examine how drive for muscularity influences the relationship between self-compassion and binge eating in men.

Adverse childhood experiences (ACEs) are associated with higher weight and mental health conditions (including affect-related binge eating in people with severe obesity) (Brewerton et al., 2015; Wiss & Brewerton, 2020). In adults considering bariatric surgery, ACEs have been linked to binge eating behaviors (Horvath et al., 2022). Specific adverse experiences like emotional abuse and household substance use have been identified as key factors in the development of overeating and disordered eating behaviors in adulthood among men (Yoon et al., 2022). Further, self-compassion has been shown to weaken associations between ACEs and eating-related outcomes in youth—a finding that indicates self-compassion could be a beneficial

intervention strategy for individuals with a history of ACEs (Hazzard et al., 2021). Individuals with histories of abuse or neglect, or who report being shamed by caregivers as a child are at greater risk for eating disorders and may see offering compassion to themselves as threatening since they did not often receive compassion during their upbringing (Miron et al., 2016). As such, it important to understand how ACEs may affect the relationship between self-compassion and binge eating in adult men.

EMA has been touted as a valuable methodology for understanding momentary individual and environmental factors that precede and follow disordered eating behaviors (Schaefer et al., 2020). Current EMA methodology involves repeated assessment of participants through prompts delivered via an electronic device (cell phone) when participants are in their natural environment. Given the nature of data collection (when a person is in their natural environment), EMA overcomes the limitations of traditional methodologies (such as cross-sectional and longitudinal survey studies) by reducing recall bias, improving ecological validity, and permitting the study of temporal patterns of participant experiences and behaviors. Findings from EMA studies examining binge eating support emotion regulation models of eating disorders (Heatherton & Baumeister, 1991), such that negative affect (guilt, shame) peak in moments before a binge episode and significantly decrease after a binge episode (Schaeffer et al., 2020). SC has been shown to reduce guilt and shame and engender feelings of hope and emotional control (Crisan et al., 2022; Umphrey et al., 2020). Further, adults who completed a 7-day EMA study and reported higher SC experienced higher momentary positive affect and lower momentary negative affect (Mey et al., 2023). Additionally, Thogerson-Ntoumani and colleagues (2017) found that women enrolled in a 7-day EMA study who extended self-compassion toward their bodies reported lower appearance-related anxiety, drive for thinness, and body

dissatisfaction. Similarly, results from higher-weight adults enrolled in a weight loss program who completed a 14-day EMA study indicate that, although SC does not predict weight loss, it was negatively associated with reduced guilt related for dietary lapses (Thogerson-Ntoumani et al., 2021). These early EMA findings show that SC fluctuates throughout the day and that SC can influence eating symptoms and emotions relevant to eating. Unfortunately, the role of SC in binge eating symptoms has yet to be explored in men using EMA methods.

The present study examines if men with moderate to severe binge eating symptoms who report low levels of SC (between-subjects effects) experience greater binge eating symptoms and if within-day fluctuations in SC predict subsequent binge eating. As such, we sought to assess the between and within-subjects effects of SC (an affect regulation mechanism that can modify negative emotions and engender more positive emotions) on binge eating in adult men. It was hypothesized that men with lower levels of EMA-assessed SC would report increased binge eating compared to men with higher levels of EMA-assessed SC. Within individuals, it is believed that those with lower momentary levels of SC would report increased binge eating. Additionally, we hypothesized that trait drive for muscularity and ACEs would moderate the relationship between self-compassion and binge eating in men.

Materials and Methods

Study Design

An intensive longitudinal study design using a 7-day interval-contingent/fixed time-based EMA study examined the day-level associations between self-compassion and binge eating symptoms. A baseline survey was completed online between April 20 – June 5, 2022. The EMA study was completed between April 22 - July 3, 2022. The current analyses use data from the EMA study and the online baseline survey.

Recruitment and Participants

A convenience sampling strategy was used to recruit prospective participants through social media (Facebook) and email listservs specifically for men enrolled in a health coaching program or who had expressed interest in health coaching. Inclusion criteria for the study were: 1) male sex at birth, 2) 18 years or older, 3) able to read and speak English, 4) scoring a moderate to severe score on the binge eating scale [BES], indicated as 18 or higher (Marcus et al., 1988), 5) own and regularly use a smartphone that can run mobile applications, and 5) willingness to comply with the study protocol and complete app-based surveys. Because compensatory behaviors were not part of exclusion criteria, the sample in these studies involves binge-eating spectrum disorders. Once eligibility was determined through an online screening questionnaire, individuals were provided informed consent that described study procedures, risks, and benefits. The Institutional Review Board at Northern Arizona University approved the study procedures. This study was conducted in accordance with the Declaration of Helsinki (2013).

Profile by Sanford Health Coaching Program

Of all participants in this sample, 77% were actively engaged in the Profile by Sanford program, while the remaining men indicated an interest in the program at some point. Profile by Sanford is a health coaching program that provides individuals with a reduced-calorie meal plan. Through one-on-one health coaching, individuals are encouraged to make lifestyle modifications related to diet, physical activity, and lifestyle (such as stress management). Health coaches are certified and receive extensive training. Individuals typically meet with a health coach weekly, bi-weekly, or monthly for 30 minutes. While not a program requirement, many individuals prefer to meet with the same health coach over time. One aspect of this program involves focusing on

weight loss through meal-replacement foods. Results from this program are previously reported (Bell et al., 2021; JaKa et al., 2021; Kim et al., 2021).

Procedures

After agreeing to participate in the study, participants completed a baseline survey through the online platform REDCap (Research Electronic Data Capture) (Harris et al., 2009). REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies. The baseline survey was pre-tested and took approximately 15 minutes to complete. Upon completion of the baseline survey, participants were instructed to download a free EMA data capture application (RealLife Exp app by LifeData) and complete 7 consecutive days of EMA on their personal smartphone, responding to interval-contingent/fixed time-based surveys. The app notified participants to complete five surveys daily between the following windows of time: 9-11 am, 12-2 pm, 3-5 pm, 6-8 pm, and 9-10 pm. Participants were given 15 minutes from when they were notified to answer each survey. If they missed the first 15-minute window to complete the survey, they were prompted again within the timeframe and given a second chance to complete the survey. Each survey took less than 3 minutes to complete. Participants received a $100 gift card to the health coaching program after completing the baseline survey, and at least 60% of all EMA prompts throughout the week. Gift cards could be used for purchasing pre-packaged meals, meal-replacement items, or other merchandise (fitness equipment, clothing apparel, etc.).

Measures

Initial Baseline Survey

Screener. A screener was issued via RedCAP that asked about participant sex (male/female), age (18 years or older? Yes/no), and binge eating (Binge Eating Scale

(BES); Gormally et al., 1992). The BES is a validated and reliable instrument to detect the severity level of binge eating (Gormally et al., 1992). Scores range from 0-46, with higher scores indicating more severe binge eating problems. Clinical cutoff scores for the BES include none-to-minimal (0–17), moderate (18–26), and severe (> 27). One primary objective of this study is to examine momentary fluctuations in self-compassion on binge eating. As such, individuals were eligible to participate in the study if they scored 18 or higher on the BES. Participants were deemed eligible and provided informed consent if they were 18 or older, male, and scored 18 or higher on the BES. Internal consistency reliability was previously reported at α=.88, though this study evaluated the psychometric properties of the BES in adult women enrolled in a weight loss program (Duarte et al., 2015). The internal consistency reliability of the BES in the present study was α=.96, demonstrating adequate reliability among men who binge eat.

Demographics. Demographic questions included participant's age, weight (lbs.), height (ft/in), race (American Indian/Alaska Native, Black/African-American, Asian, Native Hawaiian or Other Pacific Islander, White, More Than One Race, or Unknown), ethnicity (Hispanic or Latino, not Hispanic or Latino), sexual orientation (heterosexual, gay, lesbian, bisexual, not listed), and personal income over the past year (income<$20,000; $20,001-40,000; $40,001-60,000; $60,001-80,000; $80,001-100,000; $100,001 or greater; prefer not to say). Body Mass Index (BMI; kg/m^2) was calculated from self-reported weight and height. These items describe the sample and can help contextualize the generalizability of study findings.

Drive for Muscularity Scale (DMS). Drive for muscularity was measured at baseline using the 15-item DMS and examined as a moderator (McCreary & Sasse,

2000). Participants rated each item on a scale of 1 (*always)* to 6 *(never)*), with scores ranging from 15 to 90. Higher scores indicate higher levels of drive for muscularity. Internal consistency reliability was previously reported between α=.80-.95 (Edwards et al., 2014), and was excellent in the present study, α=.91.

Adverse Childhood Experiences (ACE). Adverse childhood experiences (ACEs) at baseline was examined as a moderator. The expanded ACE checklist measures adverse childhood experiences related to difficult experiences during childhood (Dong et al., 2004; McLennan, MacMillan, & Afifi, 2020). This instrument includes 17 items that comprise a total ACEs score that ranges from 0-17. Additionally, these 17 items create ten adverse childhood events (answered in a yes/no format) that fall within the following domains: emotional or physical neglect, domestic violence, household substance use, mental illness in the household, parental separation, or divorce, and having a household member with a criminal record (Felitti et al., 2019).

Ecological Momentary Assessment Surveys

State Self-Compassion. The 6-item State Self-Compassion Short Form (SSCS-S) was used to assess state self-compassion (Neff et al., 2021). Participants were asked to rate how true each statement is for them currently on a scale ranging from 1 (*not at all true for me*) to 5 (*very true for me)*. Sample items include: (a) *"I'm obsessing and fixating on everything that's wrong*," and (b) *"I'm keeping things in perspective*." First, to score the SSCS-S, items 2, 4, and 6 were reverse-coded. From there, a total mean was calculated to indicate a participant's state self-compassion level, with scores ranging from 1 to 5. While there are no clinical norms or scores to indicate high or low state self-compassion using the SSCS-S, an ad-hoc rubric suggests scores of 1.0-2.49 to be low, 2.5-3.5 to be

moderate, and 3.51-5.0 to be high. Initially, EMA-assessed SSCS-S demonstrated poor internal consistency reliability, α=.56. After the removal of item 3, internal consistency reliability improved, α=.63.

Binge Eating. A total of 6 items measured binge eating. Eating occasions were identified when participants indicated they ate in response to the question: *"Did you eat in the past two hours?*" (Yes/No). Overeating and loss of control eating were measured on all eating occasions. Overeating was assessed with two items: (a*) "To what extent do you feel that you overate?"* and (b) *"To what extent do you feel that you ate an excessive amount of food?"* Loss of control eating was assessed with four items: (a) *"While you were eating, to what extent did you feel a sense of loss of control?"* (b) *"While you were eating, to what extent did you feel that you could not resist eating?"* (c) *"While you were eating, to what extent did you feel that you could not stop eating once you had started?"* and (d) *"While you were eating, to what extent did you feel driven or compelled to eat?"* Participants rated each item on a scale from 1 (*not at all*) to 5 (*extremely*). Loss of control and overeating items were averaged to create two scores. From there, a dimensional rating of binge eating was calculated at each eating episode by summing the loss of control and overeating scores. For the first study (between-subjects effects), the dimensional BES rating was used to determine the level of binge eating. A mean of all items was used for a total binge eating symptom severity score, with higher scores indicating greater binge eating severity. EMA-assessed binge eating demonstrated strong internal consistency reliability, α=.95.

Statistical Analyses

The analytic plan was specified prior to analyses. Participants who completed five or

more prompts (1 day of EMA) were included in the analysis. Initially, assumptions of a mixed effects model were assessed, and violations of homoscedasticity occurred. Transformations were applied but did not yield improvements. As a result, a generalized estimation equation (GEE) with a gamma link function and an autoregressive (AR1) serial autocorrelation correction were used to determine the impact of momentary self-compassion (IV) on binge eating symptoms at the next prompt (DV) with ACEs and drive for muscularity as moderators while controlling for BMI, age, race, and ethnicity. GEEs were conducted using IBM SPSS Statistics for Macintosh, Version 27.0 (Chicago, IL), with statistical significance set at $p < .05$. Unstandardized regression coefficients, standard errors, and confidence intervals are reported. For observed significant effects, Cohen's f^2 was also calculated to represent effect size (Selva et al., 2012). It was hypothesized that there would be an inverse relationship between self-compassion and binge eating. Lower momentary levels of self-compassion would be linked to increased binge eating, and higher self-compassion would be associated with reduced binge eating.

Results

Participant Demographic Results

A total of 85 men (m_{age}=35.71 ± 10.71; $mean_{BingeEatingScale}$ = 34.16 ± 9.93, range:18-46) completed the baseline and EMA surveys (see Figure 1). Most men reported higher personal/individual incomes exceeding $80,000 USD per year. Most participants White (43.5%) or Black/African American (43.5%), and non-Hispanic (89.4%). Fraudulent participants were determined through a number of mechanisms, namely: cell phone type, examining and removing anyone with multiple IP address entries in the baseline survey, and reviewing if phone records matched the IP location of participants. Participants who are listed as quitting are those who emailed the study team to share that they would no longer be participating in the study. See

Figure 1 for study attrition and Table 2 for participant demographic results.

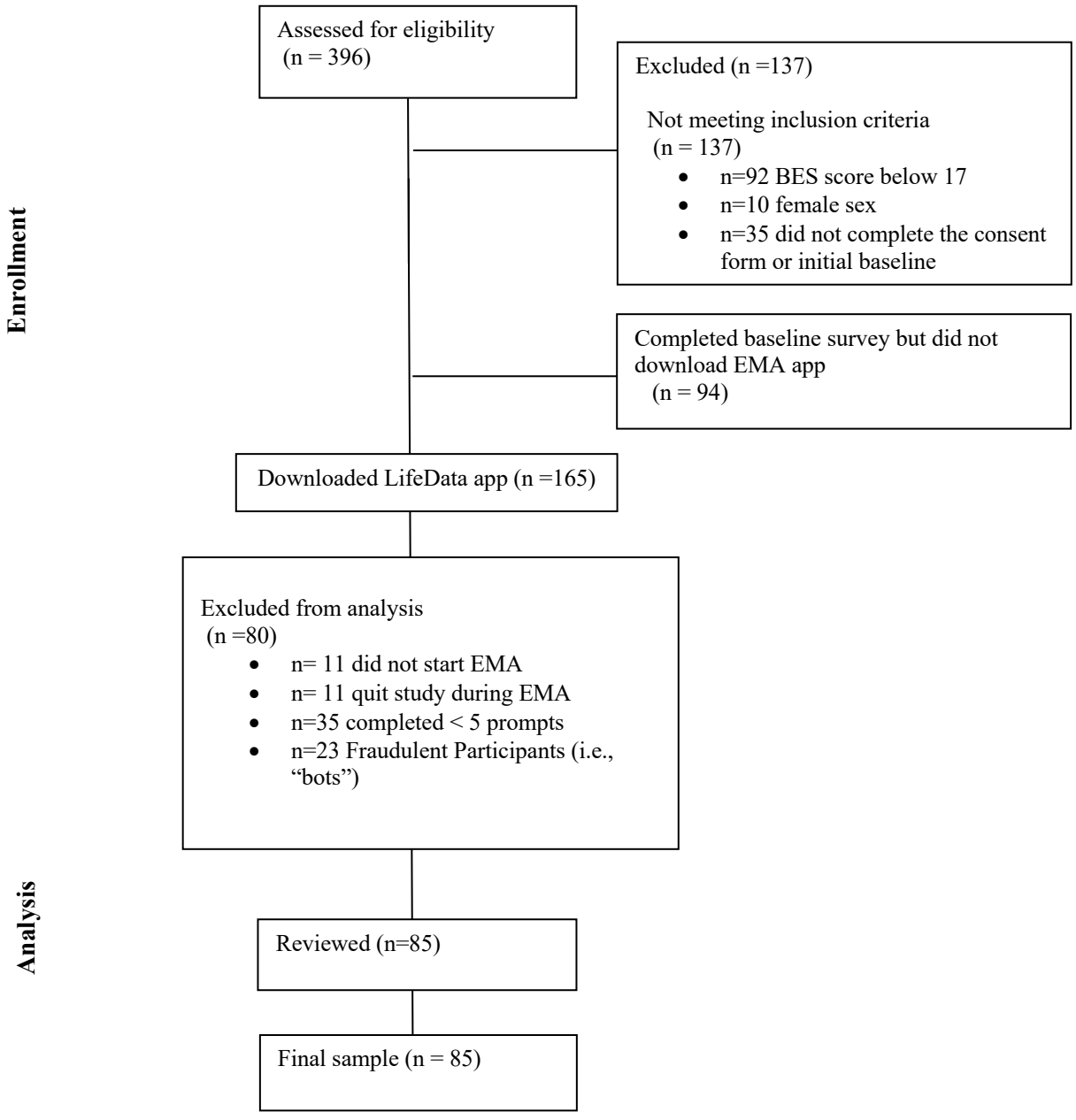

Figure 1.
Participant Attrition

Table 2

Participant characteristics (n=85)

