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Alcohol Use and Drinking-Related Eating Restriction Behaviors Among College Students

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ALCOHOL USE AND DRINKING-RELATED EATING RESTRICTION BEHAVIORS AMONG COLLEGE STUDENTS

by

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ABSTRACT

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The combination of eating restrictions and alcohol use is a prevalent problem on college campuses. Some students engage in eating restrictions prior to drinking to limit their overall caloric intake or to enhance intoxication effects. To date, limited research suggests that drinking-related eating restriction behaviors are associated with additional and unique health risks relative to high-risk drinking or eating restrictions alone. As such, additional research examining this unique, risky set of behaviors is warranted. Consequently, the present study aimed to address gaps in the literature by further examining the risks associated with drinking-related eating restrictions and testing trait factors related to use of these behaviors. Specifically, the study used a baseline plus 14-day daily diary design to: (1) examine the between-subjects association between drinking-related eating restrictions and alcohol outcomes, (2) examine the between-person characteristics contributing to drinking-related eating restrictions, (3) examine the within-subjects association between drinking-related eating restrictions and same-episode alcohol outcomes, (4) test trait characteristics as moderators to the daily associations between drinking-related eating restrictions and same-episode alcohol outcomes, and (5) explore whether motivations for using drinking-related eating restriction behaviors impact same-episode alcohol outcomes. Participants were 227 (180 women) moderate drinking college students. The mean age was 20.64 (*SD* = 2.01) years. Participants completed a baseline questionnaire and 14 days of daily surveys. Results found between-level effects of drinking-related eating restrictions, such that typical restrictors exhibited higher alcohol outcomes than non-restrictors. Multilevel

modeling found within-person effects of drinking-related eating restrictions, such that participants consumed more alcohol, were more likely to binge drink, and were more likely to experience a problem on restricting days. Lower self-control was found as an indicator of typical drinking-related eating restrictions. Self-control also moderated the daily association between drinking-related eating restrictions and binge drinking, such that individuals with low self-control were more likely to binge on days they restricted. Sex was also supported as a moderator, such that women consumed more alcohol and experienced more problems on days they restricted, whereas men did not. Despite these findings, emotion regulation and perceived weight were not supported as relevant constructs to drinking-related eating restrictions in any analyses. Further, the reported reasons for restricting did not have a significant effect on same-day alcohol outcomes. Overall, this study was the first to examine both between- and within-person effects of drinking-related eating restrictions in a daily diary design with a sample of women and men. Findings supported unique risks associated with drinking-related eating restrictions, above and beyond risks of high-quantity drinking. Self-control and sex also emerge as important constructs in understanding who uses drinking-related eating restrictions and the effect restrictions have on alcohol outcomes. Future research can further elucidate the predictors and risks associated with drinking-related eating restrictions.

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CHAPTER I

INTRODUCTION

Two behaviors associated with health risks among college students are alcohol use and unhealthy eating habits. Recent estimates suggest that over 60% of college students have consumed alcohol within the past month (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016), and approximately 30% report having had a heavy drinking episode (as defined as 4/5 or more standard drinks for women/men; Wechsler, Dowdall, Davenport, & Rimm, 1995) within the past two weeks. Heavy episodic drinking is of particular concern, as it is associated with increased risk of blackouts (White, Jamieson-Drake, & Swartzwelder, 2002), risky sexual behaviors (Cooper, 2002), physical violence (Wekerle & Wall, 2002), and injuries (Brewer & Swahn, 2005).

Unhealthy dieting, eating, and exercise practices to lose weight or prevent weight gain are also prevalent among college students. An estimated 14-32% of college women and 4-25% of college men meet criteria for an eating disorder (Eisenberg, Nicklett, Roeder, & Kirz, 2011; White, Reynolds-Malear, & Cordero, 2011). Moreover, approximately 50% of college students use sub-diagnostic levels of unhealthy eating behaviors in an attempt to lose or maintain weight (Lowry et al., 2000). Regular and continued use of disordered eating behaviors can be accompanied by severe physiological and psychological effects (Von Ranson & Wallace, 2014), such as organ failure (Jáuregui-Garrido & Jáuregui-Lobera, 2012) and suicide attempts (Stein, Lilenfeld, Wildman, & Marcus, 2004).

In the past few decades a new trend, coined "drunkorexia" by media outlets, has emerged to describe a phenomenon in which college students combine unhealthy eating behaviors (e.g., eating restrictions) with heavy episodic drinking. While limited research suggests heightened

risks accompany these combined behaviors (e.g., Burke, Cremeens, Vail-Smith, & Woolsey, 2010), much is still unknown about drinking-related eating restrictions. Consequently, the current study aimed to better understand the associations between intentional eating restrictions and various general alcohol consumption behaviors (e.g., alcohol quantity consumed during a typical week, number of drinking occasions in a typical week), as well as their association within a daily context (e.g., number of drinks consumed *today*, number of alcohol-related consequences experienced *today*). Additionally, the study sought to identify who may be most at risk to restrict calories before drinking, as well as psychological traits which may moderate the daily association between eating restrictions and alcohol outcomes.

Drinking-Related Eating Restrictions

The association between heavy alcohol use and disordered eating behaviors has been established in both clinical and non-clinical populations. Specifically, comorbid diagnoses for alcohol use disorders (AUDs) and eating disorders (EDs) are common among treatment seeking populations for each disorder (Gadalla & Piran, 2007a; Gadalla & Piran, 2007b; Holderness, Brooks-Gunn, & Warren, 1994). Furthermore, in non-treatment-seeking populations, substance use and disordered eating behaviors are highly correlated at subclinical levels (Anderson, Martens, & Cimini, 2005; Anderson, Simmons, Martens, Ferrier, & Sheehy, 2006; Kelly-Weeder, 2011).

Despite substantial research dedicated to drinking and eating behaviors, two gaps remain in the literature. First, extant studies have primarily examined and established a high comorbidity between AUD and ED diagnoses (e.g., Dunn, Larimer, & Neighbors, 2002), whereas less research has looked at how changes in one behavior (e.g., eating behaviors) relate to changes in the other (e.g., drinking behaviors) in a non-treatment seeking sample. Second, much

of the research examining these two health risks overlooks how the behaviors relate within the context of a single event. In other words, prevalence and co-occurrence rates capture global or typical eating and drinking behaviors, but may miss how these behaviors relate on the same day. Therefore, despite understanding that these risky health behaviors are positively correlated, scant research has examined how individuals balance the competing social demands to drink high quantities of alcohol and compensate for calories with disordered eating behaviors generally and within the context of a single day. Furthermore, examining these behaviors within the same occasion could illuminate additional reasons for the concurrent drinking and eating restrictions. For instance, in addition to managing calories, eating restrictions within the context of a drinking episode could also be used to enhance intoxication.

Of the 26 studies to examine drinking-related eating restrictions (see Table 1), Peralta (2002) first sought to understand college students' eating habits on days in which they consumed alcohol. His qualitative study found that nearly 18% of college students intentionally ate less on days on which they drank, while a separate 18% specifically sought lower calorie alcoholic beverages. Students endorsed two main motivations for these behaviors: to manage weight and to enhance or expedite intoxication. Though not mutually exclusive, these motivations were cited by students as reasons to limit food calories on drinking days in order to either compensate for the added caloric intake from alcohol or get drunk more quickly. Peralta's findings suggested that college students, in particular, may feel pressured to meet the two competing social demands of college drinking culture and the thin ideal (Lindner, Hughes, & Fahy, 2008; Suls & Green, 2003). Therefore, students strive to minimize calories while maximizing intoxication. To meet both of these social expectations, some individuals combine drinking and calorie compensation

within a single drinking occasion, thus contributing to a unique problem of drinking-related eating restriction.

Table 1

Literature Review of Drinking-Related Eating Restriction Research

Reference	Sample	*N*	Main Research Questions	Findings
Conceptual				
Chambers, 2008	N/A	N/A	Described drunkorexia	N/A
Piazza-Gardner & Barry, 2013	N/A	N/A	Addressed use of term "drunkorexia"	N/A
Cross-sectional, qualitative design				
Peralta, 2002	Women and men	78	Explored concurrence of alcohol use and fear of weight gain	Participants endorsed desires to enhance intoxication and reduce caloric intake
Piazza-Gardner & Barry, 2014	Women and men	36	Explored relationships of eating, drinking, and exercise behaviors related to weight management strategies	Participants endorsed eating less before drinking and exercising more after drinking to manage weight
Cross-sectional, quantitative design				
Blackstone et al., 2019	Women and men	412	Explore prevalence of drunkorexia and associated compensatory behaviors	62% engaged in at least one drunkorexia behavior often; disordered eating behaviors correlated with drunkorexia behaviors
Bryant et al., 2012	Women and men	274	Examined ways in which students manage calories and drink	Participants exercised and restricted diet before and after drinking episodes
Burke et al., 2010	Freshmen women and men	692	Examined the prevalence of DRER and associated reasons	14% restricted calories before drinking; participants endorsed wanting to avoid weight gain and get more drunk
Castañeda et al., 2019	Women and men	1149	Examined whether binge drinking behavior was predicted by facets of drunkorexia	Several factors of drunkorexia, including restriction and dietary restraint, were associated with binge drinking behavior
Eisenberg & Fitz 2014	Women and men	63	Examined who engages in DRER and associated reasons	Women endorsed weight control reason more than men; heavy drinking and strong weight control motivations led to greater chance of endorsing drunkorexia behaviors
Giles et al., 2009	Women and men	4271	Examined the prevalence, alcohol outcomes, and reasons for DRER	39% restricted calories, 67% of whom endorsed weight control reasons; restricting calories associated with greater odds of getting drunk
Gorrell et al., 2019	Women and men	530	Examined the association between disordered eating motives and drunkorexia behaviors	DRER found to be associated with disordered eating behaviors

Continued

Reference	Sample	*N*	Main Research Questions	Findings
Hunt & Forbush, 2016	Women and men	579	Examined whether problematic alcohol use or disordered eating behaviors better predict DRER; examined sex differences	DRER related to increased risk for eating and substance use disorders; relationship with disordered eating especially strong among women
Knight et al., 2017	Women	85	Examined whether DRER exist unique from disordered eating behaviors	58% reported drunkorexia behaviors; 16% reported drunkorexia but no general disordered eating behaviors
Laghi et al., 2019*	Girls and boys	849	Examined factors predicting drunkorexia	Support for emotion dysregulation as an important construct to understanding drunkorexia
Lupi et al., 2015	Women and men	1311	A pilot study that examined the prevalence of DRER in Italian sample	32% limited calories before drinking
Lupi et al., 2017	Women and men	4275	Examined prevalence of DRER for each gender; explored drug use correlates with DRER	34% limited calories before drinking, no gender difference; binge drinking, cocaine use, and psychoactive substance use associated with greater DRER odds
Martin et al., 2016	Women and men	482	Examined DRER in sample of collegiate athletes	25% endorsed DRER for weight motivations, 25% endorsed DRER to achieve greater intoxication; women more likely to endorse weight motivations
Peralta & Barr, 2017	Women and men	651	Examined sex and gender orientation in relation to DRER	Binge drinking, other substance use, and masculine orientation positively associated with DRER; no sex differences for DRER prevalence
Pompili & Laghi, 2018	Women and men	1000	Examined relationship between DRER and problematic alcohol use and disordered eating behaviors; explored whether emotion regulation is related to DRER	Fasting, binge drinking, and getting drunk were found predictors of drunkorexia behaviors; among men drunkorexia correlated with emotion regulating difficulties
Rahal et al., 2012	Women and men	274	Developed CEBRACS scale, which measures various types of drunkorexia behavior clusters	Four factors: alcohol effects, bulimia, dieting and exercise, restriction; no sex differences in DRER
Roosen & Mills, 2015	Study 1: Women and men	3409	Examined the prevalence of dietary changes prior to drinking and associated motivations	46% restricted food before alcohol consumption; endorsed motives include: to avoid weight gain and to get intoxicated faster
	Study 2: Women	226	Explored mental health correlates and motivations behind DRER	DRER associated with greater disordered eating behaviors, alcohol problems, and symptoms of depression and anxiety; concerns with calories endorsed as primary motive
Ward & Galante, 2015	Women and men	349	Developed motivation measure for drunkorexia behaviors before, during, and after drinking	Final scale found drunkorexia motives are primarily conformity motives; men endorsed higher levels of drunkorexia motives

Continued

Reference	Sample	*N*	Main Research Questions	Findings
Ward et al., 2015	Women and men	349	Explored relationship between Greek affiliation, salience of alcohol, with drunkorexia behaviors	Greek affiliation and strong feeling that alcohol is important endorsed greater DRER
Wilkerson et al., 2017	Women and men	510	Explore characteristics of students described as weight conscious drinkers	Greek affiliation and those who endorsed desire to lose weight found more likely to be weight conscious drinkers
Daily, prospective design				
Buchholz et al., 2018	Women	59	Examined temporal relationships between eating behaviors and drinking days	Daily intentions to restrict associated with same-day increases in drinking and alcohol-related problems
Luce et al., 2013	Women	79	Compared how eating behaviors on drinking days varied based on status desired weight loss	Daily DRER not associated with decreased calorie via food intake, as explained by increased after-drinking eating

Note. Articles included in this table: 1) were published in peer-reviewed journals, 2) measured/discussed both eating restrictions and alcohol use, 3) used college student samples (*with the exception of Laghi et al., 2019, whose sample was adolescents), and 4) were interested in the intentional use of eating restrictions *in relation to* alcohol consumption. *DRER = drinking-related eating restrictions.*

Since Peralta's (2002) seminal qualitative investigation, media outlets have coined the non-medical term "drunkorexia" to describe behaviors concerning simultaneous alcohol consumption and calorie management (CBS News, 2008; Kershaw, 2008; Science Daily, 2011). Drunkorexia generally refers to behaviors that drinkers use to compensate for the calories in alcohol or optimize intoxication. Behaviors such as eating less than usual, skipping meals, over-exercising, purging, using diuretics, and using laxatives have all been considered as compensatory behaviors under the working definition of drunkorexia (Peralta, 2002; Piazza-Gardner & Barry, 2014). Academic publications have also examined this phenomenon, although an exact operational definition does not yet exist (Chambers, 2008; Piazza-Barry & Gardner, 2013). Despite the lack of a clear definition, the term has gained traction in scientific journals in the United States (e.g., Burke et al., 2010; Wilkerson, Hackman, Rush, Usdan, & Smith, 2017) and internationally (e.g., Knight, Castelnuovo, Pietrabissa, Manzoni, & Simpson, 2017; Lupi, Martinotti, & Di Giannantonio, 2017).

To further understand and define drunkorexia, Hunt and Forbush (2016) examined whether the intentional combination of compensatory eating behaviors and drinking was more closely related to ED symptoms or AUD symptoms. Using a cross-sectional sample, they discovered that symptoms for EDs and AUDs could each significantly predict drunkorexia behaviors among college students, even while controlling for the other set of symptoms. Among men, ED and AUD symptoms were equally strong predictors of drinking-specific compensatory behaviors, however ED symptoms were a stronger predictor than AUD symptoms among women. More recent cross-sectional studies have replicated these findings, where eating restrictions associated with drinking were predicted by general disordered eating behaviors (Blackstone, Johnson, & Sutton, 2019; Castañeda et al., 2019; Gorrell, Walker, Anderson, &

Boswell, 2019) or each of alcohol use and disordered eating behaviors (Pompili & Laghi, 2018), however no sex differences were observed. These results highlight that eating and drinking behaviors, separately, are important to understanding drunkorexia; however, neither behavior alone can explain drunkorexia.

Related to these findings, individuals who report using drunkorexia behaviors endorse two main reasons: to minimize calories and to get intoxicated more quickly (Burke et al., 2010; Peralta 2002). A more recent attempt to validate a measure for motivations to restrict before drinking found caloric compensation to be the most frequently endorsed reason for drinking-related eating restrictions (Ward & Galante, 2015). However, while the broad scope of behaviors associated with drunkorexia may serve to compensate for calories, only behaviors which occur *before* drinking (e.g., eating less *before* a drinking occasion) can also be used to enhance intoxication. As such, the present study will specifically examine eating restrictions before drinking, which individuals could utilize to compensate for calories and/or enhance intoxication effects from alcohol. Therefore, the present study will use the term *drinking-related eating restrictions* in favor of drunkorexia in order to capture behaviors in which individuals intentionally eat less *prior to* and *because they are* drinking alcohol.

Prevalence. Research has demonstrated that drinking-related eating restrictions exist among college students, though the extent to which these behaviors occur remains unclear. Lower range cross-sectional estimates have found that approximately 14% of first year college students reported eating restrictions on at least one drinking day within the last 30 days (Burke et al., 2010; Ward & Galante, 2015). Higher range cross-sectional findings suggest approximately 40% of all college students engage in eating restrictions on drinking days (Bryant, Darkes, & Rahal, 2012; Eisenberg & Fitz, 2014; Giles, Champion, Sutfin, McCoy, & Wagoner, 2009;

Roosen & Mills, 2015). Moderate estimates posit 25% of college drinkers restrict before drinking (Martin, Chaney, Vail-Smith, & Gallucci, 2016). Bryant and colleagues (2012) measured more specific eating behaviors and found that college students endorsed intentionally eating low-calorie foods (28.1%), eating less than usual (37.6%), skipping one or more meals (17.2%), and not eating (9.9%) on at least one quarter of their drinking days.

It is also unclear what role sex plays in prevalence. Historically, research examining unhealthy eating behaviors has focused on behaviors in women (Jones & Morgan, 2010), likely related to higher prevalence of EDs among women relative to men (Hoek & Van Hoeken, 2003). In line with general eating research, a subset of studies examining drinking-related eating restrictions have samples of only women (e.g., Knight et al., 2017; Roosen & Mills, 2015). Of those studies including men and women, drinking-related eating restrictions were more common among women than men (e.g., Bryant et al., 2012; Giles et al., 2009); however, some studies find no significant sex differences (e.g., Burke et al., 2010; Peralta & Barr, 2017). Nevertheless, drinking-related eating restrictions are used by both men and women.

One reason that existing estimates of intentional drinking-related eating restrictions remain unclear could be due in part to restriction behaviors on non-drinking days. More specifically, it is possible that individuals who endorse restricting calories on drinking days typically restrict on non-drinking days as well, and therefore may not be intentionally modifying their diet on drinking days. As such, Knight et al. (2017) aimed to identify those individuals who restrict on drinking days but otherwise do not endorse general disordered eating behaviors. In a cross-sectional sample of college women, they found over 72% of participants endorsed calorie restriction on at least some drinking days. Of most interest, perhaps, was that of those reporting restrictions on drinking days, 78% also reported unhealthy eating behaviors on non-drinking

days, indicating that drinking-related eating restrictions are a unique form of compensatory behaviors. Overall, drinking-related eating restrictions impact a sizeable minority of college students, are endorsed by men and women, and pose a unique risk apart from risky drinking or eating alone. Further research could help clarify the prevalence of drinking-related eating restrictions among college students.

Drinking outcomes associated with eating restrictions. In addition to knowing the prevalence of drinking-related eating restrictions, it is also important to understand how these eating behaviors are related to alcohol outcomes. Limited research provides support that calorie restrictors endorse greater alcohol consumption than non-restricting peers (Eisenberg & Fitz, 2014; Giles et al., 2009; Patte & Leatherdale, 2016). Among women, cross-sectional research has shown that restrictors consume greater quantities of alcohol than non-restrictors (Eisenberg & Fitz, 2014; Giles et al., 2009). Other cross-sectional data have demonstrated a link between drinking-related eating restrictions and greater alcohol-related consequences, but found that quantity alone was unrelated to restrictions (Roosen & Mills 2015; Ward & Galante, 2015). Further, college students who engage in drinking-related eating restrictions may be more likely to experience greater perceived intoxication (Giles et al., 2009) and endorse more frequent binge drinking than non-restrictors (Burke et al., 2010; Castañeda et al., 2019). These studies indicate that use of drinking-related eating restrictions may be associated with consuming greater quantities of alcohol and experiencing more alcohol-related consequences; however, the findings remain inconclusive as to whether restricting before drinking is associated with increases in same-day alcohol use and related problems. Cross-sectional designs are unable to examine same-day associations between eating restrictions and alcohol outcomes. Investigating same-day associations could test if daily variations in eating restrictions are related to same-day alcohol

outcomes. In other words, it could clarify whether alcohol outcomes differ between drinking days on which individuals restrict eating before drinking and drinking days on which individuals do not restrict food. Knowing whether drinking-related eating restrictions are associated with greater same-day alcohol outcomes would extend the cross-sectional findings that the two behaviors are generally related and clarify the specific, additive risks associated with restricting before drinking. To address this limitation, two studies utilized prospective designs to further our understanding of the specific drinking indices associated with same day drinking-related eating restrictions.

