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A Psychometric Evaluation of the Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS)

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by

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ABSTRACT

Drunkorexia refers to a set of disordered eating behaviors that occur in the context of a drinking episode for the purpose of 1) off setting caloric intake of the alcohol or 2) increasing the effects of alcohol. The Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS) was developed with the purpose of measuring drunkorexia behaviors at three time points: before, during, and after a drinking episode. The purpose of this study was to further validate the measure for use in men and women by examining measurement invariance, reliability, and validity. First, single group confirmatory factor analyses (CFA) were conducted separately by gender to examine the underlying factor structure of the measure. The two groups independently showed similar factor structure. The factor structure for both men and women indicated the removal of the original CEBRACS Restriction subscale. A multi-group CFA was conducted on the modified factor structure using gender as the grouping variable. This revised measure was found to have scalar invariance suggesting that means and variances of this measure can be compared. The current study addressed several limitations of previous measurement validation studies including a large diverse sample and thorough examination of the psychometric properties of the CEBRACS. This work provides additional evidence supporting the validity of the CEBRACS and suggests measurement invariance between genders.

INTRODUCTION

Emerging adulthood, the period of time between the ages of 18 and 25 years, is a period of greater exploration of self, education, work, and love (Arnett, 2000). It is characterized by an increased sense of individual volition, decreased supervision, and a relative lack of social responsibilities (e.g., marriage or parenthood; Arnett, 2000). These three characteristics create conditions allowing individuals to engage in and seek out novel experiences, which often include health-risk behaviors. In fact, the prevalence of several types of health-risk behaviors peak during emerging adulthood including: risky sexual encounters, substance use, alcohol use, and eating disorders. The following study will focus on two of these: alcohol use and eating disorders.

Alcohol Use in Emerging Adults

Emerging adults report the highest rate of current alcohol use (59.6%) and binge drinking (37.7%) of any age group (Center for Behavioral Health Statistics and Quality, 2015). Binge drinking is commonly defined as consuming five or more drinks by a man, or four or more drinks by a woman, in one instance of drinking (NIAAA). Monitoring the Future (MTF), a report tasked with monitoring trends in drug and alcohol use among Americans, described a general trend in college students such that in 2014 this group had more often and more consistently engaged in heavy drinking than any other population since the survey began in 1980 (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015).

Gender differences have been found in frequency and amount of alcohol consumed among young adults. For instance, men are more likely to report binge drinking than women

(Johnston et al., 2015). A large multinational study found men not only are more likely to be current drinkers than women, but are more likely to be "high-volume" drinkers; whereas women are more likely to be former drinkers (Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, & Gmel, 2009). A current drinker is someone who has consumed alcohol in the previous 12 months, while a former drinker is someone who has consumed alcohol, but not in the previous 12 months (Wilsnack et al., 2009). Men also are more likely to experience negative alcohol-related consequences in areas such as family and work, and are more likely to engage in morning drinking (Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000). Further, men are more likely to miss class, get into trouble with police, and overdose on alcohol than women (Park & Grant, 2005). A review of the literature reported that while men potentially suffer more social consequences of alcohol use, women suffer negative physical consequences of alcohol that can potentially be life threatening (Nolen-Hoeksema, 2004). Women's blood alcohol levels become elevated more rapidly than men's increasing the possibility of serious health concerns including blackouts or alcohol poisoning. Women who are heavy drinkers are more likely to suffer from alcohol-related illness (e.g., cirrhosis, reproductive problems, sexual dysfunction, and death) than men. Women also are at greater risk for cognitive deficiencies due to alcohol use. While women may experience more negative physical consequences of alcohol use than men, a grave social consequence of drinking for women can be sexual or physical assault; female heavy drinkers are more likely to become victims of both sexual and physical violence than males (Nolen-Hoeksema, 2004).

Despite negative physical and social consequences, individuals continue to drink alcohol and do so for various reasons. Emerging adults are more likely to endorse drinking for social and enhancement motives (Foster et al., 2014). Enhancement motives include drinking for enjoyment

or other positive emotions. Although coping and conformity motives are less likely to be endorsed by emerging adults, they still are endorsed by a subset of individuals and are more strongly related to negative alcohol-related consequences (Kuntsche, Knibbe, Gmel, & Engels, 2006).

Importantly, gender differences in motives to consume alcohol begin to develop as early as adolescence (Kuntsche et al., 2006). There is a clear trend for men whereby they are more likely to engage in drinking for social and enhancement motives; however, the trend is less distinct for coping motives. It appears that age may modify any gender differences in those who report coping as their motive for drinking. Kuntsche et al.'s (2006) review reported that younger adolescent females are more likely to report drinking to cope than males. In college-aged individuals there are no gender differences in students 18-21 years; however, findings from a sample of slightly older students (mean age 23 years) indicated that men are more likely to report drinking as a coping mechanism. Underscoring the complexities of associations between gender and drinking motives, Foster et al. (2014) reported an interaction of coping motives, gender, and depressive symptoms in which women with low symptoms of depression drank more frequently; however, men with high depressive symptoms and high coping motives had a higher drinking frequency. Gender by age interactions may exist that change the relationship between gender and drinking overtime. However, when taken together, the research suggests that gender differences exist in the motives for consuming alcohol and these differences develop into early adulthood. Understanding gender differences in drinking provides potential opportunities for tailored interventions to prevent problems associated with drinking.

Disordered Eating, Alcohol Use, and Drunkorexia

Alcohol use and eating disorders are commonly co-occurring disorders (Bulik et al., 2004; Gadalla & Piran, 2007). Bulik et al. (2004) reported that the prevalence of alcohol dependence and/or abuse differs drastically between eating disorder diagnoses. This study replicated earlier findings indicating the co-occurrence of alcohol abuse or dependence and anorexia nervosa (AN) – restricting type (approximately 9.5% to 16.8%) is significantly lower than AN -- binge/purge subtype (14.8% to 37.8%) or bulimia nervosa (24.6% to 46.1%). These researchers also found that the onset of alcohol use occurred before eating disorder onset in approximately 34% of the sample, regardless of eating disorder diagnosis. The percentage of those for whom the onset of the eating disorder occurred prior to alcohol use disorder ranged between 46.7% (AN - restricting) and 59.2% (AN - binge/purge). While causality cannot be inferred, these rates suggest potential for a reciprocal relationship between alcohol use disorders and eating disorders. In further support of this relationship, a meta-analysis of 41 studies revealed only four studies in which the relationship between alcohol use and eating disorders was negative whereas the other 37 studies analyzed found a positive correlation between the two diagnoses (Gadalla & Piran, 2007). Effect sizes ranged from small to medium among different populations (e.g., community, clinical, or university) with the most robust effect sizes found among college students exhibiting purging behaviors, suggesting that the relationship between alcohol use and disordered eating not only is present in diagnostically significant eating or alcohol use disorders, but that this relationship may be stronger in non-clinical samples. A study of first-year college students found that dieters were more likely to engage in drinking compared to non-dieters. Moreover, those who engaged in risky dieting behaviors had an even higher risk for more recent alcohol use than casual dieters or non-dieters (Krahn, Kurth, Gomberg, &

Drewnowski, 2005). Risky and intense dieting behaviors significantly predicted problematic drinking, where casual dieting did not (Krahn et al., 2005). In a related line of research, Barry and Piazza-Gardner (2012) found that college students who engaged in vomiting or laxative use to lose weight were the most likely to binge drink. Finally, the same study indicated that individuals who engage in vigorous exercise or strength training as a form of weight control were more likely to binge drink. Taken together, these findings indicate that risky eating behaviors and drinking behaviors are highly related. The intersection of these behaviors could potentially have deleterious effects on the health of the individuals engaging in them and thus should be studied more closely.

At the intersection of disordered eating and alcohol use is "drunkorexia", or the specific use of restriction, purging, or over exercising to compensate for alcohol consumption, as a means of reducing or offsetting total caloric intake. One theory for the existence of drunkorexia is that it serves as a mechanism through which weight gain can be avoided or intoxication can be experienced more quickly by drinking on an empty stomach (Chambers, 2008). In a sample of first-year college students, approximately 14% reported restricting calories on days they knew they would consume alcohol. Of these individuals, the majority (70%) were female students (Burke, Creemens, Vail-Smith, & Woolsey, 2010). Restrictors reported two motivations: 1) to avoid weight gain and 2) to feel the effects of alcohol more strongly. Although women more frequently reported engaging in these behaviors, men also endorsed these behaviors (e.g., Burke et al., 2010; Barry & Piazza-Gardner, 2012; Bryant, Darkes, & Rahal 2012). One study revealed that men reported higher mean levels on all three subscales of the Drunkorexia Motives and Behaviors Scale (drunkorexia motives, approach when drunkorexia fails, and approach calories; Ward & Galante, 2015). The motives subscale of this scale is an indication of the number of

reasons an individual engages in drunkorexia behaviors. This finding indicated that males in this study reported more reasons why they engage in drunkorexia behaviors than females. Males also report higher scores on the "when drunkorexia fails" subscale indicating that males still will engage in drinking on days when they have not compensated for calories (e.g. "If I eat a normal amount on a day I drink, I will drink more so I don't think about the calories" or "drink more because I want to get as drunk as possible"). Alternatively, women are more likely to engage in certain drunkorexia behaviors than men, including eating low calorie or low-fat food or eating less than usual before, during, and after drinking. Women report significantly more days in which they engage in drunkorexia behaviors than men (Eisenberg & Fitz, 2014). However, weight concern motivations for engaging in drunkorexia behaviors mediated the relationship between gender and drunkorexia, even after controlling for number of drinks consumed. This indicates that the motivations behind drunkorexia may be a more powerful predictor of those who will engage in drunkorexia behaviors than gender, but more research is necessary.

It is reasonable to conjecture, based on gender differences in drinking motives, drinking patterns, and eating disorder prevalence, that there are different underlying mechanisms that drive compensatory behaviors in response to alcohol use. If one considers drunkorexia a form of disordered eating in which an individual compensates for calories consumed during alcohol intake, then it is reasonable to apply the same theoretical framework to drunkorexia that has been previously used to explain the maintenance of other disordered eating behaviors.

A well-established model of the maintenance factors associated with eating disorders is Fairburn's transdiagnostic model (Fairburn, 2008; see Figure 1). This model has been validated with both men and women (Dakanalis, Timko, Clerici, Zanetti, & Riva 2014). The fundamental element of Fairburn's model (2008) is the overvaluation of weight, shape, and control, which he

refers to as the core psychopathology of eating disorders. This overvaluation of weight and shape can manifest itself in many ways; one pertinent manifestation is its effects on eating habits, specifically dietary restriction and restraint. According to the original model, dietary restriction and restraint are, in most cases, accompanied by binge eating episodes (consumption of objectively large quantities of food with a loss of control). Due to the fear of associated weight gain, binge eating episodes are then followed by a compensatory act - a purge (which can include excessive exercise, self-induced vomiting, or misuse of laxatives or diuretics). Once the binge episode has concluded, the individual returns to caloric restriction and the cycle continues.

In line with the overvaluation of weight and shape seen in individuals with eating disorders, some individuals report using drunkorexia behaviors to avoid weight gain. Further, there is research to suggest that some individuals restrict their calories before an episode of drinking (Burke et al., 2010). Following the transdiagnostic model, an alcohol binge follows the period of caloric restriction; the difference, however, is that the restriction occurred as a planned mechanism to compensate for the calories the individual intends to consume during the period of drinking as opposed to restriction in an effort to control weight. The subsequent alcohol binge, especially heavy binge drinking, leads to feelings of guilt and compensatory behaviors post-alcohol consumption (e.g., diuretics or exercise), and/or a return to caloric restriction. In summary, Fairburn's transdiagnostic model of eating disorders can be applied to the specific pattern of disordered eating and alcohol use seen in the context of drunkorexia.