Characteristic	Category	n (%)
Ethnicity		
	Hispanic or Latino	5 (5.9)
	Not Hispanic	76 (89.4)
Race (check all that apply)		
	Asian	1 (1.2)
	Native Hawaiian or Other Pacific Islander	1 (1.2)
	Black or African American	37 (43.5)
	American Indian or Alaska Native	3 (3.5)
	White/Caucasian	37 (43.5)
	More than one race	1 (1.2)
Services Received		
	Profile by Sanford	66 (77.6)
	No services received	18 (21.2)
Profile by Sanford Service Quality		
	Extremely dissatisfied	1 (1.2)
	Dissatisfied	1 (1.2)
	Neutral	6 (7.1)
	Satisfied	27 (31.8)
	Extremely Satisfied	25 (29.4)
Body Mass Index (BMI; kg/m^2)	mean=32.66±6.83	
	BMI below 25	4 (4.8)
	BMI of 25-29.9	20 (39.8)
	BMI of 30-39.9	36 (48.2)
	BMI of 40+	6 (7.2)
Weight Change Status		
	No weight loss in the past year	4 (4.7)
	Weight gain in the past year	17 (20)
	Lost 0-4% of starting body weight in the past year	15 (17.6)
	Lost 5-10% of starting body weight in the past year	20 (23.5)
	Lost 11%+ of starting body weight in the past year	11 (12.9)
Personal Income		
	Under $20,000	2 (2.4)
	$20,001 - $40,000	2 (2.4)
	$40,001 - $60,000	13 (15.3)
	$60,001 - $80,000	13 (15.3)
	$80,001- $100,000	29 (34.1)

Greater than $100,001	24 (28.2)
Prefer not to say	2 (2.4)

Ecological Momentary Assessment Results

It took participants an average of 2 minutes and 13 seconds the time a prompt was sent to when it was answered. Total EMA compliance was 74.4%, and men enrolled in the study averaged 3.6 out of five total prompts per day (SD: 0.95). In total, there were 2,109 complete EMA observations over the span of 7 days. Response rates did not change as a function of time of day, X^2 (4, N=2146) = 8.77 p=0.07. Similarly, results indicated no significant differences in response rates across the 7 days X^2 (6, N=2146) = 7.58, p=0.27, although the final two days (6 and 7) account for 8.6% and 2.18% of all completed prompts in the study, respectively. The final two days of the study resulted in lower total amount of data collected (days 6 and 7), and this was notably lower than the previous study days. An independent samples t-test indicated no significant difference in the mean values of completed sessions between days 1-5 (group 1) and days 6-7 (group 2), $t(2144)= -0.01$, $p=0.99$. The lower total amount of EMA data collected on days 6 and 7 (i.e., there were 46 completed responses and 0 missing responses on day 7 of the EMA vs. 431 completed responses and 7 missing responses on day 1) is plausibly explained by participants deleting the app off their phone once reaching the required total number of responses acceptable to receive compensation.

Other factors, including BMI and socioeconomic status, were not associated with compliance. However, significant compliance differences were observed based on ethnicity, race (White, Black, Other Race), and age. Non-Hispanic individuals, participants who endorsed races besides Black/African American or White/Caucasian, and older adults had lower compliance rates. A total of 35 completed fewer than five prompts and were excluded from analysis. Reasons provided for dropping out were phone not accessible during work hours and phone/technical

difficulties. As a result of compliance differences by sociodemographic characteristics, age, race, and ethnicity variables were added as covariates.

Over the course of one week, men reported 1,285 eating occasions. In total, 31.5% of all eating occasions had a mean binge-eating score of 3 out of 5 or higher (defined in other EMA studies as a "severe" binge occasion; Mason et al., 2021). Using definition of a binge-eating episode as a score of 3 or greater (Mason et al., 2021; Smith et al., 2018; Smith et al., 2019), roughly 76% of participants in this sample reported at least one binge-eating episode. Of all binge-eating episodes reported, 12.8% were at the highest severity level (5 out of 5). Table 3 shows descriptive statistics for the study variables.

Table 3

Descriptive Statistics of Study Variables

Variable	M	SD	ICC	Min.	Max.
Binge Eating	2.37	1.17	0.76	1.00	5.00
Within-Subject Self-Compassion	-0.003	0.43	0.23	-2.14	1.70
Between-Subjective Self-Compassion	3.34	0.87	0.23	1.00	5.00
Trait Drive for Muscularity	48.78	16.34	-	15.00	87.00
Adverse Childhood Experiences	3.88	4.50	-	0.00	17.00
BMI	32.67	6.39	-	19.05	64.64
Age	36.90	10.46	-	18	66

Note. M = mean; SD = standard deviation; ICC = intraclass correlation coefficient, values less than .40 are considered low, values of .40-.75 are considered moderate, and values exceeding .75 are considered high.

Four models were examined: 1) only IVs (between and within self-compassion) and DV (momentary binge eating), 2) IVs and covariates with DV, 3) ACEs as a moderator, 4) Drive for Muscularity as a moderator. Table 4 shows the within- and between-subjects effects of time-lagged self-compassion before the 2-hour EMA window in relation to binge eating symptoms. Additionally, individuals with higher levels of self-compassion reported significantly lower

binge eating symptoms than those with lower self-compassion. Specifically, one unit increase in between-subjects SC resulted in a 0.19 decrease in binge eating two hours later at the next prompt. Within-subjects self-compassion was not found to prospectively predict later binge eating occurrences. The QIC Quasi Likelihood under Independence Model Criterion for the final model was 149.41. The QIC is a measure of the accuracy of the final model, where values closer to zero are preferred. A score of 149.41 indicates the final model fits the data well as demonstrated by the lowest QIC of all models examined. Neither drive for muscularity (ß = 0.002, *SE*=0.003, *p*=0.51) or adverse childhood experiences (ß = 0.003, *SE*=0.007, *p*=0.65) moderated the relationship between momentary self-compassion and subsequent binge eating in men.

Table 4

Parameter Estimates from General Estimating Equations of Associations Among Self-Compassion and Binge Eating

Variable	ß	S.E.	*p*	95% CI
Within-subjects Self-Compassion•	0.001	0.04	0.98	[-0.08,0.08]
Between-subjects Self-Compassion•	**-0.19**	**0.03**	**<.001**	**[-0.26, -0.12]**
Adverse Childhood Experiences¥*	**0.03**	**0.01**	**0.003**	**[0.01, 0.05]**
Adverse Childhood Experiences * Within-Subjects Self-compassion•	0.003	0.007	0.65	[-0.01,0.02]
Drive for Muscularity¥	0.00	0.004	0.85	[-0.07, 0.008]
Drive for Muscularity¥ * Within-Subjects Self-Compassion•	0.002	0.003	0.51	[-0.004, 0.007]
BMI ¥	**-0.01**	**0.005**	**0.02**	**[-0.02, -0.002]**
Age ¥	**-0.01**	**0.004**	**0.05**	**[-0.02, 0.00]**

Note. p values < .05 are bolded. * indicates significance at the .001 level. • indicates momentary, EMA-assessed variable. ¥ indicates a variable assessed once at baseline.

Discussion

The present study highlights the relationship between momentary self-compassion and

binge eating in men enrolled in a health coaching program. Most men in this sample had a BMI within the overweight or obesity categories, and roughly 76% of men in this sample experienced at least one binge eating episode during the week of EMA prompting. While the present study did not compare participants from different BMI groups, the binge symptoms reported in this study of mostly men with overweight and obesity is aligned with findings from Nagata and colleagues (2018) who reported that individuals in higher BMI categories reported greater disordered eating behaviors than participants in underweight or normal BMI categories. Results indicate that men with higher self-compassion reported significantly lower binge eating symptoms than those lower in self-compassion, but that momentary self-compassion was not significantly related to binge eating at the subsequent prompt. Trait drive for muscularity and ACEs did not moderate the relationship between self-compassion and binge eating in this sample. Overall, results suggest that an individual's self-compassion is an important consideration for binge eating in adult males, but that momentary self-compassion throughout the day have little predictive utility over later binge eating in men. These results provide partial support for the notion that future efforts could be developed to encourage men to practice self-compassion to prevent eating disorder behavior and cognitions, however, developing ecological momentary interventions (EMIs) to cultivate momentary self-compassion in men may not be an efficient use of time and effort (Mason et al., 2021).

The present work expands upon Bicaker and colleagues' (2022) work by examining an adult male sample and collecting momentary binge eating data through EMA. Findings from the present study are aligned with a cross-sectional daily diary study that concluded self-compassion was associated with less frequent loss of control of eating in university students and that cultivating self-compassion could lower negative emotions to reduce binge frequency (Bicaker et

al., 2022). When examining sex differences, findings indicated that self-compassionate male college students experienced lower negative affect intensity and that more research is needed to improve understanding of sex differences in self-compassion and binge eating behaviors (Bicaker et al., 2022). It is important to note that Bicaker and colleagues (2022) only collected loss of control of eating at the end of each day. In contrast, the present study collected momentary data by asking participants about binge eating after every confirmed eating occasion.

Matsumoto and Rodgers (2020) proposed an integrated theoretical model to explain the development of eating disorders among midlife men using sociocultural theory, objectification theory, social identity theory, developmental theory of embodiment and positive body image, and existential and terror management theory. This integrated model suggests that several pressures and interpersonal experiences are distal risk factors of eating disorder behaviors, such as binge eating. Psychological (such as conformity to masculine norms) and body image (such as reduced body appreciation and higher body dissatisfaction) constructs are proposed to mediate the relationship between these distal risk factors and eating disorder behaviors. The present study adds to our understanding of self-compassion as a protective factor that can work to disrupt the impact of distal risk factors on disordered eating in men. It is possible that men higher in self-compassion are able to better cope with pressure to look a certain way and weight and body changes associated with aging.

Neither ACEs or trait drive for muscularity moderated the relationship between self-compassion and binge eating. This was unexpected since prior work indicates both constructs could influence the strength of this relationship and that self-compassion could attenuate harsh judgments related to body image and personal characteristics. In a narrative review of all muscularity research published from 2000 through 2019, Lennon and Johnson (2021) found that

personal characteristics of perfectionism and endorsing beliefs around traditional masculine norms predicted drive for muscularity. Self-compassion has been shown to weaken the relationship between maladaptive perfectionism and depression in both adolescents and adults (Ferrari et al., 2018). Among men, self-compassion was strongly and inversely associated with body shame and body surveillance (e.g., looking at one's body from an outside perspective to determine if it meets cultural standards) and was shown to moderate the relationship between body surveillance and body shame (Wollast et al., 2020). However, in male athletes, self-compassion was not related to either body dissatisfaction or disordered eating (Cusack, Petrie, & Moore, 2022). Future work should investigate the relationships between drive for muscularity, self-compassion, and disordered eating further in a more diverse sample of men who represent a wide range of ages, ethnicities, races, gender identities, and sexual orientations.

We observed a significant main effect of ACEs on binge eating but did not observe ACEs as a moderator of self-compassion and binge eating. The significant main effect indicates that as ACEs increases, so does binge eating symptoms. This is somewhat aligned with previous findings. In adults seeking bariatric surgery, abuse and neglect ACEs were found to predict binge eating in adulthood (Horvath et al., 2022). Among men, emotional abuse and household substance use have been salient adverse early childhood experiences linked to overeating and disordered eating behaviors in adulthood (Yoon et al., 2022). Previous work shows that one reason for this association may be neurological changes that occur regarding leptin receptors in the lateral hypothalamus (Shin et al., 2022). Patients receiving inpatient, residential, or partial hospitalization for eating disorders reported higher ACEs than individuals in a nationally representative sample, and patients with binge eating disorder were more likely than those with anorexia nervosa to experience household ACEs (household divorce, substance use, mental

illness) and abuse ACEs (physical abuse, emotional, abuse) (Rienecke et al., 2022). Self-compassion was shown to buffer the association between ACEs and eating-related outcomes in youth, where ACEs were also retrospectively reported as they were in the present study (Hazzard et al., 2021). The main effect finding from the present study adds to the growing support that self-compassion may be a worthwhile practice for individuals with a history of early, adverse trauma.

Strengths and Limitations

This study has several strengths, including a racially diverse sample of men and strengthened ecological validity inherent in EMA methods. EMA has several advantages over traditional approaches in that it 1) minimizes recall bias inherent in retrospective self-report and 2) enhances ecological validity by gathering real-time self-reports of behaviors, moods, beliefs, attitudes, and perceptions within the natural environment (Dunton, 2017; Shiffman & Stone, 1998). Another strength was that all participants were screened using the Binge Eating Scale (Gormally et al., 1984), and all had moderate or severe levels of binge eating. The BES was used to identify binge eating spectrum individuals and increase the likelihood that participants would experience binge episodes throughout the EMA assessment.

A third strength involves the diverse sample collected in the study, which included significant numbers of White and Afrian American participants. While the present study was not intended to focus on race and binge eating, we were able to recruit and retain Black/African American men. It is well documented that the field of eating disorder research involves the study of mostly White samples, such that roughly 70% of all samples collected where race and ethnicity were reported in publications from the International Journal of Eating Disorders in the years 2000, 2010, and 2020 were white (Egbert et al., 2022). It is possible that we were able to

recruit and retain as many Black men as we did because we recruited from a company owned by a reputable healthcare organization that may have circumvented known barriers to black men participating in research, such as mistrust of the system based on historical abuses in research (Nichols, 2022).

Another aspect that may have improved the willingness to participate was the design of the EMA study. Using findings from Smyth and colleagues (2021), which posit shorter study duration, fewer prompts per day, shorter prompt duration (in minutes), and higher compensation are associated with increased willingness to participate in EMA research. We employed a single-wave design. We tested the initial baseline survey and EMA prompts before study recruitment to ensure participant burden was kept at a minimum. However, despite being intentional about reducing participant burden and trying to maximize participant compliance through study design, men in this study had a compliance rate of 74%, slightly shy of the 80% ideal compliance rate (Stone & Shiffman, 2002).

While we did report some important and innovative findings, these findings must be considered in light of study limitations. First, participants subjectively reported using an app on their mobile device. Synced EMA and passive sensing using wearable devices have been proposed as promising new approaches to the study of binge eating behaviors and better understand characteristics of markers for a binge eating episode (i.e., eating behaviors such as more bites, time spent chewing, etc.) (Goldstein et al., 2022). That said, passive sensing is currently unable to measure loss of control of eating. Still, incorporating an additional way of measuring binge episodes to compare to those subjectively reported in EMA could improve confidence in these findings. Future work should consider incorporating passive eating monitoring into EMA studies examining binge eating to gain more insight into eating

characteristics unique to certain populations. These findings could inform future interventions designed to improve binge eating behaviors and could validate existing DSM-5 criteria for binge eating disorder, especially since clinical presentation of binge eating are known to differ between men and women (APA, 2013; Lydecker & Grilos, 2018). Physiological data, such as glucose variability, could also be incorporated into future studies using EMA to study binge eating disorder, as some individuals with BED may experience elevated glucose variability, and the degree to which glucose variability is elevated is associated with the frequency of binge episodes (Juarascio et al., 2022). Adding other objective and reliable measures of binge eating to the subjective EMA binge eating symptoms reported in this study could improve confidence in EMA reported binge eating occasions.

There have been concerns about participant reactivity (participant changing behavior because of being prompted) due to prompting in EMA studies. Findings indicate that participants may initially become more emotionally aware after prompts, but emotional awareness wanes over time (Eisele et al., 2022) Very few participants reported any changes in behavior because of prompting (Eisele et al., 2022), therefore, it is unlikely that prompting in the present study changed binge eating behaviors. Prompting may have made men more aware of self-compassionate states, but results from Eisele and colleagues (2022) suggest this awareness occurs soon after prompting and decreases with time.

Compared to heterosexual men, gay men have reported increased rates of disordered eating behaviors, likely due to minority stress (Laska et al., 2015; Nagata et al., 2018; Strong et al., 2000). Unfortunately, only 1.2% of the sample in the present study identified with a sexual minority group. The lack of diverse sexual identities limited our ability to examine how self-compassion and binge eating may be moderated by sexual identity. Recent findings indicate that

sexual minority undergraduate student participants experienced more weight-related teasing, greater weight bias internalization, and more severe BED symptoms. Further, a direct effect was observed for sexual minority status on BED symptoms (Rosenbaum & Bernstein, 2022). In EMA studies, daily discrimination experienced by lesbian women resulted in greater negative affect, lowered self-awareness, and more frequent binge eating occasions (Mason et al., 2017). Further, Panza and colleagues (2021) examined sexual minority women and found that internalized homophobia, sexual orientation concealment, and experienced and internalized weight bias reported greater binge eating. Future work should extend the current study to utilize EMA methodologies to examine momentary binge eating severity in sexual minority male populations.