Two prospective design studies have been conducted using college women samples to examine the temporal relationship between drinking-related eating restrictions and alcohol outcomes, thus addressing the gap left by cross-sectional studies. First, Luce, Crowther, Leahey, and Buchholz (2013) examined eating and drinking behaviors among college women across a 10-day period. Participants completed daily surveys about their eating and drinking intentions and behaviors, and were grouped based on whether they were actively trying to lose weight (i.e., "restrictors" and "non-restrictors"). Their results showed that, on days in which they intended to drink, restrictors ate fewer meals than non-restrictors; however, there were no differences between the groups on drinking days when drinking was not planned. Interestingly, despite consuming fewer meals than non-restrictors, restrictors and non-restrictors reported similar caloric intake through food prior to drinking, suggesting that restrictors' efforts to limit caloric intake on drinking days were unsuccessful. One limitation with this study, however, is that participants did not report daily drinking behaviors, only their intentions to drink that day. Therefore, it was unclear whether daily intentions to restrict were related to same-day alcohol use or problems experienced.

In another prospective study, Buchholz, Crowther, and Ciesla, (2018) examined the relationship between eating restrictions and alcohol outcomes using a 10-day ecological momentary assessment (EMA) design. An EMA design typically collects multiple brief assessments throughout the course of the day, aiming to increase the validity of the data by collecting information from participants in their natural environments (Shiffman, 2007). Among a sample of college women, Buchholz et al. (2018) found that greater intentions to restrict calories on drinking days, as reported during a scheduled morning assessment, predicted greater alcohol-related consequences later that day, as reported through five randomly administered afternoon/evening assessments. Additionally, each incremental alcoholic beverage consumed increased the likelihood of eating after a drinking occasion, such that greater restrictions before drinking predicted increased eating after drinking. Further, results showed temporal mediation, such that morning intentions to restrict indirectly associated with same-day alcohol-related problems through alcohol quantity. Greater post-drinking food consumption also was associated with increased likelihood of next-day eating restrictions.

One important finding from these prospective designs suggests that intentions to restrict food on drinking days are associated with greater drinking outcomes and post-drinking eating (Buchholz et al., 2018). However, despite their additions to the literature, these daily studies were limited in that they only included female participants. Considering cross-sectional research has shown that men engage in drinking-related eating restrictions, potentially at similar rates to women (Burke et al., 2010), examining these behaviors using a prospective study with men would clarify drinking risks associated with eating restrictions and how these risks compare to risks for women. Further, because the Luce et al. (2013) study did not report on daily drinking, only one study (Buchholz et al., 2018) has examined the daily association between eating

restrictions and alcohol outcomes, and that study examined *intentions* to restrict (i.e., "How likely are you to restrict your caloric intake *today?*"), rather than measuring eating behaviors reported that day (i.e., *earlier* food restrictions). Additional prospective studies are needed to expand upon the limited research that has examined the within-person consequences of intentional drinking-related eating restrictions.

Drinking-related eating restrictions across alcohol indices. One specific limitation with existing drinking-related eating restriction research is a lack of uniformity in the measurement of alcohol use. Differences in operational definitions of alcohol use across the limited drinking-related eating restriction research make it difficult to understand exactly how eating restrictions relate to drinking outcomes. This measurement issue exists across general alcohol research as well. Studies utilize a variety of instruments to measure drinking behaviors, each able to provide different information about alcohol use (Borsari, Neal, Collins, & Carey, 2001). Typical use can be understood as alcohol quantity (i.e., total drinks consumed) or frequency (i.e., number of drinking occasions) across a reporting timespan. These measurements provide an understanding of an individual's regular patterns of use, such as how much and how often they tend to drink. However, these measures may fail to capture information about high-risk alcohol use, as higher quantity drinking occasions can be lost when reporting overall or average drinking quantity.

Examining measures of risky use, such as binge drinking (i.e., 4/5+ drinks in one occasion for women/men) and peak drinking (i.e., the highest quantity consumed on any one drinking occasion across a timespan), can provide valuable information regarding the riskiest drinking occasions (Read, Beattie, Chamberlain, & Merrill, 2008). For example, measuring binge and peak drinking allows researchers to differentiate between two individuals who report

consuming 10 drinks in the previous month. One individual may have consumed 10 drinks in one heavy-drinking episode, while another individual may have consumed one drink with dinner each night across 10 different days. One reason it can be important to examine these riskier measures of alcohol use is to understand which individuals, and which drinking days, have the highest potential for alcohol-related problems.

Aside from these risky drinking indices, researchers can directly measure the number of consequences related to alcohol use (Devos-Comby & Lange, 2008). By measuring alcohol-related consequences (e.g., blackouts, hangovers), researchers can clarify who experiences adverse consequences following alcohol use, separate from those at risk for future consequences. While measures of typical drinking, risky drinking, and alcohol-related consequences are often correlated (Read, Merrill, Kahler, & Strong, 2007; Simons, Wills, Emery, & Marks, 2015), each provides unique and valuable information to understanding drinking behaviors.

As it relates to eating restrictions, extant research has measured alcohol use in various ways. Most cross-sectional studies have examined how drinking-related eating restrictions associate with measures of typical alcohol use, finding that restrictors endorse greater typical alcohol quantity (e.g., Eisenberg & Fitz, 2014; Giles et al., 2009). However, some studies have found no relationship between typical alcohol quantity and drinking-related eating restrictions, instead finding that restrictors endorse a higher number of alcohol-related consequences (Roosen & Mills 2015; Ward & Galante, 2015). Two cross-sectional studies have examined a risky drinking index (Burke et al., 2010; Castañeda et al., 2019), finding that restrictors endorsed more binge drinking episodes than non-restrictors. Among prospective studies, Buchholz et al. (2018) measured both use (i.e., daily quantity) and alcohol-related consequences, finding that quantity mediated the daily association between intentions to restrict and alcohol consequences.

However, this study did not examine risky drinking measures (e.g., binge drinking) and included only women.

Thus, despite research examining how eating restrictions associate with various measures of typical drinking, risky drinking, and alcohol-related consequences, no studies have included a comprehensive set of alcohol indices as outcome variables. Examining a comprehensive set of alcohol indices in a single study design could clarify how drinking-related eating restrictions are associated with alcohol use, providing valuable information about the specific risks associated with eating restrictions on drinking days. As such, the current study aimed to provide a more fine-grained understanding of how drinking-related eating restrictions associate with a broad set of alcohol indices, thus potentially informing future intervention and prevention efforts among college students at risk for these behaviors.

Summary. Overall, limited research has focused on drinking-related eating restrictions despite the prevalence of these behaviors. Specifically, research suggests that a sizable minority of college students intentionally restricts their food intake on drinking days, and that both men and women use these behaviors. Students use these behaviors both to manage their weight and to enhance or accelerate getting drunk. Moreover, it is likely that food restriction contributes to greater alcohol consumption, alcohol-related consequences, and eating after a drinking occasion; however, further research could illuminate the specific ways in which restrictions correspond with alcohol use. A between-person design would permit future research to examine the specific alcohol indices related to eating restrictions and explore trait characteristics relevant to the use of drinking-related eating restrictions, while a within-person design would allow the examination of these behaviors as they occur in daily life. Therefore, examining these relationships utilizing between- and within-person designs could bolster our understanding of these behaviors.

Research Design

As noted previously, much of the extant research on drinking-related eating restrictions is limited by various aspects of study design. Specifically, the majority of our knowledge about drinking-related eating restrictions stems from between-subjects designs and retrospective cross-sectional data. These designs have a few inherent limitations. Cross-sectional, between-subject designs do not measure drinking and eating behaviors within the context of a single event, thus preventing the ability to examine how eating restrictions and drinking outcomes are associated on a given drinking episode. Examining daily associations between drinking-related eating restrictions and alcohol outcomes could clarify whether there are any unique or additional daily drinking risks associated with restricting food intake on a drinking day. Further, retrospective studies introduce potential recall bias, which may lead to less accurate self-reports relative to prospective data collection (Shiffman, 2009). Prospective, within-subjects research designs can address these limitations by examining daily associations between eating and drinking behaviors while reducing potential recall bias. However, despite the limitations, additional cross-sectional research could be useful in identifying between-subjects characteristics relevant to the combined use of heavy drinking and food restriction behaviors, a remaining gap in the literature. Therefore, both cross-sectional and prospective study designs, which together account for between- and within-subjects factors, may aid researchers in better understanding personal risk factors for restricting on drinking days, as well as the influence of drinking-related eating restrictions on alcohol outcomes.

Between-subjects. Of the limited research dedicated to drinking-related eating behaviors, the large majority of it has been examined cross-sectionally (see Table 1). These studies have mainly focused on defining drinking-related eating restrictions or similar terms

(e.g., Bryant et al., 2012) and investigating typical prevalence rates (e.g., Burke et al., 2010). For studies that examined negative consequences associated with restrictions before drinking (e.g., Eisenberg & Fitz, 2014; Giles et al., 2009), the cross-sectional design necessarily limited the conclusions. While these studies found that individuals who endorsed drinking-related eating restrictions also reported higher typical alcohol use, it was unclear whether restricting before drinking increased risks associated with alcohol use, or if, perhaps, there were other factors which contributed to both drinking-related eating restrictions and alcohol use. Though a few studies (e.g., Castañeda et al., 2019; Gorrell et al., 2019; Hunt & Forbush, 2016; Pompili & Laghi, 2018) have sought to understand who might be at greatest risk for drinking-related eating restrictions, they have looked at AUD and ED symptoms as predictors for eating restrictions on drinking days, rather than broader and potentially relevant constructs. Therefore, despite the limitations associated with between-person designs, future cross-sectional research can add to the literature by examining psychological characteristics as predictors of drinking-related eating restriction behaviors.

Within-subjects. One methodological concern regarding between-subject research is the limited ability to understand what contributes to between-person differences. In the case of drinking-related eating restrictions, a positive between-subjects correlation between eating restrictions and drinking outcomes might indicate that individuals who restrict before drinking tend to have greater alcohol use. While these findings could reflect a causal relationship such that individuals who restrict tend to drink more *because of* their eating restrictions, it could also be that typical characteristics which predict eating restrictions *also* lead to greater alcohol outcomes. That is, it could be that individuals who choose to restrict eating before drinking have characteristics which draw them to consume more alcohol regardless of whether they restrict

before drinking. In this case, restrictors would experience more negative alcohol outcomes than non-restrictors because of a difference in typical characteristics, rather than due to any unique risk associated with drinking-related eating restrictions. Between-subject research cannot parse apart whether alcohol outcomes are associated specifically with drinking-related eating restrictions or with general characteristics. Instead, one way to determine if intentional drinking-related eating restrictions are correlated with same-day alcohol outcomes is to conduct a within-subjects, prospective study design.

There are several benefits to using a within-subjects, daily design to examine how drinking-related eating restrictions are associated with alcohol use. First, as mentioned above, daily designs allow researchers to examine both between- and within-subject effects among two variables. In other words, such a study could clarify how much between-person trait differences and within-person daily differences in eating restrictions contribute to daily drinking outcomes. Second, daily data collection could test the same-day association between drinking-related eating restrictions and alcohol outcomes while limiting potential recall bias. Understanding the daily association between eating restrictions and alcohol outcomes can provide information on the daily drinking risks experienced when restricting before a drinking episode. Testing the daily association could illuminate potentially additive drinking risks associated with drinking alcohol after restricting food intake. Finally, combining between- and within-subject designs can allow researchers to explore potential moderating trait characteristics to the within-person daily associations. It could be that typical characteristics affect the strength of the relationship between drinking-related eating restrictions and alcohol outcomes, thus clarifying who is at greatest risk when restricting.

Despite the benefits of within-person, prospective designs, only two such studies have examined drinking-related eating restrictions (Buchholz et al., 2018; Luce et al., 2013). These studies are limited in that they only included women participants. Further, each study spanned just 10 days. This likely resulted in some participants reporting data over only one weekend, days typically associated with greater and more frequent alcohol use among young adults (Maggs, Williams, & Lee, 2011). Finally, neither extant daily study examined potential moderators (i.e., psychological trait factors), which could enhance the risks associated with drinking-related eating restrictions. Given the limited research utilizing within-subjects designs, additional daily diary research could compare alcohol outcomes on restricting drinking days with non-restricting drinking days, and test psychological characteristics as potential moderators to the daily relationship.

Factors Associated with Drinking-Related Eating Restrictions

Much of the research on drinking-related eating behaviors has examined the prevalence and risks associated with calorie restriction and alcohol use (e.g., Bryant et al., 2012; Burke et al., 2010; Giles et al., 2009). These findings suggest that individuals who restrict before eating may drink more alcohol (e.g., Eisenberg & Fitz, 2014), endorse more binge-drinking episodes (Burke et al., 2010), and experience greater alcohol-related consequences (e.g., Roosen & Mills, 2015) relative to drinkers who do not restrict eating. Based on the unique and additive drinking risks associated with eating restrictions, it is important to begin to understand factors which may contribute to the combined use of these behaviors. Certain psychological factors (e.g., self-control, emotion regulation, perceived weight) may help predict which individuals are more likely to restrict food intake on drinking days. Further, it is important to consider these variables as potential moderators to the relationship between drinking-related eating restrictions and

alcohol use. Conceptually, a moderator is a third variable which affects the association between the independent and dependent variables (e.g., Cohen, Cohen, West, & Aiken, 2013). Examining moderators could provide novel insight into who is at most risk for experiencing negative alcohol outcomes associated with eating restrictions. Therefore, examining these factors could help determine who is most likely to restrict before drinking and who might be at greatest risk when they do restrict.

Self-control, emotion regulation, and perceived weight are psychological traits known to be relevant to problematic drinking and eating behaviors. Although little research has examined these traits in relation to the combination of risky drinking and eating behaviors, empirical and theoretical support indicate each may be associated with drinking-related eating restrictions. Further, this group of trait-based variables influences the internal processes which determine how individuals behave in certain situations. For example, trait-based self-control informs how individuals respond to potentially unhealthy temptations (Carver & Scheier, 1982). Emotion regulation can influence how individuals cope with negative emotions (John & Gross, 2004). Finally, the way in which individuals perceive their weight relative to others contributes to how they behave in social situations (Duncan, Grant, Bucholz, Madden, & Heath, 2009). Together, examining how these trait-based psychological factors associate with drinking-related eating restrictions could further our understanding who is at greatest risk for these behaviors.

Self-control. One potential psychological factor associated with drinking-related eating restrictions is self-control. Self-control can be defined as an individual's ability to intentionally or effortfully modify or regulate internal processing to help achieve goals (Baumeister & Heatherton, 1996; Vohs, 2006). Several iterations of similar theories rely on the concept of self-control, including control theory (Carver & Scheier, 1982), choice theory (Glasser, 2010), and

self-regulation theory (Baumeister, Heatherton, & Tice, 1994). Despite variations among them, central to each of these theories is the role negative feedback plays in self-control. Glasser (2010) posits that in protective or supportive environments, most individuals can successfully behave in ways compatible with their goals. However, individuals have greater challenges behaving consistently with their goals in harmful or unsupportive environments (Barber, Munz, Bagsby, & Grawitch, 2009). Therefore, compared to individuals with higher self-control, those with lower self-control tend to be less successful at behaving in line with their goals when posed with negative environmental feedback.

Control theory may help clarify how individuals can behave in unhealthy ways despite pursuing healthy goals. For instance, individuals have limited resources to devote towards self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998). This concept, termed ego depletion (see Baumeister, 2003), posits that using effortful control to regulate one's behaviors diminishes remaining capacity for self-regulation. In other words, it is difficult to behave in accordance with all goals due to the finite resources individuals can dedicate towards self-control efforts. As such, it could be that individuals allocate self-control to top health priorities, leaving limited resources for self-regulation of lower health priorities. Further, failing to act in line with one's desires can increase the likelihood of future poor decisions, especially when confronted with choices in a challenging environment (Carver & Scheier, 1982). Therefore, individuals with lower self-control may struggle to consistently make healthy decisions, thus creating more challenging environments (e.g., health problems, risky situations) and contributing to a pattern of unhealthy behavior over time.

Self-control and drinking. Research supports self-control as a variable that contributes to alcohol use (Muraven, Collins, & Nienhaus, 2002). In an experimental setting, individuals

who were given more taxing cognitive tasks ahead of an ad libitum drinking session consumed greater amounts of alcohol compared with participants who received less strenuous tasks (Ostafin, Marlatt, & Greenwald, 2008). This could be explained by ego depletion, in that exerting greater mental demand left minimal resources to regulate drinking behaviors. Further, individuals with lower self-control may have difficulty 'saving' self-control efforts for a later task. Specifically, individuals were given an ad lib alcohol tasting session before a simulated driving task (Muraven et al., 2002). Before drinking they were informed that the highest-performing participant on the driving task would receive a cash reward, thus incentivizing reduced intoxication. Despite the incentive, individuals who scored lower on self-control measures consumed higher quantities of alcohol, whereas individuals with high self-control drank less. In an examination of drinking restraint, Collins (1993) posited that individuals with low self-control are more likely to try to intentionally limit or control their alcohol use, which in turn corresponds with greater risk for binge drinking. Similarly, among treatment-seeking men, those who met criteria for alcohol dependence had lower scores of impulse control compared to social drinkers (Fox, Hong, & Sinha, 2008). Based on its relation to alcohol use, it is important to examine self-control as it relates to drinking-related eating restrictions, as it could help clarify who is likely to restrict before drinking or at risk for greater alcohol drinking outcomes following food restrictions.

Self-control and eating behaviors. Self-control has also been examined in relation to eating behaviors. Much of the research investigating self-control and eating behaviors has focused on a similar process to substance use, such that lower levels of self-control are associated with overeating or binge eating (Smith & Robbins, 2013; Volkow, Wang, Tomasi, & Baler, 2013). Across a 30-day daily diary design, individuals with self-control deficits reported a

greater number of binge eating episodes (Nadel, 2014). Additionally, measures of self-control have been shown to be negatively associated with other disordered eating behaviors (Tangney, Boone, Baumeister, 2004). Specifically, self-control is thought to be an essential component underlying anorexia nervosa (Fairburn, Shafran, & Cooper, 1999). However, in addition to self-control being central to eating disorders (Fairburn, 2001), it may also be important to understanding subclinical levels of eating restraint. Compared to individuals with high self-control, those with low self-control have been shown to binge eat, show unhealthy restricting habits, and have poorer overall success at losing weight (Meule, Papies, & Kübler, 2012). Further, in laboratory design, individuals with low self-control were more likely to make less healthy food choices than those with higher self-control (Kahan, Polivy, & Herman, 2003). Ultimately, among individuals who desire to lose weight via dieting, those with higher self-control tend to be more successful (Crescioni et al., 2011). Taken together, empirical data illustrate the importance of self-control as it relates to dieting and other eating behaviors.

Self-control and drinking-related eating behaviors. To date, self-control has not been investigated as a contributing factor to drinking-related eating restrictions; however, there may be support for self-control as a risk factor for college students restricting on drinking days. First, as emerging adults, college students likely have still-developing self-control abilities based on the growth of vital brain regions (Casey, Jones, & Hare, 2008; Romer, Duckworth, Sznitman, & Park, 2010). In a sample of adolescents and emerging adults ages 14-22 years, older participants scored higher on measures of self-control, suggesting that self-control abilities may not be fully developed within this age range (Romer et al., 2010). Further, self-control is considered central to various eating disorders (Fairburn, 2001; Tangey et al., 2004) and subclinical unhealthy eating behaviors (Kahan et al., 2003; Meule et al., 2012), and as such may relate to eating restrictions

on drinking days. For instance, dieters with higher self-control have more success using dieting behaviors (Crescioni et al., 2011), although individuals with low self-control have been found more likely to use dieting behaviors (Keller & Hartmann, 2016). Additionally, individuals with higher impulsivity, a facet of self-control (Tangney et al., 2004), tend to consume more drinks per drinking occasion (Balodis, Potenza, & Olmstead, 2009), and as such may have greater motivation to reach intoxication. Ultimately, self-control may enable college students to successfully restrict; therefore, it may be that high self-control is associated specifically with drinking-related eating restrictions.