The transdiagnostic model also identifies other factors that can lead to failure of dietary restraint, including life events and the associated mood changes (Fairburn, Cooper, & Shafran, 2003). Mood changes associated with negative life events sometimes are called "mood intolerance" and refer to one's inability to cope with certain emotional states in an appropriate

manner. Inappropriate methods of coping with moods may be substance abuse (e.g., alcohol) or self-injury, as well as the binge-purge cycle. There also is some evidence that positive moods affect binge eating behavior and lead to an increase in caloric consumption or a binge eating episode (e.g., Canetti, Bachar, & Berry, 2002; Patel & Schlundt, 2001). Similarly, there is evidence to suggest that as a response to life events an individual may increase their alcohol consumption either in order to cope with the associated negative moods or emotions or enhance associated positive moods. For an individual who overemphasizes weight and shape the increased caloric intake associated with the drinking is likely to cause feelings of guilt. Subsequently the individual may compensate for the calories to alleviate that guilt (see Figure 2).

The transdiagnostic model has been used to explain eating pathology for both men and women (Fairburn, 2008). A recent comprehensive evaluation of this model in men found differences in the pathways from the original model (Dakanalis, Timko, Clerici, Zanetti, & Riva, 2014). Dakanalis et al. (2014) found that there was no direct relationship between restriction and binging for men; however, both binge eating and compensatory behaviors were predicted by mood intolerance. Since gender differences in motives leading an individual to engage in drunkorexia noted previous may exist it is reasonable to conjecture that the pathways leading to drunkorexia also may be different for men and women. Men who exhibit mood intolerance may be responding to external cues that lead to binge drinking (e.g., mood intolerance), which cause men who overvalue weight and shape to feel guilty and thus engage in compensatory behaviors.

Alternatively, the theoretical model may be different for women. Previous research suggests that women are more likely to restrict before an episode of heavy drinking (Burke et al., 2010). They are also more likely to report compensating after the intake of alcohol to avoid weight gain. In line with Fairburn's model, restriction will be followed by a binge eating episode,

in this case an alcohol binge (or simply a period of heavy drinking). Subsequent to an episode of drinking, women who overvalue weight and shape will feel guilty and worry about weight gain leading them to compensate after drinking (see Figure 2). If the proposed model is supported it would indicate that women tend to restrict before and compensate after a drinking episode, whereas men tend to compensate only after drinking, thus accounting for previous research indicating that women report more drunkorexia behaviors than men (Eisenberg & Fitz, 2014). This proposed framework also is supported by researchers who have theorized that drunkorexia serves two purposes: reduce possible weight gain and to get drunker faster (e.g., Chambers, 2008; Rahal et al., 2012). A possible reason an individual may want to get drunker faster is as a means to enhance or cope with strong emotions. To date this study is the first theoretical model proposed for drunkorexia; however, without an adequately validated measure of drunkorexia, a theoretical model cannot be tested.

Methods of Examining Drunkorexia

While the relationship between alcohol use and disordered eating behaviors is well established, specific measurements of disordered eating behaviors in the context of drinking episodes have been few and those that exist are limited in important ways. Historically, drunkorexia has been assessed through the use of previously validated measures of eating pathology and alcohol use separately (e.g., Barry & Piazza-Gardner, 2012; Krahn et al., 2005). Barry and Piazza-Gardner (2012) used several items to assess alcohol use, disordered eating, and excessive exercise independently of each other. The data suggested that both vigorous-intensity exercise and vomiting or laxative use to lose weight predicted binge-drinking (odds ratio of 1.04 and 1.76, respectively). This suggests a relationship between these constructs; however, it cannot be concluded that vigorous-intensity exercise and other compensatory behaviors are in response

to the binge drinking since the compensatory behaviors were not measured in the context of a drinking episode, but rather as an overall occurrence in the individual's life at that time. The commonly used assessment of alcohol use and compensatory behaviors as separate concepts is not adequate to capture the nuances of the specific behaviors of and motives for drunkorexia. In order to adequately examine drunkorexia, one must examine compensatory behaviors directly related to alcohol use (e.g., skipping a meal in anticipation of consuming calories during a drinking episode).

Some studies have attempted to examine drunkorexia more accurately than the previously mentioned method. It appears that the first strategy specifically designed to measure drunkorexia was a semi-structured interview to evaluate major themes in the overlap of alcohol consumption and disordered eating (Peralta, 2002). The first self-report scale developed to measure drunkorexia was the Drunkorexia Scale, a three item scale used to assess restricted eating prior to drinking (Burke et al., 2010). Content and face validity of this measure were assessed through consultation with experts. One limitation of this work is the lack of psychometric validation of the Drunkorexia Scale (with the exception of test retest reliability). A relative strength was the researcher's use of qualitative analysis of a small sample of participants who responded to a question about why they restricted calories before drinking. Results revealed five themes: 1) to increase their ability to drink; 2) to prevent being sick; 3) they forgot to eat; 4) lack of appetite; and 5) lack of money. The development of the Drunkorexia Scale was qualitatively sound; however more psychometric evaluation is needed to ensure the validity of the measure.

Babiarz et al. (2013) used an adapted version of this measure, noting that in addition to the original 11 items examining behaviors that occurred the night of drinking, three scenario items and one response item were added. This modified scale had a good internal reliability

(α=.84), but no further psychometric investigation was included. Neither Burke et al. (2010) nor Babiarz et al. (2013) provided sample questions or a description of how the measures were created. Thus, it is unclear how the original measure was adapted for use by Babiarz et al. (2013). While these measures begin to capture the nuances of drunkorexia by evaluating restriction during a night of drinking, they fail to assess compensatory behaviors other than restriction throughout the entire scope of a drinking episode (e.g., before, during, and after).

Until recently, when the Drunkorexia Motives and Behaviors Scale (Ward & Galante, 2015) was developed, the CEBRACS was the only validated measure of drunkorexia to capture multiple methods of compensation as well as compensatory behaviors throughout the course of a drinking episode. The Drunkorexia Motives and Behaviors Scale was developed using a sample of 349 individuals (254 females and 95 males). Using Exploratory Factor Analysis (EFA), motives and behaviors were discerned, along with three other subscales: drunkorexia fails, drunkorexia during alcohol consumption, and post drinking compensation. Convergent validity analyses indicated that subscales were significantly, but weakly, correlated with disordered eating behaviors (*r*s ranging from.14 to.30). One strength of this study was the small number of men (N = 95) included in the sample; however, the only comparison of gender conducted was mean differences of subscale scores. Men reported higher scores on the drunkorexia motives subscale than females indicating more motives for compensatory behaviors compared to females. Men were also more likely to drink even if they had not engaged in restriction prior to drinking. A strength of the Drunkorexia Motives and Behaviors Scale was that the measure was developed using a sample of both men and women, which allowed for a surface level exploration into possible gender differences. However, a deeper understanding of how the measure functions in

men and women is necessary to demonstrate whether there are underlying differences in the drunkorexia behaviors.

The CEBRACS is a scale theorized to measure behaviors and motives of compensatory behaviors at three time points -- before, during, and after drinking. Examining compensatory behaviors at several time points allows for a broader understanding of the behaviors over the whole binge drinking episode. A principal components factor analysis was conducted to determine the factor structure (Rahal et al., 2012). The validation sample for the CEBRACS consisted of 51 males and 233 females. A 2015 study (Pinna et al.) examined the factor structure in Italian teenagers, which concluded that the original 20-item five factor structure fit the data adequately: 1) Alcohol Effect, 2) Laxative Use, 3) Dietary Restraint and Exercise 4) Diuretic Use, and 5) Restriction and Vomiting. Based on mixed findings (Pinna et al., 2015; Rahal et al., 2012), more psychometric evaluation is necessary.

The original CEBRACS validation only included a small sample of men and due to this small sampling of men, the psychometric equivalence between men and women has not been examined. As articulated above, it is reasonable to hypothesize that gender differences in motives for alcohol use, as well as presentation and frequency of eating disorders, may affect how individuals respond to the items. Subsequently, items may not function the same for men and women. It is also possible that the underlying construct is not the same for men and women, which has never been assessed. While extant data support the original factor structure of the CEBRACS, additional psychometric examination is necessary to understand if the measure is psychometrically sound for both men and women or if it functions differently between genders.

The purpose of the current study was to examine the factor structure of the CEBRACS in a larger sample of women and men. Additionally, the present study examined measurement

invariance to determine if the factor structure of the CEBRACS differs between men and women. Measurement invariance is a statistical property that demonstrates whether or not the same concepts are being measured across groups. In the case of the CEBRACS, it was possible that different styles of compensatory behaviors or motives for behaviors (e.g., to get drunker faster) would reveal that drunkorexia manifests differently for men and women. Since this was the first study of measurement invariance on a measure of drunkorexia it was unknown whether or not measurement invariance would be found. If a lack of measurement invariance is found then the measure cannot be used to compare drunkorexia between men and women. While differences across gender does not invalidate the measure, it suggests that drunkorexia may be different across men and women. However, if measurement invariance is found, the measure can be used to compare men and women and the construct functions similarly across genders.

A secondary purpose of this study was to examine gender differences in frequency and type of drunkorexia behaviors. Based on gender differences in alcohol use and disordered eating behaviors, it was expected that there would be differences on the CEBRACS. Since men exhibit less disordered eating behaviors than women, it was expected that men would exhibit less compensatory behaviors in response to alcohol use. It was also expected that men would be more likely to endorse engaging in these behaviors to get drunker faster than women. Finally, the third purpose of this study was to evaluate the validity of the CEBRACS measure using measures of body image, eating disturbance, and alcohol use. CEBRACS scores were expected to positively correlate with alcohol use, eating pathology, drive for thinness, and drive for muscularity. Body satisfaction was expected to be negatively correlated with CEBRACS scores. The correlations between drive for thinness and CEBRACS scores were predicted to be stronger for women and

the correlations between drive for muscularity and CEBRACS scores were predicted to be stronger for men.

METHODS

Participants

Participants were recruited from a large Southeastern university during the spring and fall of 2015. Participants were given partial class credit for their participation. Data were collected from 1,001 participants; 414 were excluded from analyses leaving a final sample of 587 participants (131 males, 455 females, 1 unreported). Data cleaning procedures based on the suggestions of Meade and Craig (2012) for identifying careless responders were employed. Participants who missed both attention checks (n = 71) and/or did not finish the questionnaire within the allotted time (n = 92) were excluded (15 participants missed both attention checks; a total of 148 participants did not complete the survey within a reasonable timeframe). Specifically, if participants completed the survey below the 5th percentile or above the 95th percentile for duration they were excluded. Meade and Craig (2012) report that the relationship between time to complete a survey and quality of response is often a nonlinear relationship and thus participants with a response time of above the 95th percentile were considered to be missing in the final data set. There were no gender or age differences between those excluded for careless responding and those that were not.