Another limitation of the present study includes poor reliability of the full 6-item SSCS-S used in EMA. To improve the reliability of EMA-assessed self-compassion and reach a satisfactory Cronbach's alpha, we had to remove item 3 from the analysis. Even with the removal of item 3, the reliability of the SSCS-S was not ideal. The State Self-Compassion Scale was released shortly before the study started and was selected because it was designed to use in research settings and to measure momentary (state) self-compassion (Neff, 2021). To our knowledge, this study is one of the first EMA studies to incorporate this scale. In another study utilizing EMA to measure self-compassion, six self-constructed items were used that yielded fair reliability estimates (Mey et al., 2023). Future EMA studies may want to adopt the self-compassion measure used in Mey and colleaugues (2023) rather than using the SSCS-S.

Future Directions

Because this study was so novel, several future research directions were identified. Fear of self-compassion is defined as the extent to which an individual is fearful of being self-compassionate out of concern that they do not deserve compassion, will rely on it too much, lose

their ability to be self-critical, become a less desirable person, and lower personal standards (Gilbert et al., 2011). Fear of self-compassion and self-compassion are negatively correlated in male athletes (Reis et al., 2019). To our knowledge, there is no EMA study that examines fear of self-compassion at the momentary level to understand if it fluctuates throughout the day, factors that may enhance or reduce fear of self-compassion, and how this could influence the observed relationships between self-compassion and binge eating. It would be insightful for future work to examine both momentary self-compassion and momentary fear of self-compassion to elucidate their relationships to momentary eating behaviors. Additionally, it would be interesting to incorporate a qualitative component to an EMA study that examines fear of self-compassion to best characterize the types of fears men experience throughout the day. This may be especially informative for health coaching programs that could benefit from addressing common fears of extending compassion to oneself during challenges.

Evidence shows that adults participating in weight loss programs experience dietary lapses, and certain behaviors like socializing predict greater dietary lapse risk (Chwyl et al., 2022). A future application of this work could be to replicate this study in other groups of adult men who binge eat but are not trying to actively lose weight through dietary restriction and weight loss. It would be important to observe if self-compassion predicted binge eating in men who are not enrolled in programs promoting dietary restriction and weight loss but still engage in binge eating behaviors. Furthermore, it would be important to understand the predictive utility of self-compassion on binge eating in men who identify with various sexual identities outside of heterosexual identity.

Observational EMA studies can serve as precursors to the development of Just in Time Adaptive Interventions (JITAIs)- an intervention delivered through prompts that target behavior

change by providing the right type and amount of support needed at the right time. In research focused on eating disorders, JITAIs can be leveraged to monitor relapse-related triggers and deliver effective interventions to the individual when needed to prevent lapses or relapse (Goldstein, Evans et al., 2017). However, the present study showed that momentary within-person self-compassion was not a salient predictor of later binge eating. As such, it may be more valuable for health coaching programs and other public health programming to focus on cultivating self-compassion in men, but not necessarily focus on developing a JITAI. The mindful self-compassion program (Neff & Germer, 2013; Germer & Neff, 2019) has been shown to increase self-compassion and body satisfaction in a variety of populations (Augusta Quist Moller et al., 2019). Further, self-compassion randomized controlled trials successfully reduced self-criticism, and this effect was moderate (Wakelin et al., 2021). The BEfree program is a 12-session group intervention that integrates self-compassion, mindfulness, and value-based action in adult women with binge eating disorder and comorbid overweight or obesity (Pinto-Gouveia et al., 2017). Participants enrolled in this program improved in binge eating severity, self-criticism, and self-compassion (Pinto-Gouveia et al., 2017). Future work could consider examining programs such as the mindful self-compassion and BEfree programs for men with binge eating symptoms who are actively trying to lose weight to determine if cultivating self-compassion through these programs reduces binge eating symptoms.

Finally, evidence suggests that tailoring interventions to target groups or populations can be effective (Noar et al., 2007; Short et al., 2022). To improve participant engagement and keep interventions person-centered, qualitative studies can provide more context and understanding of how a certain group perceives and relates to a construct such as self-compassion (Yardley et al., 2016). Thus, a next step of this work would be to qualitatively examine the lived experience of

self-compassion among men enrolled in a health coaching program. Qualitative findings paired with findings from the current study could guide and inform future self-compassion programming.

Conclusions

Overall, this study serves as an important first step toward understanding the relationship between self-compassion and binge eating in a sample not widely studied. Our work serves to inform future research on binge eating in adult men with binge eating symptoms enrolled in health coaching programs. Even though men generally score higher in self-compassion than women (Yarnell et al., 2015), and self-compassion appears to be a mechanism through which women reduce binge eating and body shame (Pinto-Gouveia et al., 2019), we observed that self-compassion is also a useful between-subjects protective factor against binge eating in adult males. This work supports future studies that aim to design interventions designed to increase overall, but not necessarily momentary, self-compassion in men.

CHAPTER 4

Investigating the Momentary Association Between Self-Compassion and Internalized Weight Bias in Adult Men: An Ecological Momentary Assessment (EMA) Study.

Abstract

Objective: Self-compassion has been inversely linked to internalized weight bias (IWB) in cross-sectional studies, though little research exists examining momentary associations between these constructs. Thus, this study aims to examine the effects of momentary self-compassion on momentary IWB in adult men with moderate to severe binge eating symptoms.
Methods and Measures: Adult men (n=85, M_{age}= 35.71± 10.71; $M_{BingeEatingScale}$ = 34.16 ± 9.93, range: 18-46; 43.5% White, 43.5% Black/African American) were recruited from a health coaching program to complete an Ecological Momentary Assessment (EMA) study where they were asked to complete surveys on a smartphone using the LifeData app across seven days. Generalized estimating equations (GEE) with a gamma function and an autoregressive serial autocorrelation correction assessed the prospective associations between self-compassion and IWB in the next two hours and trait drive for muscularity and adverse childhood experiences as potential moderators of this association. Self-compassion and IWB were assessed through signal-contingent prompting via five semi-random signals evenly distributed between 8 AM and 10 PM. Covariates included: ethnicity, race, socioeconomic status, and age.
Results: Results confirmed an inverse association between-subjects self-compassion and IWB ($p < .001$). Specifically, one unit increase in between-subjects self-compassion was associated with a 0.12 decrease in IWB in the subsequent 2 hours. Neither trait drive for muscularity nor adverse childhood experiences moderated the relationship between momentary self-compassion and momentary IWB.
Conclusions: Self-compassion may be a critical skill to cultivate in adult men with moderate to severe binge eating symptoms to reduce IWB. Health coaching programs should consider novel ways to address IWB in adult men.

Introduction

Individuals in larger bodies are particularly vulnerable to experiencing weight stigma, which is the social marginalization of people in larger bodies, ultimately leading to negative generalizations and poor treatment of individuals perceived as carrying excess weight (Brownell & Puhl, 2006). Weight-based discrimination is pervasive across several domains, including employment, education, healthcare, relationships, and within public health research studies (Spahlholz et al., 2016; Hart et al., 2021; Jacobs et al., 2020). Further, the adverse effects of weight stigma are associated with disordered eating behaviors, and weight stigma's impacts are seen in all people across the weight spectrum (Romano et al., 2021). Despite the harmful consequences experienced by individuals who are the target of weight stigma, it is one of the last socially acceptable stigmas, as attitudes of U.S. adults related to body weight are the only implicit and explicit attitudes that have moved away from neutral toward negative while other attitudes (sexuality, race, and skin tone) improved from 2007 to 2016 (Charlesworth et al., 2019; Puhl & Heuer, 2009). Weight stigma estimates range from 57-61%, and individuals in higher BMI categories report greater odds of weight discrimination and weight-based teasing (Prunty et al., 2020; Spahlholz et al., 2016).

Individuals who experience weight stigma are prone to develop internalized weight bias (IWB), defined as the internalization of negative stereotypes and self-defeating ideas regarding higher-weight people (Durso & Latner, 2008). Individuals who report greater IWB report diminished psychosocial, physical, and behavioral health outcomes, including worse mental health, social functioning, lower health-related quality of life, and disordered eating (Romano et al., 2022). In a sample of college students, IWB was inversely associated with physical and mental health-related quality of life, and sex (male/female) did not moderate the association

(Purton et al., 2019).

IWB is prevalent in men and women across all weights (Puhl et al., 2018; Purton et al., 2019; Romano et al., 2022). When compared to individuals at normal BMIs, individuals with overweight or obesity report the highest levels of IWB, and those in overweight or obese BMI categories report the highest odds of IWB (Prunty et al., 2020; Puhl et al., 2018). Individuals who reported the highest IWB were White, lower income, less educated, actively attempting weight loss, had higher BMIs, and reported previous experiences with weight stigma, (e.g., teasing and interpersonal stigma experiences) (Puhl et al., 2018). IWB is also higher in individuals who believe people are personally responsible for their weight (Prunty et al., 2020). While Boswell and White (2015) found that women reported higher levels of IWB than men, men who reported high levels of IWB reported more objective and subjective binge eating episodes and higher BMIs than women. Interestingly, other work suggests no difference in IWB between men and women (Purton et al., 2019). Regardless, these studies show that IWB is a relevant psychosocial risk for men and IWB is understudied in men compared to women. To further understand how IWB affects men, the present study will focus on an exclusive male sample as it is critical to include men in research that examines modifiable psychosocial correlates of IWB. One possible way IWB could be reduced is through self-compassion.

Self-compassion acknowledges that suffering and inadequacies are part of the human experience and that the self and others deserve compassion (Neff, 2003b). Self-compassion contains three components: 1) self-kindness (acting in a kind and understanding way toward self), 2) common humanity (the ability to recognize feelings of inadequacy or periods of struggle as part of the shared human experience), and 3) mindfulness (willingness to experience thoughts and feelings accurately without becoming absorbed by them or evading them) (Neff, 2003b).

Self-compassion has been shown to help people better regulate emotions, including reducing negative emotions and engendering more positive emotions (Berking & Whitley, 2014; Neff, Kirkpatrick, & Rude, 2007). Taken together, self-compassion may be a plausible mechanism through which to reduce the impact weight IWB. Early research on self-compassion and IWB shows significant negative associations between self-compassion and IWB in women (Braun et al., 2021; Fekete et al., 2021).

Previous work indicates that IWB may have the strongest influence on psychosocial well-being, with impairments in positive and negative mental health, emotion regulation, self-compassion, and social functioning (Romano et al., 2022). Moderate to large effects were observed between increased IWB and worse self-compassion and social functioning (Romano et al., 2022). IWB may help explain varying reactions to weight stigma (Pudney et al., 2020). For example, adults who experienced weight stigma and had long-term distress report negative views of themselves, higher self-blame, and rumination (Pudney et al., 2020). In contrast, adults who experienced weight stigma but reported low distress note higher self-acceptance, lower worries about how others perceive their bodies, and they prefer toward focusing on their health instead of their weight (Pudney et al., 2020). Knowing that self-acceptance helps people avoid enduring distress characteristic of IWB and that self-compassion has been shown to enhances feelings of self-acceptance (Voci et al., 2018), it is imperative to investigate the role of self-compassion on IWB.

A significant limitation of the existing evidence examining IWB and health-related correlates is that studies need to diversify samples to yield greater insight into how IWB functions across men and women (Romano et al., 2022). Men must be better represented in the literature on IWB and its associations with psychological distress (Alimoradi et al., 2019).

Additionally, much of the literature on IWB uses predominantly White, female samples, and as such, lacks generalizability to a variety of diverse racial, ethnic, gender, and sexual identities (Romano et al., 2022). Moreover, most research on IWB and health-related outcomes is cross-sectional, with only four known studies utilizing a prospective design. To our knowledge, this is the first study to examine males who binge eat using ecological momentary assessment (EMA) methods. EMA accumulates data on an individual's behavior, thoughts, and emotions in real-time by collecting detailed information in the moment using prompts delivered through a smartphone app. Compared to retrospective and cross-sectional designs, EMA has several advantages, including improved ecological validity and minimized recall bias (Dunton, 2017; Schaefer et al., 2020; Shiffman & Stone, 1998).

Drive for muscularity is defined as an individual's desire to increase muscle mass and change certain physical characteristics to align more with cultural standards or personal standards of an "ideal body" (McCreary & Sasse, 2000). Individuals who report higher drive for muscularity are often men, and higher drive for muscularity is associated with depression, dieting, and use of muscle-building supplements (Eik-nes et al., 2018). Body dissatisfaction is highly correlated with IWB in men, resulting in significant reduced physical and mental health-related quality of life (Purton et al., 2019). In gay men, more experiences with weight stigma were significantly positively associated with drive for muscularity (Foster-Gimbel & Engeln, 2016). As a result of these known associations, it was expected that drive for muscularity may change the strength of the relationship between self-compassion and IWB, resulting in a stronger negative relationship among men reporting higher drive for muscularity.

Adverse childhood experiences (ACEs) are chronic and pervasive experiences of early life adverse experiences, that include abuse, neglect, and household dysfunction (Felitti et al.,

2019). Women in larger bodies who report more ACEs also report higher IWB (Keirns et al., 2021). ACEs and self-compassion have been previously shown to be significantly, negatively correlated in adults (Garbutt et al., 2022). In individuals seeking bariatric surgery, number of ACEs showed a positive significant association with IWB and a significant negative correlation with self-compassion (Braun et al., 2021). Thus, it was expected that ACEs would moderate the relationship between self-compassion and IWB in the present study.

We hypothesized that men with lower levels of EMA-assessed self-compassion would report increased IWB than men with higher levels of EMA-assessed self-compassion (between individual effects). Furthermore, those with lower momentary levels of self-compassion would report increased IWB (after controlling for BMI, age, ethnicity, and race (within individual effects). Thus, the present study examined the between and within-subject effects of self-compassion on IWB in adult men with moderate to severe binge eating symptoms (defined as a score of 18 or greater on the (Binge Eating Scale; Gormally et al., 1992). We examined total ACEs and drive for muscularity as moderators of the relationship between self-compassion and IWB.

Materials and Methods

Study Design

An intensive longitudinal study design using a 7-day interval-contingent/fixed time-based EMA study examined the day-level associations between self-compassion and binge eating behaviors. A baseline survey was completed online between April 20 – June 5, 2022. The EMA study was completed between April 22 - July 3, 2022. The current analyses use data from the EMA study and the online baseline survey.

Recruitment and Participants

Prospective participants were recruited through convenience sampling strategy from a health coaching program. Men were electronically invited through social media (Facebook) and email listservs for men enrolled in a health coaching program or men who expressed interest in health coaching at some time. Study inclusion criteria were: 1) male sex at birth, 2) 18 years or older, 3) able to read and speak English, 4) scoring a moderate to severe score on the binge eating scale, indicated as 18 or higher (Marcus et al., 1988), 5) own and regularly use a smartphone that can run mobile applications, and 5) willing to comply with the study protocol and complete app-based surveys. Because compensatory behaviors were not part of exclusion criteria, the sample in these studies involves binge-eating spectrum disorders. Once eligibility was determined through an online screening questionnaire, men provided consent to participate through an online informed consent that described study procedures, risks, and benefits. The Institutional Review Board at Northern Arizona University approved the study procedures. This study was conducted following the Declaration of Helsinki.

Profile by Sanford Health Coaching Program

Roughly 77% of the present sample was actively enrolled in Profile by Sanford, and the remaining men had expressed interest in the program at some point. Profile is a personalized health coaching program that combines health coaching with a reduced-calorie meal plan. Through one-on-one health coaching, individuals learn to make long-term lifestyle modifications. Health coaches are certified professionals who receive extensive training and are monitored for quality assurance. Participants collaborate with health coaches to customize meal plans, develop healthier diet and lifestyle habits, and increase physical activity. Individuals typically meet with a health coach weekly, bi-weekly, or monthly. While not required, many individuals prefer to meet with the same health coach over time. Results from this program are

previously reported (Bell et al., 2021; JaKa et al., 2021; Kim et al., 2021).

Procedures

After providing informed consent, participants completed a baseline survey through an online survey platform, REDCap (Research Electronic Data Capture) (Harris et al., 2009). REDCap (Research Electronic Data Capture) is a secure, web-based software platform to support data capture for research studies. The baseline survey took approximately 15 minutes to complete. Participants were then provided instructions on downloading a free EMA application (RealLife Exp app by LifeData) and completed 7 consecutive days of EMA on their personal smartphone by responding to interval-contingent/fixed time-based survey sampling on their phone. In order to reduce participant burden, participants were prompted during waking hours, and EMA surveys were designed to take less than 5 minutes to respond. Participants were notified to complete five surveys daily between the following windows of time: 9–11 AM, 12–2 PM, 3–5 PM, 6–8 PM, and 9–10 PM. Participants were given 15 minutes from when they were notified to answer each survey. If they missed the 15-minute window to complete the survey, they were given a second chance within the two-hour timeframe to complete the survey. Participants received a $100 gift card to the health coaching program after completing the baseline survey, and at least 60% of all EMA prompts throughout the week. The analysis included men who completed at least 5 prompts (1 full day of EMA).