There may also be a reason to consider self-control as a moderator of the relationship between drinking-related eating restrictions and drinking outcomes. Self-control can be understood in terms of a tangible skill and a limited resource (Baumeister, 2003; Baumeister, Vohs, & Tice, 2007). Individuals activate a combination of energy and effort to exhibit self-control and manage their behaviors to achieve their goals. Baumeister (2003) argues that as individuals employ self-control in one domain, they necessarily deplete resources which could otherwise be devoted to self-control in other contexts. Therefore, typical self-control could help explain eating and drinking behaviors on drinking days. Specifically, individuals exert energy when they intentionally limit or reduce food intake on drinking days, which may deplete resources to regulate drinking behaviors later in the day. Although this depletion process occurs for all individuals, those with low levels of typical self-control have fewer overall resources, and as such may be at greater risk for excessive drinking after eating restriction. Further, research suggests that glucose is vital to self-control (Gailliot et al., 2007), such that the nutritional consequences of consuming fewer calories likely amplify deficits in self-control. Therefore, individuals may have trouble controlling alcohol and late-night food intake on drinking days in

which they intentionally restrict eating (Buchholz et al., 2018). In other words, deficits with self-control may not only predict eating restrictions on drinking days (Tangney et al., 2004), but they may also moderate the relationship between drinking-related eating restrictions and drinking outcomes.

Summary. Self-control is related to both alcohol use (Muraven et al., 2002) and unhealthy eating behaviors (Volkow et al., 2013). Despite a lack of empirical support related specifically to drinking-related eating restrictions, self-control has theoretical support as a relevant construct for these specific eating restrictions (Baumeister, 2003; Baumeister et al., 2007), as well as support from physiological research as a potential moderator to the restriction-drinking outcomes relationship (Gailliot et al., 2007). Therefore, it could further the understanding of drinking-related eating restrictions to test self-control as both a predictor and moderator explaining the relationship between eating restrictions and same-day drinking outcomes.

Emotion regulation. Aspects of emotional functioning may also be associated with intentional drinking-related eating restrictions. Emotion regulation can be defined as the way in which an individual processes or copes with emotional stimuli (Gross, 1998). It refers to the internal processes or skills which help an individual respond to an emotionally stimulating event. Specifically, stressors or other difficult stimuli may evoke negative emotions, and individuals respond to and cope with these negative emotions to varying degrees. Therefore, emotion regulation can encompass one's recognition and understanding of their own emotions, as well as the behaviors they use to cope with negative emotion when it arises (Gratz & Roemer, 2004). Individuals who have strong emotion regulation abilities may have more practiced, varied, and successful ways to respond to negative emotions. However, individuals who have deficits in

emotion regulation are at risk for using unhealthy and unhelpful strategies of managing emotional distress (Linehan, 1993).

Although similar to self-control (see Tice & Bratslavsky, 2000), emotion regulation is different in that efforts to regulate emotions are reactionary, whereas regulation of self-control can refer to ongoing efforts to reduce or avoid impulsive behaviors. While college drinking culture makes self-control salient for impulse control, students also experience high levels of negative affect relative to the general population (Furr, Westefel, McConnell, & Jenkins, 2001). As such, emotion regulation could be relevant to understanding unhealthy behaviors such as drinking-related eating restrictions.

Theoretical models posit that two types of strategies play into emotion regulation: reappraisal and suppression (John & Gross, 2004). *Reappraisal*, broadly, is when an individual responds to an emotional response by modifying their thoughts to incorporate and understand their emotions. These strategies may include attending to negative emotions intentionally and directly. Conversely, *suppression* refers to behavioral responses which help an individual put aside or avoid negative emotions. Suppression strategies can include behaviors which distract attention from the negative affect or even produce positive emotional responses (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Generally, reappraisal strategies are associated with long-term relief from emotional distress, whereas suppression strategies, which provide short-term relief, are not as effective at reducing negative emotions over time (Boden & Baumeister, 1997). Various behaviors, including eating and drinking, may serve as suppression strategies used to cope with emotions in place of other techniques. Therefore, it is important to consider how emotion regulation strategies relate to drinking-related eating restrictions, which

include both drinking and eating behaviors. As such, this specific behavior could serve as a suppression strategy in an attempt to regulate negative emotions.

Emotion regulation and drinking. Alcohol use is one harmful health behavior associated with deficits in emotion regulation. Research has established that emotion regulation is related to both alcohol use (Aldao & Dixon-Gordon, 2014; Berking et al., 2011) and alcohol-related consequences (Dvorak et al., 2014). Further, compared to social drinkers, alcohol-dependent individuals have been found to have relatively lower scores in measures of emotion regulation (Fox et al., 2008). Therefore, alcohol use may serve as a means to regulate negative emotions. It could be that individuals with deficits in emotion regulation drink greater quantities of alcohol as a strategy to cope with negative emotions, and experience more alcohol-related consequences as a result.

Drinking to cope with negative emotions is well-researched, and is considered a common motivation for alcohol use among college students (e.g., Holahan, Moos, Holahan, Cronkite, & Randall, 2001; Park & Levenson, 2002). While alcohol has been considered a short-term coping strategy, emotion regulation may also impact outcomes over longer periods. For instance, among adolescents with environmental risks, higher levels of emotion regulation may protect against later adult drinking outcomes (Fischer, Forthun, Pidcock, & Dowd, 2007). Together, research suggests that individuals who have difficulties regulating their emotions may in turn drink alcohol as a means to cope with negative emotions, thus increasing alcohol use and risk for alcohol-related consequences.

Emotion regulation and eating behaviors. Emotion regulation has also been examined in relation to disordered eating behaviors. When comparing a sample of young adult women with diagnosed EDs to healthy controls, those with EDs had significantly greater deficits across

several emotion processing domains (Bydlowski et al., 2005), including emotion regulation (Harrison, Sullivan, Tchanturia, & Treasure, 2010). While emotion regulation has been shown to most closely relate with binge eating behaviors and binge eating disorder (see Leehr et al., 2015), it may still play an important role with other disordered eating behaviors (e.g., restricting). For instance, emotion regulation has been shown to mediate the association between childhood abuse and later expressed symptoms of eating disorders (Burns, Fischer, Jackson, & Harding, 2012; Mills, Newman, Cossar, & Murray, 2015). Emotion regulation also helps explain part of the relationship between parent-child attachment style and later disordered eating behaviors (Van Durme, Braet, & Goossens, 2015). Further, cross-sectional research has shown that individuals with anorexia nervosa, which is characterized by intentional eating restrictions, exhibit lower scores in emotion regulation compared with healthy controls (Geller, Cockell, Hewitt, Goldner, & Flett, 2000; Harrison, Sullivan, Tchanturia, & Treasure, 2009). Additionally, a 20-month prospective study found that adolescent girls who experienced greater negative affect and had difficulties regulating emotion at baseline had a significantly greater risk of reporting symptoms of bulimia nervosa at two follow-up time points (Stice, 2001). Collectively, research supports emotion regulation as an important variable to consider in relation to various disordered eating behaviors.

Emotion regulation and drinking-related eating behaviors. Minimal research has looked at how emotion regulation is related to both drinking and eating behaviors, and many of the studies which include both behaviors look that them separately, rather than considering drinking-related eating behaviors specifically (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Pompili & Laghi, 2017). Recently, two studies examined how emotion regulation associates with drinking-related eating restrictions. In one study with a sample aged 16-21 years,

emotion regulation was found to predict drinking-related eating restrictions for men, such that deficits in emotion regulation were associated with greater restricting behaviors, though there was no relationship found between emotion regulation and drinking-related eating restrictions for women (Pompili & Laghi, 2018). The authors had predicted this same relationship among women, suggesting that drinking-related eating restrictions might be used as a means to cope with negative emotions. To understand their null findings among women, they noted that women typically develop adaptive coping strategies at an earlier age than men (Nolen-Hoeksema, 2012), such that they may have been utilizing healthier strategies to address negative emotions. The authors replicated these findings with a younger sample of adolescents (Laghi, Pompili, Bianchi, Lonigro, & Baiocco, 2019). Given the preliminary support for emotion regulation as a predictor for drinking-related eating restrictions among adolescent men, further research in college populations could increase the understanding of emotion regulation's role with women restrictors.

It also may be important to assess emotion regulation as a potential moderator to the eating restrictions-alcohol outcomes link. From a theoretical perspective, the tension reduction hypothesis (TRH; Cappell & Herman, 1972; Greeley & Oei, 1999), a common model utilized to understand alcohol use, provides support for emotion regulation's role in drinking-related eating restrictions. The TRH posits that individuals drink alcohol to alleviate psychological distress, such that drinking behaviors are used to reduce or regulate negative affect. Therefore, drinkers who have less adaptive coping skills may use drinking as a suppression strategy to address negative emotions, and may restrict calories ahead of drinking to enhance intoxication. In other words, restrictors with lower emotion regulation may be at risk for greater alcohol use following calorie restriction based on their attempt to reduce negative emotions using a combination of

eating and drinking behaviors. Research has shown that greater intoxication is a motivation for some individuals to restrict before drinking (Peralta, 2002; Ward & Galante, 2015), and consuming large quantities of alcohol on an empty stomach leads to a quicker rise in blood alcohol concentration (BAC; White, 2003). Individuals with lower emotion regulation abilities look for various strategies to reduce their emotional distress, such as drinking to cope (Grant, Stewart, & Mohr, 2009) and restricting calorie intake (Geller et al., 2000). Knowing that suppression strategies are often ineffective (Boden & Baumeister, 1997), it could be that restrictors with emotion regulation deficits are more likely to seek additional suppression strategies, thus increasing alcohol outcomes associated with drinking-related eating restrictions. Therefore, examining the role emotion regulation plays both in predicting who is more likely to restrict before drinking, as well as whether it moderates daily associations between eating restrictions and alcohol outcomes, may clarify present knowledge regarding drinking-related eating restrictions.

Summary. Emotion regulation is associated with drinking (Aldao & Dixon-Gordon, 2014) and disordered eating behaviors (Harrison et al., 2010). Although only one known study has looked at the relationship between drinking-related eating restrictions and emotion regulation (Pompili & Laghi, 2018), the TRH provides additional theoretical support for testing whether emotion regulation relates to drinking-related eating restrictions. Therefore, it would address a gap in the current literature to examine whether difficulties in regulating emotions contribute to drinking-related eating restrictions. Further, it could be important to examine whether emotion regulation impacts the daily relationship between drinking-related eating restrictions and subsequent drinking outcomes following those restrictions, thus clarifying who may be most at risk when drinking following eating restrictions.

Perceived weight. Another potential factor predicting drinking-related eating restrictions could be an individual's perception of their own weight. Historically, weight (or body mass) has been considered an important factor in understanding various health risks (e.g., Barry & Petry, 2009; Duncan et al., 2009; Hudson, Hiripi, Pope, & Kessler, 2007; Neumark-Sztainer et al., 2006). However, one's perception of their own weight (i.e., how an individual categorizes their own weight) can also contribute to different health risks (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), and may even be a more robust predictor of other health outcomes than actual weight or body mass (Antin & Paschall, 2011; Cash & Pruzinsky, 2004). Weight misperceptions are common among the general population, with some overestimating and others underestimating their actual weight (e.g., Brener, Eaton, Lowry, & McManus, 2004; Edwards, Pettingell, & Borowsky, 2010; Page & Allen, 1995). While the impact of an inaccurate weight perception varies from individual to individual, body dissatisfaction based on misperceived weight has been found across sexes and ethnic groups (Viner et al., 2006). Based on its prevalence and wide impact, it is important to understand how perceived weight corresponds with drinking-related eating restrictions.

Theories integral to body image also support the potential relevance of perceived weight as an important factor in understanding drinking-related eating restrictions. For one, social comparison theory (Festinger, 1954; Suls & Wills, 1991) posits that individuals often make intentional and unintentional comparisons with peers. Individuals compare themselves with others either favorably or unfavorably, and self-esteem and affect are influenced by the valence of social comparisons (Buunk, Collins, Taylor, VanYperen, & Dakof, 1990). As it relates to body image, individuals may be more likely to make upward social comparisons, comparing themselves with lower-weight individuals and feeling relatively overweight as a result

(Morrison, Kalin, & Morrison, 2004). Further, sociocultural theory stipulates that women may be particularly prone to upward comparisons in body image, based on the "skinny ideal" common in Western cultures (Morrison et al., 2004), thus increasing risk for disordered eating behaviors (Fitzsimmons-Craft et al., 2014). Therefore, one's perceived weight may be important to consider when exploring drinking-related eating restrictions, as individuals who perceive themselves to be overweight may be at greater risk for risky health behaviors to manage or lower their weight.

Perceived weight and drinking. Empirical research has demonstrated an association between perceived weight and alcohol use (e.g., Antin & Paschall, 2011; Holzhauer, Zenner, & Wulfert, 2016). In a cross-sectional sample of young adults, higher perceived body weight was correlated with a greater risk for binge drinking, while controlling for measured BMI (Antin & Paschall, 2011). In a college sample, Holzhauer et al. (2016) found that students with both higher perceived body weight and greater concern for social acceptance consumed more alcohol on average than peers with lower perceived weight and social concern. Additional cross-sectional studies (e.g., Andrew, Tiggemann, & Clarke, 2016; Littleton, Breitkopf, & Berenson, 2005; Nelson, Lust, Story, & Ehlinger, 2009) have demonstrated that young adult women with lower body satisfaction, measuring both weight and shape, typically consume greater quantities of alcohol, perhaps due to a clustering of unhealthy behaviors associated with higher perceived weight (Holzhauer et al., 2016) or as a product of lower self-esteem (Fonseca, Matos, Guerra, & Pedro, 2009). These relationships appear to begin before young adulthood, as adolescents who perceive themselves as overweight are more likely to drink alcohol, even after controlling for measured weight (Fonseca et al., 2009; Wild, Flisher, Bhana, & Lombard, 2004). Dissatisfaction with body weight and shape, a broader measure than perceived weight, also has been linked with

higher rates of substance use among adolescents (Palmqvist & Santavirta, 2006). Although the majority of weight perception and drinking literature is conducted among women, young adult health outcomes related to body image are often similar between men and women (Gillen, 2015). Together, the research suggests that individuals who perceive themselves as heavier, regardless of their actual weight, may be at increased risk for heavy drinking and other substance use.

Perceived weight and eating behaviors. Weight perception is central to body satisfaction and eating behaviors (Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002; Thompson et al., 1999; Tylka, 2004). Unsurprisingly, perceiving oneself as overweight is predictive of body dissatisfaction (Durkin & Paxton, 2002), which in turn can contribute to unhealthy dieting, restricting, and compensatory eating behaviors (Levine & Murnen, 2009). Therefore, how one perceives their own weight and body is important to understand when examining unhealthy eating behaviors. Prospective studies have found that concerns about being overweight are predictive of subsequent ED diagnoses (Keel, Baxter, Heatherton, & Joiner, 2007; Killen et al., 1996; Neumark-Szainer et al., 2006). Specifically, longitudinal studies have shown that greater concern regarding one's weight was linked with increased likelihood for disordered eating behaviors four (Killen et al., 1996) and five years later (Neumark-Sztainer et al., 2006). Similarly, across a 20-year period, higher weight perceptions and increased dieting were each associated with greater disordered eating symptomology, even when controlling for measured weight (Keel et al., 2007). In summary, perceiving oneself to be heavy is associated with greater disordered eating behaviors, such as restricting calories.

Perceived weight and drinking-related eating behaviors. Perceived weight and body satisfaction may also help to explain drinking-related eating restrictions. Peralta (2002) observed a theme across his qualitative data that suggested drinking-related eating restrictions were a

means for students to partake in college drinking culture without sacrificing their drive to achieve or maintain the thin ideal. More recent research has echoed Peralta's work, suggesting that men and women restrict on drinking days to enhance intoxication and manage weight (Piazza-Gardner & Barry, 2014; Ward & Galante, 2015). Individuals who express greater concern with their weight are more likely to report drinking-related eating restrictions (Buchholz et al., 2018; Eisenberg & Fitz, 2014; Giles et al., 2009). Further, use of weight control behaviors following drinking occasions (i.e., next-day exercise or eating restrictions) are positively associated with calorie restriction before drinking (Barry, Whiteman, Piazza-Gardner, & Jensen, 2013; Davis, Riley, Smith, Milich, & Burris, 2017; Piazza-Gardner & Barry, 2013). For these compensatory behaviors, the motivation is less ambiguous, as next-day behaviors can serve to reduce or burn calories but cannot impact intoxication. Therefore, it is likely that weight concerns are central reasons for compensatory behaviors related to alcohol use, including same-day drinking-related eating restrictions. As such, individuals who perceive themselves to be overweight may be more likely to restrict on drinking days.

Weight perceptions may also play a role in the risks associated with drinking-related eating restrictions. Peralta (2002) hypothesized that college students restrict before drinking to balance competing social norms of drinking culture and the thin ideal. It could be that individuals with heavier perceived weight more regularly make social comparisons. In other words, they may be more sensitive to and observant of social expectations and norms, which contribute to their perceptions of being overweight. Therefore, these same individuals may be more likely to try to meet the social expectations of college drinking culture. For those who perceive themselves to be overweight, it could be that the social comparisons which contribute to eating restrictions exacerbate the drinking risks associated with calorie restriction, based on an

increased desire to meet social expectations within the college drinking culture. As such, individuals who perceive themselves to be overweight may be at risk for restricting food intake before a drinking episode, and subsequently experiencing greater alcohol-related harms.

Summary. Perceived weight is integral to the development and use of disordered eating behaviors (Tylka, 2004) and is associated with alcohol use (Antin & Paschall, 2011). Although weight perception has not been examined as a specific predictor of drinking-related eating restrictions, both qualitative (Peralta, 2002; Piazza-Gardner & Barry, 2013) and quantitative research (Eisenberg & Fitz, 2014; Giles et al., 2009; Ward & Galante, 2015) indicate that concern for weight gain is a primary motivation associated with eating restrictions on drinking days. Therefore, examining perceived weight as a predictor for drinking-related eating restrictions could clarify who is most at risk for this behavior. Additionally, it may be important to consider how perceived weight impacts the relationship between drinking-related eating restrictions and alcohol consequences, as it could be that individuals who perceive themselves as heavier are at greater risk for alcohol-related consequences after restricting.

Current Study

The overall aim of the current research was to broaden understanding of drinking-related eating restrictions, their association with alcohol use, and psychological factors relevant to these eating restrictions. Toward this end, there were five primary goals. The first was to examine between-person sources of variability in intentional drinking-related eating restrictions as they related to various alcohol indices. We examined how typical drinking-related eating restrictions associated with typical alcohol indices to inform and clarify what aspects of drinking behavior were related to eating restrictions. Second, we examined within-person sources of variability between drinking-related eating restrictions and various alcohol indices. To investigate within-

person variability, we used data collected from a 14-day daily diary study to examine whether drinking outcomes were predicted by within-person differences in same-episode eating restrictions. The third main goal was to test key psychological trait factors (i.e., self-control, emotion regulation, perceived weight) and sex as potential risk factors predicting typical drinking-related eating restriction behaviors. As a fourth goal, trait self-control, emotion regulation, perceived weight, and sex also were examined as potential moderators to the daily associations between intentional drinking-related eating restrictions and same-episode drinking outcomes in order to assess which factors may exacerbate the drinking risks associated with eating restrictions. Finally, we explored whether daily motivations for drinking-related eating restrictions impacted the same-day alcohol outcomes.

The current research contributes to the literature on drinking-related eating restrictions in several ways. First, the dataset utilized for the present study included both cross-sectional (i.e., collected at baseline) and daily diary data (i.e., collected daily for 14 consecutive days). One major gap in prior research in this area is that most studies have used cross-sectional designs, which are able to test only between-subject effects. The current data permitted us to examine between-subject effects using baseline data and within-subject effects using daily diary data. Thus, the current study not only tested associations between the variables of interest, but also examined daily associations between drinking-related eating restrictions and drinking outcomes. As only the third known study examining within-person variability in drinking-related eating restrictions, the present study adds to the literature by clarifying the unique risks associated with calorie restrictions on drinking days. Further, examining the relationship between reasons for restricting food and subsequent alcohol outcomes illuminates risks associated with various reasons for restricting.

Second, the present study examined drinking-related eating restrictions in relation to comprehensive set of alcohol indices. Testing various alcohol indices (i.e., typical use, risky use, alcohol-related consequences) allowed us to clarify the specific ways in which drinking is associated with same-episode eating restrictions. Understanding the specific risks associated with drinking-related eating restrictions provides a more fine-grained understanding of this risky health behavior, potentially clarifying whether and how individuals who restrict food before drinking experience greater alcohol outcomes.

Third, the study tested four trait factors as potential moderators to explore who is at risk to restrict calories on drinking days and for whom drinking-related eating restrictions may be associated with heightened alcohol-related consequences. Investigating these trait variables aimed to expand the current understanding of drinking-related eating restrictions, as no studies had examined moderating variables to date. Better understanding the characteristics associated with drinking-related eating restrictions sheds light not only on who is most likely to use these risky behaviors, but also relevant traits to target with intervention efforts.