The construct of drunkorexia is defined as compensatory behaviors in the context of drinking, thus participants who indicated that they do not drink were excluded from the analysis. The AUDIT-C was used to determine whether a participant met drinking eligibility criteria. Participants were excluded if they scored a 0 on the AUDIT-C (n=246). Finally, drunkorexia is assumed to be a phenomenon occurring mainly in college populations. As such, participants over

the age of 30 were excluded from the analyses (*n*=27). Eight participants were identified as both non-drinkers and over the age of 30, thus the total number of participants excluded based on drinking and age inclusion criteria was 265. One final participant was not included in the group-related analyses because this participant did not indicate their gender. Altogether, a final sample of 587 participants was used for the confirmatory factor analysis and 586 of this sample were included in the multiple group analysis to test for gender invariance.

This final sample had a mean age of 20.52 (*SD*= 2.31, range 18 to 30). Male participants were slightly older (*M* = 20.98) than females (*M* = 20.39), *t* (170.78) = -2.61 *p* = .01, *d* = 0.23. While this difference was statistically significant, the associated effect size was small. The sample represented a demographic comparable to the population of the University of South Florida with the majority of participants identifying as White (55.7%), followed by 20.8% Hispanic, 10.2% Black, 4.8% Asian, 7.2% Multiple ethnicities/races, 0.3% American Indian/Alaskan, 0.3% Native Hawaiian or Pacific Islander, and 0.5% chose not to identify their race/ethnicity. The sample was representative of all undergraduate years. The majority of participants were freshmen (25.9%), followed by 15.7% sophomores, 20.4% juniors, 20.4% seniors, and 1.2% identified themselves as 5th year or post-graduation.

Measures

The data were collected as part of a larger investigation into health behaviors, consequences, and communication about health behaviors. In total, 11 questionnaires were administered to the participants. The following are relevant to the current study.

Demographic Information. Participants completed a brief demographics measure in which they indicated age, ethnicity, year in school, height, and weight (see Appendix A).

The Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS; Rahal et al., 2012). The CEBRACS was developed to measure alcohol-related compensatory behaviors before, during, and after alcohol consumption (see Appendix B). The CEBRACS consists of 21 items divided into four subscales that represent specific behaviors and motivations for compensating for alcohol use (see Table 1 for original factor structure of the items). Each item is rated by the frequency of which each behavior occurs from 1 (*Never*) to 5 (*Almost all the time*). The four subscales are Alcohol Effects, Bulimia, Dietary Restraint, and Exercise and Restriction. The scale scores are calculated by summing the items. The Alcohol Effects subscale consists of seven items and measures the specific motivation of using compensatory behaviors to "get drunker" or "get drunk faster". The Bulimia, Dietary Restraint, and Exercise and Restriction subscales are intended to measure specific behaviors in which an individual engages before, during, and after the consumption of alcohol (e.g., purging, exercise, and skipping meals). The original scale total score had good internal consistency reliability (α= .89) and convergent validity; the total CEBRACS score was associated with higher levels of body dissatisfaction, drive for thinness, and bulimia symptoms. Example items include "In the past 3 months, I have eaten less than usual during one or more meals before drinking to get DRUNKER." and "In the past 3 months, I have eaten low-calorie or low-fat foods while I was drinking to make up for the calories in alcohol that I was consuming." In the current sample the scale had excellent internal consistency (α= .93 for women and α= .92 for men). The CEBRACS was presented to respondents as the fourth questionnaire in the larger packet.

The Alcohol Use Disorders Identification Test of Consumption (AUDIT-C; Bush et al., 1998). The AUDIT-C is a three-item alcohol use screener. Response format varied between questions, but each question is scored 0 to 4 for a total score range of 0 to 12 with higher scores indicating problematic drinking. The cutoff to identify potentially problematic drinking on the AUDIT-C is a total of three. The sensitivity at this cut off is 98% and the specificity is 57% (Bush et al., 1998). The AUDIT-C was used to establish convergent validity. An example question is "How often do you have a drink containing alcohol?" The internal consistency of the AUDIT-C for men ($\alpha = .66$) and women ($\alpha = .59$) was poor for the current sample. A reliability analysis including nondrinkers was slightly better for both men ($\alpha = .72$ and women ($\alpha = .64$).

Eating Disorder Diagnostic Scale for the Diagnostic and Statistical Manual 5th edition (EDDS DMS-5; Stice, n.d.**).** The EDDS DSM-5 is a brief self-report measure of eating pathology. The EDDS DSM-5 provides diagnostic clarification for anorexia, bulimia, and binge eating disorder. It is a 23-item scale with response format that vary between questions. Example questions include "Have you ever felt fat?" and "Has your weight or shape influenced how you judge yourself as a person?" It was used to examine convergent validity. Due to the scoring of this measure, traditional internal consistency measures cannot be used. The EDDS DSM-5 has not yet been validated; however, the EDDS for DSM IV has been validated (Stice, Telch, & Rizvi, 2000) and further the EDDS DSM-5 was developed using the DSM-5 (American Psychiatric Association, 2013) criteria for eating disorders. Sysko et al. (2015) reported that when compared to clinical interview the EDDS DSM-5 demonstrates accuracy for DSM-5 diagnoses ranging from .87 to .93. Further the EDDS DSM-5 raw score and EDEQ-Global score have been shown to be highly correlated ($r = .73$; Ahlich, Choquette, & Rancourt, 2017). The EDDS raw symptom count was used to determine convergent validity.

Multidimensional Body-Self Relations Questionnaire – Appearance Evaluation subscale (MBSRQ-AE; Cash, 2000). The MBSRQ-AE is a 7-item scale that assesses body and appearance satisfaction. Participants respond to items such as "My body is sexually appealing" on a 5 point Likert scale ranging from 1 (*definitely disagree)* to 5 (*definitely agree).* The original published internal consistency of this scale was .88 (Brown et al., 1990). The MBRSQ-AE was used to establish convergent validity. The internal consistency for the current sample was excellent for men (α = .92) and women (α = .92).

Eating Disorder Inventory— Drive for Thinness subscale (EDI-DT; Garner, Olmstead, & Polivy, 1983). The EDI-DT assesses respondents' degree of over concern with dieting and thinness, and fear of weight gain (e.g., "I am terrified of gaining weight"). Individuals are asked to respond to seven items indicating the frequency of which they experience each item on a 6-point scale from 1 (*never*) to 6 (*always*). The internal consistency for men (α = .89) and women (α = .93) was good to excellent. The symptom count was used for convergent validity because it is expected that individuals who are higher on drive for thinness will engage in more disorder eating behaviors.

Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000**).** The DMS is a 15-item measure used to assess attitudes and behaviors reflecting a participant's preoccupation with increasing muscularity. Participants respond to questions such as "I think that I would look better if I gained 10 pounds in bulk" on a 6-point scale ranging from 1 (*never*) to 6 (*always*). The scores are averaged to indicate drive for muscularity with higher scores indicating more drive for muscularity. The internal consistency for this measure was excellent for both men (α = .91) and women (α = .90).

Procedure

Participants completed an online questionnaire consisting of 11 measures. Data were collected during spring and fall of 2015 using Qualtrics. The questionnaire was administered using an account created for the sole purpose of collecting data for the Body Image Research Group at the University of South Florida. Data were collected through an anonymous link provided to participants once they signed up for the study using the online subject pool. Data were not linked to any personal identifiers.

Data Analysis

Single Group Confirmatory Factor Analysis. Prior to conducting analyses, statistical assumptions were tested. The item normality assumption of maximum likelihood estimation was violated (see Table 2). Skewness with an absolute value greater than 2 is considered to be a substantial departure from normal distribution (West, Finch, & Curran, 1996). Further, West et al. (1996) describes kurtosis with an absolute value greater than 7 to be indicative of non-normal distribution. Twelve of the 21 items exceeded these criteria for both men and women.

Several confirmatory factor analyses were conducted to examine the fit of the original four scale factor structure for males and females individually. These CFAs were conducted using *Mplus* (Muthén & Muthén, 1998-2011). The robust weight least squares approach (estimator =WLSMV) was employed since it does not hold the same normality assumption as maximum likelihood. Model fit and modification indices were examined before determining whether a model had good fit. Model fit was evaluated using the Comparative Fit Index (CFI; Bentler, 1990), chi-square value (Jöreskog, 1969), and the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990). In large samples, the chi-square value often is overly sensitive to detecting misfit (Reise, Widaman, & Pugh, 1993). While the chi square values still were

considered in this study, cutoff scores of CFI >.95 and RMSEA <.06 (Browne & Cudeck, 1993) were considered more heavily in the assessment of fit of each model.

In addition to the original four-factor structure, a confirmatory factor analysis using time points as the latent variables was employed. This was used to determine if the observed variables of the CEBRACS were better estimated based on time structure – i.e., before, during, or after drinking – compared to content.

Multi-Group Confirmatory Factor Analysis. To examine measurement invariance a multi-group CFA was conducted using gender as the grouping variable. The factor structure that indicated the best fit for the single group analyses was used to test invariance. Two phases of testing were conducted to determine invariance: 1) configural invariance and 2) scalar invariance. Configural invariance was used to determine whether the factor structures were the same across genders. If a measure demonstrates configural invariance the factor structure is considered to be the same between genders. Brown (2015) writes that after determining configural invariance when using categorical variables the next step is to examine measurement invariance when both the factor loadings and the thresholds must be constrained to be equal. Metric invariance does not constrain thresholds and is not appropriate for use with categorical data, and as such, metric invariance was used to investigate measurement invariance of the CEBRACS. Instead, scalar invariance was examined to test for gender differences in the CEBRACS factor structure. Scalar invariance would indicate that the factor loadings and thresholds were comparable across men and women. To determine scalar invariance, a model in which factor loadings and thresholds were free to vary was compared to a model in which factor loadings were constrained across groups (configural model). The model fit was determined by examining the change chi-square, CFI, and RMSEA. If the fit of the scalar model is statistically

worse than the configural model based on the above fit indices, it can be concluded that there is a lack of scalar invariance and factor loadings and thresholds should be allowed to vary across genders.

Sparse data were a problem when testing the multi-group models. Sparse data are defined as inconsistent numbers of response categories across groups (Liu et al., 2016). Due to an inconsistency in response patterns between men and women, the response categories for several questions were collapsed. A precedent for this technique has been set in the literature (e.g., Ligtvoet, 2015, Liu et al., 2016; Sass, 2011). Item analysis revealed items 3, 4, 5, 6, 7, 8, 13, 14, 15, 16, 17, 19, and 21 had inconsistent response patterns (i.e., one gender did not use all of the response options) and thus adjacent categories were collapsed. Adjacent categories were collapsed such that responses that indicated more frequent behavior engagement were collapsed into categories that indicated less frequent engagement (e.g. "Always" was collapsed into "Often"). This method was used in an effort to not overestimate the frequency of behaviors and thus decrease the risk of type I errors.

Reliability and Validity. Cronbach's alpha was examined to determine internal consistency of the measure within the current sample. Cronbach's alpha above $\alpha=.70$ is considered to be good (DeVellis, 2012). Validity was established through bivariate correlations between CEBRACS total and subscale scores with body image, eating disturbance measures, and alcohol use. Correlation coefficients were calculated separately for males and females. In order to determine if the strength of the relationship differed as a function of gender, these correlations were compared using Fisher's *r* to *z* transformation.

RESULTS

Descriptive Results

Males and females did not differ on their ethnicity or year in school. Male participants reported significantly higher drive for muscularity and body satisfaction than females, while, females reported significantly higher drive for thinness and eating disorder symptoms than males (see Table 3). There was no significant difference between men and women on alcohol use, t (185.32) = -1.82, p =.07. No differences were found between men and women on any of the original CEBRACS subscales or the total score, with the exception being the Restriction subscale. For the CEBRACS Restriction subscale, the assumption of homoscadascity was violated, p <.001 so the adjusted t value was examined. This examination revealed that women (M = 2.36, SD = 1.00) reported more restriction on the CEBRACS than men (M = 2.20, SD = .60, p = .02). More information about gender differences for key variables can be found in Table 3.