Measures

Initial Baseline Survey

Demographics. Demographic questions assessed the participant's age, weight, height, race, ethnicity, gender, sexual orientation, and socioeconomic status. Body mass index (BMI; kg/m^2) was calculated from participants' self-reported height and weight data. These items were used to describe the sample and can help contextualize the

generalizability of study findings.

Binge Eating Scale. The Binge Eating Scale (BES) is a validated and reliable instrument to detect binge eating (Gormally et al., 1992). Scores range from 0-46, with higher scores indicating more severe binge eating problems. Clinical cutoff scores for the BES include none-to-minimal (0–17), moderate (18–26), and severe (> 27). One primary objective of this study is to examine momentary fluctuations in self-compassion on binge eating. As such, individuals are eligible to participate in the study if they score 18 or higher on the BES. The internal consistency reliability of the BES in the present study is α=.96, demonstrating adequate reliability. Internal consistency reliability was previously reported at α=.88, though this study evaluated the psychometric properties of the BES in adult women enrolled in a weight loss program (Duarte et al., 2015). To date, no studies have examined the BES's psychometric properties in adult men in the US.

Drive for Muscularity Scale (DMS). Because male disordered eating often stems from muscularity ideals as a prominent feature of male body image concerns (DeBlaere & Brewster, 2017; Kinasz, Accurso, Kass, & LeGrange, 2016), drive for muscularity was examined as a moderator and measured at baseline using the 15-item DMS (McCreary & Sasse, 2000). Participants rate each item on a scale of 1 (*always*) to 6 (*never*), items are summed, and scores range from 15 to 90, with higher scores indicating higher levels of drive for muscularity. Internal consistency reliability is previously reported between α=.80-.95 (Edwards et al., 2014), and α=.91 was observed in the present study suggesting adequate reliability.

Adverse Childhood Experiences (ACEs). Adverse childhood experiences (ACEs) were examined as a moderator because of shared associations with obesity and

mental health conditions (including affect-related binge eating in people with severe obesity). The ACE checklist measured adverse childhood experiences (Dong et al., 2004). This survey includes 10 categories of childhood adversity (yes/no) that fall within the following domains: emotional or physical neglect, domestic violence, household substance use, mental illness in the household, parental separation or divorce, and having a household member with a criminal record. Past reliability for retrospective ACE reports is adequate (Hardt & Rutter, 2004; Rueben et al., 2016).

Ecological Momentary Assessment Surveys

State Self-Compassion. The 6-item State Self-Compassion Short Form (SSCS-S) assessed state self-compassion (Neff et al., 2021). Participants were asked to rate how true each statement is for them currently on a scale ranging from 1 (*not at all true for me*) to 5 (*very true for me)*. Sample items include: (a) *"I'm obsessing and fixating on everything that's wrong*," and (b) *"I'm keeping things in perspective*." To score the SSCS-S, responses to items 2, 4, and 6 first are reverse coded. From there, a total mean score was calculated, indicating a participant's state self-compassion level. Scores range from 1 to 5. While there are no clinical norms or scores to indicate high or low state self-compassion using the SSCS-S, an ad-hoc rubric suggests scores of 1-2.49 to be low, 2.5-3.5 to be moderate, and 3.51-5 to be high. Initially, EMA-assessed SSCS-S demonstrated poor internal consistency reliability, α=.56. It was decided to remove item 3 from the scale upon reviewing item reliability estimates. After the removal of item 3, internal consistency reliability improved, α=.63.

Internalized Weight Bias. The Weight Bias Internalization Scale (WBIS; Kleim et al., 2020) measures how much a participant believes negative stereotypes and self-statements about people with overweight and obesity apply to themselves (Durso & Latner, 2008; Hillbert et al.,

2014). A three-item short form of the modified Weight Bias Internalization Scale (WBIS-3) was used to assess IWB. Previous work indicates the WBIS-3 has demonstrated excellent psychometric properties and high correlation with the WBIS full-length form (Kleim et al., 2020). Participants were asked to rate their agreement with the following statements based on what they were experiencing in the present moment, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*): (a) "*I feel anxious about my weight because of what people might think of me*," (b) "*Whenever I think a lot about my weight, I feel depressed*," and (c) "*I hate myself for my weight*." Items are averaged for a total WBIS score, and scores range from 3 to 21. Higher scores indicate higher IWB. To date, the WBIS-3 has yet to be used in an EMA study to measure IWB. While other studies have used EMA to measure weight stigma, little to no work uses this methodology to examine IWB. EMA-assessed WBIS demonstrated adequate internal consistency reliability, α=.89.

Demographic Characteristics

Men (n=85; m_{age}=35.71 ± 10.71; m_{BES} = 34.16 ± 9.93) were primarily non-Hispanic (89.4%), Black/African American, or White/Caucasian (43.5% each) and receiving health coaching services from Profile by Sanford (77%) (see Table 5).

Table 5

Participant characteristics (n=85)

Characteristic	**Category**	**n (%)**
Ethnicity		
	Hispanic or Latino	5 (5.9)
	Not Hispanic	76 (89.4)
Race (check all that apply)		
	Asian	1 (1.2)
	Native Hawaiian or Other Pacific Islander	1 (1.2)

	Black or African American	37 (43.5)
	American Indian or Alaska Native	3 (3.5)
	White/Caucasian	37 (43.5)
	More than one race	1 (1.2)
Services Received		
	Profile by Sanford	66 (77.6)
	No services received	18 (21.2)
Profile by Sanford Service Quality		
	Extremely dissatisfied	1 (1.2)
	Dissatisfied	1 (1.2)
	Neutral	6 (7.1)
	Satisfied	27 (31.8)
	Extremely Satisfied	25 (29.4)
Body Mass Index (BMI; kg/m^2)		
	BMI below 25	4 (4.8)
	BMI of 25-29.9	20 (39.8)
	BMI of 30-39.9	36 (48.2)
	BMI of 40+	6 (7.2)
Weight Change Status		
	No weight loss in the past year	4 (4.7)
	Weight gain in the past year	17 (20)
	Lost 0-4% of starting body weight in the past year	15 (17.6)
	Lost 5-10% of starting body weight in the past year	20 (23.5)
	Lost 11%+ of starting body weight in the past year	11 (12.9)
Personal Income		
	Under $20,000	2 (2.4)
	$20,001 - $40,000	2 (2.4)
	$40,001 - $60,000	13 (15.3)
	$60,001 - $80,000	13 (15.3)
	$80,001- $100,000	29 (34.1)
	Greater than $100,001	24 (28.2)
	Prefer not to say	2 (2.4)

Note. BMI= Body mass index; (kg/m^2) was calculated by participants' self-reported height and weight.

Statistical Analyses

This study examined the between and within-subject effects of self-compassion on IWB in adult men with moderate to severe binge eating. The analytic plan was specified prior to

analyses. Assumptions of a mixed effects model were assessed, and violations of homoscedasticity occurred. Transformations were applied but did not yield improvements in error variance. As a result, a generalized estimation equation (GEE) with a gamma link function and an autoregressive (AR1) serial autocorrelation correction was used to determine the impact of momentary self-compassion (IV) on momentary IWB with ACEs (total score) and drive for muscularity as moderators while controlling for BMI, age, race, and ethnicity. GEEs were conducted using IBM SPSS Statistics for Macintosh, Version 27.0 (Chicago, IL), with statistical significance set at $p < .05$. Unstandardized regression coefficients, standard errors, and confidence intervals are reported. It was hypothesized that those with lower daily levels of self-compassion would report increased IWB after controlling for BMI, age, race, with ACEs (total) and drive for muscularity as moderators.

Results

In total, 51.5% (n=85) of participants who downloaded the EMA app also completed the study. Fraudulent participants were determined through several mechanisms, specifically: cell phone type, examining and removing anyone with multiple IP address entries in the baseline survey, and reviewing if phone records matched the IP location of participants. Participants who are listed as quitting are those who emailed the study team to share that they would no longer be participating in the study. See Figure 1 for total study attrition.

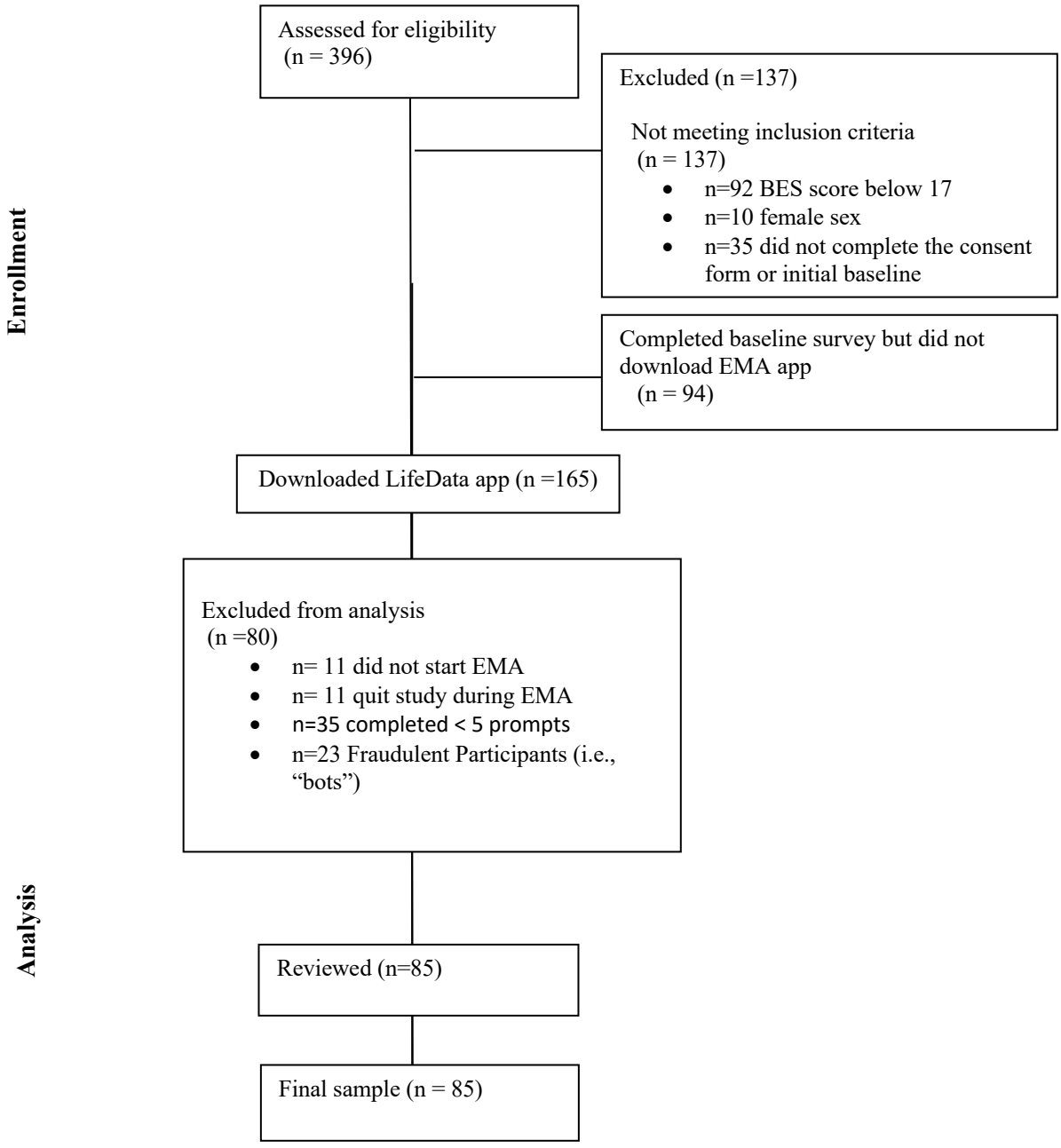

Figure 1.
Consort Diagram

Ecological Momentary Assessment Results

Participants averaged 2 minutes and 13 seconds (SD = 0.13) to complete the EMA survey. EMA compliance was 74.4%, and individuals answered 3.6 prompts per day out of five total prompts per day (SD: 0.95), resulting in 2,109 EMA observations across 7 days. Response rates did not change based on time-of-day X^2 (4, N=2146) = 8.77 p=0.07. Similarly, response rates were not different across days 1 through 7 X^2 (6, N=2146) = 7.58, p=0.27), although the final two days (6 and 7) account for 8.6% and 2.18% of all completed prompts, respectively. Other factors, including BMI and socioeconomic status, were not associated with compliance. However, significant compliance differences were observed based on ethnicity, race (White, Black, Other race), and age. Non-Hispanic individuals, participants who endorsed races besides Black/African American or White/Caucasian, and older adults had lower compliance rates (p<.001). In total, 35 men did not have complete EMA data (fewer than 5 prompts) and were excluded from the analysis. Reasons provided for low compliance were 'unfeasible to access phone during work hours' and 'phone/technical difficulties.' Table 6 shows descriptive statistics for the study variables.

Table 6

Descriptive Statistics of Study Variables

Variable	M	SD	ICC	Min.	Max.
Internalized Weight Bias	4.23	1.86	0.75	1.00	7.00
Within Self-Compassion	-0.008	0.43	0.23	-2.14	1.70
Between Self-Compassion	3.30	0.83	0.23	1.00	5.00
Adverse Childhood Experiences	4.64	5.01	-	0	17.00
Drive for Muscularity	54.35	17.84	-	15.00	90.00
BMI	33.02	7.24	-	19.05	64.64
Age	36.18	10.41	-	18	66

Note. M = mean; SD = standard deviation; ICC = intraclass correlation coefficient, values less than .40 are considered low, values of .40-.75 are considered moderate, and values exceeding .75 are considered high.

Four models were examined: 1) only IVs (between and within self-compassion) and DV (momentary IWB), 2) IVs and covariates with DV, 3) ACEs as a moderator, 4) Drive for Muscularity as a moderator. The Quasi Likelihood under Independence Model Criterion (QIC) of the final two models (with moderators) were 286.16 (ACEs as a moderator) and 289.55 (Drive for Muscularity as a moderator). Within- and between-subjects effects of time-lagged self-compassion in relation to IWB are presented in Table 7. Higher between-subjects momentary self-compassion prospectively predicted IWB ($p < .001$). Men with lower self-compassion reported greater IWB at a later prompt. Within-subjects momentary self-compassion was not found to prospectively predict later IWB. The total number of ACEs prospectively predicted momentary IWB but did not moderate the relationship between self-compassion and IWB. Drive for muscularity did not predict momentary IWB, and there was no significant interaction of drive for muscularity and within-person momentary self-compassion on IWB. This indicates that neither ACEs nor drive for muscularity moderates the relationship between self-compassion and IWB ($p>.05$).

Table 7

Parameter Estimates from General Estimating Equations of Association Among Self-Compassion and Internalized Weight Bias

Variable	ß	SE	*p*	95% CI
Within-subjects Self-Compassion•	0.001	0.02	0.94	[-0.04-0.04]
Between-subjects Self-Compassion*•	**-0.12**	**0.02**	**<.001**	**[-0.15- -0.07]**
Adverse Childhood Experiences¥	**0.02**	**0.01**	**0.01**	**[0.01-0.04]**
Trait Drive for Muscularity ¥	0.004	0.003	0.21	[-0.02-0.01]
Trait Drive for Muscularity ¥ x Within-subjects Self-Compassion•	0.003	0.002	0.06	[0.00-0.006]

Adverse Childhood Experiences[¥] x Within-subjects Self-Compassion	0.003	0.004	0.42	[-0.01-0.01]
BMI[¥]	-0.01	0.008	0.26	[-0.03- 0.01]
Age[¥]	-0.01	0.005	0.32	[-0.02-0.005]

Note. p values < .05 are bolded. * indicates significance at the .001 level. • indicates a momentary, EMA-assessed variable. [¥] indicates a variable collected once at baseline.

Discussion

To understand how research can address the harms of IWB, the social-ecological model can help guide research efforts beyond the individual level, eventually focusing at macro-levels (such as changing policy protections and societal beliefs around higher-weight people) (Puhl, 2018, p. 6). For example, public policy recommendations can be made at the national, state, and local levels to ensure that people in larger bodies are protected from stigma and discrimination (Puhl, 2018, p. 6). Research efforts can also focus on the individual level to change an individual's knowledge, attitudes, and behaviors. The present study focuses on modifiable psychosocial factors for people in larger bodies to mitigate the negative effects of internalized weight bias. Self-compassion may be one mechanism at the individual level of the social-ecological model that individuals who experience IWB can develop to improve emotion regulation and reduce binge eating.

Findings from the present study elucidate the relationship between state-level self-compassion and momentary IWB in adult men with moderate to severe binge eating symptoms. Between-subjects self-compassion predicted IWB at the following prompt, but within-subjects self-compassion had no association to subsequent IWB. Specifically, men with lower self-compassion reported greater IWB at a later prompt. This finding lends support to improving self-compassion in men enrolled in a weight centric health coaching program. Interestingly, neither ACEs nor trait drive for muscularity moderated the relationship between self-compassion and

IWB.