Finally, the study included both men and women participants. Of the extant research (see Table 1), including both published prospective designs (Buchholz et al., 2018; Luce et al., 2013), a portion is conducted with women. While women likely exhibit these behaviors more frequently than men (Hunt & Forbush, 2016), men are known to report drinking-related eating restrictions (e.g., Bryant et al., 2012; Eisenberg & Fitz 2014) and, as such, the present study adds to the literature for college men. By testing for sex differences, this study helps clarify the specific, within-person risks for men who restrict before drinking. Additionally, findings helped shape the understanding about whether drinking-related eating restrictions, associated risks, and reported reasons for restricting present differently for women and men.

Study Aims

Between-subject, baseline associations.

Aim 1. To examine the association between drinking-related eating restrictions and various alcohol indices assessed over the past year (i.e., typical drinking quantity, typical drinking frequency, binge drinking status, number of binge drinking days, peak number of drinks, alcohol-related consequences). While several studies have examined the associations between drinking-related eating restrictions and specific drinking outcomes, such as alcohol quantity (Eisenberg & Fitz, 2014), self-reported level of intoxication (Giles et al., 2009), the odds of reporting heavy drinking episodes (Burke et al., 2010), no research has examined the relationship between drinking-related eating restrictions and a comprehensive set of alcohol indices (i.e., measures of typical drinking, risky drinking, and alcohol-related problems). Further, extant research examining typical drinking measures reveals conflicting results (e.g., Bryant et al., 2012; Eisenberg & Fitz, 2014). Therefore, by testing how drinking-related eating restrictions relate with several alcohol measures, the present study was able to clarify in what ways and to what extent eating restrictions correlated with drinking.

Hypothesis 1. Based on prior research showing that typical drinking-related alcohol restrictions associate with higher alcohol outcomes (e.g., Eisenberg & Fitz, 2014; Giles et al., 2009), it was predicted that participants who reported intentional drinking-related eating restrictions would consume a greater quantity of alcohol, report drinking on more days, be more likely to report a binge drinking episode, report a greater number of binge drinking days, report a greater peak number of standard drinks than non-restrictors, and experience a greater number of alcohol-related consequences.

Aim 2. To examine between-person characteristics contributing to drinking-related eating restrictions. Few studies have investigated factors accounting for who engages in drinking-related eating restrictions. Of those, most have sought to examine whether ED symptoms or AUD symptoms better predict drinking-related eating restrictions (Pompili & Laghi, 2018) or "drunkorexia" behaviors, more generally (e.g., Hunt & Forbush, 2016). Therefore, examining psychological traits (i.e., self-control, emotion regulation, perceived weight) and sex related to drinking-related eating restrictions added to our understanding of the potential factors that could place an individual at risk for drinking-related eating restrictions and their associated harms.

Aim 2a. To test the association between *self-control* and typical drinking-related eating restriction behaviors.

Hypothesis 2a. Experimental studies have demonstrated that lower self-control leads to greater ad lib alcohol use (Muraven et al., 2002), while cross-sectional research has shown deficits in self-control are associated with binge- and overeating (Volkow et al., 2013). Further, longitudinal research shows that higher self-control is associated with more successful weight loss through dieting behavior (Crescioni et al., 2011). Therefore, it was predicted that self-control would be positively associated with typical drinking-related eating restrictions, such that participants with higher self-control would be more likely to endorse typical restrictions on drinking days.

Aim 2b. To test the association between *emotion regulation* and typical drinking-related eating restriction behaviors.

Hypothesis 2b. Cross-sectional research has demonstrated that deficits in emotion regulation are associated with increased alcohol consumption (Aldao & Dixon-Gordon, 2014),

greater alcohol-related consequences (Dvorak et al., 2014), disordered eating behaviors (Mills et al., 2015), and drinking-related eating restrictions (Pompili & Laghi, 2018). Further, individuals who rely on suppression strategies to cope with negative affect often do so using a variety of behaviors (Mauss et al., 2005). Therefore, it was predicted that emotion regulation would be negatively associated with typical drinking-related eating restrictions, such that participants with lower emotion regulation would be more likely to endorse typical restrictions on drinking days.

Aim 2c. To test the association between *perceived weight* and typical drinking-related eating restriction behaviors.

Hypothesis 2c. Individuals who perceive themselves as overweight also report greater alcohol consumption (Antin & Paschall, 2011) and use of compensatory eating restrictions (Levine & Murnen, 2009). Further, balancing the competing social expectations of college drinking and body image may serve as motivation for drinking-related eating restrictions (Peralta, 2002; Ward & Galante, 2015). Therefore, it was predicted that perceived weight would be positively associated with typical drinking-related eating restrictions, such that participants who perceived themselves to be heavier would be more likely to endorse typical restrictions on drinking days.

Aim 2d. To test the association between *sex* and typical drinking-related eating restriction behaviors.

Hypothesis 2d. Epidemiological research has demonstrated consistent differences in prevalence and risks of alcohol use (Holmila & Raitasalo, 2005) and disordered eating behaviors (Hoek & Van Hoeken, 2003) between men and women. Further, cross-sectional studies examining drinking-related eating restrictions show women endorsing greater use of restrictions

(e.g., Eisenberg & Fitz, 2014). Therefore, it was predicted that women would be more likely than men to endorse typical drinking-related eating restrictions.

Within-subject, daily associations.

***Aim 3*:** To examine the prospective link between daily drinking-related eating restrictions and same-episode alcohol outcomes (i.e., alcohol quantity, alcohol-related consequences, likelihood of binge episode, post-drinking food consumption). Only two studies to date have examined drinking-related eating restrictions using a prospective design (Buchholz et al., 2018; Luce et al., 2013). While each has added to the literature, neither addressed how drinking-related eating restrictions associate with various same-episode drinking indices. Doing so would allow researchers to conclude the specific drinking risks associated with same-day eating restrictions. Therefore, the current study aimed to clarify the unique risks associated with drinking days with eating restrictions. Understanding these specific risks could inform college campus intervention and education efforts by targeting the particular alcohol outcomes associated with eating restrictions.

Hypothesis 3. Intentions to restrict eating have been shown to predict greater same-day alcohol quantity, while alcohol quantity also predicted same-day post-drinking food consumption (Buchholz et al., 2018). The present study examined eating restriction behaviors from the prior day, thus furthering the Buchholz et al. (2018) study, which measured *intentions* to restrict calories before drinking (without asking whether participants restricted as they intended). Therefore, it was predicted that, among all drinking days, days with drinking-related eating restrictions would be associated with higher same-day alcohol quantity, alcohol-related consequences, likelihood of a binge drinking episode, and post-drinking food consumption.

Aim 4. To test between-subject psychological trait factors and sex moderating the daily association between intentional drinking-related eating restrictions and alcohol outcomes. Given preliminary support that drinking-related eating restrictions are associated with higher-risk drinking outcomes, Aim 4 sought to examine between-subject psychological variables (i.e., self-control, emotion regulation, perceived weight) as well as sex to identify individuals most at risk when engaging in drinking-related eating restriction behaviors at the daily level.

Aim 4a. To test *self-control* as a between-subject moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4a. Self-regulation theory posits that dedicating energy towards self-control for one task (e.g., eating restrictions) necessarily depletes the remaining resources to dedicate towards self-control for another task (e.g., drinking; Baumeister, 2003). Therefore, it was predicted that lower between-person self-control will strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Aim 4b. To test *emotion regulation* as a between-subject moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4b. Individuals with emotion regulation deficits tend to use suppression strategies, which are often ineffective, to avoid negative emotions (Boden & Baumeister, 1997; John & Gross, 2004). Therefore, individuals who restrict before drinking and have lower emotion regulation abilities may be more likely to engage in additional suppression strategies, such as greater alcohol use. As such, it was predicted that lower between-person emotion regulation would strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Aim 4c. To test *perceived weight* as a between-subject moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4c. Body image research suggests that social factors contribute to the link between perceived weight (i.e., perceiving oneself to be underweight, overweight, etc.) and eating restrictions (Morrison et al., 2004). It could be that individuals who restrict calories to meet the social expectations of ideal body weight may be at risk for drinking more to meet the college drinking culture norms. Therefore, it was predicted that higher between-person perceived weight would strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Aim 4d. To test *sex* as a between-subject moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4d. Drinking-related eating restriction behaviors may be more common among women than men (e.g., Burke et al., 2010; Bryant et al., 2012; Eisenberg & Fitz, 2014), however findings are mixed (Ward et al., 2015; Wilkerson et al., 2017). Despite this discrepancy, Ward and Galante (2015) found that men endorsed stronger motives for restricting on drinking days and consumed less alcohol on days in which they *did not* restrict, relative to women. In other words, not engaging in eating restriction on drinking days may serve as a stronger protective strategy for men than women regarding subsequent alcohol outcomes. As such, it could be that men who restrict before drinking are at risk for higher same-day alcohol outcomes. Therefore, it was predicted that daily association between drinking-related eating restrictions and alcohol outcomes would be stronger for men such that eating restrictions would associate with greater alcohol outcomes.

Aim 5. To explore whether daily alcohol outcomes (i.e., alcohol quantity, alcohol-related consequences, likelihood of binge episode, post-drinking food consumption) differ based on the same-day reason for restricting food before drinking (i.e., to minimize calorie intake, to get drunk faster). Qualitative (Peralta, 2002, Piazza-Gardner & Barry, 2014) and quantitative studies (e.g., Ward & Galante, 2015) have consistently found that calorie management and enhanced intoxication are primary reasons for college students to engage in drinking-related eating restrictions. No known studies have examined whether the reasons for using eating restrictions on drinking days impact the risks associated with same-day drinking. Based on a lack of previous research, we had no basis for a directional hypothesis, and Aim 5 was considered exploratory.

CHAPTER II

METHOD

Study Overview

The current study is a secondary analysis of an archival dataset that was collected between February 2014 and November 2015 at Old Dominion University. The study design included two phases. Phase I consisted of a 45-60 minute online survey with the purpose of studying health behaviors of college students. Phase II comprised 14 daily diary surveys, which participants completed online in approximately 5-10 minutes. Participants from Phase II were a subset of eligible and interested Phase I participants (see Figure 1).

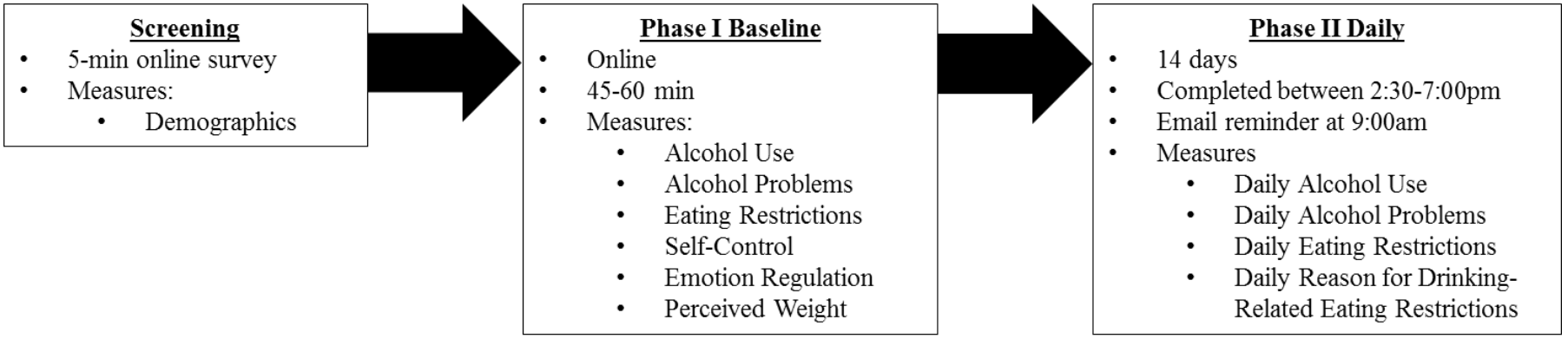

Figure 1. Study procedures.

Participants

All participants were undergraduate students recruited through Old Dominion University via the psychology research pool. Interested participants completed a brief, online screening to determine eligibility for Phase I. To be eligible for Phase I, participants must have been 1) between the ages of 18 and 25, 2) currently enrolled in at least one college course, and 3) have consumed alcohol at least once in the prior month. Overall, 1133 participants completed the Phase I baseline assessment. To be eligible for the Phase II daily diary portion of the study, participants who completed Phase I must have had reliable internet access for the 14-day timeframe. Of the 397 Phase I participants eligible and interested in completing Phase II of the study, 250 completed at least 1 of 14 daily follow-up surveys and 227 completed at least 2 of 14 surveys. Based on the present aims, participants who completed at least two daily surveys were included in the final sample (Black, Harel, & Matthews, 2012), and thus the final sample included 227 participants (see Figure 2).

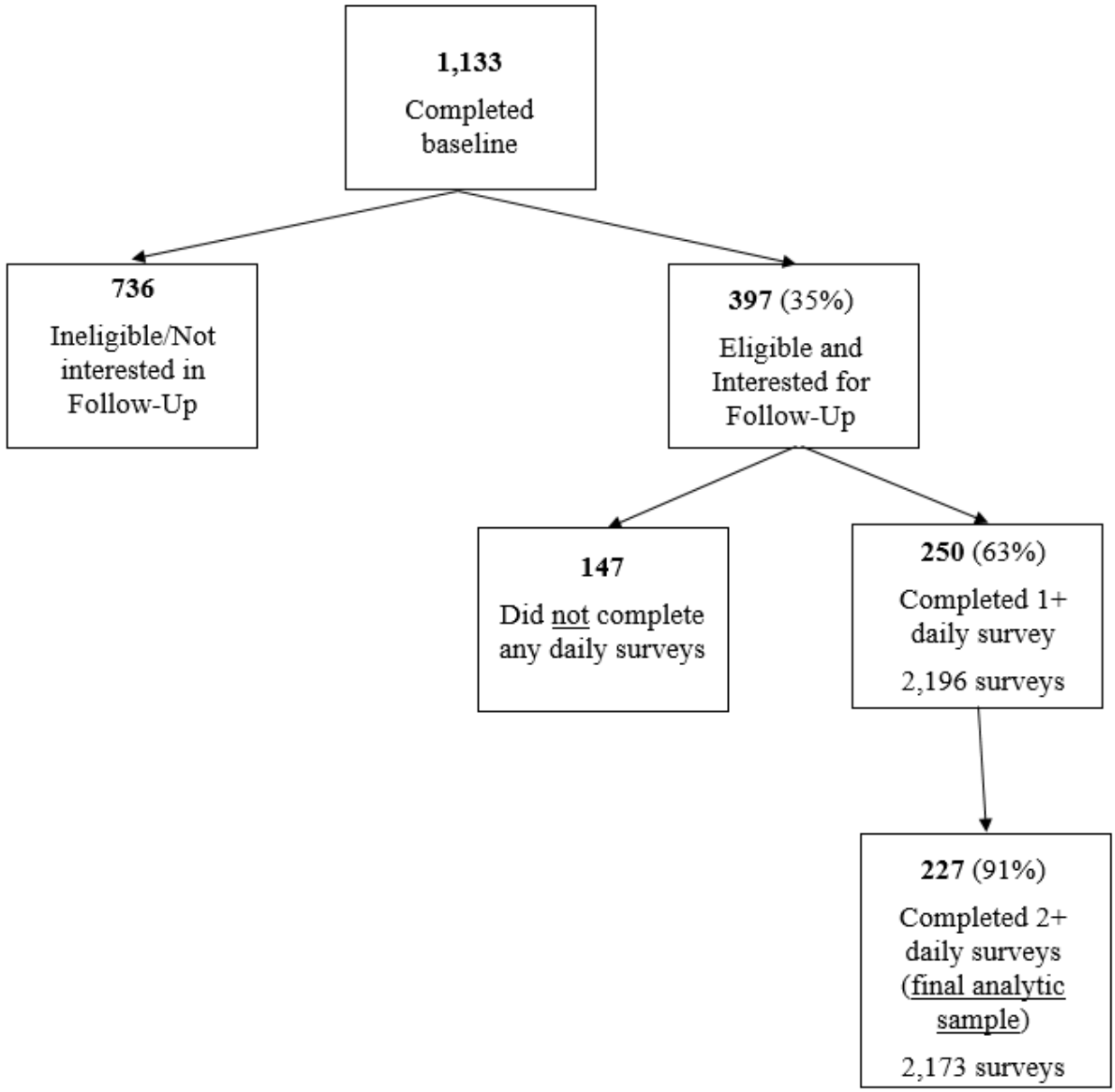

Figure 2. Study flow chart.

The final sample consisted of 227 (180 women, 79.3%) participants. The mean age was 20.64 (*SD* = 2.01) years; 48.5% of participants were under the age of 21. Class standing was 25.9% freshman, 15.6% sophomore, 26.8% junior, and 31.7% senior. Ethnicity was 47.6% Caucasian/White, 37.4% African American/Black, 5.7% self-reported "other" or multiracial, 4.4% Asian/Pacific Islander, 3.1% Hispanic/Latinx, and 1.8% Native American/Indian. The plurality was not employed (42.7%); others were employed part-time (40.5%) or full-time (16.3%). Most participants reported a yearly individual income of less than $10,000 (77.2%), followed by $10,001 to $20,000 per year (17.0%), $20,001 to $40,000 per year (4.5%), and $40,001 to $60,000 per year (1.3%). The majority was single or never married (89.0%); others were living with a partner (5.3%), married (4.0%), separated/divorced (1.3%), or widowed (0.4%).

Procedure

Participant screening. Prior to Phase I, participants completed a brief, online screening survey. The purposes of screening were to 1) determine eligibility, 2) provide study purpose, and 3) obtain informed consent. Participants were asked demographic questions (e.g., age, student status) and about typical alcohol use. Eligible and interested participants were directed to the Phase I survey to complete immediately.

Phase I baseline assessment. The purpose of Phase I was to study the health behaviors of college students. Specifically, participants in Phase I were asked questions about physical activity, diet, weight-related issues, substance use, and sexual behaviors. The online survey took approximately 45-60 minutes to complete, and participants received 1.0 SONA credits for completing the Phase I survey. At the conclusion of Phase I, participants were screened for their eligibility and interest in completing the Phase II daily portion of the study. In addition to

meeting Phase I eligibility criteria, participants needed consistent internet access across the 14-day period to be eligible for Phase II.

Phase II daily diary assessments. Following Phase I, eligible participants were emailed a web survey link to initiate the 14-day daily diary assessments for Phase II. Participants were instructed to begin Phase II (i.e., to complete the first daily survey) within two weeks of their Phase I baseline assessment, thus ensuring all Phase II assessments (i.e., 14 days) were completed within, at most, four weeks of the Phase I assessment. Participants were sent two emails (one each of the first two weeks following their Phase I assessments) inviting them to the initiate the Phase II portion. After the two-week timeline, participants were no longer eligible to complete the Phase II assessments.

For Phase II, participants were asked to complete a brief, 5-10 minute survey each day for 14 consecutive days. During the 14-day period, participants were sent a daily email reminder at 9:00 am to complete the daily questionnaire with a link to the online survey. They were instructed to take the survey each day between 2:30-7:00 pm in order to ensure consistent response times. In the daily assessments, participants provided information about the day they completed the survey and the previous day. Daily variables of interest in the present investigation measure *yesterday's* behavior. In other words, participants reported whether or not they consumed alcohol the previous day/night and provided information regarding prior-day drinking and eating habits. To encourage completion, participants were compensated $10 and 2.5 SONA credits for completing at least 12 of the 14 surveys. Participants who completed 7 to 11 surveys received 1.0 SONA credit, while participants who completed fewer than 7 surveys were not compensated.

Measures

Screening. A general background questionnaire assessed demographic information, such as sex, age, ethnicity, and class standing (Appendix A). Participants also reported height and weight, from which body-mass index (BMI) was calculated.

Phase I: baseline assessment.

Alcohol use. Alcohol use was assessed using the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985; Appendix B). Participants reported the number of standard drinks they consumed each day of a typical week averaged over the past year. Five drinking indices were calculated from the DDQ: quantity (i.e., total drinks reported in a typical week), frequency (i.e., total reported drinking days in a typical week), binge drinking status (i.e., based on the presence/absence of at least one binge drinking day), binge frequency (i.e., total number of binge drinking days in a typical week), and peak drinks (i.e., the highest number of drinks reported on a single day). The DDQ has been found to have adequate test-retest reliability (r = .72; Collins et al., 1985). The DDQ also has adequate convergent validity with collateral reports of participants' alcohol use over a one-year study (r = .72; Marlatt et al., 1998).