Single Group Confirmatory Factor Analyses

Gender. A single group CFA was performed for men and women individually. First, a single factor model was examined (Model 1; see Figure 3). For both men and women this model had suboptimal fit (see Table 4). The CFI scores for men (.980) and women (CFI=.971) indicated good fit; however, RMSEA values (both above .08) indicated poor fit. No modification indices were indicated. Model 2 (see Figure 4) tested the original CEBRACS four subscale factor structure (Rahal et al., 2012). This model did not terminate normally; the latent variable Restriction was non-positive definite. The Restriction subscale consisted of two items: four and

twenty-one. Further, the internal consistency for this measure was unacceptable for both men (α = .31) and women (α = .42). Thus items four and twenty-one were removed and a three factor latent structure was explored (Model 3; see Figure 5). This revised model had good fit for both males and females (see Table 4). In order to thoroughly evaluate possible iterations of the measure, items four and twenty-one were added to the diet and exercise subscale as restriction could be considered similar to engaging in dieting behavior; however, this model indicated worse fit than Model 3 and thus the changes were not retained. Model 3 exhibited the best fit for both the male and female samples. The three factor model showed better fit than the one factor model. This indicates that statistically the total score should not be used as a measure of drunkorexia, the subscales should be used individually to describe drunkorexia behaviors.

Time. The CEBRACS is structured into three time points: 1) before alcohol consumption; 2) during alcohol consumption; and 3) and after drinking. To ensure that modeling the measure by time did not generate a better fit for the structure of the measure than the originally proposed subscales, a model characterizing the scale by time point was tested (Model 4; see Figure 6). For men, the fit was good, χ^2 (186) = 328.90, RMSEA = .076, CFI = .984. However, the fit indices for the 3 factor model (Model 3) indicated better fit than this model. This time-specific model did not terminate normally in the female sample because of a non-positive definite in question five. Question five was removed and the model was estimated again with the female sample (Model 5; see Figure 7). The fit of Model 5 was adequate for women, χ^2 (167) = 734.844, RMSEA = .087, CFI = .974, but showed worse fit than Model 3. After comparing fit statistics for all five models, Model 3 was retained for invariance testing because it exhibited the best overall fit for both men and women.

Measurement invariance – Multi-Group Factor Analysis

Measurement invariance testing was used to examine whether the CEBRACS structure was the same across men and women. First the configural model was examined. In this model factor loadings and intercepts were free to vary between groups. The fit statistics of this model indicated good fit, χ^2 (298) = 507.34, RMSEA = .05, CFI = .99. This finding suggests a similar factor structure across gender. The second model constrained factor loadings and thresholds to be equal across genders, thus testing the hypothesis of scalar invariance. Constraining the factor loadings did not significantly decreased model fit, $\Delta\chi^2$ =62.608, $p > .05$ (see Table 5 for fit statistics). The non-significant change in fit indicated that item loadings and thresholds do not vary across gender. The standardized and unstandardized factor loadings are reported in Table 6. Further, based on the fact that scalar invariance was found a comparison of scores can be made across gender.

Reliability and Convergent Validity

Due to the nature of this study comparing men and women, all reliability and convergent validity analyses were conducted separately by gender. Every subscale, except for Restriction, had good internal consistency. The Restriction subscale had an internal consistency rating in the unacceptable range (α= .42 for women and α= .31 for men). The total scale excluding the Restriction subscale exhibited excellent internal consistency when combining men and women (α= .93) and when men and women were examined separately (see Table 7). Internal consistency for the other three subscales was good to excellent for the overall sample as well as for men and women individuals.

Correlates for subscales. Correlations between each subscale and the total score of the CEBRACS and theoretically related variables were conducted separately for men and women (see Table 7). The Bulimia subscale of the CEBRACS was significantly correlated with eating disorder symptoms for both men (r = .37) and women (r = .19), and the difference between the correlations was marginally significant (z = -1.96, p = .052), with the association between CEBBRACS Bulimia and eating disorder symptoms being marginally stronger among men. The CEBRACS Bulimia subscale was significantly correlated with drive for thinness for women (r = .11, p =.02), but not for men (r =.12, p =.14). The CEBRACS Bulimia subscale was not significantly correlated with alcohol use, drive for muscularity, or body satisfaction for men or women.

The CEBRACS Alcohol Effects Subscale was significantly, positively correlated with alcohol use, drive for muscularity, drive for thinness, and eating disorder symptoms for both men and women. It was negatively correlated for women with body satisfaction (r = -.11, p = .02), but the relationship was not significant for men (r = -.14, p = .11). The CEBRACS Alcohol Effects subscale score correlation with eating disorder symptoms was significantly stronger for men (r = .40) than for women (r = .21, z = 2.1, p =.04).

A similar pattern of results was revealed for the CEBRACS Diet & Exercise subscale and CEBRACS total score. These scores were positively correlated with alcohol use, drive for muscularity, drive for thinness, and eating disorder symptoms for both men and women, and negatively correlated with body satisfaction for women, but not for men. There were no significant differences between the strength of the correlations between men and women (see Table 8). Further, subscale scores were positively and strongly correlated with each other and the total score (r ranging from .57 to .91; see Table 9).

DISCUSSION

The Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS) was designed to assess behaviors and motives for engaging in drunkorexia behaviors (Rahal et al., 2012). The purpose of this study was to thoroughly examine the psychometric properties and confirm the original factor structure proposed by Rahal et al. (2012). Findings revealed that the original four factor structure was not a good fit in the current sample. Single group confirmatory factor analyses conducted in this study indicate that the scale has 19 items that load on to three factors. The Restriction subscale (items 4 & 21) was removed from this scale due to issues with model convergence and unacceptable internal consistency scores for both men and women (see Appendix C for revised version). Further, the data suggest that the total score should not be used, but that the three subscale scores should be used to measure drunkorexia behaviors.

Statistically, the one factor model demonstrated suboptimal fit and was comparatively worse than the three factor model. In further support of interpreting subscale scores separately, the theoretical interpretation of the one factor model is complicated. The CEBRACS Bulimia and Diet and Exercise subscales are a measure of risky eating behaviors in the context of a drinking episode. The CEBRACS Alcohol Effects subscale is a measure of alcohol risk behaviors (e.g., engaging in behaviors such as restriction to get drunker fast). The total score of these subscales would be a measure of risky eating and alcohol use behaviors. While drunkorexia encompasses both types of behaviors, at the core of drunkorexia behaviors is the compensation for calories

consumed during a drinking episode. These behaviors are truly captured in the CEBRACS Bulimia and Diet and Exercise subscales. Thus, the interpretation of the total score would be ambiguous. Taken together, the CEBRACS total score should not be used due to the statistical and theoretical issues stated above, and the individual subscale scores should instead be used as a measure of drunkorexia behaviors.

The findings indicate there was configural invariance in this measure. This suggests that the overall factor structure is the same for men and women. This is important to understand because it means that the CEBRACS is measuring the same underlying construct in men and women. Further, there was no significant difference between the configural model, which allows all parameters to vary between genders, and the scalar model, which constrains factor loadings and thresholds to be equal. More plainly, this indicates that the latent variable means, covariances, and variances can be compared between men and women. Previous measurement invariance testing has not been conducted on drunkorexia measures, thus, it was uncertain what pattern of results would be observed within this study. Measurement invariance testing has been conducted on measures of disordered eating behaviors. While this research has focused on ethnic and racial differences (e.g., Burke et al., 2017;Carr, Catak, Pejsa-Reitz, Saules & Gearhardt, 2017; Belon et al., 2015), as well as differences between clinical and nonclinical samples (e.g., Dakanalis, Timko, Clerici, Riva, & Carrà, 2017; Allen, Byrbe, Lampard, Watson, and Fursland, 2011), some work has examined gender invariance. This research generally has found at least partial strict measurement invariance between males and females (Carr et al., 2017; Dakanalis et al., 2017; Elosua & Hermosilla, 2013; Maïano, Morin, Lanfranchi, & Therme, 2013; Fonseca-Pedrero, Sierra-Baigrie, Paino, Lemos-Giráldez & Muñiz, 2011; Landt et al., 2009). Strict invariance occurs when error variances are constrained to be equal across groups and this

measurement models show no significant difference from the fit of the configural model. This indicates that the error variance is the same across groups. Partial strict invariance indicates that one or more questions do not meet this criteria and should be left free to vary. This pattern of results is consistent with the current findings and suggests that while gender differences generally are observed in both disordered eating and alcohol use, these differences do not seem to be a function of measurement bias.

It was originally hypothesized that subscales would be positively correlated with eating disorder symptoms, drive for muscularity, drive for thinness, and alcohol, and negatively correlated with body satisfaction. In contrast with this hypothesis, the CEBRACS Bulimia subscale was not correlated with drive for thinness for men or alcohol use, drive for muscularity, or body satisfaction for men or women. The CEBRACS Bulimia subscale was significantly positively correlated with eating disorder symptoms for men and women, as well as, drive for thinness for women. Gadalla and Piran (2007) found that among college students exhibiting purging behaviors there were robust relationships between purging and alcohol use. This is in direct contrast to the finding that the CEBRACS Bulimia subscale is not correlated with alcohol use. Further, it is of note that eating disorder symptoms were significantly correlated with alcohol for men, but not for women in our sample.

The CEBRACS Alcohol Effects and Diet and Exercise subscales followed the hypotheses more closely. These subscales were significantly positively correlated with alcohol use, drive for muscularity, drive for thinness, and eating disorder symptoms for men and women. These scales were negatively correlated with body satisfaction for women, but not for men.

Prior to this paper, no theoretical model existed describing the development and maintenance of drunkorexia behaviors. The model proposed in this study theorizes that there

may be distinct pathways for men and women. For instance, in the original transdiagnostic model of eating disorders, restriction predicts binge eating (Fairburn, 2008). However, more recent research suggests that for men, mood intolerance is predictive of binge eating, but restriction is not (Dakanalis et al., 2014). Measurement invariance and non-significant gender differences between men and women on CEBRACS subscales may suggest that overall behaviors may be similar between men and women, but more research into this model is needed.

The current study addressed several limitations noted in previous studies. This study had a large, diverse sample. Minority participants made up 42% of the sample. Further, this was the largest sample used to validate a measure of drunkorexia. The participants exhibited a wide range of disordered eating and alcohol use. This variance is important for assessing drunkorexia since this construct appears at the intersection of these two behaviors. Finally, this study was the first to thoroughly examine psychometric properties of a drunkorexia measure. Measurement invariance was found which indicates that the measure can be used to examine drunkorexia in men and women.

Some limitations of this study include the large ratio of female to male participants. A more equal sample size would have been preferable; however, there were still an adequate number of men included in the analyses (n =131). Another limitation was the cross sectional nature of the data. Finally, this study did not examine racial/ ethnic differences. Previous research has shown differences in alcohol use among different ethnicities. Caucasian Americans have been found to have higher levels of alcohol use than African American (for review see Zapolski, Pedersen, McCarthy, & Smith, 2014). There is a relative lack of studies that compare racially and ethnically diverse college students on drunkorexia; however, one study did report no

ethnic differences (Burke et al., 2010). More research should be conducted to understand ethnic differences in drunkorexia.