Individuals who report IWB undergo self-devaluation due to their body weight (Durso & Latner, 2008; Pearl & Puhl, 2014). Self-compassion is a mechanism proposed to mitigate the adverse consequences of IWB and the guilt and shame people may internalize as a result of weight-based stereotypes. This study's findings align with previous cross-sectional literature that found lower self-compassion levels mediated the relationship between IWB and emotional eating in (mostly female) patients enrolled in a surgical weight loss clinic (Braun et al., 2021). Similar to the present study findings, Fekete and colleagues (2021) found that self-compassion was associated with lower IWB and that the relationship between self-compassion and maladaptive eating (emotional and eating restraint) was explained through IWB in a sample of adult women (Fekete, Herndier, & Sander, 2021). We observed a significant prospective association of between-subjects self-compassion and IWB. However, our study used EMA methods to collect momentary data and focused exclusively on adult men enrolled in a health coaching program emphasizing dietary restriction and weight loss. Still, self-compassion is inversely associated with IWB, and this association occurs in adult men at the momentary level. Findings implicate self-compassion as a potential treatment target to reduce IWB.

While trending toward significance, trait DMS did not moderate the relationship between self-compassion and IWB. The combination of higher self-compassion and lower drive for muscularity was expected to yield lower momentary IWB. Drive for muscularity, defined as the desire to increase muscularity levels and build a muscular physique, can increase because of individual perceptions that they are insufficiently muscular and often results in a person engaging in muscularity-increasing behaviors as a way to reduce the discrepancy between ideal versus actual body and physique (Bergeron & Tylka, 2007; McCreary & Sasse, 2000).

Furthermore, high self-compassion has been shown to predict lower levels of body dissatisfaction and moderated the relationship between the internalization of lean appearance ideals and body fat dissatisfaction in adult men (Maher et al., 2021). However, other findings show that self-compassion did not affect body satisfaction or disordered eating in male athletes (Cusack et al., 2022). Previously self-compassion was associated with lower levels of IWB in women (Fekete et al., 2021). It was expected that men in the present study with a lower drive for muscularity and lower self-compassion would report increased IWB at the following prompt and that a higher drive for muscularity and lower self-compassion would lead to lowered IWB at the next prompt. It is possible that certain groups of men (such as adult males with moderate to severe binge eating) could benefit from self-compassion more than other groups of men (such as male athletes recruited in Cusack et al., 2022).

Contrary to what was hypothesized, ACEs did not moderate the relationship between self-compassion and IWB. Previous work indicated that ACEs could be an early life risk factor that increased the risk of IWB in adult women in larger bodies who were enrolled in a program designed to evaluate weight, neurocognitive health, and stress reactivity in women with and without a history of ACEs (Keirns et al., 2021). While we observed a significant main effect of ACEs on momentary IWB in adult men, these early adverse experiences did not moderate the relationship between self-compassion and IWB. It was expected that ACEs would influence the strength of the relationship between self-compassion and IWB, such that individuals with a higher number of ACEs may be less likely to offer themselves self-compassion during struggles or adversity and more likely to report IWB. Self-compassion was found to buffer against depressive symptoms and disordered eating behaviors in emerging adults with ACEs (Hazzard et al., 2021).

Strengths

There are several notable strengths of the present study. First, using EMA methods to measure IWB states is relatively novel, and more EMA research is needed to understand the affective, environmental, and behavioral antecedents of IWB. To our knowledge, this is the first study to examine IWB in males who binge eat using EMA methods. The present study's focus on males is aligned with recommendations from Romano and colleagues (2022) to diversify study populations beyond White females to improve the generalizability of IWB findings. Another strength was reducing participant burden through EMA design. The EMA design of the present study was created using recommendations from Smyth and colleagues (2021), who found that fewer prompts and shorter prompt duration improved an individual's willingness to participate in an EMA study. We piloted the EMA app prior to the study launch and timed the amount of time it took throughout a few days of prompting to ensure prompts could be completed quickly. Despite using previous study findings to build the EMA prompting schedule and testing the EMA portion of the study to ensure brevity, our compliance rate fell slightly short of the 80% compliance rate ideal (Stone & Shiffman, 2002). This could indicate that male adult samples warrant further consideration when designing EMA studies to improve compliance.

Limitations

Much of the research involving IWB suffers from a lack of diverse participants and utilizes cross-sectional methods. While this study recruited a relatively racially diverse sample, the sample does not adequately represent men from underrepresented groups regarding gender identity and sexual orientation. The sample was predominantly heterosexual and identified their gender as male. Future work must focus on diversifying samples so that IWB and associated health outcomes are better understood among LGBTQIA+ and diverse gender identities.

Preliminary research shows that sexual minority men significantly reduced body dissatisfaction, improved body appreciation, and increased self-compassion following a self-compassion intervention (Grey et al., 2022). As such, understanding how momentary self-compassion may improve IWB in sexual minority men could inform future intervention work.

Another limitation of the present study is the lack of follow-up to determine reasons for attrition. Given that the study was conducted remotely/digitally, we did not actively identify reasons for participant dropout. Some participants contacted the study coordinator to provide reasons for dropout, primarily listing that their phone was inaccessible during work hours and that they experienced phone/technology issues. It would be valuable to gain greater insight into reasons for dropout within this sample to inform future EMA studies targeting adult men who binge eat. Another limitation of the present study involves the internal consistency of the SCSS-S. This state self-compassion scale became widely available during study design, and it was unclear how this measure would perform in an EMA study. Reliability through Cronbach's alpha only reached an adequate level after removing item 3 from the SCSS-S. The modest reliability coefficient may indicate that other short versions of self-compassion may be preferred in this population, such as the self-compassion short scale (Raes et al., 2011) or the six items developed to measure self-compassion in the EMA study conducted by Mey and colleagues (2023).

Future Directions

There is a strong need to develop interventions for reducing weight bias and weight bias internalization, which can profoundly impact individuals opting for bariatric surgery (Bennett et al., 2022). Present study findings can inform several future research opportunities to extend knowledge and interventions focused on IWB in adult men. Romano and colleagues (2021) posited that interventions focused on reducing weight stigma should focus on decreasing IWB

for individuals of all weights and sizes. Since self-compassion is a trainable skill that can be cultivated to help individuals better regulate emotions and has been shown to be associated with binge eating and IWB in adult men, it could be a helpful intervention strategy as a standalone intervention or integrated into health coaching programs (Papini et al., in press).

Previous interventions focused on developing gratitude through writing exercises found that young adults who engaged in body-focused gratitude writing improved weight bias internalization (Davies et al., 2022; Dunaev et al., 2018; Haley et al., 2022). Haley and colleagues (2022) examined a 3-session self-compassion intervention in women in larger bodies who had IWB and found that this approach may be feasible and benefit young adult women. Similarly, Davies and colleagues (2022) evaluated body gratitude journaling in young adult women with IWB. They observed that participants experienced significant improvements in IWB, self-compassion, and stress related to accessing and visiting healthcare professionals at one-week follow-up. Findings from these studies lack generalizability to adult men with moderate to severe binge eating. However, they are among the first to indicate that self-compassion writing exercises, such as "Exploring Self-Compassion Through Writing" (Neff, n.d.), may reduce IWB. Ruby, the first digital self-compassion intervention designed to reduce IWB, is currently being piloted in adults with elevated IWB and a BMI exceeding 30 (Hopkins et al., 2021). This intervention is designed to deliver psychoeducation, mindfulness exercises, and self-compassion focused on body concerns over four weeks (Hopkins et al., 2021). It is unclear if this pilot will actively recruit a mix of men and women to test the efficacy of Ruby. However, if Ruby yields significant reductions in IWB, findings from this study could support the use of Ruby in men who binge eat and are enrolled or interested in joining a health coaching program.

Because we did not find a significant effect of within-subject self-compassion on IWB, it

may not be prudent to devote resources into developing and incorporating ecological momentary interventions (EMIs) or Just-in-Time-Adaptive Interventions (JITAI) designed to improve momentary self-compassion into this health coaching program. Instead, helping men cultivate more self-compassion (but not focused on the momentary level) through general programming could be an effective approach to reduce IWB.

Ideally, interventions focused on reducing IWB in adult men with moderate to severe binge eating symptoms would embrace a community-based participatory research (CBPR) approach where research seeks to establish sustainable programs that improve health behaviors and outcomes, like IWB (NIMH, 2018). A systematic review of the efficacy of CBPR studies shows that successful CBPR research forges collaborations with community partners, researchers, and organizations to improve the health and well-being of the target population (Salimi et al., 2012). To apply CBPR in the present study, the next step would be to collaborate with Profile by Sanford to modify existing self-compassion programs (such as the mindful self-compassion program; Germer & Neff, 2019) to best fit the needs of adult men enrolled in a health coaching program informed by their individual experiences with weight stigma, self-compassion, and IWB (Minkler & Wallerstein, 2011). Future qualitative work could examine the preferred types of self-compassion exercises that men would be most interested in completing and the optimal delivery modalities of interventions. Such qualitative work would inform ways to improve adherence, and lower attrition in potential self-compassion interventions developed to target IWB in adult men.

Contrary to what was expected, drive for muscularity and ACEs did not influence the strength of the relationship between self-compassion and IWB. Future work should continue to investigate self-compassion and IWB at the momentary level in men to improve insights on how

these constructs can reduce IWB in high-risk samples.

Conclusion

The present study informs future research on IWB in adult men with moderate or severe binge eating symptoms. Results show that between-person, but not within-person, self-compassion prospectively predicted IWB at the following prompt. Future work could consider the role of self-compassion in programming designed to reduce IWB in adult men. Several self-compassion interventions have shown promise in reducing IWB when piloted in adult women. The present study supports the need to modify or test those interventions in an adult male sample.

CHAPTER 5 Clarifying the Relationship between Internalized Weight Bias, Self-Compassion, and Binge Eating in Men: An Ecological Momentary Assessment (EMA) Study

Abstract

This study aimed to examine if momentary self-compassion moderated the relationship between momentary internalized weight bias and binge eating in adult men. Participants were men (n=85, M_{age}= 35.71± 10.71; $M_{BingeEatingScale}$ = 34.16 ± 9.93, range: 18-46; 43.5% White, 43.5% Black/African American) who completed surveys on a smartphone using the LifeData app across 7 days. SC, IWB, and binge eating were assessed by 7 days of signal-contingent prompting through five semi-random signals evenly distributed between 8 AM and 10 PM. Generalized estimating equations (GEE) with a gamma function and an autoregressive serial autocorrelation correction assessed moderation. The model controlled for ethnicity, race, and age. Main effect analyses showed that self-compassion at time 1 predicted lower binge eating at the following prompt where it was reported (times 2-5). Self-compassion at time 1 moderated the relationship between internalized weight bias and binge eating (p=0.002). The combination of low internalized weight bias and high self-compassion resulted in the lowest reported binge eating. Future work should replicate this study with a larger sample that involves more waves of EMA carried out over a more extended period. Self-compassion did not buffer the association of IWB on binge eating. Findings suggest that while self-compassion can be a helpful tool, it may not be sufficient to negating the influence on IWB on binge eating. This work underscores the importance of addressing IWB in adult men who binge eat.

Introduction

The American Psychiatric Association (2013) defines binge eating disorder (BED) as the recurrent consumption of food larger than what most people would eat in a similar period, such as a 2-hour window. While overeating, individuals experience a lack of control over eating, in which they feel they cannot stop eating or control what or how much they eat (APA, 2013). They may also experience eating quickly, eating beyond the point of satiety, consuming large amounts of food when not physically hungry, eating in socially isolated environments out of shame or embarrassment, and feeling disgusted or guilty after the binge episode (APA, 2013). Additionally, to be diagnosed with BED, individuals must binge eat once a week for three months (APA, 2013). Further, binge eating occurs without compensatory behaviors such as extreme fasting or laxative use. BED is highly prevalent in the US population, and it is estimated that up to 30% of people seeking weight loss services have BED (Giel et al., 2022; Westerberg & Waitz, 2013). Binge eating occurs in both men and women, and the lifetime prevalence of binge eating disorder is 3.5% for women and 2% for men (Tanofsky-Kraff, 2020; Udo & Grilo, 2018).

BED is associated with increased psychiatric and physical health conditions (Udo & Grilo, 2019). Co-occurring mental health conditions include lifetime mood disorders, anxiety disorders, and substance use disorders (Keski-Rahkonen, 2021; Udo & Grilo, 2019). Roughly 23% of individuals with BED have attempted suicide, and more than 70% reported that BED symptoms occurred before the suicide attempt (Udo et al., 2019). Beyond mental health conditions, BED is also associated with increased type 2 diabetes mellitus, hypertension, and higher cholesterol and triglycerides (Udo & Grilo, 2019). Irrespective of socioeconomic status, early risk factors for BED include having a higher body weight, experiencing weight-related teasing, experiencing body dissatisfaction, and dieting behaviors (West et al., 2019). Individuals

who put more emphasis on their weight and the shape of their bodies report severe impairments in everyday daily living, interpersonal relations, and completing daily tasks (Coffino et al., 2019).

It is important to note that an early risk factor of BED is experiencing weight-based teasing, one form of weight stigma. Research indicates that experienced/perceived weight stigma is significantly and positively associated with internalized weight bias (IWB) (Bidstrup et al., 2022). IWB occurs when 1) an individual is aware of and agrees with negative stereotypes of people in larger bodies, 2) they apply those negative stereotypes to themselves, and 3) they devaluate themselves because of their higher-weight status (Durso & Latner, 2008). In a systematic review of IWB and health, significant positive associations between IWB and binge eating were consistently observed across 18 studies, with the majority indicating moderate to strong correlations (Pearl & Puhl, 2018). Further, evidence shows IWB mediates the relationship between experienced weight stigma and disordered eating, including binge eating and loss of control of eating (Bidstrup et al., 2022; Meadows & Higgs, 2020; O'Brien et al., 2016).

Interventions to reduce IWB are primarily rooted in acceptance and commitment therapy (ACT) or mindfulness meditation (Berman et al., 2016; Levin et al., 2018; Poelke, 2009). While these programs have successfully lowered IWB, previous studies have utilized mostly female participants, leaving a gap in the research on how men may respond to these treatments (Berman et al., 2016; Levin et al., 2018). Findings show that when ACT is combined with health coaching delivered through technology (phone and email), IWB improves for higher-weight adults (Potts et al., 2022). One component of ACT is self-compassion (SC), an affect-regulation skill that entails extending kindness to yourself (self-kindness), recognizing that negative experiences are

part of being human (common humanity), and practicing mindfulness when confronted with negative experiences or a negative sense of self (mindfulness) (Barnard et al., 2011; Neff, 2003). SC has been shown to improve disordered eating behaviors, including binge eating, and has been suggested as a skill that might mitigate the adverse effects of IWB (Braun et al., 2016; Hunger et al., 2020)

The goals for interventional studies on weight stigma are two-fold: 1) decrease weight stigma experiences overall and 2) alleviate the harmful effects of weight stigma after it occurs (Hunger, 2020). SC could be a coping strategy that eases shame and guilt when an individual experiences IWB. Further, interventions should focus on people who are targets of weight stigma and should aim to promote self-acceptance (Kaufmann & Bridgeman, 2021). If individuals who experience IWB and are prone to binge eating extend kindness and care to themselves in the moment instead of treating themselves unkindly or critically, they may be able to avoid binge eating and better regulate emotions, thus improving both IWB and binge eating behaviors. Observational EMA studies can provide more insight into the relationships between SC, IWB, and binge eating.

Since most existing research primarily includes samples of female participants, there are generalizability issues regarding the interpretation of the relationships among binge eating, SC, and IWB. These generalizability issues include theoretical underpinnings of how SC may work to improve binge eating and IWB in adult men. Preliminary findings suggest SC may be a protective factor for IWB and emotional eating in individuals seeking bariatric surgery (Braun et al., 2021). Further, stigmatizing experiences (i.e., experienced/perceived weight stigma, not IWB) have been shown to predict binge eating behavior and overall psychological distress in adults with obesity enrolled in a weight loss program (Ashmore et al., 2008). In women, SC was

associated with lower levels of IWB (Fekete, Herndier, & Sander, 2021).

Additionally, the relationship between SC and maladaptive eating (emotional and eating restraint) was explained through IWB (Fekete, Herndier, & Sander, 2021). Other moderation analyses showed that individuals who experience IWB and have low levels of SC exhibited lower body appreciation and higher disordered eating (Pullmer et al., 2021). However, it is unknown if the relationships between these constructs would occur in adult men who binge eat, and it is unclear if measuring these variables at the momentary level would produce similar findings (Pullmer et al., 2021).