Alcohol-related consequences. The Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong & Colder, 2006; Appendix C) measured negative consequences related to drinking. The YAACQ has 48 items, on which participants responded "*yes*" or "*no*" to indicate whether they experienced each alcohol-related problem within the past year. Sample items include "I have gotten into physical fights because of drinking," and "I have awakened the day after drinking and found that I could not remember a part of the evening before." All items are summed into a total, with higher scores representing a greater number of reported negative consequences. The YAACQ has been shown to have strong internal consistency ($.79 < \alpha < .86$)

and high test-retest reliability (r = .86; Read et al., 2006), be predictive of actual alcohol-related consequences (Read et al., 2007), and have convergent validity (r = .79) with the Rutgers Alcohol Problems Inventory (RAPI; White & Labouvie, 1989). Internal consistency for the present study was .94.

Typical drinking-related eating restrictions. Drinking-related eating restrictions were measured using the Eating and Alcohol Use Questionnaire (EAUQ; Lloyd-Richardson, Lucero, DiBello, Jacobson, & Wing, 2008; Appendix D). In line with cross-sectional studies in the literature (e.g., Burke et al., 2010; Eisenberg & Fitz, 2014; Giles et al., 2009), a single item was used to assess drinking-related eating behaviors. Considering the past 30 days, participants responded to the question "how much food do you eat *before* starting to drink alcohol that day?" Responses were coded from 1 (*much more than usual)* to 3 (*my eating habits do not change*) to 5 (*much less than usual*). For the present study, participants were categorized into two groups: restrictors (i.e. endorsed eating at least somewhat less than usual on drinking days; coded as -1) and non-restrictors (i.e., endorsed no change or eating more than usual; coded as 1). While the 13-item EAUQ is a validated measure, and more recently a scale to measure "drunkorexia" behaviors was created (Rahal, Bryant, Darkes, Menzel, & Thompson, 2012), no extant scales or subscales specifically measure food restriction before consuming alcohol on a drinking day.

Self-control. Self-control was assessed using the Brief Self-Control Scale (BSCS; Tangey et al., 2004; Appendix E). On the 13-item scale, participants were asked how much each statement reflects themselves on a scale from 1 (n*ot at all*) to 5 (*very much*). Sample items include "I refuse things that are bad for me," and "Sometimes I can't stop myself from doing something, even if I know it is wrong," and a total score is created from all items. Higher overall scores reflect greater levels of self-control. The BSCS has shown strong internal consistency (α

= .89) and three-week test-retest reliability (*r* = .89; Tangney et al., 2004), and subsequent research has demonstrated convergent validity with other measures of self-control (Maloney, Grawitch, & Barber, 2012; Morean et al., 2014). Internal consistency for the present study was .82.

Emotion regulation. Emotion regulation was assessed with the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003; Appendix F). The ERQ is a 10-item scale, in which participants indicated how much they agreed with each statement regarding emotional expression and experiences from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample items include "When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about," and "I control my emotions by not expressing them." Higher overall scores indicate greater emotion regulation ability. The ERQ has adequate three-month test-retest reliability (*r* = .69) and has been demonstrated to show convergent validity with measures of emotional avoidance (Kashdan, Barrios, Forsyth, & Steger, 2006). Internal consistency in the present study was .73.

Perceived weight. Perceived weight was assessed using a single-item, which asked "What of the following do you believe best describes your current weight?" Responses options were: 1 (*underweight*), 2 (*normal weight*), 3 (*overweight*), and 4 (*obese*). Prior research (e.g., Brener et al., 2004; Edwards et al., 2010; Eichen, Conner, Daly, & Fauber, 2012) has measured weight perceptions using a similar continuous measure (Appendix G).

Phase II: daily diary assessments.

Daily alcohol measures. Participants were asked to report the number of alcoholic drinks they consumed the previous day (Appendix H). That is, they were asked the number of beers, glasses of wine, shots, and mixed drinks consumed the night before. Participants were provided with standard drink definitions and picture examples to inform their response. Daily

prospective reports have been found to be reliable (Gmel & Rehm, 2004), and have been demonstrated in the target population (Linden-Carmichael & Lau-Barraco, 2017).

Daily alcohol-related consequences. Alcohol-related problems were assessed with the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler, Strong, & Read, 2005; Appendix I), which contains a subset of 24 items from the YAACQ. Participants responded yes (1) and no (0) to indicate whether they had experienced for each item the previous night. Responses were summed to reflect the number of alcohol-related harms experienced from the previous day's drinking episode. This measure has been used in daily study designs to examine within-person variability in alcohol-related consequences (e.g., Linden-Carmichael & Lau-Barraco, 2017; Pearson, D'Lima, & Kelley, 2013).

Daily drinking-related eating restrictions. Eating restrictions before drinking episodes were measured using a single-item adapted from the EAUQ to gather daily data (Lloyd-Richardson et al., 2008; Appendix J). Specifically, participants responded to the question "How much food did you eat yesterday before starting to drink alcohol?" Each response regarding a drinking episode yesterday was coded as either restriction before drinking (-1) or no restriction before drinking (1). This procedure was guided by precedent from Buchholz et al., (2018), who measured same-day intentions to restrict (rather than *yesterday's* restriction behaviors).

Daily reasons for drinking-related eating restrictions. Reasons for eating less than usual on a drinking day were assessed using a single-item adapted from the EAUQ to gather daily data (Lloyd-Richardson et al., 2008; Appendix J). Participants were asked "If you ate **less** than usual yesterday before you drank, why?" Response options were in line with previous literature regarding frequent reasons for restricting on drinking days (e.g., Peralta, 2002; Ward &

Galante, 2015), and were coded as follows: to minimize your caloric intake (1), to get drunk faster (2), and both (3).

Daily post-drinking eating. Daily post-drinking eating behaviors were measured using an adaptation from the EAUQ (Lloyd-Richardson et al., 2008; Appendix J). Specifically, participants responded to the question "How much food did you eat *after you had been drinking* before you went to sleep yesterday?" Responses ranged from 1 (*much more than usual*) to 3 (*my eating habits did not change*) to 5 (*much less than usual*). This single-item measure has been used in a daily context to examine overall caloric intake on drinking days (Buchholz et al., 2018).

CHAPTER III

RESULTS

Power Analysis

A power analysis was conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the necessary participants to detect an effect for study Aim 4. Aim 4 tested psychological trait factors (i.e., self-control, emotion regulation, perceived weight) and sex as moderators to the daily association between drinking-related eating restrictions and same-day alcohol outcomes. Aim 4 was chosen for the power analysis because testing Aim 4 required moderation analysis, therefore a sample size large enough to detect any true effect for Aim 4 would have also been sufficiently large to detect a true effect for Aims 1, 2, 3, and 5, which utilized regression and ANOVA analyses (Hayes, 2017).

Based on .80 power and a conservative, small estimated effect size of .2 (derived from Buchholz et al., 2018), it was estimated that approximately 65 participants would be required to test moderation in a cross-sectional sample. However, to test moderation in a daily diary design (Aim 4), I used the formula put forth by West, Ryu, Kwok, and Chan (2011). The formula requires intraclass correlation coefficient (ICC) estimates to compute the necessary sample size. ICCs determine how much daily measurement is attributable to within-person and between-person variance. It is measured on a scale from 0 to 1, with lower scores (i.e., below .5) indicating within-person variability has a greater impact on daily measurements while higher score (i.e., above) indicating between-person variability is more responsible for daily measurements. Neither study examining drinking-related eating restrictions in a daily context reported ICCs (Buchholz et al., 2018; Luce et al., 2013). However, other daily studies have found between- and within-person variability to be similarly important in measures of daily

eating restraint (ICC = .56; Kelly & Stephen, 2016) and daily fruit consumption (ICC = .46; Conner, Brookie, Richardson, & Polak, 2015). Using the G*Power estimate of 65 participants and a conservative ICC of .4, West et al.'s (2011) formula determined a sample of approximately 30 participants would be adequate to detect effects using a 14-day daily diary design. Therefore, the present sample of 227 participants, which exceeded sample sizes for prior similar daily designs (Buchholz et al., 2018; Luce et al., 2013), had adequate power to detect any small effects.

Data Cleaning

All analyses were conducted using HLM 7.03 software and SPSS 25. Aims 1 and 2, which analyzed baseline data exclusively, were conducted in SPSS. Aims 3, 4, and 5 were analyzed using HLM. Due to the nested nature of the data, two datasets were created: (1) a dataset for all level 1 variables at the daily level and (2) a dataset for all level 2 variables at the person level.

Prior to conducting analyses, data were cleaned. First, participants who completed fewer than 2 daily reports were removed from all analyses, resulting in 227 participants used in each analysis. Second, the data were addressed for missingness. For baseline measures, no participants exceeded 5% missingness across all items within measures. Therefore, no data were missing after sum scores were totaled. For the daily portion of the study, all 227 participants completed at least 2 out of 14 daily reports, for a total 2,173 out of a possible 3,178 surveys (68%). Of the completed daily surveys, participants reported drinking *yesterday* on 417 days (19% of all daily reports). For daily measures, missing data were deleted listwise, which is the default approach to handling missing data in HLM software. As such, HLM analyses are generally resilient to missing data because individuals who complete fewer or incomplete daily

reports have less influence on outcome variables.

Statistical assumptions were addressed prior to conducting analyses (Raudenbush, 2004). First, normality was assessed using histograms, examining skewness and kurtosis, and assessing outliers using boxplots. Among baseline variables, only DDQ quantity and DDQ peak number of drinks were non-normal, each with positive skew and kurtosis. All daily variables were normally distributed. Second, outliers were addressed. Among baseline variables, seven outliers were present for DDQ quantity, six outliers were present for DDQ peak number of drinks, two outliers were present for YAACQ total problems, and five outliers were present for BMI. These extreme outliers beyond 3 *SD* were winsorized to match the next highest data point for that variable (Barnett & Lewis, 1994). Third, all main effects and interaction terms were centered to reduce the potential for multicollinearity. Level 1 predictors were group-mean centered (e.g., to reflect the daily score relative to that person's typical score) and level 2 predictors were grand-mean centered (e.g., to reflect the participant's baseline score relative to the entire sample's mean). Fourth, HLM analyses assessed different types of outcome variables using the appropriate distributions. A Bernoulli distribution was specified for all dichotomous outcomes (i.e., whether someone binge-drank yesterday) and a Poisson distribution was specified for continuous outcomes (i.e., number of drinks consumed). Finally, for Aims 3, 4, and 5, variance components of each model were examined to determine whether they should be treated as fixed or random effects. For each model, random variance components were nonsignificant, therefore these effects were fixed. Unit-specific models with robust standard errors were reported for all HLM analyses.

Variability in Study Outcomes

To determine how much variability could be explained by within-person differences, the intraclass correlation coefficient (ICC) was calculated for drinking-related eating restrictions. For multilevel analyses, values should be neither too close to 0 (i.e., fluctuations are entirely *within*-persons) nor too close to 1 (i.e., fluctuations entirely *between*-persons; Preacher, Zyphur, & Zhang, 2010). Overall, there was a moderate amount of variability in the predictor variable (i.e., drinking-related eating restrictions). Drinking-related eating restrictions' ICC was .1691; thus, 16.91% of the variability in daily drinking-related eating restrictions could be explained by between-person differences, whereas 83.09% was due to within-person variability. Therefore, analyzing drinking-related eating restrictions across days allowed us to examine the factors (e.g., within-person) that account for the majority of these behaviors over time.

Statistical Analyses for Study Aims

Aim 1. Aim 1 was to examine the association between drinking-related eating restrictions and various alcohol indices assessed over the past year (i.e., typical drinking quantity, typical drinking frequency, binge drinking status, number of binge drinking days, peak number of drinks, alcohol-related consequences; see Figure 3).

Hypothesis 1. It was predicted that participants who reported intentional drinking-related eating restrictions would consume a greater quantity of alcohol, report drinking on more days, be more likely to report a binge drinking episode, report a greater peak number of standard drinks, and experience a greater number of alcohol-related consequences than non-restrictors.

Findings. To assess Aim 1, drinking-related eating restriction was the predictor variable, coded as -1 (eat less on drinking days) or 1 (eating behaviors unchanged on drinking days). Therefore, analyses examined whether restrictors and non-restrictors differed on outcome

measures. An analysis of variance (ANOVA) found that restrictors reported higher DDQ scores than non-restrictors, indicating greater typical alcohol consumption [$F(1,149) = 7.444$, $p = 0.007$]. Further, ANOVAs showed that restrictors reported a higher number of drinking days [$F(1, 149) = 13.667$, $p < .001$], a greater number of binge drinking days [$F(1, 149) = 4.927$, $p = .028$], and a higher number of drinks on their peak night of drinking [$F(1, 149) = 6.035$, $p = .015$] than non-restrictors. A chi-square test revealed that restrictors were also more likely than non-restrictors to report a binge drinking episode over the timespan [$\chi 2\ (151) = 5.07$, $p = .024$]. Finally, an analysis of covariance (ANCOVA) demonstrated that restrictors experienced a greater number of problems than non-restrictors, while controlling for typical alcohol quantity [$F(1, 148) = 5.585$, $p = .019$]. See Tables 2 and 3 for drinking variable descriptive statistics based on restriction status and sex, respectively.

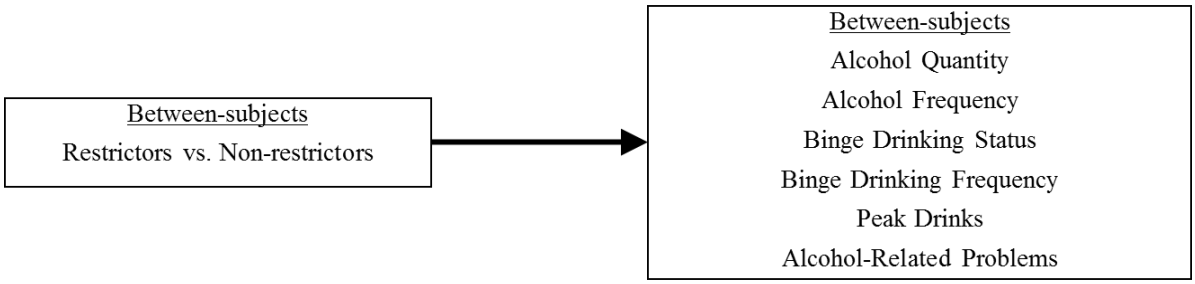

Figure 3. Aim 1. Proposed model of between-subject associations of drinking-related eating restrictions and alcohol outcomes (i.e., alcohol quantity, alcohol frequency, binge drinking status, binge drinking frequency, peak drinks, and alcohol-related problems).

Table 2

Baseline Drinking Variable Statistics by Restrictor Status

Variable	Restrictors n=26 *M* (*SD*)	Non-Restrictors n=125 *M* (*SD*)
DDQ Quantity**	12.42 (11.26)	7.42 (7.84)
DDQ Frequency***	3.50 (2.21)	2.25 (1.41)
DDQ Peak Drinks*	5.40 (3.82)	3.60 (3.32)
DDQ Binge Frequency*	1.23 (1.27)	0.72 (1.02)
DDQ Likelihood Binge*	n=16 (61.5%)	n=47 (37.6%)
YAACQ*	13.62 (9.63)	7.46 (7.86)

Note. Baseline participants who endorsed eating *more* than usual on drinking days where not included in this table. DDQ = Daily Drinking Questionnaire (measuring drinks in a typical week); Likelihood Binge = number (percentage) of participants who endorsed at least one binge drinking day (4/5+ drinks for women/men); YAACQ = Young Adult Alcohol Consequences Questionnaire (measuring problems over the past year). *$p < .05$, **$p < .01$, ***$p < .001$.

Table 3

Baseline Drinking Variable Statistics by Sex

Variable	Female n=179 *M* (*SD*)	Male n=47 *M* (*SD*)
DDQ Quantity*	8.12 (7.45)	12.71 (13.05)
DDQ Frequency	2.59 (1.69)	2.43 (1.57)
DDQ Peak Drinks*	3.88 (3.14)	5.80 (5.19)
DDQ Binge Frequency*	0.88 (1.13)	1.09 (1.30)
DDQ Likelihood Binge	n=82 (45.6%)	n=24 (51.1%)
YAACQ	8.92 (8.63)	8.91 (8.66)

Note. DDQ = Daily Drinking Questionnaire (measuring drinks in a typical week); Likelihood Binge = number (percentage) of participants who endorsed at least one binge drinking day (4/5+ drinks for women/men); YAACQ = Young Adult Alcohol Consequences Questionnaire (measuring problems over the past year). *$p < .01$.

Aim 2a. Aim 2a was to test the association between self-control and use of typical drinking-related eating restriction behaviors (see Figure 4).

Hypothesis 2a. It was predicted that self-control would be positively associated with typical drinking-related eating restrictions, such that participants with higher self-control would be more likely to endorse typical restrictions on drinking days.

Findings. Logistic regression examined whether levels of self-control (IV) were related to typical drinking-related eating restrictions (DV). Analysis revealed that participants who reported higher self-control were less likely to have changed their eating habits on drinking days. In other words, lower self-control was associated with greater likelihood of reporting drinking-related eating restriction behavior (B = .057, Wald = 4.290, p = .038).

Aim 2b. Aim 2b was to test the association between emotion regulation and use of typical drinking-related eating restriction behaviors.

Hypothesis 2b. It was predicted that emotion regulation would be negatively associated with typical drinking-related eating restrictions, such that participants with lower emotion regulation would be more likely to endorse typical restrictions on drinking days.

Findings. Using the same analytic approach, logistic regression revealed a non-significant relationship between emotion regulation and typical drinking-related eating restriction behaviors (B = .057, Wald = .737, p = .391).

Aim 2c. Aim 2c was to test the association between perceived weight and use of typical drinking-related eating restriction behaviors.

Hypothesis 2c. It was predicted that perceived weight would be positively associated with typical drinking-related eating restrictions, such that participants who perceived themselves to be heavier would be more likely to endorse typical restrictions on drinking days.

Findings. In line with prior weight perception research (e.g., Antin & Paschall, 2011), self-reported BMI was entered as a covariate for this binomial regression analysis. Findings revealed a non-significant relationship between typical perceived weight and drinking-related eating restriction behaviors when controlling for BMI [$\chi 2$ (149) = 6.224, p = .101].

Aim 2d. Aim 2d was to test the association between sex and typical drinking-related eating restriction behaviors.

Hypothesis 2d. It was predicted that women would be more likely than men to endorse typical drinking-related eating restrictions.

Findings. For this aim, a chi-square test examined whether sex (0 = male, 1 = female) was related to the likelihood of typical drinking-related eating restrictions (0 = non-restrictor, 1 = restrictor). Findings revealed a non-significant relationship between sex and typical drinking-related eating restrictions [$\chi 2$ (151) = .035, p = .853]. See Table 4 for descriptive statistics for Aim 2 variables.

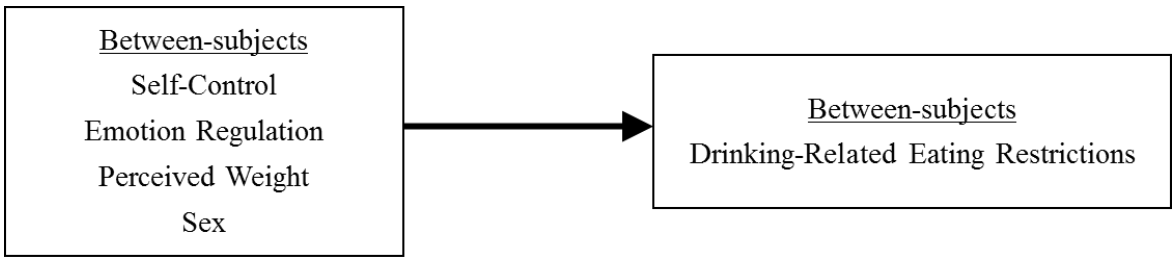

Figure 4. Aim 2. Proposed model of between-subjects psychological trait (i.e., self-control, emotion regulation, and perceived weight) and demographic (i.e., sex) factors predicting baseline drinking-related eating restrictions.

Table 4

Baseline Psychological Variable and Sex Statistics by Restrictor Status

Variable	Restrictors n=26 *M* (*SD*)	Non-Restrictors n=125 *M* (*SD*)
BSCS*	40.04 (6.29)	44.00 (9.02)
ERQ	42.20 (8.30)	43.77 (8.33)
Perceived Weight	2.36 (0.57)	2.39 (0.69)
Sex	n=20 (76.9%)	n=95 (75.2%)

Note. Number listed for sex is number of female participants and the percentage of female participants in the group (i.e., percentage of all restrictors who are female). BSCS = Brief Self-Control Scale (measuring self-control); ERQ = Emotion Regulation Questionnaire (measuring emotion regulation). *$p < .05$.

Aim 3. Aim 3 was to examine the prospective link between daily drinking-related eating restrictions and same-episode alcohol outcomes (i.e., alcohol quantity, alcohol-related consequences, likelihood of binge episode, post-drinking food consumption; see Figure 5).