Future Directions

This paper presents the only theoretical model proposed to date for the maintenance of drunkorexia. In order to better understand this phenomenon a thorough examination of the precipitating and mediating factors must occur. Understanding this phenomenon will allow for intervention into these risky behaviors. Further, understanding of the predictive factors will help researchers and clinicians to better understand the decision to engage in such behaviors and potentially allow for a clearer picture of disordered eating patterns in young adults. Secondly, examining racial and ethnic differences in both drunkorexia behaviors and measurement would help to more fully understand if this phenomenon in minorities. Research on measurement invariance in eating disorder measures has provided mixed findings with some research pointing to measurement invariance (Burke et al., 2017; Carr et al., 2017) and others indicating a lack of measurement invariance (Belon et al., 2015). These mixed findings could be due to variety of measures used and differences in racial/ethnic groups compared. Further, it would allow for examination of the generalization of the measure to diverse samples. Finally, a longitudinal study would allow for more accurate predictions of the causes and mechanisms that cause drunkorexia behaviors.

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TABLES

Table 1

Original Factor Structure of the CEBRACS for Time and Subscale with Sample Internal Consistency

	Before Drinking	During Drinking	After Drinking	Cronbach's Alpha
	Item number			
Alcohol Effects	1	7		.90
	3	9		
	6	12		
		14		
Bulimia	5	8	15	.86
		13	17	
			19	
Diet & Exercise	2	10	16	.86
		11	18	
			20	
Restriction	4		21	.41

Table 2

Item Means, Skewness and Kurtosis for the CEBRACS by Gender for the Current Sample

	Female		Male	
Item	Mean (*SD*)	Skew/Kurt	Mean (*SD*)	Skew/Kurt
1. In the past 3 months, I have eaten less than usual during one or more meals before drinking to get DRUNKER.	1.44 (0.84)	1.97 / 3.21	1.38 (0.79)	2.36 / 5.51
2. In the past 3 months, I have exercised before drinking to make up for the calories in alcohol that I anticipated consuming.	1.60 (1.07)	1.75 / 2.06	1.64 (1.15)	1.62 / 1.29
3. In the past 3 months, I have eaten less than usual during one or more meals before drinking to feel the effects of alcohol FASTER.	1.41 (0.83)	2.12 / 3.91	1.36 (0.77)	2.23 / 4.13
4. In the past 3 months, I have skipped one or more meals before drinking to make up for the number of calories in alcohol that I anticipated consuming.	1.30 (0.78)	2.84 / **7.57**	1.17 (0.55)	**3.88 /16.07**
5. In the past 3 months, I have taken laxatives before drinking to make up for the calories in alcohol that I anticipated consuming.	1.08 (0.43)	**6.07 /39.45**	1.07 (0.36)	**6.16 /42.27**
6. In the past 3 months, I have skipped one or more meals before drinking to feel the effects of alcohol FASTER.	1.22 (0.64)	**3.03 / 8.63**	1.27 (0.75)	**3.05 / 9.07**
7. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1.31 (0.71)	2.43 / 5.21	1.39 (0.86)	2.49 / 5.83
8. In the past 3 months, I have taken diuretics while I was drinking to make up for the calories in alcohol that I was consuming.	1.08 (0.40)	**6.14 /41.79**	1.11 (0.48)	**4.81 /23.26**
9. In the past 3 months, I have not eaten <u>at all</u> while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1.23 (0.62)	**3.21 /11.14**	1.29 (0.73)	2.89 / **8.56**
10. In the past 3 months, I have eaten low-calorie or low-fat foods while I was drinking to make up for the calories in alcohol that I was consuming.	1.30 (0.73)	2.78 / **7.69**	1.27 (0.71)	2.96 / **8.96**
11. In the past 3 months, I drank low-calorie beer or alcoholic drinks to get fewer of the calories that are in alcohol.	1.51 (0.95)	1.87 / 2.66	1.40 (0.88)	2.40 / 5.19
12. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to get DRUNKER.	1.29 (0.71)	2.69 / 6.90	1.31 (0.81)	2.82 / **7.29**
13. In the past 3 months, I have taken laxatives while I was drinking to make up for the calories in alcohol that I was consuming.	1.07 (0.38)	**5.95 /40.31**	1.07 (0.31)	**4.89 /24.98**
14. In the past 3 months, I have not eaten <u>at all</u> while I was drinking because I wanted to get DRUNKER.	1.23 (0.66)	**3.35 /11.92**	1.19 (0.57)	**3.29 /10.83**
15. In the past 3 months, I have <u>taken diuretics</u> to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol	1.08 (0.47)	**6.60/ 46.62**	1.05 (0.31)	**5.92 /34.40**
16. In the past 3 months, I have <u>eaten low-calorie or low-fat foods</u> during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.46 (0.90)	2.08 / 3.84	1.24 (0.68)	2.93 / **7.86**

17. In the past 3 months, I have taken laxatives to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.07	(0.43)	**6.65/ 47.61**	1.06	(0.32)	**5.48 /29.71**
18. In the past 3 months, I have exercised to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.72	(1.16)	1.48 / 1.03	1.76	(1.23)	1.40 / 0.58
19. In the past 3 months, I have made myself vomit to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.11	(0.48)	**5.11/ 27.60**	1.06	(0.41)	**8.13 /72.37**
20. In the past 3 months, I have eaten less than usual during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.32	(0.79)	2.73 / **7.22**	1.19	(0.62)	**3.95 /16.96**
21. In the past 3 months, I have skipped an entire day or more of eating to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1.11	(0.51)	**5.59/ 34.08**	1.05	(0.27)	**6.36 /41.30**
Total Score	26.82	(9.75)	2.45 / 5.99	26.18	(8.95)	2.19 / 4.57
Alcohol Effects Subscale	9.08	(4.27)	2.32 / 5.07	9.11	(4.60)	2.56 / 6.25
Bulimia Subscale	6.48	(2.24)	**5.80/ 36.49**	6.40	(1.64)	**4.38 / 18.75**
Diet & Exercise Subscale	8.87	(4.39)	1.88 / 3.83	8.47	(4.14)	2.00 / 3.62
Restriction	2.39	(1.13)	**3.50 /14.38**	2.20	(0.60)	**3.15 / 10.80**

Note. Bolded items indicate item issues with normality. *SD* = standard deviation. Skew = Skewness. Kurt = Kurtosis

Table 3

Means (and standard deviations) of Demographic Variables

	Females	Males	t / χ^2	*p*	*Cohen's d*
	M / % (*SD*)	*M* / % (*SD*)			
Age	20.39 (2.10)	20.98 (2.90)	*t* (170.78) = -2.61	**.01**	0.23
White	57%	51%	$X^2(4) = 2.17$	.70	
Minority Race	42%	48%			
AUDIT	2.84 (1.62)	3.18 (1.94)	*t* (185.32) = -1.82	.07	0.19
DMS	1.15 (0.88)	2.08 (1.03)	*t* (185.96) = -9.35	**.001**	0.97
DTS	15.41 (9.91)	9.63 (7.78)	*t* (260.20) = 7.00	**.001**	0.65
AppE	23.52 (2.10)	25.15 (5.94)	*t* (581) = -2.62	**.001**	0.37
EDsym	19.16 (15.69)	14.65 (13.65)	*t* (577) = 2.97	**.003**	0.31
CEBRACS AE	9.07 (4.23)	9.09 (4.53)	*t* (583) = -0.60	.95	0.005
CEBRACS BN	6.43 (1.94)	6.40 (1.60)	*t* (583) = 0.19	.85	0.02
CEBR4.ACS DE	8.86 (4.33)	8.47 (4.14)	*t* (583) = 0.92	.36	0.09
CEBRACS R	2.36 (1.00)	2.20 (0.60)	*t* (355.04) = 2.32	**.02**	0.19
CEBRACS Total	24.35 (8.55)	23.95 (8.39)	*t* (583) = 0.47	.64	0.05

Note. Percentages for White versus minority race do not add up to 100 because some people did not identify a race *(N*=4). DMS = Drive for Muscularity. DTS = Drive for Thinness. CEBRACS AE = Alcohol Effects subscale. CEBRACS BN = Bulimia subscale. CEBRACS DE = Diet & Exercise subscale. CEBRACS R = Restriction subscale.

Table 4

Single Group CFA Fit Indices

Model	χ^2	df	RMSEA	CFI
		Females (N = 454)		
Model 1	845.681	189	.087	.971
Model 2		Latent Variable Not Positive Definite for Variable R*		
Model 3	365.676	149	.057	.990
Model 4		Nonpositive definite question 5		
Model 5	734.844	167	.087	.974
		Males (N = 132)		
Model 1	364.031	189	.084	.980
Model 2		Latent Variable Not Positive Definite for Variable R*		
Model 3	185.073	149	.043	.996
Model 4	328.905	186	.076	.984

Note: * tested C4 and C21 on diet and exercise subscale and fit was worse

Table 5

Measurement Invariance Tests with Model 3

Model	X^2	*df*	CFI	ΔCFI	RMSEA	Model Comparison	ΔX^2	Δ*df*
Configural	507.344	298	.993	0	.049	Metric - Configural	37.362*	16
Metric	530.685	314	.993	0	.049	Scalar - Configural	62.608	56
Scalar	546.195	354	.993	0	.043	Scalar - Metric	35.847	40

Table 6

Unstandardized loadings (Standard Error) and Standardized Loadings for the Confirmatory Factor Analysis of Model 3 of the CEBRACS for Males (N=131) and Females (N=455)

	Alcohol Effects				Bulimia				Diet and Exercise			
	Males		Females		Males		Females		Males		Females	
Item	UNS	STD	UNS	STD	UNS	STD	UNS	STD	UNS	STD	UNS	STD
1	1.000 (---)	.886	1.000 (---)	.917								
3	1.092(.028)	.967	1.063(.027)	.975								
6	1.113(.034)	.986	1.008(.023)	.924								
7	1.117(.031)	.990	1.012(.022)	.928								
9	1.060(.046)	.939	1.003(.025)	.920								
12	1.057(.036)	.936	1.031(.023)	.945								
14	1.072(.036)	.950	.999 (.026)	.916								
5					1.000 (---)	.829	1.000 (---)	.953				
8					1.176 (.089)	.975	1.028(.022)	.980				
13					1.176 (.121)	.975	1.024(.028)	.976				
15					1.075 (.088)	.891	1.033(.023)	.985				
17					1.156 (.103)	.958	1.025(.027)	.977				
19					.943 (.098)	.781	.913 (.039)	.870				
2									1.000 (---)	.872	1.000 (---)	.769
10									1.032(.068)	.899	1.148(.060)	.883
11									1.017(.065)	.887	.960 (.067)	.738
16									.945 (.063)	.823	1.159(.061)	.892
18									1.003(.095)	.875	1.101(.091)	.847
20									1.080(.078)	.941	1.170(.066)	.900

Table 7

Internal Consistency of Factors Based on the Final Model

	Overall	Men	Women
Alcohol Effects	.90	.91	.90
Bulimia	.86	.77	.88
Diet & Exercise	.86	.86	.85
Total	.93	.93	.97