Ecological momentary assessment (EMA) is real-time data collection in a real-world environment. This methodology permits the study of time and within-person varying factors better than traditional methods. Additionally, EMA has several advantages over traditional approaches, including 1) minimizing recall bias inherent in retrospective self-report and 2) enhancing ecological validity by gathering real-time self-reports of behaviors, moods, beliefs, attitudes, and perceptions within a person's natural environment (Dunton, 2017; Shiffman & Stone, 1998). EMA is the preferred methodology to examine how SC may moderate the relationship between IWB and binge eating. First, SC can fluctuate over time, and using EMA to examine moderation effects accounts for state variation (Shiffman, 2013). Additionally, EMA is beneficial in elucidating binge eating since factors such as changes in affect both influences and is influenced by binge eating (Goldschmidt, Crosby, et al., 2018; Grange, Gorin et al., 2001; Schaefer, Smith, et al., 2020).

EMA findings implicate the role of guilt and shame in maintaining binge eating behaviors, and EMA findings show that these negative feelings improve after a binge episode in individuals with BED (Schaefer et al., 2020). The alleviation of guilt following a binge eating

episode supports the two primary hypotheses of the emotional regulation model: 1) negative emotions trigger binge eating, and 2) binge eating is associated with decreased negative emotions (Hawkins & Clement, 1984; Haedt-Matt & Keel, 2011). EMA findings also show that perceived stress predicts binge eating symptoms, where increasing amounts of stress throughout the day can accumulate to trigger a binge eating episode later in the day (Smith, Mason et al., 2021). These momentary findings highlight the importance of utilizing EMA methods in binge eating research since it is likely that traditional methodologies cannot adequately capture momentary changes in constructs like SC that may work to moderate the relationship between IWB and binge eating. SC alleviates guilt and body shame and can reduce perceived stress (deSouza et al., 2020; Liss & Erchull, 2015; Thogersen-Ntoumani et al., 2020; Wang et al., 2020).

Given that IWB predicts binge eating frequency and correlates with uncontrolled eating, it is crucial to understand if an affect-regulation skill like SC moderates the relationship since SC lessens guilt and body shame (deSouza et al., 2020; Liss & Erchull, 2015; Puhl et al., 2007; Remmert et al., 2019; Thogersen-Ntoumani et al., 2020; Wang et al., 2020). Thus, the present study was exploratory and aimed to examine if momentary SC (time 1) moderates the relationship between internalized weight bias (time 1) and binge eating (times 2-5) in adult men who binge eat.

Materials and Methods

Participants

Participants were enrolled or expressed interest in a health coaching program focused on helping individuals reach health goals through one-on-one meetings targeting nutrition, physical activity, and lifestyle behaviors (e.g., stress management). Individuals were electronically invited

to participate in the study through social media (Facebook), email listservs, and word-of-mouth from health coaches who distributed fliers. Inclusion criteria for the study were: 1) male sex at birth, 2) 18 years or older, 3) able to read and speak English, 4) scoring a moderate to severe score on the binge eating scale, indicated as 18 or higher (Marcus et al., 1988), 5) own and regularly use a smartphone that can run mobile applications, and 5) willingness to comply with the study protocol and complete (60% or more) of the app-based surveys. The inclusion criteria permitted recruitment of men who experience binge-eating spectrum disorders since we did not exclude any participant who engaged in compensatory behaviors. After eligibility was determined through an online screening questionnaire, individuals provided consent to participate through an online informed consent that described study procedures, risks, and benefits. The Institutional Review Board at a large state university in the Western States approved the study procedures. This study was conducted following the Declaration of Helsinki.

Profile by Sanford Health Coaching Program

A total of 77% of participants in the present study were actively engaged in the Profile by Sanford program. The remaining men had indicated an interest in the program at some point. Profile by Sanford provides one-on-one health coaching and a reduced-calorie meal plan. Participants are encouraged to make long-term dietary, physical activity, and lifestyle (such as stress management) behavior changes. Individuals typically meet with a health coach weekly, bi-weekly, or monthly for 30 minutes. Most individuals prefer to meet with the same health coach throughout the program. Results from this program are previously reported (Bell et al., 2021; JaKa et al., 2021; Kim et al., 2021).

Procedure

Individuals who agreed to participate in the study by signing an informed consent

completed a 15-minute baseline survey through REDCap (an online survey platform; Harris et al., 2009). Next, participants received instructions on downloading a free EMA application (RealLife Exp app by LifeData) and completed seven consecutive days of EMA on their personal smartphones. Participants responded to interval-contingent/fixed time-based surveys on their phones. Participants were notified to complete five surveys daily between the following windows of time: 9–11 AM, 12–2 PM, 3–5 PM, 6–8 PM, and 9–10 PM. Each survey took less than 3 minutes to complete. Participants were given 15 minutes from when they were notified in the app to answer each survey. If they missed the 15-minute window to complete the survey, they were given a second chance within the two-hour window to complete the survey. Participants received compensation after completing the baseline survey, and at least 60% of all EMA prompts throughout the week. Compensation for completing both parts of the study included a $100 gift card to the health coaching program.

Measures

Baseline Questionnaires

Before the EMA protocol, participants completed questionnaire assessments, including demographics such as age, race, and self-reported height and weight, from which body mass index (BMI; kg/m^2) was calculated. These variables were used as covariates in the present study since they are commonly associated with IWB (Puhl et al., 2018).

EMA Measures

Internalized Weight Bias (IWB). Momentary internalized weight bias was assessed by the following items, which comprise the 3-item Weight Bias Internalization Scale (WBIS-3; Kleim et al., 2020): "*I feel anxious about my weight because of what people might think of me*,";

"*Whenever I think a lot about my weight, I feel depressed*,"; "*I hate myself for my weight.*" Each item was rated on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Items were summed for a total WBIS score at each signal to create a composite measure of general momentary internalized weight bias. Scores ranged from 3 to 21, with higher scores indicating more significant internalized weight bias. Internal consistency reliability for the WBIS-3 collected through EMA was α=.89.

Self-Compassion (SSCS-S). Momentary self-compassion was assessed by the 6-item State Self-Compassion Short Form (SSCS-S; Neff et al., 2021). This scale was selected to assess in the moment (state) self-compassion and to reduce participant burden since it is shorter than the 12-item Self-Compassion Scale Short Form (Raes et al., 2011). At each prompt, participants responded to the following items: 1: "*I'm giving myself the caring and tenderness I need*"; 2: "*I'm obsessing and fixating on everything that's wrong*"; 3: "*I'm remembering that there are lots of others in the world feeling like I am*"; 4: "*I feel intolerant and impatient toward myself*"; 5: "*I'm keeping things in perspective*"; 6: "*I feel like I'm struggling more than others right now*." Items 2, 4, and 6 were reverse scored, and a total mean was calculated to indicate a participant's state self-compassion level. Scores ranged from 1 to 5. While there are no clinical norms or scores to indicate high or low state self-compassion using the SSCS-S, an ad-hoc rubric suggests scores of 1.0-2.49 to be low, 2.5-3.5 to be moderate, and 3.51-5.0 to be high. EMA-assessed SSCS-S initially demonstrated poor internal consistency reliability, α=.56. Because of poor reliability, we removed item 3 from the scale. Removal of item 3 improved the internal consistency reliability of the SSCS-S, α=.63.

Binge Eating. Momentary binge eating was measured only after respondents confirmed that they had eaten between the last and current prompt by a positive response to, "*Have you*

eaten since responding to the last prompt?". After each confirmed eating occasion, four EMA questions assessed loss of control eating (*While you were eating, to what extent did you feel a sense of loss of control?; feel that you could not stop eating once you started?; you could not resist eating?; feel driven or compelled to eat*?) and two items assessed overeating (*To what extent do you: feel that you overate?; consider what you ate to be an unusual or excessive amount of food?*). These items were based on previous EMA research in EDs (e.g., Smith et al., 2021) and were assessed using a Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). Scores on loss of control eating and overeating items were averaged to create a composite score. Momentary binge eating demonstrated strong internal consistency reliability, α=.95.

Analytic Plan

A generalized estimating equation (GEE) with a gamma link function and an autoregressive (AR1) serial autocorrelation correction was used to test the moderation model. All analyses were run in SPSS Statistics for Macintosh, Version 27.0 (Chicago, IL), with statistical significance set at $p < .05$. The independent variable was momentary IWB at Time 1, the moderating variable was momentary SC at Time 1, and the dependent variable was momentary binge eating at Times 2-5. The covariates included in the moderation model were race, age, ethnicity, and BMI demographic variables.

Results

Participant Demographic Results

A total of 85 male participants (m_{age}=35.71 ± 10.71; m_{BES} = 34.16 ± 9.93, range 18-46) completed the baseline survey and at least 5 of the EMA surveys. Participants who completed less than 5 EMA surveys (less than one day) were excluded from the analysis (n=35). The sample had equal percentages of non-Hispanic White and Black/African American participants. Most men did not identify as Hispanic and reported an annual income exceeding $80,000. The

study team determined fraudulent participants through examining cellphone data, removing anyone with multiple IP address entries in the baseline REDCap survey and reviewing if phone records matched the IP location of participants. Participants who quit emailed the study team to share that they would no longer participate. See Figure 1 for study attrition and Table 8 for participant demographic results.

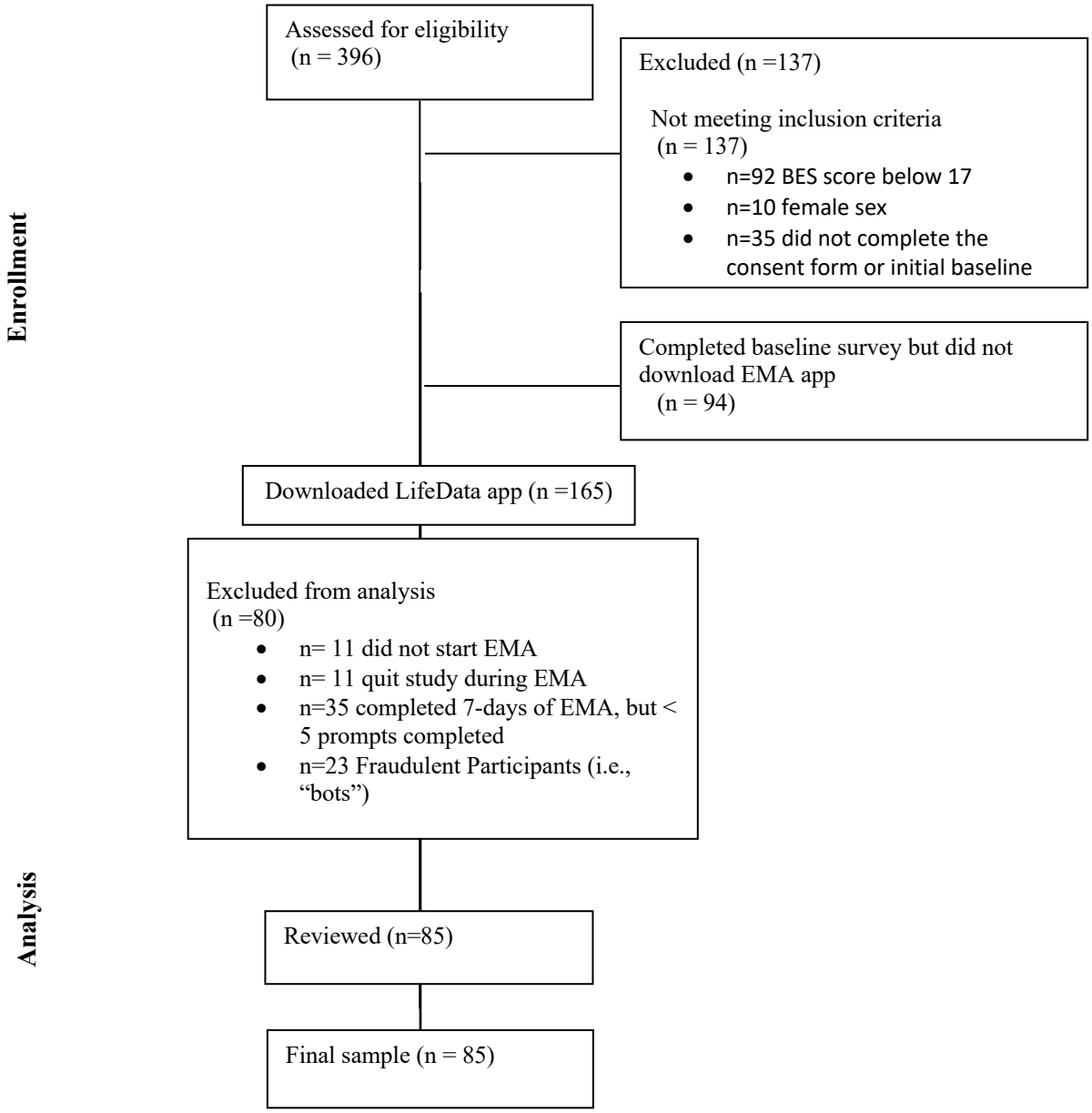

Figure 1.
Participant Attrition

Table 8

Participant characteristics (n=85)

Characteristic	Category	n (%)
Ethnicity		
	Hispanic or Latino	5 (5.9)
	Not Hispanic	76 (89.4)
Race (check all that apply)		
	Asian	1 (1.2)
	Native Hawaiian or Other Pacific Islander	1 (1.2)
	Black or African American	37 (43.5)
	American Indian or Alaska Native	3 (3.5)
	White/Caucasian	37 (43.5)
	More than one race	1 (1.2)
Body Mass Index (BMI; kg/m^2)		
	BMI below 25	5 (5.8)
	BMI of 25-29.9	20 (39.8)
	BMI of 30-39.9	36 (48.2)
	BMI of 40+	6 (7.2)

Ecological Momentary Assessment Results

On average, participants completed the EMA survey in 2:13 minutes (SD = 0.13) across the 7 days of prompting. Total EMA compliance was 74.4% (range: 14–100%). A total of 2,109 EMA observations were collected, which narrowed to 459 due to available data: each day of EMA only has one "Time 1" (self-compassion moderator and IWB independent variable). Each participant provided up to 7 days of EMA, limiting the maximum number of "Time 1" variables to 7.

Men enrolled in this study completed 3.6 out of 5 total prompts per day on average (SD: 0.95). Response rates did not change as a function of time of day, χ^2. (4, N=2146) = 8.77 p=0.07.

Similarly, results indicated no significant differences in response rates across the seven days X^2 (6, N=2146) = 7.58, p=0.27, although the final two days (6 and 7) account for 8.6% and 2.2% of all completed prompts in the study, respectively. The final two days of the study resulted in a lower total amount of data collected (days 6 and 7), notably lower than the previous study days. An independent samples t-test indicated no significant difference in the mean values of completed sessions between days 1-5 (group 1) and days 6-7 (group 2), t (2144) = -0.01, p=0.99. The lower total amount of EMA data collected on days 6 and 7 is plausibly explained by participants deleting the app from their phone once reaching the required total number of responses acceptable to receive study compensation (i.e., there were 46 completed responses and 0 missing responses on day 7 of the EMA vs. 431 completed responses and 7 missing responses on day 1).

Demographic and anthropometric variables like BMI and socioeconomic status were not associated with compliance. However, non-Hispanic individuals, participants who endorsed races besides black/African American or non-Hispanic White/Caucasian, and older adults were more likely to have lower compliance rates. Table 9 shows descriptive statistics for the study variables.

Table 9

Descriptive Statistics of Study Variables

Variable	M	SD	Min.	Max.
Internalized Weight Bias	4.08	1.83	1.00	7.00
Self-Compassion	3.17	0.70	1.00	5.00
Binge Eating	2.44	1.18	1.00	5.00
Age	35.92	10.64	18	66

Note. M = mean; SD = standard deviation

Moderation was examined using GEE with a gamma link function and an autoregressive (AR1) serial autocorrelation correction, with p-values set to .05 apriori. The Quasi Likelihood under

Independence Model Criterion (QIC) was 99.59. Results indicate a significant main effect of self-compassion (p<.001) at time 1 on subsequent binge eating at the next prompt where eating occurred (See Table 10). This finding indicates that as between-person self-compassion increases by one-unit, momentary binge eating decreases by .22. There was no significant main effect of IWB on binge eating. Additionally, self-compassion at time 1 significantly moderated the relationship between IWB at time 1 and the next completed binge eating prompt (p=0.002). The interaction of momentary self-compassion and momentary IWB is displayed in Figure 2. Higher self-compassion strengthened the negative association between IWB and binge eating.

Table 10

Parameter Estimates from General Estimating Equations of Self-Compassion as a Moderator for Internalized Weight Bias and Binge Eating at the Next Prompt

Variable	ß	SE	*p*	95% CI
Between-subjects Self-Compassion at Time 1*	**-0.22**	**0.06**	**<.001**	**[-0.34,-0.11]**
Momentary Weight Bias Internalization at Time 1	-0.45	0.05	0.346	[-0.14,0.05]
Within Self-Compassion x Internalized Weight Bias	**0.04**	**0.01**	**0.002**	**[0.01, 0.06]**
Age¥	-0.01	0.003	0.06	[-0.02, -0.002]

Note. p values < .05 are bolded. * indicates significance at ≤ .001 level. ¥ indicates a variable collected once at baseline.