Hypothesis 3. It was predicted that, among all drinking days, days with drinking-related eating restrictions would be associated with higher same-day alcohol quantity, alcohol-related consequences, likelihood of a binge drinking episode, and post-drinking food consumption.

Findings. HLM analyses tested whether daily drinking-related eating restrictions were associated with greater levels of same-episode alcohol outcomes. For each outcome variable, typical alcohol use quantity at level 2 was input into the model as a control. For example:

$$\text{TotalDrinks}_{ti} = \pi_{00} + \pi_{10}(\text{Restriction}_{ti}) + \pi_{01}(\text{Drinks}_{\text{Avg}}) + e_{ti} + r$$

For the continuous level 1 outcome variables (i.e., alcohol quantity, alcohol-related consequences, and post-drinking eating), a Poisson distribution was used to account for zero inflation. Results indicated that daily alcohol use quantity was greater on drinking days in which participants used drinking-related eating restrictions before drinking, Event Rate Ratio (ERR) = 0.645, CI = 0.457-0.910. The number of alcohol-related consequences was not found to be related to whether participants reported intentional drinking-related eating restrictions, ERR = 0.648, CI = 0.398-1.057. Finally, contrary to the hypothesis, participants reported eating less than usual post-drinking food on days in which they exhibited intentional drinking-related eating restrictions before drinking, ERR = 1.136, CI = 1.034-1.249.

For dichotomous level 1 outcome variables (i.e., whether or not drinking episode met binge criteria), a Bernoulli distribution was used to account for zero inflation. Results indicated that participants were more likely to report a binge drinking episode on days in which they also reported intentional drinking-related eating restrictions, Odds Ratio (OR) = 0.298, CI = 0.122-

0.725. Participants were also more likely to experience *at least one* alcohol-related consequence on days in which they exhibited intentional drinking-related eating restrictions, OR = 0.265, CI = 0.124-0.567. See Table 5 for full results.

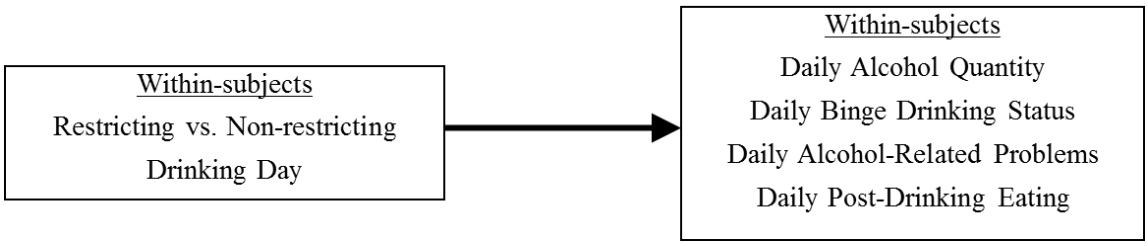

Figure 5. Aim 3. Proposed model of within-subject associations of drinking-related eating restrictions and alcohol outcomes (i.e., alcohol quantity, binge drinking status, alcohol-related problems, post-drinking eating).

Table 5

Multilevel Models of Drinking-Related Eating Restrictions Predicting Daily Drinking Outcomes

	Number of Drinks ERR (CI)	Whether Negative Problem Occurred (Y/N) OR (CI)	Number of Negative Problems ERR (CI)	Whether Binge Episode (Y/N) OR (CI)	Late Night Eating ERR (CI)
Intercept	**2.09 (1.83-2.39)*** **	**0.67 (0.46-0.96)***	**0.56 (0.38-0.81)****	**0.15 (0.09-0.26)*** **	**1.88 (1.80-1.97)*** **
Level 1: Day level					
DRER	**0.64 (0.46-0.91)***	**0.26 (0.12-0.57)*** **	0.64 (0.40-1.06)	**0.30 (0.12-0.73)****	**1.14 (1.03-1.25)****
Level 2: Person level					
Baseline Alcohol Use	**1.02 (1.01-1.03)*** **	1.02 (0.98-1.05)	1.02 (1.00-1.05)	**1.06 (1.03-1.09)*** **	1.00 (1.00, 1.01)

Note. Negative problems measured using Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ). Binge episode defined as 4+/5+ drinks reported for females/males. ERR = Event Rate Ratio, OR = Odds Ratio. *$p < .05$, **$p < .01$, ***$p < .001$. Significant effects are bolded.

Aim 4a. Aim 4a was to test self-control as a between-subjects moderator of the daily association between drinking-related eating restrictions and alcohol outcomes (see Figure 6).

Hypothesis 4a. It was predicted that lower between-person self-control would strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Findings. Separate multilevel models analyzed whether each level 1 outcome (i.e., alcohol quantity, alcohol-related consequences, likelihood of binge episode, post-drinking food consumption) was predicted by level 1 eating restrictions, level 2 self-control, and their cross-level interaction. Level 2 typical alcohol quantity was included as a control variable. Level 1 variables were group-mean centered and level 2 variables were grand-mean centered. As with Aim 3, a Poisson distribution was used to account for zero inflation for continuous outcome variables and a Bernoulli distribution was used for dichotomous outcomes. Below is a sample equation (similar equations used for all Aim 4 analyses):

$$\text{TotalDrinks}_{ti} = \pi_{00} + \pi_{10}(\text{Restriction}_{ti}) + \pi_{01}(\text{Selfcontrol}_{ti}) + \pi_{20}(\text{Restriction}_{ti} \text{ X } \text{Selfcontrol}_{ti}) + \pi_{02}(\text{Drinks}_{\text{Avg}}) + e_{ti} + r$$

Of the outcome variables, only the likelihood of a binge-drinking day was significantly predicted by the interaction of self-control and drinking-related eating restrictions (see Table 6 for full Aim 4 results). Follow-up simple slope analyses were conducted to compare the slopes of the level 1 drinking-related eating restriction-alcohol association at -1 SD, mean, and +1 SD of level 2 self-control to reveal the nature of the moderation relationship. Results revealed that individuals with average (B = -0.41, SE = 0.13, p = 0.002) and below average levels of self-control (B = -1.35, SE = 0.13, $p < 0.001$) were more likely to report a binge drinking episode on days in which they endorsed drinking-related eating restrictions. However, individuals with

above average levels of self-control were less likely to report a binge drinking episode on days in which they endorsed drinking-related eating restrictions, $B = 0.53$, $SE = 0.21$, $p = 0.012$.

Aim 4b. Aim 4b was to test emotion regulation as a between-subjects moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4b. It was predicted that lower between-person emotion regulation would strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Findings. Similar to Aim 4a, separate multilevel models analyzed whether each level 1 outcome was predicted by level 1 eating restrictions, level 2 emotion regulation, and their cross-level interaction. Results revealed no significant interaction effects for any of models, therefore no simple slope analyses were conducted as follow-up (see Table 6).

Aim 4c. Aim 4c was to test perceived weight as a between-subjects moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4c. It was predicted that higher between-person perceived weight would strengthen the daily association between drinking-related eating restrictions and alcohol outcomes such that eating restrictions would associate with greater alcohol outcomes.

Findings. Similar to Aims 4a and 4b, separate multilevel models analyzed whether each level 1 outcome was predicted by level 1 eating restrictions, level 2 perceived weight, and their cross-level interaction. For these models, level 2 BMI was included as an additional control variable, as is common in perceived weight research (Antin & Paschall, 2011). Results revealed no significant interaction effects for any of models, therefore no simple slope analyses were conducted as follow-up (see Table 6).

Aim 4d. Aim 4d was to test sex as a between-subject moderator of the daily association between drinking-related eating restrictions and alcohol outcomes.

Hypothesis 4d. It was predicted that the daily association between drinking-related eating restrictions and alcohol outcomes would be stronger for men such that eating restrictions would associate with greater alcohol outcomes.

Findings. Similar moderation analyses were conducted for this aim. Separate multilevel models analyzed whether each level 1 outcome was predicted by eating restrictions (level 1), sex (level 2), and their cross-level interaction. Results revealed that the interaction between sex and drinking-related eating restrictions significantly predicted daily alcohol quantity, number of problems, and the likelihood of a binge episode (Table 6). Simple slope analyses were conducted to reveal the nature of the moderation relationships.

For the model predicting daily alcohol quantity, simple slope analyses revealed that women consumed more alcohol on days in which they endorsed restricting behaviors, $B = -0.36$, $SE = 0.14$, $p = 0.012$. However, there was no significant relationship between daily restriction behaviors and alcohol quantity among men, $B = 0.03$, $SE = 0.12$, $p = 0.839$.

For the model predicting daily alcohol-related problems, simple slope analyses revealed that women experienced a greater number of problems on days in which they endorsed restricting behaviors, $B = -0.46$, $SE = 0.22$, $p = 0.036$. However, men experienced fewer problems on days in which they restricted, $B = 0.56$, $SE = 0.03$, $p < 0.001$.

For the model predicting the likelihood of a binge drinking episode, simple slope analyses revealed that women were more likely to have a binge-drinking episode on days in which they endorsed restricting behaviors, $B = -0.70$, $SE = 0.39$, $p = 0.044$. However, there was

no significant relationship between daily restriction behaviors and binge drinking episodes among men, $B = 0.45$, $SE = 0.30$, $p = 0.136$.

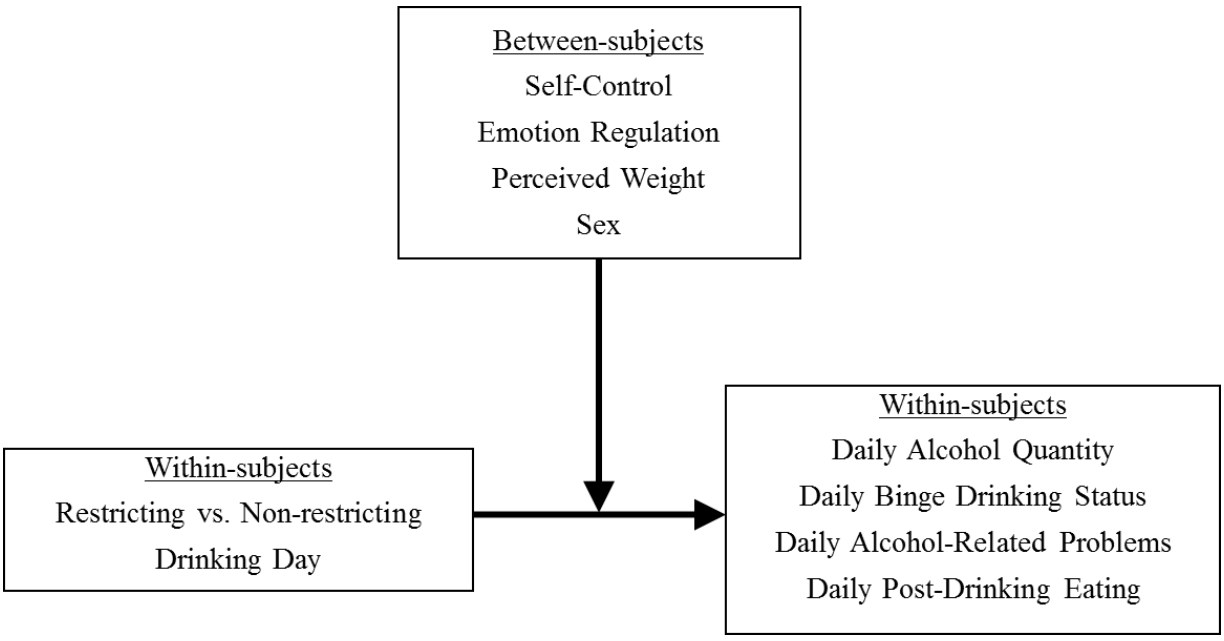

Figure 6. Aim 4. Proposed model of within-subject association of drinking-related eating restrictions and alcohol outcomes (i.e., alcohol quantity, binge drinking status, alcohol-related problems, post-drinking eating), as moderated by between-subject psychological (i.e., self-control, emotion regulation, and perceived weight) and demographic (i.e., sex) factors.

Table 6

Multilevel Models of Drinking-related Eating Restrictions and Prospective Moderators Predicting Daily Drinking Outcomes

	Number of Drinks ERR (CI)	Number of Problems ERR (CI)	Whether Binge Drink (Y/N) OR (CI)	Late Night Eating ERR (CI)
Intercept	**3.28 (2.73-3.95)*****	0.81 (0.54-1.23)	**0.36 (0.17-0.77)****	**1.44 (1.19-1.75)*****
Level 1: Day level				
DRER	**0.75 (0.60-0.94)***	0.71 (0.47-1.08)	0.65 (0.29-1.48)	**1.37 (1.12-1.68)****
DRER x Self-Control	1.02 (1.00-1.04)	1.01 (0.96-1.07)	**1.12 (1.03-1.22)****	1.01 (0.99-1.04)
Level 2: Person level				
Baseline Self-Control	0.98 (0.96-1.00)	0.95 (0.90-1.01)	**0.91 (0.84-0.99)***	0.99 (0.96-1.02)
Baseline Alcohol Use	**1.02 (1.01-1.03)*****	1.00 (0.97-1.03)	**1.06 (1.02-1.09)****	1.00 (1.00-1.01)
Intercept	**3.42 (2.74-4.27)*****	0.85 (0.56-1.28)	**0.43 (0.22-0.85)***	**1.47 (1.21-1.75)*****
Level 1: Day level				
DRER	**0.72 (0.55-0.93)***	0.70 (0.46-1.07)	0.53 (0.26-1.10)	**1.35 (1.12-1.64)****
DRER x Emotion Regulation	1.00 (0.98-1.02)	1.01 (0.93-1.10)	1.05 (0.96-1.14)	1.00 (0.97-1.03)
Level 2: Person level				
Baseline Emotion Regulation	1.00 (0.98-1.02)	1.00 (0.93-1.07)	0.96 (0.88-1.04)	1.00 (0.97-1.03)
Baseline Alcohol Use	**1.02 (1.01-1.03)*****	1.02 (0.99-1.04)	**1.06 (1.03-1.09)*****	1.00 (1.00-1.01)
Intercept	**3.43 (2.77-4.24)*****	0.82 (0.55-1.21)	**0.47 (0.24-0.94)***	**1.42 (1.19-1.69)*****
Level 1: Day level				
DRER	**0.71 (0.56-0.92)****	0.73 (0.48-1.10)	**0.47 (0.22-1.00)***	**1.38 (1.15-1.67)*****
DRER x Perceived Weight	1.00 (0.59-1.71)	2.10 (0.89-4.99)	1.14 (0.29-4.64)	0.77 (0.58-1.02)
Level 2: Person level				
Baseline Perceived Weight	0.89 (0.57-1.41)	0.50 (0.19-1.32)	0.43 (0.11-1.76)	**1.40 (1.04-1.87)***
Baseline Alcohol Use	**1.02 (1.01-1.03)*****	1.02 (0.99-1.04)	**1.06 (1.03-1.10)*****	1.00 (1.00-1.01)
Baseline BMI	1.00 (0.98-1.03)	0.99 (0.91-1.09)	1.06 (0.95-1.17)	1.00 (0.98-1.00)
Intercept	**2.24 (1.49-3.36)*****	**0.25 (0.13-0.48)*****	**0.08 (0.03-0.20)*****	**2.31 (1.37-3.90)****
Level 1: Day level				
DRER	1.02 (0.981-1.30)	**1.76 (1.65-1.87)*****	1.57 (0.87-2.86)	0.87 (0.51-1.48)
DRER x Sex	**0.68 (0.48-0.98)***	**0.35 (0.23-0.55)*****	**0.32 (0.12-0.82)***	1.58 (0.91-2.77)

Continued

	Number of Drinks ERR (CI)	Number of Problems ERR (CI)	Whether Binge Drink (Y/N) OR (CI)	Late Night Eating ERR (CI)
Level 2: Person level				
Sex	**1.58 (1.;00-2.48)***	**3.80 (1.82-7.92)*****	6.71 (2.08-21.65)**	0.62 (0.36-1.07)
Baseline Alcohol Use	**1.02 (1.01-1.03)*****	1.02 (0.99-1.0)	1.07 (1.04-1.11)***	1.00 (1.00-1.01)

Note. OR = Odds Ratio; ERR = Event Rate Ratio; CI = confidence interval; DRER = drinking-related eating restrictions. Significant effects are bolded.

*$p < .05$. **$p < .01$. ***$p < .001$.

Aim 5. Aim 5 was to explore whether daily alcohol outcomes (i.e., alcohol quantity, alcohol-related consequences, likelihood of binge episode, post-drinking food consumption) differed based on the same-day reasons for restricting food before drinking (i.e., to minimize calorie intake, to get drunk faster; see Figure 7). Because this aim was exploratory, no hypothesis was made.

Findings. Participants who endorsed drinking-related eating restrictions were asked *why* they intentionally restricted before drinking. Participants were coded as 1 (to minimize your caloric intake), 2 (to get drunk faster), or 3 (both) based on their response. A qualitative option labeled "other" was also available, and participants who selected this were able to enter their reason into an open text box.

Of the 76 drinking days in which participants reported drinking-related eating restriction behaviors, 31 (40.8%) reported it was to minimize caloric intake, 15 (19.7%) reported it was to get drunk faster, 3 (3.9%) reported it was for both of these reasons, and 27 (35.5%) endorsed "other" reasons. Qualitative responses to "other" reasons were coded into thematic categories. The author and a colleague separately coded responses. Following separate coding, results were compared. No discrepancies were found. See Table 7 for results.

Due to the categorical nature of this question, the low distribution of responses for "both," and the array of options for "other," it was determined that the method to best determine whether reasons for restricting impacted alcohol outcomes was to compare participants who endorsed minimizing caloric intake (coded as 0) with those who endorsed getting drunk faster (coded as 1). Sample analysis equations were similar to the previous two aims:

$$\text{TotalDrinks}_{ti} = \pi_{00} + \pi_{10}(\text{Reasons}_{ti}) + \pi_{01}(\text{Drinks}_{\text{Avg}}) + e_{ti} + r$$

No significant differences in alcohol outcomes were observed when comparing these reasons for endorsing drinking-related eating restrictions (see Table 8).

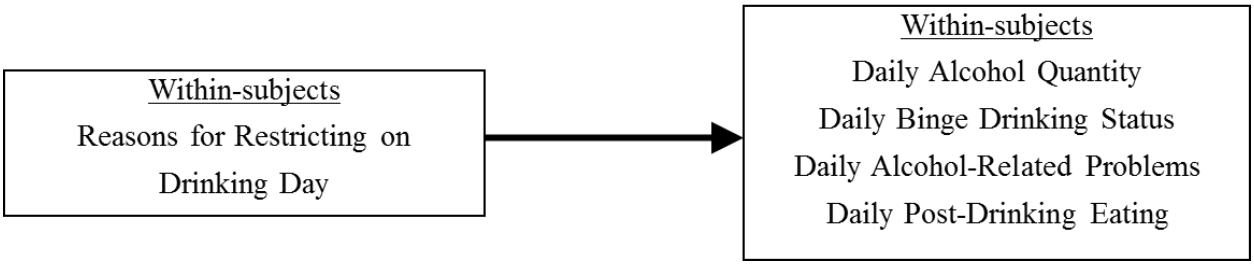

Figure 7. Aim 5. Proposed model of within-subject associations of reasons for drinking-related eating restrictions and alcohol outcomes (i.e., alcohol quantity, binge drinking status, alcohol-related problems, post-drinking eating).

Table 7

Qualitative Responses to Reasons for Drinking-Related Eating Restrictions

Category	N (%)
Too Busy/No Time to Eat	10 (13.2%)
Not Hungry	7 (9.2%)
Forgot to Eat	4 (5.3%)
On a Diet	2 (2.6%)
No Access to Food	2 (2.6%)
No Specific Reason Given	2 (2.6%)

Note. All participants included in this table responded "other" and then entered free response options as their reasons for endorsing drinking-related eating restriction behaviors. Percentages listed are in relation to total 76 responses.

Table 8

Multilevel Models of Reasons for Drinking-Related Eating Restrictions Predicting Daily Drinking Outcomes

	Number of Drinks ERR (CI)	Whether Negative Problem Occurred (Y/N) OR (CI)	Number of Negative Problems ERR (CI)	Whether Binge Episode (Y/N) OR (CI)	Late Night Eating ERR (CI)
Intercept	**2.94 (2.12-4.08)****	1.71 (0.55-5.38)	1.24 (0.66-2.33)	**0.27 (0.07-0.97)***	**1.40 (1.03-1.90)***
Level 1: Day level					
Reasons for DRER	1.44 (0.78-2.66)	1.28 (0.22-7.59)	2.29 (0.97-5.40)	2.93 (0.38-22.40)	1.02 (0.97-1.02)
Level 2: Person level					
Baseline Alcohol Use	1.02 (1.00-1.05)	**1.11 (1.02-1.20)***	1.01 (0.99-1.04)	1.05 (0.97-1.14)	1.00 (0.97-1.02)

Note. Reasons coded as to minimize calories (0) and to get drunk faster (1). Negative problems measured using Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ). Binge episode defined as 4+/5+ drinks reported for females/males. ERR = Event Rate Ratio, OR = Odds Ratio. *$p < .05$, **$p < .001$. Significant effects are bolded.