Table 8

Correlations of Validity Measures and CEBRACS scores

	1	2	3	4	5	6	7	8	9	10	11
1. Age	--	.01	.01	-.08	-.02	.14	-.14	.00	-.07	-.04	-.05
2. Minority	.09*	--	-.07	-.03	.20*	.06	.15	.15	.06	.08	.09
3. ADUIT	-.04	-.13**	--	.25**	.17*	-.14	.20*	.09	.27**	.20*	.25**
4. DMS	.10*	-.01	.12*	--	.23**	-.11	.22*	.14	.21*	.35**	.29**
5. DTS	-.12*	-.17**	.18**	.14**	--	-.42**	.66**	.12	.23**	.28**	.26**
6. AppE	.11*	.19**	-.043	-.05	-.59**	--	-.37**	.01	-.14	-.07	-.10
7. EDsym	-.06	-.07	.17**	-.19**	.67**	-.51**	--	.37**	.40**	.40**	.45**
8. BN	.11*	.06	.08	.08	.11*	-.04	.19**	--	.64**	.59**	.79**
9. AE	.05	-.06	.29**	.10*	.18**	-.11*	.21**	.64**	--	.61**	.91**
10. DE	.07	-.10*	.29**	.21**	.36**	-.14**	.36**	.59**	.57**	--	.86**
11. Total	.08	-.06	.28**	.16**	.27**	-.12**	.30**	.82**	.88**	.86**	--

Note. Correlations for men appear above the diagonal and women below the diagonal. Minority dummy coded ethnicity 0 = white, 1 = minority. AUDIT = AUDIT-C S sum. DMS = Drive for Muscularity Average Score. DTS = Drive for thinness symptom count. AppE = Appearance Evaluation. EDsym = EDDS DSM 5 symptom count. BN = CEBCRACS Bulimia Subscale Score. AE = CEBRACS Alcohol Effects Subscale Score. DE = CEBRACS Diet and Exercise Subscale Score. Total = CEBRACS Total Score. ** = < .01; * = < .05

Table 9

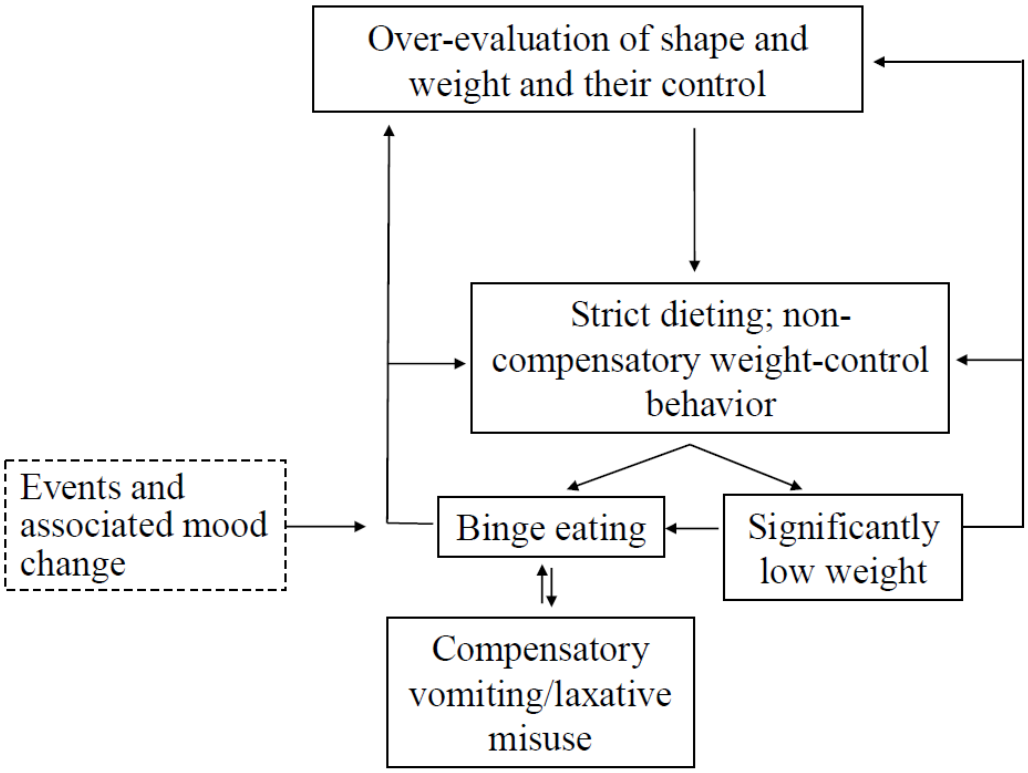
Correlations and Fisher's r to z Transformation Values

CEBRACS Bulimia Subscale with:	*r* men	*r* women	*z*
AUDIT-C Total	.09	.08	.1
Drive for Muscularity	.14	.08	.61
Drive for Thinness	.12	.11	.1
Appearance Evaluation	.01	-.04	.5
Eating Disorder Symptoms	.37	.19	1.95[a]
Alcohol Effects Subscale	.64	.64	0
Diet & Exercise Subscale	.59	.59	0
CEBRACS Total Score	.79	.82	-.85
CEBRACS Alcohol Effects Subscale with:			
AUDIT-C Total	.27	.29	-.22
Drive for Muscularity	.21	.10	1.12
Drive for Thinness	.23	.18	.52
Appearance Evaluation	-.14	-.11	-.3
Eating Disorder Symptoms	.40	.21	2.1*
Diet & Exercise Subscale	.61	.57	.61
CEBRACS Total Score	.91	.88	1.51
CEBRACS Diet & Exercise Subscale with:			
AUDIT-C Total	.20	.29	-.96
Drive for Muscularity	.35	.21	1.52
Drive for Thinness	.28	.36	-0.89
Appearance Evaluation	-.07	-.14	.71
Eating Disorder Symptoms	.40	.36	.47
CEBRACS Total Score	.86	.86	0
CEBRACS Total with:			
AUDIT-C Total	.25	.28	-.32
Drive for Muscularity	.29	.16	1.37
Drive for Thinness	.26	.27	-.11
Appearance Evaluation	-.10	-.12	.20
Eating Disorder Symptoms	.45	.30	1.75

Note. [a] denotes the effect is marginally significant $p = .052$.

FIGURES

Figure 1: Transdiagnostic Model of Eating Disorders



Model from Fairburn, C., (2008), *Cognitive Behavior Therapy and Eating Disorders*. New York: Guilford Press. Reprinted with permissions from Guilford Press. See Appendix D