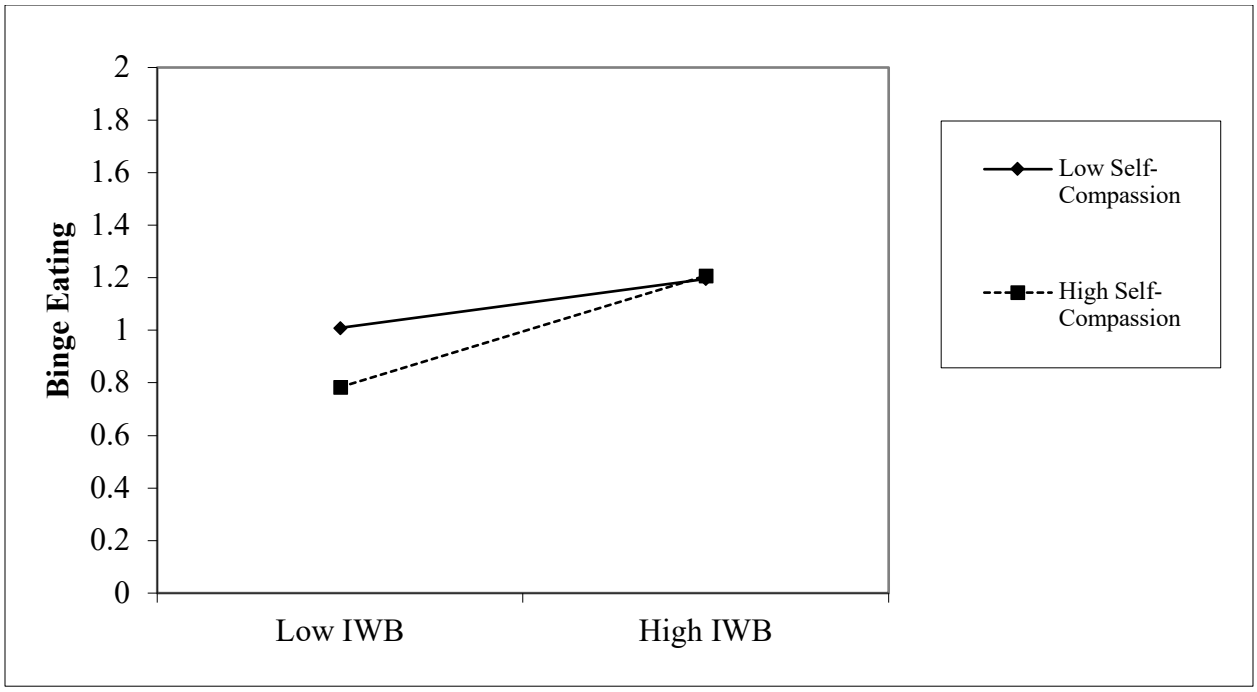

Figure 2.
Self-Compassion Moderates the Relationship Between IWB and Binge Eating

Discussion

The present study indicates that self-compassion plays a critical role moderating the occurrence of binge eating in adult men enrolled in a health coaching program. First, a significant main effect of self-compassion was observed on binge eating. As between-person self-compassion increases one unit, binge eating decreases by 0.22 in the next prompt, where binge eating is reported. There was no observed significant main effect of IWB on binge eating. Finally, self-compassion at time 1 was shown to moderate the relationship between IWB at time 1 and binge eating at the next prompt where eating occurred (prompts 2-5). The nature of this moderation suggests that the combination of high self-compassion and low IWB yielded the lowest binge eating. Interestingly, the level of self-compassion did not change the amount of binge eating in men who reported higher IWB, and higher IWB was associated with increased binge eating, though not statistically significant as a main effect.

The present study observed no significant main effect of IWB on binge eating. Still, past research shows that others' lack of understanding of obesity is a primary driver of weight stigma and subsequent IWB (Ramos Salas et al., 2019). Participants in the present study were enrolled in a health coaching program, and findings from past research indicate that health coaches and other wellness professionals should be required to learn more about weight science and the myriad of factors that influence weight to avoid stigmatizing people in larger bodies (Ramos Salas et al., 2019). Individuals who experience IWB recover from the adverse effects of IWB by increasing their self-compassion and self-acceptance (Ramos Salas et al., 2019).

A significant main effect of self-compassion on binge eating was observed, suggesting that as self-compassion increases, binge eating decreases. This finding complements prior work, which shows that self-compassion interventions can significantly reduce binge eating in women (Kelly & Carter, 2015; Pinto-Gouveia et al., 2019). Findings from the present study are some of the first to show that self-compassion can reduce binge eating in men enrolled in weight-centric health coaching programs. In addition to binge eating, self-compassion has been suggested as a promising target for reducing forms of bias, including IWB in adult women (Fekete et al., 2021). Future work should examine ways to tailor self-compassion programs to reduce binge eating in men.

It was hypothesized that the relationship between IWB and binge eating would vary based on a participant's self-compassion. It was expected that individuals with higher self-compassion would report lower IWB and lower binge eating. This hypothesis was supported, and men who reported higher self-compassion and lower IWB reported the lowest binge eating. Regardless of self-compassion level, men with higher IWB reported higher binge eating than those with lower IWB. The lowest reported binge eating occurred in men with low IWB and high

self-compassion. This suggests that self-compassion may reduce IWB, thus reducing binge eating.

Unexpectedly, men who reported high IWB and low self-compassion had roughly the same binge eating estimates as those with high IWB and high self-compassion. Prior work shows that IWB significantly contributed to eating disorder pathology in a sample of adult men and women in larger bodies seeking treatment for binge eating disorder (Durso et al., 2012). Specifically, IWB was significantly and positively correlated with total eating disorder examination (EDE) score, EDE eating concern, EDE shape concern, EDE weight concern, and EDE overvaluation of weight and shape scores (Durso et al., 2012). Further, weight bias internalization has been shown to uniquely contribute to binge eating in people of different BMI categories (Romano et al., 2021). Further, it was expected that higher IWB would result in higher binge eating scores later in the day. However, the present study observed an insignificant inverse association between IWB and binge eating, such that as IWB increases, binge eating decreases. This deviates from previous work indicating that IWB is positively associated with binge eating (Romano et al., 2021). In a study examining gender differences on how shame operates to influence binge eating in men and women, Duarte and Pinto-Gouveia (2017) found that self-criticism focused on personal inadequacy mediated the relationship between body image-focused shame experiences and binge eating. Since self-compassion is able to reduce shame and encourages treating the self with kindness instead of harsh criticism, it was expected that self-compassion would work to reduce both IWB and binge eating in men. Instead, it appears that self-compassion may reduce binge eating in men with lower IWB than in men with high IWB. Additional work is needed to better understand these relationships and explore other mechanisms that may be useful to lower binge eating in men with higher weight bias internalization.

Strengths

There are several notable strengths of the present study. First, previous literature posits that weight management programs could be an ideal setting to combat the harmful consequences of weight stigma (Himmelstein, Puhl, & Quinn, 2018; Puhl, Himmelstein, & Pearl, 2020). Data collection in the present study was from a group of men affiliated with a health coaching company with nearly 50 store locations scattered throughout the United States. While the present study was not an intervention to directly addressed internalized weight bias or binge eating through programming, the findings from this observational EMA are relevant to health coaching programs that focus on weight and other health behaviors. The applied nature in which these data were collected is a strength in that findings could be transferred into practice. This is a central tenant of translational science: that findings can be used for practical application and to bridge the gap between science and practice (Austin, 2021).

Next, men are poorly represented in self-compassion or eating disorder research (Biber & Ellis, 2019; Thapliyal et al., 2019). In fact, the stereotypes around eating disorders as a condition only afflicting women are a barrier to seeking treatment for an eating disorder in men (Thapliyal et al., 2019). The present study addresses a critical gap in the literature by explicitly targeting men who are enrolled or interested in weight management with moderate to severe binge eating symptoms.

Limitations

One major limitation of this study is that the sample of 459 prompts approximates 20% of the total sample collected during the 7-day EMA data collection period. The relationship between self-compassion and binge eating seen in the current study aligned with prior literature showing that self-compassion reduces eating pathology and binge eating (Biber & Ellis, 2019; Neff,

2023). Findings should be interpreted with caution however, given the exploratory nature of this study. It is important to consider that this work could benefit from future replication with a larger sample of male participants and include multiple waves of data collection via EMA over time.

Another limitation is the reliability of the 6-item State Self-Compassion Short Form (SSCS-S; Neff et al., 2021). While reliability of this instrument was improved by removing item three, the reliability of the SSCS-S fell within the lower end of the acceptable threshold range of 0.6-0.7 (Taber, 2018). This was the first known study to incorporate the SSCS-S into an EMA study. The SSCS-S was intended for research purposes and is designed to measure self-compassion in the moment (Neff et al., 2021). Previous work shows this scale had a nearly perfect correlation with the long-form version and demonstrated strong reliability in a community sample of adults (Neff et al., 2021). It is unclear why the reliability of the SSCS-S was lower in the present study. It could be that the sample in the present study differs significantly from the community sample used by Neff and colleagues (2021). The SSCS-S could benefit from continued study to refine understanding of how it performs in different samples. Additionally, test-retest reliability estimates in EMA studies fluctuate, with Cronbach's alphas ranging from 0.38 to 0.77 (Csikszentmihalui & Larson, 2014). While a strength of EMA is that it more easily generalizes to real-life settings because of the nature of data collection through prompting, perhaps reliability estimates are lower because of changing interpersonal and physical contexts in which people respond. Future EMA studies should use discernment over whether the SSCS-S is the best instrument to measure self-compassion or if alternative scales would be better.

Another limitation of the present work is the methodology used for collecting data on weight stigma experiences that occur in everyday life. To minimize participant burden, we did not include an event-contingent EMA component for participants to report experiences with weight

stigma. Had we collected data on weight stigma experiences, we could support the model proposed by Romano and colleagues (2021) to collectively account for the intermediary role of weight bias internalization on weight stigma and eating disorder behaviors. Still, there is a paucity of EMA research examining IWB and modifiable psychosocial factors that influence it, which speaks to the novelty of the present work.

Future Directions

The present study supports self-compassion as a way to reduce binge eating and as a critical variable that strengthens the relationship between IWB and binge eating in adult men. Recent research shows how specific facets of self-compassion (like common humanity, mindfulness, and self-kindness) are related to different disordered eating behaviors and emotional eating in adults in larger bodies (Kalantzis et al., 2023). Researchers did not identify significant bivariate associations between self-compassion and binge eating severity; however, self-judgment, over-identification (becoming overly absorbed in adversity), and self-kindness were significantly related to disordered eating (as measured by the global score of disordered eating from the Eating Disorder Examination- Questionnaire) (Kalantzis et al., 2023). Still, it would be interesting to explore if certain momentary facets of self-compassion drive binge eating behaviors in men, as this cross-sectional study included only 3% male participants (Kalantzis et al., 2023). Future work could investigate whether specific subscales of self-compassion (common humanity, isolation, over-identification, mindfulness, self-judgment, and self-kindness) predict increased binge eating severity in men prone to exhibiting binge eating behaviors and symptoms. Gaining more insight into the "negative" subscales (isolation, over-identification, and self-judgment) and "positive" subscales (common humanity, mindfulness, and self-kindness) of self-compassion and how they may work at the momentary level to influence eating behaviors

could guide the development of future interventions designed to regulate eating behaviors and reduce disordered eating symptoms.

Conclusion

Overall, we found that self-compassion moderated the relationship between IWB and binge eating at the next prompt after an eating occasion. The findings from this study are relevant to health coaching programs that work with adults. These results indicate that increasing self-compassion in men enrolled in these programs may lessen binge eating symptoms. Health coaches who work with clients in one-on-one settings may want to consider incorporating programming to increase self-compassion to reduce binge eating symptoms in men trying to make long-term behavior changes. Successful interventions to reduce binge eating involve mindfulness-based interventions (Grohmann & Laws, 2021), acceptance and commitment therapy approaches (Cuneo et al., 2018), medications, and cognitive behavioral therapy (CBT), (Brownley et al., 2007). Of these, acceptance and commitment therapy approaches have been shown to be successful in adult male binge eating samples (Cuneo et al., 2018). Finally, self-compassion was a significant moderator of IWB and binge eating. Findings are aligned with prior research that suggests that self-compassion may strengthen the relationship between IWB and binge eating in women. Future work should investigate how to best tailor self-compassion programs for adult men in larger bodies with moderate to severe binge eating symptoms.

CHAPTER 6

Overall Discussion of Results and Conclusions

These three observational studies aimed to contribute to the existing literature on self-compassion, internalized weight bias, and binge eating spectrum disorders in men. This research observed significant prospective associations of between-subject self-compassion and binge eating and internalized weight bias at the next prompt in adult men with moderate to severe binge eating symptoms. While adverse childhood experiences were found to predict binge eating symptoms, drive for muscularity and ACEs did not moderate the associations between our variables of interest. Lastly, self-compassion significantly moderated the relationship between IWB and binge eating, such that those who reported higher self-compassion and lower IWB had the lowest binge eating scores. All three studies indicate that self-compassion may be critical in helping adult men change binge eating behavior and improve IWB, which could render other beneficial mental and physical health improvements. This work highlights a need for programming that targets self-compassion through weight management and health coaching services.

Overall, findings consistently pointed to between-subjects self-compassion as a construct to target to change binge eating and internalized weight bias. In study 1, one unit increase in self-compassion was associated with a 0.19 decrease in binge eating in the subsequent prompt. In study 2, one unit increase in self-compassion was associated with a 0.12 decrease in IWB in the next prompt. Finally, in study 3, self-compassion was shown to moderate the relationship between IWB and binge eating. Specifically, self-compassion at time 1 strengthened the association between IWB at time 1 and binge eating reported at the next prompt. These findings are some of the first to demonstrate the role of self-compassion in binge eating and internalized

weight bias in adult men.

Study 1: Self-Compassion and Binge Eating

Previous research demonstrates the utility of self-compassion as a tool to address eating disorders and binge eating (Turk & Waller, 2020). Findings from the first study complement previous research and demonstrate that men enrolled in health coaching programs could benefit from programs designed to increase self-compassion. Results from study 1 also suggest that focusing resources on just-in-time adaptive interventions (JITAIs) may not be necessary to reduce binge eating symptoms in this sample since within-person self-compassion did not significantly predict binge eating or IWB. Because observational EMA studies can inform future intervention work, it is important to consider the significant between-person findings of the first study and that this may mean interventions focused on improving self-compassion may improve binge eating. Much of the existing literature on programs or interventions designed to increase self-compassion comes from the Mindful Self-Compassion Program (Germer & Neff, 2013). This program focuses on helping participants develop three primary skills: 1) self-kindness, being kind toward yourself when experiencing adversity or suffering; 2) common humanity, acknowledging that imperfections and struggle are part of what it means to be human, and 3) mindfulness, being aware without ignoring suffering or over-identifying with it (Germer & Neff, 2013). Typically, the Mindful Self-Compassion Program includes eight weekly group sessions with trained facilitators who follow a facilitation guide (Germer et al., 2015).

Most research examining the Mindful Self-Compassion Program includes samples of women; however, a pilot study examining Mindful Self-Compassion Program in a group of racially diverse, primarily male (71%) veterans found that the program was well received, as indicated by high engagement and completion rates (Serpa et al., 2020). Additionally, the

veterans in this program reported significant increases in self-compassion, happiness, and social role satisfaction, with small to medium effect sizes (Serpa et al., 2020). This supports the Mindful Self-Compassion Program as a benefit to men and for improving their overall self-compassion. Germer and Neff (2019) pointed out that most participants in the Mindful Self-Compassion Program are women. Consequently, much of the language used throughout the training is geared toward feminine women. Men may require adaptations to programming and marketing of such programs (Germer & Neff, 2019). Discrete choice experiments may help elicit preferences of men enrolled in health coaching programs to improve the overall messaging of self-compassion programs and make them more appealing to men (Merino-Castello, 2004). Discrete choice experiments involve exposing participants to a series of program messaging options and having them select their preferences. This type of study would be ideal, given that this dissertation was completed in an applied setting with data from a health coaching program in the United States. Insights yielded from discrete choice experiments could help marketing teams, health coaches, and program development teams best communicate self-compassion to improve eating behaviors and help men in larger bodies challenge negative stereotypes around weight and size.

Qualitative research is needed to examine the barriers men face when practicing self-compassion. This could yield essential insights on how to structure programs designed to improve adherence and retention in self-compassion programming for men. Furthermore, conducting a qualitative study that examines the lived experience of self-compassion in men could be helpful for health coaching programs looking to integrate self-compassion training. Qualitative work could be modeled after the study conducted by Jeziorek and Razi (2022), who conducted semi-structured interviews with women enrolled in a weight-centric program to better

understand their lived experience with self-compassion.