CHAPTER IV

DISCUSSION

Problematic drinking (Johnston et al., 2016) and eating behaviors (Eisenberg et al., 2011) have been well-documented among college students for decades. More recently, research has examined the combination of these behaviors, such that some individuals intentionally restrict their eating before they consume alcohol (e.g., Burke et al., 2010: Peralta, 2002). This phenomenon, referred to here as *drinking-related eating restrictions*, has been linked with greater alcohol consumption (Buchholz et al., 2018; Peralta & Barr, 2017) and alcohol-related problems (Buchholz et al., 2018; Roosen & Mills, 2015). However, with limited research to date, much remains unknown about who engaged in these behaviors and the associated risks with restricting. The current study sought to address gaps in the literature by examining 1) how typical drinking-related eating restriction behaviors relate to a comprehensive set of alcohol indices, 2) how within-person differences in drinking-related eating restriction behaviors relate with daily drinking outcomes, 3) how psychological variables (i.e., self-control, emotion regulation, perceived weight) and sex associate with drinking-related eating restriction behaviors, and 4) whether the endorsed reason(s) for drinking-related eating restriction behavior correspond with different alcohol outcomes.

Drinking-related Eating Restrictions and Drinking Outcomes

Between-person differences. Between-person analyses found drinking-related eating restrictions to be associated with each of the drinking indices examined. In other words, participants who endorsed past month drinking-related eating restrictions consumed more alcohol and exhibited higher-risk drinking (i.e., higher number of alcohol-related problems, more likely to report a binge episode, higher number of drinks consumed on peak drinking occasion)

than their non-restricting peers. These findings are in line with hypotheses. There are several possible explanations for this phenomenon.

One possible reason for the observed relationship could be that individuals who use drinking-related eating restrictions are riskier drinkers than non-restrictors, and that restricting behaviors are just one behavioral marker of this greater risk. Much of the literature suggests that a primary motivation for restricting before drinking is to enhance intoxication (e.g., Martin et al., 2016; Peralta, 2002; Roosen & Mills, 2015). For individuals looking to get more intoxicated or get drunk faster, restricting simply enables them to achieve their goals related to intoxication. In this case, drinking-related eating restrictions could be conceptually similar to pre-gaming (Read, Merrill, & Bytschkow, 2010) or playing drinking games (Borsari, 2004), which help higher-risk drinkers consume more alcohol and increase intoxication. This explanation for drinking-related eating restrictions necessarily puts an emphasis on the drinking aspect of the behavior, in that it assumes restricting food only serves to enable greater intoxication.

The biological effects of calorie restriction before drinking could also explain the significant differences between restrictors and non-restrictors. Specifically, restricting food intake before a drinking episode leads to an increase in the rate at which BAC rises (White, 2003) and the peak BAC achieved (Jones, 2000) as compared to consuming the same quantity of alcohol on a full stomach. Increased BAC is also indirectly linked with more alcohol-related problems experienced on a drinking occasion (Neal & Carey, 2007). Further, BAC is linked with decision-making and executive functioning. Experimental studies have shown that individuals with higher BAC are more likely to want to continue drinking (Weafer & Fillmore, 2008) and make riskier decisions (e.g., risky sex; Davis et al., 2009). As such, restrictors who intend only to minimize calorie intake, and who may not be purposefully looking for a high-

quantity drinking night, could still end up consuming more alcohol and experiencing more consequences as a result of increased BAC from drinking on an empty stomach. Although we did not directly or indirectly examine BAC in the current study, these biological effects could help explain Aim 1 results. Based solely on cross-sectional data, however, it remains unclear what contributes to the differences between restrictors and non-restrictors.

Within-person differences. Some of the limitations from cross-sectional analyses were addressed in Aim 3, which examined drinking-related eating restrictions over a 14-day period. This allowed us to explore potential within-person differences in how drinking-related eating restrictions impact alcohol outcomes. Prior to interpreting model results, it is important to address the within-person variability of drinking-related eating restrictions. For restricting behaviors, the ICC was .1691. Therefore, over 83% of the variability in drinking-related eating restrictions across the 14-day period was attributable to within-person differences. Drinking-related eating restrictions were measured dichotomously, however, and ICC estimates tend to be less accurate for binary variables than for continuous ones (Ridout, Demetrio, & Firth, 1999). Still, based on Preacher et al.'s (2010) guidelines, there is sufficient between- and within-person variability to interpret results for multilevel analyses.

Multilevel model results supported some of our Aim 3 hypotheses. Specifically, individuals consumed higher quantities of alcohol and were more likely to have a binge-drinking episode on days in which they endorsed drinking-related eating restrictions, holding constant typical alcohol use. In other words, both between- and within-person differences existed in how restricting behaviors associated with drinking. Not only were restrictors (i.e., those who endorsed past 30-day drinking-related eating restrictions at baseline) riskier drinkers than non-restrictors, restricting on a given day was related to higher same-day alcohol consumption

compared to drinking days without restrictions. Therefore, aspects of restricting contribute to higher alcohol quantity on a given drinking day, above and beyond differences between individuals.

However, despite within-person effects of eating restriction on alcohol quantity and the likelihood of a binge-drinking episode, multilevel results found no daily effects of drinking-related eating restrictions on the number of alcohol-related problems. This null finding was in contrast with our hypothesis and complicates the overall understanding of within-person effects of restricting. Unsurprisingly, the literature supports a positive association between alcohol quantity and number of problems experienced (Wechsler, Lee, Gledhill-Hoyt, & Nelson, 2001), although they are not perfectly correlated (Borsari et al., 2001). Further, some research suggests college students in particular may consume high quantities of alcohol without necessarily incurring more alcohol-related consequences (Perkins, 2002). Still, considering we found a significant within-person effect of restrictions on drinking quantity, it is surprising no relationship was seen with problems, especially when factoring in how restrictions before drinking contribute to higher BAC (Jones, 2000; White, 2003), which in turn is positively linked with alcohol-related problems (Neal & Carey, 2007).

One possible explanation for the null finding with alcohol-related problems could be related to the context in which drinking-related eating restrictions occur. The concept of these restrictions, dating back to Peralta's (2002) seminal article, incorporates the intentional nature of the behavior. Individuals restrict their food because they are *planning* to drink, which means they may also be planning or preparing other aspects of their drinking occasion, potentially to mitigate negative consequences from drinking. One such example is driving after drinking. Research suggests that individuals are more likely to drive while intoxicated when drinking

occasions are not planned or are planned on short notice (Morrison, Begg, & Langley, 2002). Conversely, having a "big night" of drinking planned may serve as a protective factor against drinking and driving (Connor, Cousins, Samaranayaka, & Kypri, 2014), as individuals may be more likely to leave their car at home in advance. Ultimately, because drinking-related eating restrictions are planned ahead of drinking, individuals may also have plans to avoid negative consequences despite consuming more alcohol.

Another possible explanation for the null findings related to the number of alcohol-related problems could derive from the overall variance of problems reported in the daily dairy portion of the study. At baseline, the YAACQ was used to assess 48 different consequences from alcohol use experienced over the past year, leading to a slightly positively skewed distribution of problems reported by the sample (M = 8.92, SD = 8.62). However, the BYAACQ, which was administered during the daily portion of the survey, assessed 24 consequences during a one-day timeframe. There were fewer reports of alcohol-related problems on drinking days and limited variance across days (M = 1.17, SD = 1.83). Taken together, it is possible that the minimal daily problems reported by the current sample did not have adequate power to detect any true within-person effects of drinking-related eating restrictions on the number of alcohol-related problems.

After observing this null finding, an additional model was run examining whether or not an alcohol-related problem was experienced on a given night as a dichotomous outcome variable. Multilevel analyses found that participants were more likely to experience at least one problem on drinking days where they reported drinking-related eating restrictions, as compared to days without restrictions. This supports our interpretation that there may be a true within-persons effect of drinking-related eating restrictions on alcohol-related problems, but that a combination

of our sample, which did not experience many problems across the daily reports, and measurement sensitivity prevented us from detecting the effect when examining number of problems experienced as a continuous outcome variable. As such, future research may examine higher-risk drinkers (e.g., diagnostic population, individuals in treatment), observe more daily reports, or utilize a more extensive measure of problems, any of which would increase the variability or responses.

Drinking-related Eating Restrictions and Post-drinking Eating

Post-drinking eating was also examined as an outcome variable in relation to daily drinking-related eating restrictions. Results suggested that daily drinking-related eating restrictions were associated with lower post-drinking food consumption. This significant finding is in the opposite direction of our prediction, which anticipated restrictors to consume greater amounts of food following their drinking episode.

Our hypothesis was based in part on the findings from the Buchholz et al. EMA study (2018). These authors found a positive association between pre-drinking restrictions and post-drinking eating, as mediated by positive alcohol quantity, such that restricting before drinking led to increased alcohol consumption and greater post-drinking food consumption. Pulling from restraint theory (e.g., Herman & Mack, 1975), they argued that early day restricting behaviors combined with increased alcohol consumption and intoxication to lower individuals' ability to continue managing their food intake, thus leading to increased eating after drinking. However, this theoretical framework cannot apply to our results, which suggest that food restrictions occurred prior to drinking and continued after the drinking occasion.

There are several possible explanations for our findings. First, although eating behaviors were assessed before and after the drinking event, no information was gathered or analyzed

about eating behaviors *during* the drinking occasion. It could be that participants who restricted, and as such drank more alcohol on those days, experienced the hypothesized disinhibitory effects while they were drinking. However, participants may have consumed greater amounts of food *while* drinking rather than *after* drinking, and thus may have consumed less food than usual at the end of their drinking night. Second, the differences between our study design and that of Buchholz et al. (2018) could lead to discrepant results. Buchholz and colleagues used an EMA design, which collected post-drinking eating behaviors in real-time as participants were eating. In the present study, participants completed surveys the following morning. Although this self-report methodology has been shown to be generally accurate (Simons et al., 2015), the delay between late night and early morning reporting increases the role of memory, thus also increasing the margin of error in reporting. This effect may be particularly relevant for post-drinking eating, when intoxication and fatigue may be the highest at the time of the behavior. Third, it could be that our findings are indeed accurate and represent the effect of increased intoxication over the duration of a drinking occasion. Our results show that daily drinking-related eating restrictions are associated with an increase in alcohol quantity and the likelihood of a binge episode. Therefore, as participants become more intoxicated throughout the night, they may become more likely to go to sleep sooner, decreasing their opportunity for post-drinking eating. Collecting and analyzing a more comprehensive log of food and alcohol intake throughout the day, as well as utilizing biological assessments in addition to self-reports, would increase our understanding of eating behaviors on drinking days in which individuals restrict before drinking.

Psychological Variables and Drinking-related Eating Restrictions

In addition to examining the risks associated with drinking-related eating restrictions, this study sought to understand psychological factors that may contribute to restriction behaviors and their associated risks. Specifically, self-control, emotion regulation, and perceived weight were examined in relation to typical drinking-related eating restrictions and as moderators to the daily link between restrictions and drinking outcomes. The following sections address results for each construct.

Self-control. Our findings suggest that between-person differences in self-control are associated with drinking-related eating restrictions, such that lower levels of self-control are correlated with an increased likelihood of past 30-day restrictions. This significant finding is in the opposite direction of our hypothesis. Based primarily on research suggesting that high levels of self-control are associated with successful dieting (Crescioni et al., 2011) and limited temptation to food (Kleiman, Trope, & Amodio, 2016), it was predicted that individuals with higher self-control would be most likely to restrict on drinking days. However, some disordered eating research found low levels of self-control to correspond with higher risk for both overeating and restricting behaviors (e.g., Smith & Robbins, 2013; Volkow et al., 2013). Further, alcohol literature has shown deficits in self-control to be associated with higher drinking outcomes (e.g., Muraven et al., 2002; Ostafin et al., 2008). Given the complexity of drinking-related eating restrictions, which incorporate both eating and drinking behaviors, it was difficult to predict how self-control would relate to the construct. It could be that the *drinking* portion of drinking-related eating restrictions is more salient as it relates to self-control. In other words, although higher levels of self-control may be associated with limited food intake while dieting, self-control could more prominently be a protective factor against risky drinking behaviors.

Indeed, there was a significant negative correlation between self-control and alcohol quantity at baseline (r = -.30, p < .001), which provides partial supporting evidence of this hypothesis. Conceptualizing drinking-related eating restrictions as a risky *drinking* behavior helps to explain why self-control would be negatively correlated with restrictions. Similar to other college student drinking behaviors, deficits in self-control appear to be a risk factor for identifying who is most likely to use drinking-related eating restrictions.

Aim 4 tested self-control as a moderator between daily restrictions and drinking outcomes. A significant interaction effect was observed between self-control and daily restrictions predicting the likelihood of a binge episode. Specifically, participants with average or below average self-control were *more* likely to binge drink on days they restricted, whereas participants with above average self-control were *less* likely to binge drink on days they restricted. Directionally, this falls in line with prediction, as individuals with lower self-control were more likely to binge when they restricted. Similar to lab tasks taxing self-control prior to ad lib drinking (Collins, 1993), it could be that individuals with lower self-control deplete their resources restricting their food intake, leaving them less capable of limiting their alcohol intake later in the day. For individuals with higher self-control, however, restricting before drinking served as a protective factor, such that it decreased the likelihood of a binge drinking episode. Dieting research could lend one possible explanation for this finding, considering high self-control predicts successful weight loss (Crescioni et al., 2011). It could be that individuals with high self-control are more likely to consistently restrict all consumption, meaning both food and alcohol. Therefore, on days in which they utilize eating restrictions they also limit their alcohol intake, which in turn lowers the likelihood of a binge-drinking episode following drinking-related eating restrictions.

Aside from the likelihood of binge drinking, self-control was not found to significantly moderate the association between drinking-related eating restrictions and any other outcome variable. Related to alcohol consequences, the same limitations that contributed to null findings in Aim 3 likely hindered our ability to detect any potential interaction effect with between-person self-control (i.e., low rates and low variance of reported daily problems). However, the null findings related to alcohol quantity are more surprising, especially given the significant interaction effect found in the model predicting binge drinking. Again, it may be that the daily descriptive drinking statistics limit the power to detect any true differences. On the daily reports, participants consumed an average of 3.13 (*SD* = 2.57) standard drinks on a drinking night, with only 25% of responses consuming greater than four standard drinks. It may be that there were insufficient heavy drinking days to detect any effects in the multilevel model examining quantity. Future research could examine a population with higher average drinking days or with greater variance to further explore self-control as a moderator.

Self-control was also not supported as a moderator of the daily association between drinking-related eating restrictions and post-drinking food consumption. Again, it is surprising that no effect was found. Self-control is seen to be a limited resource, such that individuals who restrain their eating tend to have exaggerated or intense reactions to food cues later in the day (Fedoroff, Polivy, & Herman, 2003). Again, self-control may be more relevant to the *drinking* components of drinking-related eating restrictions. Participants with low self-control are more likely to binge drink on days in which they restrict, so it could be that their drinking is unrestrained while post-drinking food consumption remains unchanged.

Considering between- and within-person results together, one possibility may be that self-control is simply more salient on a between-persons level. Restrictors and non-restrictors

differed on self-control, suggesting a significant between-persons effect. These between-person differences might be more relevant in understanding *who* uses drinking-related eating restrictions than *how* restrictions impact drinking outcomes. Drinking-related eating restrictions are a high-risk drinking behavior, and as such lower self-control increases the risk for endorsing these behaviors. Among those who restrict before drinking, self-control may have little impact on the severity of that drinking occasion, as self-control's impact may already be accounted for at the between-persons level. Alternatively, within-person differences in self-control may indeed be important but were uncaptured in our study. We assessed between-person (i.e., trait-level) self-control, however research suggests that self-control also fluctuates as a state-level variable (see Hagger, Wood, Stiff, & Chatzisarantis, 2010). Therefore, our within-person analyses were unable to account for potential effects of within-person variability in self-control in the association between restrictions and alcohol outcomes.

Emotion regulation. Emotion regulation was also analyzed in relation to restricting behaviors. However, aims examining both between- and within-person emotion regulation as a relevant construct found no significant association between drinking-related eating restrictions and emotion regulation. Specifically, between-persons emotion regulation did not significantly predict the likelihood of whether or not participants endorsed typical drinking-related eating restrictions. Further, baseline levels of emotion regulation did not moderate the daily association between drinking-related eating restrictions and any alcohol outcome measures or post-drinking food consumption.

These findings were surprising, as literature demonstrates overwhelming support for emotion regulation as an important construct in problematic drinking and eating behaviors. Specifically, individuals who exhibit fewer emotion regulation abilities are prone to consume

more alcohol (Aldao & Dixon-Gordon, 2014) and experience more problems (Dvorak et al., 2014). Similarly, both eating disorders (Harrison et al., 2010) and subthreshold unhealthy eating habits (Stice, 2001) have been shown to correlate with emotion regulation deficits. However, despite empirical support, as well as theoretical models incorporating emotion regulation as a key factor in high-risk behaviors (e.g., John & Gross, 2004; Mauss et al., 2005), our study found no support for emotion regulation as a relevant construct to drinking-related eating restrictions.

Contextual and social aspects of drinking-related eating restrictions may help explain these findings. College student drinking has been known to most commonly occur in social settings (Ham & Hope, 2003), and as such students may be more likely to drink for enhancement or conformity purposes as compared to coping with negative affect (Read, Wood, Kahler, Maddock, & Palfai, 2003). However, for emotion regulation to be a relevant construct, there necessarily needs to be negative emotions to be regulated. Moreover, drinking-related eating restrictions are used *intentionally* and ahead of planned drinking occasions. Theoretical models supporting emotion regulation as an important construct in understanding high-risk behaviors define it as the actions or abilities individuals use to respond to emotional distress (e.g., Mauss et al., 2005). Therefore, emotion regulation may not play a vital role in understanding planned behaviors, such as drinking-related eating restrictions, even if the behaviors are risky. As such, the importance of emotion regulation may be minimized.

Perceived weight. Similar to emotion regulation, perceived weight was not supported as a significant variable in any models examining drinking-related eating restrictions. Specifically considering our between-person findings of Aim 2, perceived weight did not significantly predict the likelihood of being a restrictor or non-restrictor. Reexamining the construct itself may help clarify this finding. Perceived weight captures one's perspective of their own weight (Thompson

et al., 1999). In studies examining problematic restricting or compensatory behaviors, perceived weight has been used to measure negative self-image or body dissatisfaction (e.g., Durkin & Paxton, 2002; Neumark-Sztainer et al., 2002). Among individuals with eating disorders, and particularly those with anorexia nervosa, perceiving oneself as overweight is highly correlated with body dissatisfaction (Viner et al., 2006). These individuals may have normal or even underweight BMI, such that higher perceived weight is a risk factor for unhealthy eating restrictions (Keel et al., 2007; Killen et al., 1996). Consequently, it is surprising that perceived weight had no effect on the likelihood of typical drinking-related eating restrictions.

However, the current sample is of college students, not necessarily of individuals with problematic eating behaviors. Perceived weight may not have captured the same construct related to negative self-image or body dissatisfaction among this sample. One difference with the current sample is the distribution of estimated BMI. Participants had an average estimated BMI of 24.79 (*SD* = 5.60), which falls in the normal weight range. Looking at BMI categorically, there was representation across the spectrum, with the most participants in the normal weight range (*n* = 137, 60.4%), followed by overweight (*n* = 41, 18.1%), obese (*n* = 37, 16.4%), and then the fewest in the underweight range (*n* = 11, 4.9%). This distribution is much heavier than typical disordered eating research samples. Further, because BMI was included as a covariate for perceived weight in all analyses, perceived weight was essentially measuring any differences between perceived weight and actual weight. In fact, when comparing perceived weight with BMI categories, the majority of participants (*n* = 160, 71.1%) accurately viewed their own weight (i.e., perceived their weight to be in the same categorical range as their estimated BMI). Only 18 (8.0%) participants perceived themselves as heavier than their estimated BMI, all of whom only misperceived their category by one range (e.g., their estimated

BMI was in the normal range and they perceived themselves to be overweight). The remaining participants (n = 47, 20.8%) actually perceived themselves to weigh less than their estimated BMI category. As stated above, perceived weight is a conceptually relevant construct as a correlate of body satisfaction (Viner et al., 2006). However, because the vast majority of the current sample are either accurately perceiving their weight or perceiving themselves to be lighter than they are, perceived weight may not be a precise indicator of levels body satisfaction. As such, more robust measures of body satisfaction or self-image might have more directly captured a construct relevant to drinking-related eating restrictions in this sample.