Figure 2: Fairburn's Transdiagnostic Model Adapted to Drunkorexia

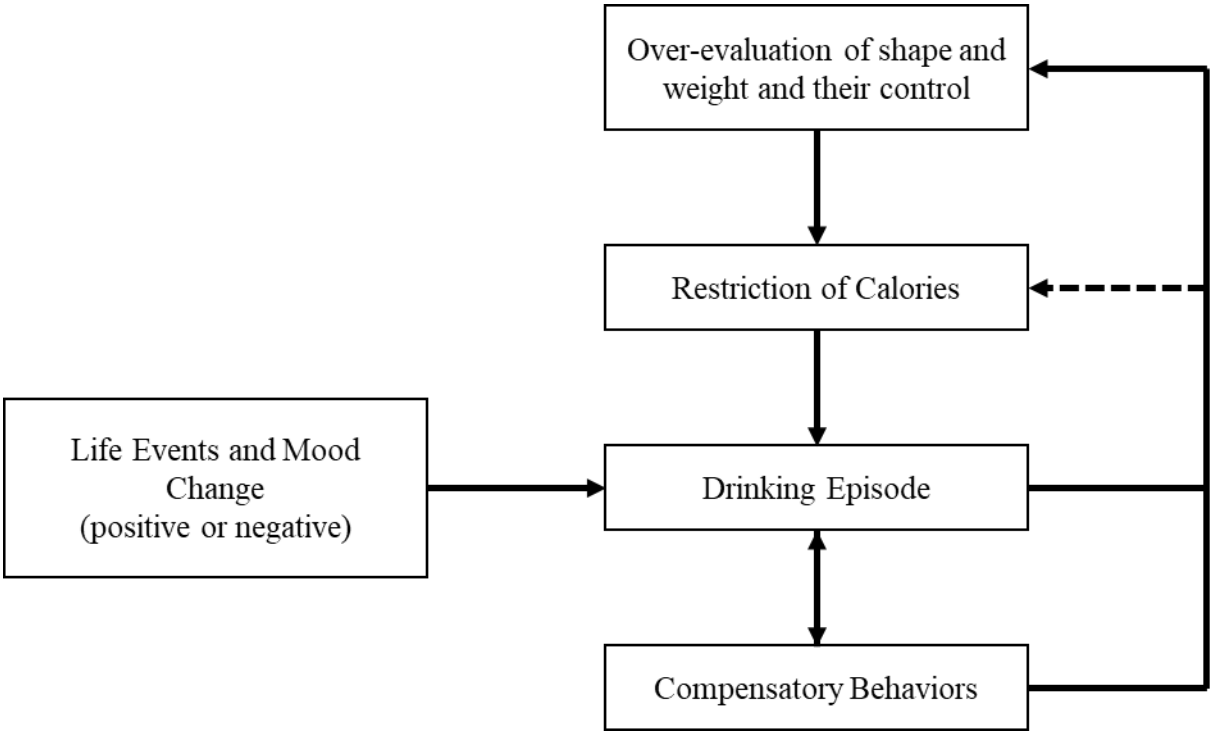


Figure 3: Model 1 – One Factor Model

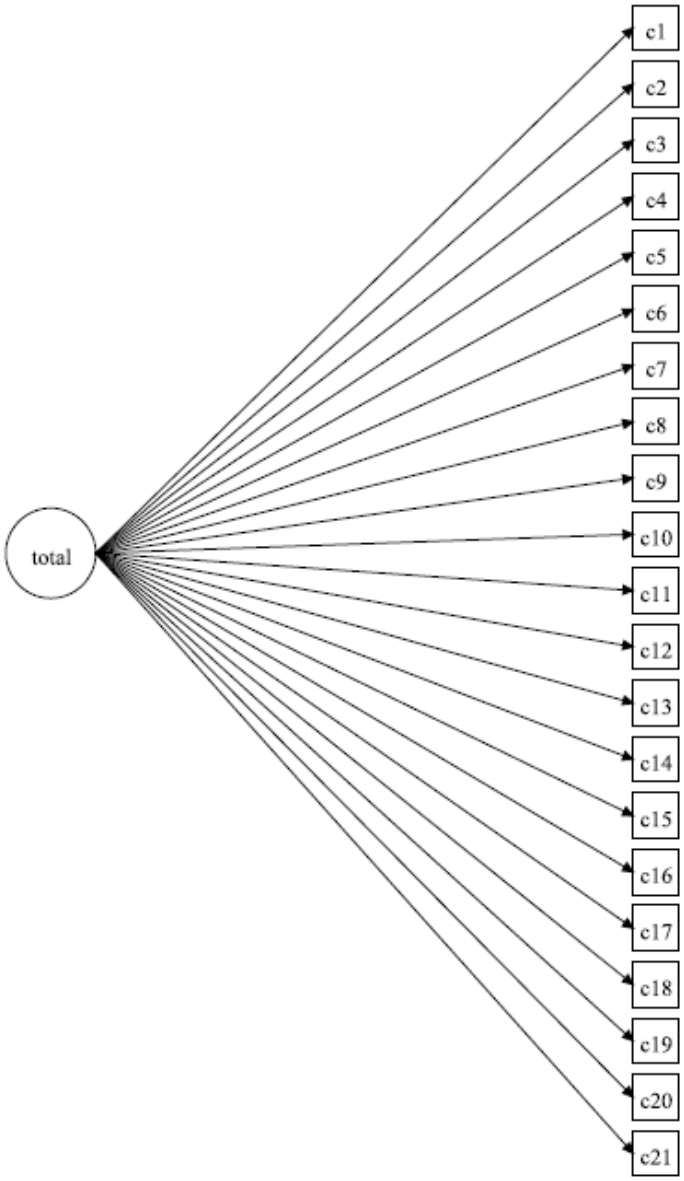


Figure 3. Model 1 One Factor Model for the CFA of the CEBRACS

Figure 4: Model 2 – Original Four Factor Model

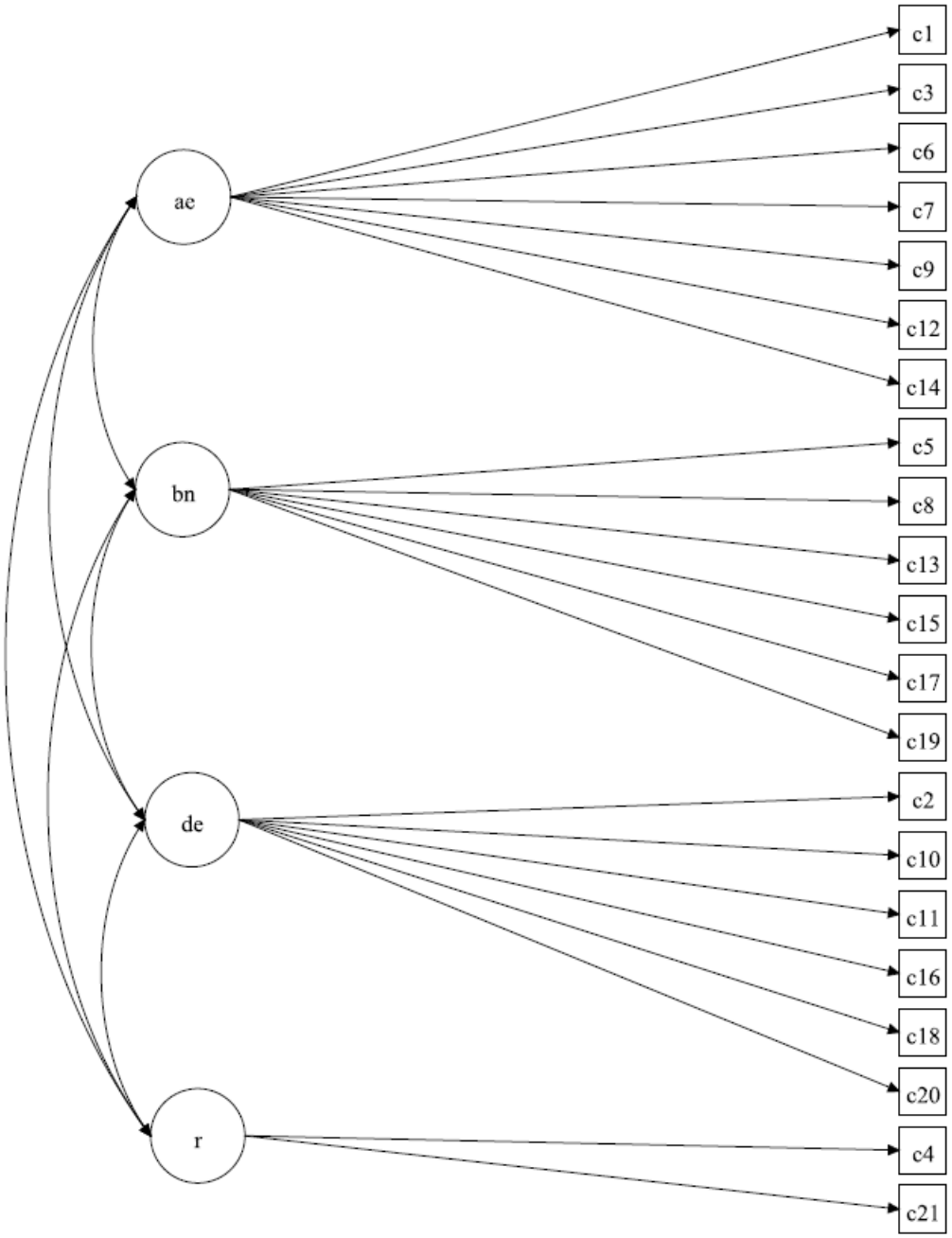


Figure 4. Model 2 Four factor model for the CFA of the CEBRACS. AE = Alcohol effects subscale; BN = Bulimia subscale; DE = Diet & exercise subscale; R = Restriction subscale.

Figure 5: Model 3 – Three Factor Model

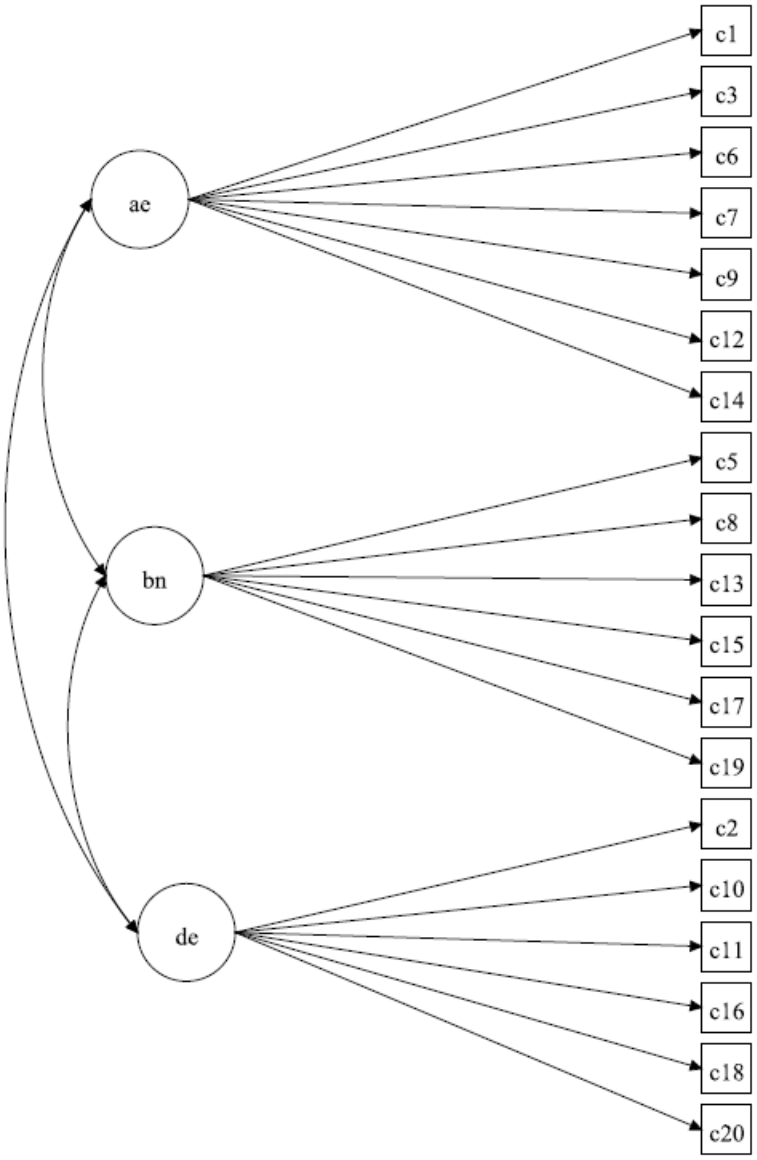


Figure 5. Model 3 Three factor model for the CFA of the CEBRACS. AE = Alcohol effects subscale; BN = Bulimia subscale; DE = Diet & exercise subscale.

Figure 6: Model 4 – Three Factor Time Model

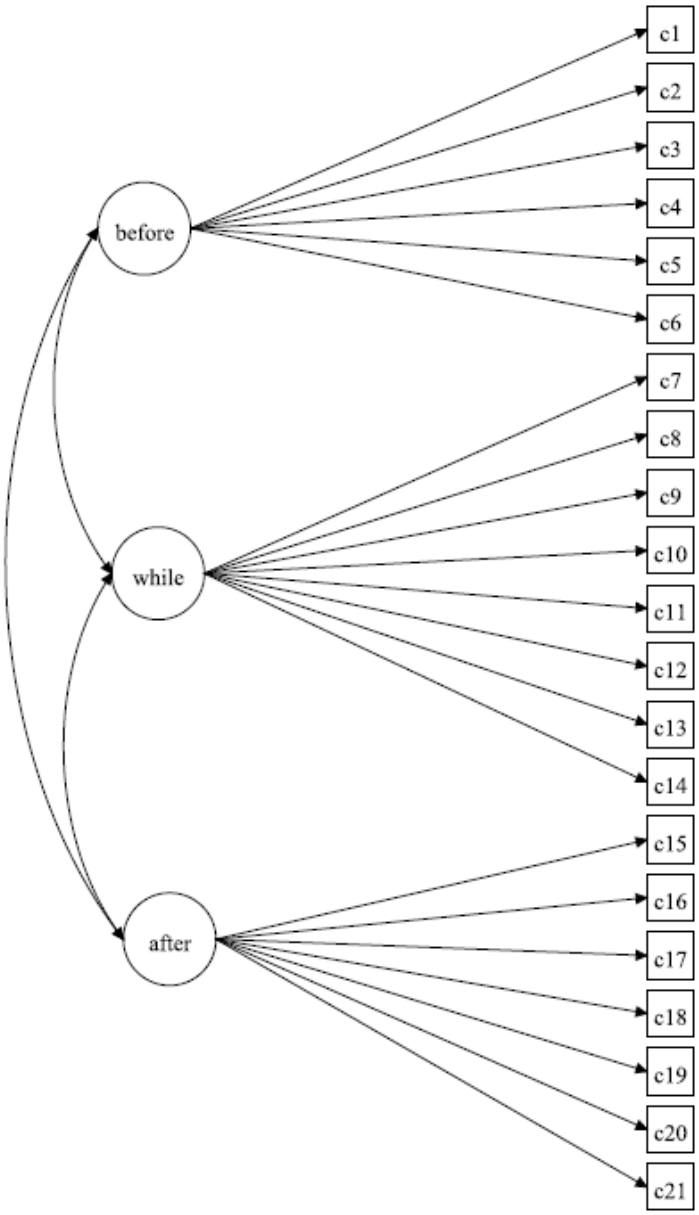


Figure 6. Model 4 Time model for the CFA of the CEBRACS. Before, during, and after represent the three time periods that are identified on the CEBRACS.