Study 2: Self-Compassion and Internalized Weight Bias

Early research reports mixed findings on whether self-compassion can reduce IWB in adult women, with some studies showing no effect (Haley et al., 2022) and others reporting that self-compassion reduces IWB (Braun et al., 2022). People in larger bodies report self-compassion as instrumental in recovering from the harmful impacts of IWB (Ramos Salas et al., 2019). Study 2 extends these findings by showing that between-subjects self-compassion significantly reduced momentary IWB in adult men with moderate to severe binge eating. This study is the first that uses EMA to examine momentary IWB in adult men enrolled or interested in a weight management program. Much of the EMA literature focuses on overt weight stigma experiences, and there is a need to further understand weight bias internalization at the state/momentary level (Carels et al., 2019).

These findings can inform future work designed to address IWB through structured programming. For example, Pearl and colleagues (2018) offered a BIAS program that included eight weekly group sessions of cognitive behavioral therapy (CBT) to reduce weight bias internalization and better cope with weight stigma. This pilot trial included men and women in larger bodies who reported a history of weight stigma and high IWB (Pearl et al., 2018). Findings showed that those enrolled in the BIAS program significantly reduced weight bias internalization and fat phobia compared to those in a quasi-control group (Pearl et al., 2018). In the "Expand your Horizon" program, young adult women who had endorsed at least some weight bias internalization completed three writing tasks over one week (Davies et al., 2022). Participants in the active control group were tasked with viewing three videos and presented with writing prompts that were not focused on their bodies. Women enrolled in the Expand your

Horizon program first viewed three videos showing women expressing gratitude for body functionality (how their body works/functions) and were tasked with gratitude journaling about their bodies (Davies et al., 2022). Participants in both conditions saw improvements in IWB, functionality appearance (noticing how the body functions versus how it appears/looks), and self-compassion. However, those enrolled in the gratitude writing condition experienced greater and longer-lasting improvements than those in the active control (Davies et al., 2022). A program like the "Expand your Horizon" intervention could be modified for men, and a health coaching program where men work with health coaches in a 1-1 setting may be an ideal space to deliver such programming since health coaches could deliver a consistent message focused on extending gratitude toward one's body and encourage men to engage with body image in a more private session as opposed to group sessions. Findings from study 2 support the inclusion of self-compassion improvement activities in health coaching programs to reduce IWB.

Study 3: Self-Compassion Moderates IWB and Binge Eating

The third exploratory study investigated whether self-compassion influenced the relationship between IWB and binge eating. Findings showed that self-compassion at time 1 had a significant main effect on binge eating at a later prompt (prompts 2-5) and that self-compassion moderated the relationship between IWB at time 1 and binge eating. Findings complement cross-sectional research that shows self-compassion as negatively associated with weight bias internalization and eating pathology in adults in the U.S. (Pullmer et al., 2021).

Furthermore, specific findings from study 3 are aligned with Pullmer and colleagues (2021). We observed that self-compassion moderated the relationship between IWB and binge eating for those lower in IWB, while Puller and colleagues reported self-compassion moderated psychological distress and eating pathology and that the relationship between the two was

strengthened for those lower in self-compassion. Both studies support self-compassion for individuals who experience social stigma related to weight. Higher weight bias internalization was reported in women in larger bodies with binge eating disorder than in women without binge eating disorder, and the relationship between IWB and binge eating severity was mediated by self-criticism (Palmeira et al., 2017). It's plausible that self-compassion could moderate the relationship, as those higher in self-compassion often report lower levels of self-criticism (Wakelin et al., 2022). Similarly, after controlling for ACEs, heightened internalized shame and low self-compassion attenuated the relationship between IWB and emotional eating in individuals seeking bariatric surgery (Braun et al., 2021). In study 3, we observed that the combination of low IWB and high self-compassion was related to the lowest binge eating. Contrary to what was expected, self-compassion did not demonstrate differences in binge eating for men high in IWB. Future work should examine if men higher in IWB could benefit from self-compassion as a practice to reduce binge eating or if other ways to address binge eating would work better for those higher in IWB.

Practical Implications

Since both emotion regulation difficulties and dietary restriction independently predict binge eating in men (Kukk & Akkermann, 2020), and adults seeking weight loss treatment report high levels of IWB (Puhl et al., 2019), weight management programs may be an ideal setting to offer self-compassion programming. The present work is a series of three studies utilizing data from men enrolled in a weight-centric health coaching program. Three primary aims guided the purpose of this work:

1. Assess between and within-subject effects of self-compassion on binge eating in men.
2. Examine between and within-subject effects of self-compassion on IWB in men.

3. Explore the indirect effects of self-compassion as a moderator on the relationship between internalized weight bias and binge eating.

Future work could consider combining EMA study design with machine learning analysis methods to identify predictors of binge eating and internalized weight bias. Machine learning has been applied in EMA studies to reveal interactions that predict specific behaviors or affective states, like depression (Colombo et al., 2019; Kim et al., 2019; Sala et al., 2022). For example, a machine learning model was developed to predict dietary lapses in adults with elevated BMIs (above 25) who completed six EMA surveys daily over six weeks (Sala et al., 2022). Machine learning methods can identify new combinations of risk factors that predict certain behaviors or states (Sala et al., 2022). Further, machine learning methods permit investigating interaction effects among risk factors and can better pinpoint combinations of risk factors that could predict binge eating behaviors or future increases in internalized weight bias. Research combining EMA and machine learning could extend the findings reported in the current study and could clarify the role of momentary self-compassion on binge eating and internalized weight bias in men.

Observational EMA studies can serve as precursors to the development of Just in Time Adaptive Interventions (JITAIs)- an intervention delivered through prompts that target behavior change by providing the right type and amount of support needed at the right time. JITAIs are most valuable when there are within-subjects momentary effects on an outcome variable, which was not demonstrated in the first two studies. In research focused on eating disorders, JITAIs can be leveraged to monitor relapse-related triggers and deliver effective interventions to the individual when needed to prevent lapses or relapse from occurring (Goldstein, Evans et al., 2017). Recently, compassion-focused therapy (CFT) was implemented in adults with obesity who experience body weight shame and high levels of self-criticism (Carter et al., 2023).

Individuals completed 12 sessions of group CFT focused on cultivating a compassionate motivational style to support themselves. Findings indicated that CFT could reduce body weight shame, self-criticism, and fears of compassion (Carter et al., 2023). In addition, participants reported increased self-compassion, perspective-taking, and self-reassurance compared to participants in the control group (Carter et al., 2023). Only 9% of participants in the intervention were male, though results did not change when men were excluded from the analysis (Carter et al., 2023). Findings from the present study suggest that men could benefit from interventions designed to increase self-compassion and that increasing self-compassion may improve binge eating and IWB. The work by Carter and colleagues is especially important to consider because their intervention reduced fear of self-compassion (defined as the fear that offering compassion to yourself could result in reduced motivation to meet self or other expectations), and young adult males have reported higher levels of fear of self-compassion than women (Jeong et al., 2015; Jeong et al., 2017).

These three studies demonstrate self- compassion's influence on binge eating and internalized weight bias in men with moderate to severe binge eating symptoms. Previous research has supported that self-compassion interventions reduce eating disorder pathology, eating concerns, and weight concerns more than standard behavioral weight loss (Kelly & Carter, 2015). Similarly, early evidence shows that interventions that help individuals increase self-compassion can minimize weight-related shame characteristic of internalized weight bias (Carter et al., 2023).

In conjunction with findings from the present studies, other research points to the utility of incorporating self-compassion into health coaching and behavioral weight loss programs to improve binge eating behaviors and reduce weight self-stigma. Incorporating such programming

into behavioral weight loss programs may be especially important for men for several reasons. First, it is estimated that 30% of all individuals seeking weight loss treatments experience binge eating symptoms or meet the full criteria for binge eating disorder (Westerberg & Waitz, 2013). Secondly, dietary restraint is a known predictor of later binge eating in men (Kukk & Akkermann, 2019). Finally, being male and having higher levels of self-stigma surrounding seeking psychological treatment increases the likelihood of having an undiagnosed eating disorder, with self-compassion shown to act as a facilitator for college men seeking counseling services (Griffiths et al., 2015; Heath et al., 2017). It could be that men are more willing to enroll in a behavioral weight loss program to improve loss of control of eating rather than looking for psychological treatment or counseling. Developing self-compassion programming and delivering it to individuals through behavioral weight loss services may effectively reduce binge eating behaviors and concurrently reduce the stigma men experience for getting additional support and treatment for more severe binge eating behaviors.

Interdisciplinary Health Implications

Research on self-compassion to address binge eating behaviors and internalized weight bias involves a variety of disciplines, but most notably, psychology and public health. Men who binge eat are at increased risk for adverse mental and physical health conditions (Iceta et al., 2021; McCuen-Wurst et al., 2018; Ndbuisi et al., 2022). EMA findings point to dietary restraint as a significant predictor of later binge eating in men (Kukk & Akkermann, 2019). Similarly, individuals with higher internalized weight bias report increased disordered eating, lowered social functioning, and health-related quality of life (Romano et al., 2022). Aside from adverse mental and physical health correlates, binge eating is also associated with economic burdens. Individuals with binge eating suffer productivity loss, higher healthcare resource utilization, and

higher healthcare costs than adults without binge eating disorders (Ling et al., 2017). The consequences of binge eating and internalized weight bias encompass multiple disciplines, which is why research and treatment efforts are most successful when adopting a multidisciplinary approach.

These studies are among the first to examine momentary relationships between self-compassion (a modifiable psychosocial protective factor) and internalized weight bias and binge eating. This work adds to the growing literature on eating disorders in men and stigma research. Prior work suggests that interdisciplinary teams play a vital role in reducing stigma and that interdisciplinary collaborations are uniquely suited to address stigma and health at all levels: intrapersonal, interpersonal, and structural (Cook et al., 2014). In order to reduce weight-based stigma and IWB, collaboration across scholars and professionals from various backgrounds is needed to advance knowledge and practice that embraces size diversity and promotes body/size acceptance. These disciplines include but are not limited to medicine, psychology, sociology, public health, and nutrition.

In addition to incorporating an interdisciplinary team to address reducing weight stigma (including IWB) and eating disorders (including binge eating), implementation science is highly essential to bridge the gap between research and practice (Olswang & Prelock, 2015). Implementation science is focused on developing studies with optimal methodologies that permit the application of findings into practice (Olswang & Prelock, 2015). It is crucial for future research in both stigma and eating disorder spaces to consider how their work can be applied to improve the overall health and well-being of people subject to weight stigma and IWB, as well as those afflicted with eating disorders.

This dissertation work was developed to translate and disseminate findings to the health coaching program from which participants were recruited. In the present studies, we observed that between-subjects momentary self-compassion reduced binge eating and IWB in men. However, within-subjects momentary self-compassion did not significantly influence IWB or binge eating. The findings from the first two papers support health coaching programs that work with adult men implementing some self-compassion training programs for participants. The third paper of this dissertation was exploratory by nature, and the findings should be interpreted with caution. This work shows that men with higher self-compassion and lower IWB reported the lowest binge eating. Paradoxically, self-compassion (high versus low) did not appear to matter in reducing binge eating within men higher in IWB. Future research should replicate this work to ensure that what we observed holds up in other more racially diverse samples.

Strengths and Limitations

The current studies have several important strengths. We intentionally recruited men since much of the prior literature on self-compassion, binge eating, and internalized weight bias focused on women. The present studies expand upon previous work by focusing specifically on adult males who were enrolled in a behavioral weight loss program or expressed interest in the program. The applied nature in which these data were collected is another strength. Translational science focuses on how to translate scientific findings into applied settings. The results from these studies can be shared with health coaches enrolled in the program who may encounter men who are skeptical or unsure of the benefits of self-compassion.

Additionally, people enrolled in weight management programs report higher IWB, and dieters are 2-3 times more likely than non-dieters to develop binge eating (Goldschmidt et al., 2012). In this sample alone, 31.5% of eating occasions over one week resulted in a severe binge

(defined as a score of 3 out of 5 or greater; Mason et al., 2021). Sharing these findings with program development experts and disseminating findings to health coaches could help share the benefits of practicing self-compassion for this population. It is important to note that this work should not be used to support self-compassion as a tool to improve weight loss outcomes of men enrolled in weight management programs, but rather, men who enroll in such programs could benefit from increasing self-compassion to overcome negative consequences of weight stigma and body oppression.

The novelty and contribution of these studies are also important strengths. Few, if any, projects have recruited specifically men using an EMA design to study self-compassion, binge eating, and IWB. Findings from these studies expand knowledge in key areas: men's health, eating disorders, health coaching, and stigma research. These studies serve as a starting point for future work examining how self-compassion can improve men's health. Further, this work can support future research to develop self-compassion programs for adult men exhibiting moderate to severe binge eating spectrum behaviors. Further, studies 1 and 2 align with published work on self-compassion and its ability to reduce binge eating and internalized weight bias. The analytical technique used, generalized estimating equations, provided a flexible analytic framework robust to violations of assumptions, namely, heteroscedasticity assumption.

However, these studies also had several limitations. The reliability of EMA-assessed self-compassion was on the lower end of acceptable. Future EMA work incorporating self-compassion should thoughtfully consider which self-compassion measure to use. We selected the 6-item state self-compassion scale (SSCS-S), designed to be used in research settings and yield a global self-compassion score. This measure was selected to reduce participant burden and get an overview of momentary self-compassion in men. Prior work shows acceptable reliability of the

6-item SSCS-S (Neff et al., 2021); however, this was not demonstrated in the present EMA studies. Balancing participant burden is essential to conducting an EMA study to minimize participant dropout and careless responses. Future research to examine self-compassion at the momentary level through EMA could consider using a measure such as the self-compassion short scale (Raes et al., 2011) or the six items developed to measure self-compassion in the EMA study conducted by Mey and colleagues (2023).

Another important limitation of the present work is the short study duration consisting of a single, 1-week wave of EMA prompting. Once again, the duration of the study was a thoughtful design consideration as it relates to participant burden and study attrition. Incorporating multiple waves over a year could offer an improved understanding of how self-compassion may change in different contexts. Having multiple waves of data could be especially important for men enrolled in a health coaching program that promotes weight loss since dieting programs have been shown to demonstrate seasonality variations in dieting behaviors (Towers et al., 2020), and it is unclear whether binge eating may change throughout long-term caloric restriction. Passive surveillance data show that the duration of adult dieting behaviors increases in January with new year resolutions and is lowest in December (Towers et al., 2020). Intensive, multicomponent behavioral interventions (IBIs) that focus on weight loss have been shown to suffer from poor outcomes, such as weight regain, weight cycling, and dropout (Cardel et al., 2022). Drawbacks of these IBIs that promote weight loss include serving as a gateway for people prone to develop eating disorders and encouraging weight loss as a form of weight stigma (Steinberg & Bohon, 2022). It could be helpful to incorporate a longer EMA study period spanning a year to better understand how self-compassion may change due to prolonged dietary restriction and intentional weight loss.

Finally, study 3 was exploratory, and results should be interpreted cautiously. The moderation analysis allowed us to examine 459 EMA cases out of the nearly 2100 collected in the larger study (~21%). While we observed self-compassion significantly moderated the relationship between IWB at time 1 and the following report of binge eating symptoms, it is unclear if these findings would hold up if we had more overall days of EMA or more participants. Still, the moderation analysis provides a future direction for research to continue to explore the indirect effects of momentary IWB and momentary binge eating in a sample of men with moderate to severe binge eating symptoms.

Conclusion

Self-compassion may be particularly useful to men lower in IWB to reduce binge eating symptoms. Three studies assessed the impact of EMA-assessed self-compassion on binge eating behaviors (study 1), EMA-assessed self-compassion on IWB (study 2), and whether self-compassion moderated the relationship between internalized weight bias and binge eating in adult men (study 3). Between-subjects self-compassion significantly predicted binge eating and internalized weight bias in adult men. Self-compassion at time 1 significantly moderated the relationship between IWB at time 1 and binge eating, where it was next reported.

These data suggest self-compassion is uniquely important for men with moderate to severe binge eating. Future work could integrate machine learning analysis methods to elucidate the role of self-compassion in binge eating behaviors and internalized weight bias in this sample. Furthermore, this study could inform future interventions that focus on cultivating self-compassion in men. It would be worthwhile to qualitatively explore how men relate to self-compassion and the distinctive barriers they experience when practicing self-compassion.

Opportunities exist to collaborate with behavioral weight management programs using a community-based participatory research model (CBPR) to tailor self-compassion interventions for adult men enrolled in such programs. Doing so could ensure researchers focused on eliminating weight-based health disparities are recruiting from high-risk samples (those who self-enrolled in weight loss) and could potentially improve men's binge eating and weight self-stigma.

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