Figure 7: Model 5 – Women Only Item 5 Removed for Time Model

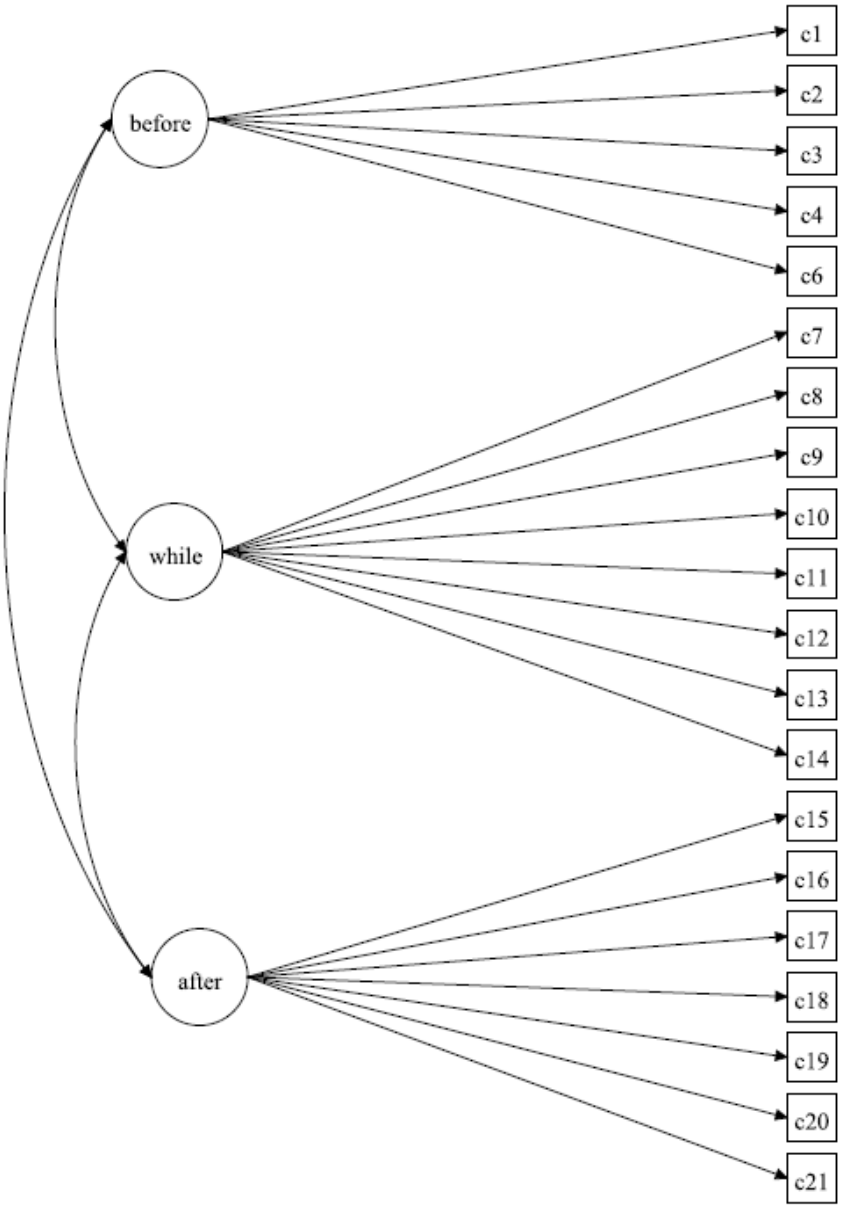


Figure 7. Model 5 Time model for females for the CFA of the CEBRACS. Before, during, and after represent the three time periods that are identified on the CEBRACS.

APPENDIX A: DEMOGRAPHIC QUESTIONS

1. Please indicate your sex.
    a. Male
    b. Female
2. Please enter your age in years.

3. What year are you in school?

4. Are you Hispanic
    a. Yes
    b. No
5. What is your race? Please select all that apply.
    a. American Indian or Alaska Native
    b. Asian
    c. Black or African American
    d. Native Hawaiian or Other Pacific Islander
    e. White
6. How tall are you? In feet and inches. (e.g. 5'4 or 5 feet 4 inches)

7. How much do you weigh in pounds? If uncertain, please give your best estimate.

8. Are you a member of a Greek organization? e.g. sorority or fraternity)
    a. Yes
    b. No
9. Do you consider yourself to be an athlete? You do not have to be currently participating in a varsity sport.
    a. Yes
    b. No
10. What sport do you participate in?
    a. Sports like Cheerleading, Dance, Equestrian, Gymnastics
    b. Sports like Soccer, Basketball, Baseball/Softball, Football, Field hockey, Lacrosse
    c. Sports like Swimming, Track, Cross Country
    d. Other: Please Specify
    e. None
11. In the context of the sport you identified above, how many times per week do you exercise?
    a. 0
    b. 1-2

c. 3-4
d. 5-6
e. 7+

12. In the context of the sport you identified above, how long on average do you exercise?
    a. <30 minutes
    b. 30-45 minutes
    c. 45 minutes - 1 hour
    d. 1-2 hours
    e. 2+ hours
13. Not in the context of an organized sport, how many times per week do you exercise?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7+
14. Not in the context of an organized sport, how long on average do you exercise?
    a. <30 minutes
    b. 30-45 minutes
    c. 45 minutes - 1 hour
    d. 1-2 hours
    e. 2+ hours

Appendix B: The Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale

Instructions:

Please read each of the following statements very carefully and respond accurately and honestly. All of these statements reflect actual behaviors you may have done in the **past 3 months**. You will be asked whether you have done any of the behaviors **before, during, or after drinking alcohol.** Please read carefully because many of the statements are closely related to each other. **Drinking** refers to drinking any alcoholic beverages such as: beer, wine, wine coolers or spirits, hard liquors or mixed drinks.

BEFORE drinking

Instructions: For the following statements think about behaviors you have engaged in **BEFORE** you anticipated drinking alcohol. That is, think of situations where you knew you would be drinking alcohol in the future (e.g. planed to go to out drinking with friends, attended a wedding or birthday where you planned to drink, or attended any other event or situation where you knew you would be drinking later).

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
1. In the past 3 months, I have eaten less than usual during one or more meals before drinking to get DRUNKER.	1	2	3	4	5
2. In the past 3 months, I have exercised before drinking to make up for the calories in alcohol that I anticipated consuming.	1	2	3	4	5
3. In the past 3 months, I have eaten less than usual during one or more meals before drinking to feel the effects of alcohol FASTER.	1	2	3	4	5
4. In the past 3 months, I have skipped one or more meals before drinking to make up for the number of calories in alcohol that I anticipated consuming.	1	2	3	4	5
5. In the past 3 months, I have taken laxatives before drinking to make up for the calories in alcohol that I anticipated consuming.	1	2	3	4	5
6. In the past 3 months, I have skipped one or more meals before drinking to feel the effects of alcohol FASTER.	1	2	3	4	5

WHILE under the effects of alcohol

Instructions: For each of the following statements, think about behaviors you have engaged in WHILE you were drinking or under the effects of alcohol (e.g. while you were drinking during a wedding reception, party, bar, club, football game). This also includes situations where you may have been done drinking, but the effects of alcohol had not completely worn off. As an example, imagine arriving home from a party where you had been drinking and you could still feel the effects of alcohol even though you had stopped drinking earlier in the night.

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
7. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1	2	3	4	5
8. In the past 3 months, I have taken diuretics while I was drinking to make up for the calories in alcohol that I was consuming.	1	2	3	4	5
9. In the past 3 months, I have not eaten at all while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1	2	3	4	5
10. In the past 3 months, I have eaten low-calorie or low-fat foods while I was drinking to make up for the calories in alcohol that I was consuming	1	2	3	4	5
11. In the past 3 months, I drank low-calorie beer or alcoholic drinks to get fewer of the calories that are in alcohol.	1	2	3	4	5
12. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to get DRUNKER.	1	2	3	4	5
13. In the past 3 months, I have taken laxatives while I was drinking to make up for the calories in alcohol that I was consuming.	1	2	3	4	5

14. In the past 3 months, I have not eaten at all while I was drinking because I wanted to get DRUNKER.	1	2	3	4	5

AFTER effects from alcohol have worn off

Instructions: For each of the following statements, think about behaviors you have engaged in AFTER you had been drinking alcohol and were no longer under the effects of alcohol. This might include your behavior later that same day, the next day, or several days after the effects of alcohol have worn off.

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
15. In the past 3 months, I have taken diuretics to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
16. In the past 3 months, I have eaten low-calorie or low-fat foods during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
17. In the past 3 months, I have taken laxatives to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
18. In the past 3 months, I have exercised to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
19. In the past 3 months, I have made myself vomit to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
20. In the past 3 months, I have eaten less than usual during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
21. In the past 3 months, I have skipped an entire day or more of eating to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5

APPENDIX C: THE REVISED COMPENSATORY EATING AND BEHAVIORS IN RESPONSE TO ALCOHOL CONSUMPTION SCALE

Instructions:

Please read each of the following statements very carefully and respond accurately and honestly. All of these statements reflect actual behaviors you may have done in the **past 3 months**. You will be asked whether you have done any of the behaviors **before, during, or after drinking alcohol.** Please read carefully because many of the statements are closely related to each other. **Drinking** refers to drinking any alcoholic beverages such as: beer, wine, wine coolers or spirits, hard liquors or mixed drinks.

BEFORE drinking

Instructions: For the following statements think about behaviors you have engaged in **BEFORE** you anticipated drinking alcohol. That is, think of situations where you knew you would be drinking alcohol in the future (e.g. planed to go to out drinking with friends, attended a wedding or birthday where you planned to drink, or attended any other event or situation where you knew you would be drinking later).

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
1. In the past 3 months, I have eaten less than usual during one or more meals before drinking to get DRUNKER.	1	2	3	4	5
2. In the past 3 months, I have exercised before drinking to make up for the calories in alcohol that I anticipated consuming.	1	2	3	4	5
3. In the past 3 months, I have eaten less than usual during one or more meals before drinking to feel the effects of alcohol FASTER.	1	2	3	4	5
4. In the past 3 months, I have taken laxatives before drinking to make up for the calories in alcohol that I anticipated consuming.	1	2	3	4	5
5. In the past 3 months, I have skipped one or more meals before drinking to feel the effects of alcohol FASTER.	1	2	3	4	5

WHILE under the effects of alcohol

Instructions: For each of the following statements, think about behaviors you have engaged in WHILE you were drinking or under the effects of alcohol (e.g. while you were drinking during a wedding reception, party, bar, club, football game). This also includes situations where you may have been done drinking, but the effects of alcohol had not completely worn off. As an example, imagine arriving home from a party where you had been drinking and you could still feel the effects of alcohol even though you had stopped drinking earlier in the night.

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
6. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1	2	3	4	5
7. In the past 3 months, I have taken diuretics while I was drinking to make up for the calories in alcohol that I was consuming.	1	2	3	4	5
8. In the past 3 months, I have not eaten at all while I was drinking because I wanted to feel the effects of the alcohol FASTER.	1	2	3	4	5
9. In the past 3 months, I have eaten low-calorie or low-fat foods while I was drinking to make up for the calories in alcohol that I was consuming	1	2	3	4	5
10. In the past 3 months, I drank low-calorie beer or alcoholic drinks to get fewer of the calories that are in alcohol.	1	2	3	4	5
11. In the past 3 months, I have eaten less than usual while I was drinking because I wanted to get DRUNKER.	1	2	3	4	5
12. In the past 3 months, I have taken laxatives while I was drinking to make up for the calories in alcohol that I was consuming.	1	2	3	4	5

13. In the past 3 months, I have not eaten at all while I was drinking because I wanted to get DRUNKER.	1	2	3	4	5

AFTER effects from alcohol have worn off

Instructions: For each of the following statements, think about behaviors you have engaged in AFTER you had been drinking alcohol and were no longer under the effects of alcohol. This might include your behavior later that same day, the next day, or several days after the effects of alcohol have worn off.

	Never (1)	Rarely (about 25% of the time) (2)	Sometimes (about 50% of the time) (3)	Often (about 75% of the time) (4)	Almost all the time (5)
14. In the past 3 months, I have taken diuretics to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
15. In the past 3 months, I have eaten low-calorie or low-fat foods during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
16. In the past 3 months, I have taken laxatives to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
17. In the past 3 months, I have exercised to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
18. In the past 3 months, I have made myself vomit to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5
19. In the past 3 months, I have eaten less than usual during one or more meals to make up for the calories in alcohol that I had consumed previously while I was under the effects of alcohol.	1	2	3	4	5

APPENDIX D: PERMISSION TO PRINT FIGURE FROM FAIRBURN, 2008

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