Sex and Drinking-related Eating Restrictions

In addition to psychological variables, participant sex was also tested as an indicator for drinking-related eating restrictions and as a moderator to the association between daily restrictions and alcohol outcomes. On a between-persons level, one's sex had no significant effect on the likelihood of whether or not a participant endorsed typical drinking-related eating restrictions. This null finding is contrary to our hypothesis, which expected women to be more likely to endorse restrictions. Although much of the prior literature has found women to endorse restricting more than men (e.g., Bryant et al., 2012; Eisenberg & Fitz, 2014; Giles et al., 2009), other such studies have seen no sex differences (e.g., Lupi et al., 2017; Peralta & Barr, 2017). One possible explanation for our finding is that the proportion of men to women (47 men to 180 women; 79.3% women) may have limited the ability to detect a true between-persons effect. Alternatively, it could be that men and women are equally likely to restrict food before drinking, explaining our results and some prior research (e.g., Peralta & Barr, 2017), whereas women are more likely than men to endorse other or all types of compensatory eating or exercising behaviors related to alcohol use (e.g., Bryant et al., 2012). Given the diversity of language and

specificity of how drinking-related eating restrictions have been measured across the literature, whether or not studies have observed sex effects may simply be a result of measurement differences. Nonetheless, it is clear that both women and men exhibit restricting behaviors and as such our results support the need for further exploration of drinking-related eating restrictions among men, who have been relatively understudied in comparison to women.

Despite finding no between-person differences on drinking-related eating restrictions based on sex, sex was found to significantly moderate the association between daily drinking-related eating restrictions and each outcome of alcohol quantity, likelihood of a binge episode, and alcohol-related problems. Specifically, women reported higher quantity, likelihood of a binge episode, and problems on days when they restricted. Men saw no effect of daily restrictions on drinking quantity or the likelihood of a binge episode, however they experienced *fewer* alcohol-related problems on days they restricted. These findings are not congruent with our hypotheses, which predicted men to have greater alcohol outcomes on restricting days based on prior research which found restrictions to be predictive of higher drinking among men.

As it relates to increased outcomes for women, the biological effects of restrictions may amplify the risks of drinking on an empty stomach. In general, there are no true differences in metabolic rates of alcohol elimination between men and women, as any observed differences can be explained by related factors, such as body weight and water content (Sutker, Tabakoff, Goist, & Randall, 1983). However, when drinking on an empty stomach, men metabolize alcohol relatively more quickly than women, such that women become more prone than men to experience sharp increases in BAC during alcohol intake (Ramchandani, Kwo, & Li, 2001). Additionally, different types of alcoholic beverages (i.e., hard liquor, wine, beer) have different ethyl alcohol concentration (Roine, Gentry, Lim, Baraona, & Lieber, 1991), contain a different

number of calories (Mitchell, Teigen, & Ramchandani, 2014), and have differential impact on acceleration in BAC (Calbet & MacLean, 1997). It could be that women are more likely to drink wine or liquor, which have lower caloric levels and higher ethyl alcohol concentration, whereas men drink more beer, with greater caloric value and lower alcohol concentration. Therefore, through both the biological differences in alcohol metabolization on an empty stomach and the interaction of absorption and alcohol type, it could be that women are at greater risk for high levels of drinking and problems on days when they restrict relative to men.

It is interesting to note that men were *less* likely to experience alcohol-related problems on days when they restricted before drinking. As mentioned above, this could be related to the deliberate or intentional nature of drinking-related eating restrictions. By planning to drink ahead of restricting, men may have been more likely to take precautions reducing the chances of potential consequences of drinking (e.g., drunk driving). However, it is not clear why this effect took place for men and not for women, who instead experienced more problems on drinking days where they restricted. The biological effects noted in the previous paragraph may help to explain the sex difference, though an exact reason for this finding remains unclear.

Finally, sex did not significantly moderate the daily association between drinking-related eating restrictions and post-drinking food consumption. As with the other null moderation findings, it could be that post-drinking food consumption is not the best indicator of food consumption on days with drinking-related eating restrictions. Measuring food intake *during* drinking occasions may more accurately capture potential differences in food consumption on days with drinking-related eating restrictions. Additionally, it could be that the link between drinking-related eating restrictions and post-drinking food consumption does not rely on sex, such that women and men continue to restrict after drinking, in line with findings from Aim 3. A

more detailed assessment of food intake on days with drinking-related eating restrictions could further clarify these null findings.

Reasons for Drinking-related Eating Restrictions

The final, exploratory aim tested whether the reasons participants endorsed using drinking-related eating restrictions on a given day impacted the various drinking outcome indices and post-drinking eating. Since the seminal article about drinking-related eating restrictions (Peralta, 2002), the two main reasons college students have restricted before drinking are to minimize overall caloric intake and enhance intoxication. Our findings did not support the reason for restricting as a meaningful predictor of alcohol outcomes following drinking-related eating restrictions.

It is possible that the measurement of this question and distribution of responses limited our ability to detect any true differences. The construct was measured using a single item in which participants selected caloric reductions, enhanced intoxication, both, or "other" reasons for restricting that day. A sizable number of participants (n = 27, 35.5%) endorsed "other" reasons for restricting, which challenges the presumption that calories and intoxication are the sole motivators for drinking-related eating restrictions. Because of this response distribution there is reduced statistical power to detect any true differences between those endorsing calorie restriction versus enhanced intoxication reasons. In contrast with other multilevel models that examined *all* daily drinking reports (n = 417), Aim 5 only analyzed days in which participants restricted before drinking (n = 76). Further, with over one-third of participants endorsing "other" reasons for restricting, and ultimately giving open-ended qualitative responses, there were even fewer days to analyze when comparing the two most common reasons for restricting (n = 46). A

larger sample of responses may have been necessary to detect differences between the two primary reasons for restricting.

However, it could also be that there are no true differences in alcohol use, related problems, or post-drinking food consumption based on the reasons for using drinking-related eating restrictions. Drinking on an empty stomach increases BAC (Jones, 2000; White, 2003), which is linked with higher alcohol outcomes (Neal & Carey, 2007). It could be that biological effects of increased BAC account for the majority of variance in alcohol outcomes, such that the reasons for restricting only account for limited unique variance. This explanation may be further supported by the fact that many of the "other" reasons for restricting did not include intentional or planned behavior. Responses categorized as "too busy" or "forgot to eat" suggest that at least some restrictors were not using restrictions intentionally, in turn reducing the role reasons for restricting would play in subsequent drinking outcome measures. Another limitation with these null findings could be related to measurement, as participants were asked to report on the previous day's reasons for restricting (i.e., If you ate less than usual *yesterday* before you drank, why?), which may have increased recall bias. Assessing reasons for use of drinking-related eating restrictions for *today* (i.e., prior to the drinking episode) may allow for a more accurate understanding of the association between reasons for restricting and alcohol outcomes. Future research may better address these issues by measuring reasons ahead of drinking episode, offering additional responses options, or examining planned (e.g., "to get more drunk") versus unplanned (e.g., "I had no food at home") reasons for drinking-related eating restriction behaviors.

General Discussion

Overall, many of the current hypotheses were supported. Specifically, our study found that (1) individuals who endorsed typical drinking-related eating restrictions had higher alcohol outcomes than non-restrictors across a number of alcohol indices, (2) within-person differences in drinking-related eating restrictions were observed, such that daily restricting was associated with greater alcohol use, increased likelihood of a binge episode, and greater odds of experiencing an alcohol-related problem, (3) sex moderated the daily association between restrictions and alcohol outcomes, such that women consumed more alcohol and experienced greater problems on drinking days with restrictions, and (4) self-control was supported as a relevant construct on both between- and within-persons levels. However, the current study did not find support for other relevant psychological constructs (i.e., emotion regulation, perceived weight) to drinking-related eating restrictions. Furthermore, results found the daily reasons for restricting to have no significant impact on subsequent outcome measures following drinking-related eating restrictions.

The current research contributed to the literature in several ways. First, our results suggest that further exploration into the phenomenon of drinking-related eating restrictions is warranted. Findings revealed that drinking-related eating restrictions are both prevalent and risky behaviors. We found that 11.5% of participants endorsed typical drinking-related eating restrictions, whereas 18.4% of daily drinking-day reports contained drinking-related eating restrictions. Although our prevalence results fall within the lower range of previous estimates (e.g., Burke et al., 2010; Giles et al., 2009; Knight et al., 2017), drinking-related eating restrictions were still endorsed by a meaningful percentage of our sample. Further, we found significant between- and within-person differences in the risks associated with drinking-related

eating restrictions. In two important ways, our findings also expanded upon prior literature. First, we demonstrated both between-person and within-person differences, extending research that had examined one or the other (e.g., between-persons, Roosen & Mills, 2015; within-persons, Buchholz et al., 2018). Second, we examined a comprehensive set of alcohol indices, revealing that drinking-related eating restrictions have between- and within-person effects on alcohol quantity, the likelihood of binge drinking, and alcohol-related problems.

Our study has also broadened the literature as it relates to understanding drinking-related eating restrictions among women and men, as ours is the first known prospective design study examining within-person difference in both sexes. Despite our hypothesis predicting women to endorse restricting at a higher rate than men, we found no between-persons differences in restricting behaviors based on sex. However, moderation analyses showed that daily restrictions led to riskier alcohol outcomes for women, whereas men experienced no effects or even protective effects on restricting days. This high-risk behavior appears to be particularly risky for women, a finding we add to existing literature. Further examination of this phenomenon could elucidate why women, and not men, experience increased drinking risks on days when they restrict.

Although results revealed null findings in relation to the psychological variables of emotion regulation and perceived weight, support for self-control as a relevant structure for drinking-related eating restrictions adds a new and important direction to the literature. Lower self-control was found to increase the likelihood of endorsing typical restrictions. Higher levels of self-control have been linked to healthy dieting behaviors (Crescioni et al., 2011), whereas lower levels of self-control have been associated with risky drinking (e.g., Muraven et al., 2002) and disordered eating (e.g., Smith & Robbins, 2013). Therefore, our results suggest that

drinking-related eating restrictions may be best categorized as a risky health behavior. Further, lower self-control strengthened the positive association between daily restricting behaviors and the likelihood of binge drinking. Control theory can help with interpretation of these findings. Individuals with lower self-control may have depleted their energies by restricting their food intake such that they were prone to uninhibited drinking later in the day (e.g., Baumeister et al., 2007). As noted earlier, this depletion can be expedited when glucose levels are involved (Gailliot et al., 2007), amplifying the importance of self-control when examining drinking outcomes on an empty stomach. Moving forward, it may be helpful and more accurate to understand drinking-related eating restrictions as risky health behaviors through the theoretical framework of control theory.

Practical Implications

There are several practical implications to be taken from the present study. First, the study supports drinking-related eating restrictions as having both between- and within-persons effects on various indices of alcohol use and outcomes. As such, college student drinking interventions should target the same-day risks of restricting before drinking. Specifically, education about the link between food intake and BAC levels may highlight the risks associated with drinking-related eating restrictions and thus discourage the behavior. By identifying the students who endorse drinking-related eating restrictions and better understanding the context around days in which they restrict, intervention efforts may reduce their use of restriction behaviors or minimize the amplified risks of restricting before drinking. Second, it is important to target women students in such intervention efforts. Although women and men endorsed baseline restrictions at similar rates, we found a stronger within-person impact of restricting on alcohol outcomes among women. Tailoring intervention efforts to women restrictors could have

the greatest impact on drinking risks, as women experienced a stronger effect of drinking-related eating restrictions on subsequent alcohol use and problems. Finally, understanding trait-level self-control as a relevant construct to drinking-related eating restrictions can further inform interventions. Students with lower self-control may benefit most from education related to the risks associated with drinking-related eating restrictions. Further, self-control practice could enhance individuals' ability to slow down decision-making, thus reducing high risk behaviors such as drinking-related eating restrictions (Friese, Frankenbach, Job, & Loschelder, 2017).

Future Directions

The current study has extended the drinking-related eating restriction literature. In general, results suggest that individuals who restrict also report higher levels of alcohol outcomes (i.e., quantity, problems, binge-drinking) and that restricting on a given day increases same-day alcohol outcomes. Additionally, sex and self-control are characteristics which appear to be relevant to the link between restricting and alcohol use. Based on our findings, we suggest several future directions for research.

First, a strength of the present study was the advanced study design, as it enabled analyses of between- and within-person effects. We recommend continued advancement of both study methodology and statistical analyses. As it pertains to methodology, one potential avenue for new research could be with use of biological data collection. With regards to drinking-related eating restrictions, physiological assessments would allow for accurate analyses of alcohol consumption, BAC levels, and caloric intake. Biologically accurate data would provide a more fine-grained approach to understanding how drinking-related eating restrictions impact the rise of and peak BAC, as well as subsequent alcohol-related consequences. With the rise in

accuracy and availability of wearable sensors (Campbell, Kim, & Wang, 2018), drinking-related eating restrictions research could benefit from studies collecting real-time, accurate BAC levels.

Regarding statistical analyses, there are several complex, dynamic variables associated with drinking-related eating restrictions. Future research could use complex multilevel models to analyze multiple trait (e.g., sex, self-control, alcohol quantity) as well as state variables (e.g., drinking-related eating restrictions, BAC, self-control). In addition to constructs analyzed in the present study, environmental factors such as the location of drinking, social context, and day of the week are potentially relevant to drinking-related eating restrictions. As initial research efforts have shown both the existence of and risks associated with drinking-related eating restrictions, the foundation has been laid for more complex statistical models. Examining these variables in a collective multilevel model would help elucidate which factors are most important to understanding drinking-related eating restrictions.

Another potential area for further research is related to self-control. The current study found support for self-control as a relevant construct to understanding drinking-related eating restrictions, as lower self-control was indicative of greater likelihood of endorsing restrictions, as well as increased risk of binge episodes on drinking days with restrictions. These findings come from statistical models using a single measure of self-control. Although the BSCS is a reliable and valid measure of self-control (Maloney et al., 2012; Tangey et al., 2004), it only represents one aspect of the broader construct. Indeed, self-control is a multi-faceted and complex construct that stems from a variety of theories (e.g., self-regulation theory, Baumeister et al., 1994; control theory, Carver & Scheier, 1982; choice theory, Glasser, 2010) and includes aspects of behavioral inhibition, executive functioning, and self-regulation (Hofmann, Schmeichel, & Baddeley, 2012). Additionally, rather than simply being a stable trait over time, self-control has

been shown to vary over time based on energy levels and environment (Hagger et al., 2010). Fluctuations in self-control have also been found to differentially impact alcohol use (Muraven, Collins, Shiffman, & Paty, 2005). Examining how both between- and within-persons differences in self-control associate with eating restrictions and subsequent drinking outcomes could be a natural next step in extending our understanding of self-control and drinking-related eating restrictions.

Finally, we recommend for future research to develop valid and reliable self-report measures to specifically assess drinking-related eating restrictions, as well as broader measures to better understand how drinking-related eating restrictions fit into the literature regarding compensatory behaviors related to drinking. The present study used single items to assess each of drinking-related eating restrictions and the reasons for restricting. Recently, measures like the Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS; Rahal et al., 2012) have been created to broadly capture the behaviors college students use before, during, and after drinking alcohol to compensate for the calories gained while drinking. Use of this measure, and development of other measures more focused on food restrictions, in study designs examining both between- and within-person effects will broaden our understanding of drinking-related eating restrictions. Additionally, Ward and Galante (2015) developed a measurement tool to assess the motivations for using "drunkorexia" behaviors. Use of this tool in a daily or momentary assessment study designs could better assess how the specific reasons for using compensatory behaviors may affect drinking outcomes on a given day. Scale development related specifically to reasons for using drinking-related eating restrictions could further elucidate how an individual's rationale for restricting associates with subsequent outcomes. As of yet, there is an ambiguous overlap between research examining drunkorexia

behaviors, broadly, and drinking-related eating restrictions, specifically. This is likely the result of a burgeoning field of research aiming to assess a complex behavioral concern. Further scale development can help clarify and define these constructs, as well as improve future research examining their impacts on drinking and overall health.

Limitations

There are several limitations to be noted. First, the present study was conducted using a sample of moderate- to heavy-drinking, young-adult college students enrolled in psychology courses. As such, findings may not be generalizable to other populations (e.g., other age ranges, treatment seekers). Second, relatedly, although we included both men and women in our sample, we did not have a similar number of each sex. Future research should use more proportionally equal samples to further examine sex difference and explore potential racial or ethnic differences related to restrictions. Third, all measures were collected via participant self-report. Although this does introduce the potential for response bias, self-report measures of alcohol use and problems are seen as accurate and generally correlate with transdermal alcohol assessment (Simons et al., 2015) and collateral reports (Borsari & Muellerleile, 2009). Fourth, of the potential 3,178 daily reports among the 227 participants, only 2,173 (68%) of daily reports were initiated. As such, results should be interpreted cautiously as it is unclear what behaviors occurred on days without completed surveys. Finally, similar to previous drinking-related eating restrictions literature, the measurement of drinking-related eating restrictions relied on a single item question. A validated, more robust questionnaire measuring drinking-related eating restrictions would allow the construct to be examined continuously, rather than dichotomously, thus strengthening any analyses examining the phenomenon.

CHAPTER V

CONCLUSIONS

This study was the first to examine between- and within-person effects of drinking-related eating restrictions in a sample of men and women across a baseline plus 14-day daily diary survey. Specifically, this study examined typical and daily alcohol risks associated with drinking-related eating restrictions, psychological variables as potential indicators of who uses drinking-related eating restrictions, and possible moderators of the daily effects of drinking-related eating restrictions. We found that individuals who endorsed typical drinking-related eating restrictions also reported higher alcohol outcomes than non-restrictors. Further, daily drinking-related eating restrictions were associated with greater alcohol consumption, increased likelihood of binge drinking, and greater odds of experiencing an alcohol-related consequence on the same day. Lower self-control was found as a risk factor for using drinking-related eating restrictions and increased the likelihood of binge drinking on a restricting day. Women and men endorsed using drinking-related eating restrictions at similar rates, however women experienced greater alcohol outcomes on restricting days, whereas men did not report greater alcohol use on days they restricted. Overall, these findings demonstrated that drinking-related eating restrictions are associated with increased between- and within-persons alcohol outcomes and may be particularly risky for women and individuals with lower self-control. Future research is needed to clarify the construct further and explore other factors relevant to understanding drinking-related eating restrictions.

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Appendix A

Demographics

It is important to know something about our participants as a whole, so we request some demographic information. Only grouped data will be used, and you will never be identified.

1. Your Sex: MALE □ FEMALE □

2. Your Age: _____

3. Your Height: _____ feet _____ inches

4. Your Current Weight: _____ lbs.

5. Ethnic Background:
□ Caucasian/White □ Asian/Pacific American
□ Native American/Indian □ Hispanic/Latino
□ African American/Black □ Other (please specify): _____

6. Where is your current residence?
□ A parent's or relative's home
□ A dormitory, residence hall, or apartment on a college campus
□ A house, apartment, or room (not affiliated with a college/university)
□ A fraternity or sorority house
□ Other: _____ (please specify)

7. What is your relationship status:
□□Single/Never Married □ Married
□□Living with partner □□Separated/Divorced □□Widowed

8. Are you employed now?
□YES, part-time only □YES, full-time only
□YES, full and part-time □NO

9. Yearly total <u>individual</u> income:
□Under $10,000 □$10,000 - $20,000
□$20,001 - $40,000 □$40,001 - $60,000
□$60,001 - $80,000 □$80,000 - $100,000
□$100,000 or more

10. What is your current class standing in school?

□college freshman

□college sophomore
□college junior
□college senior
□other

11. What is your current GPA? _____ (on 4.0 scale)

12. Are you affiliated with a Greek organization on campus? □ YES □□No

13. Have you ever been to a hospital or institution on account of: drinking, drug use or other mental health issues? Check all that apply.

1. No
2. Yes, alcohol
3. Yes, drugs
4. Yes, mental health issues
5. Yes, alcohol and drugs
6. Yes, alcohol and mental health
7. Yes, drugs and mental health
8. Yes, alcohol, drugs and mental health

14. Have you seen a therapist or counselor on account of: drinking, drug use or other mental health issues? Check all that apply.

1. No
2. Yes, alcohol
3. Yes, drugs
4. Yes, mental health issues
5. Yes, alcohol and drugs
6. Yes, alcohol and mental health
7. Yes, drugs and mental health
8. Yes, alcohol, drugs and mental health

15. Have you ever attended AA or NA for your own alcohol or drug problems? Check all that apply.

1. No
2. Yes, AA
3. Yes, NA
4. Yes, AA and NA

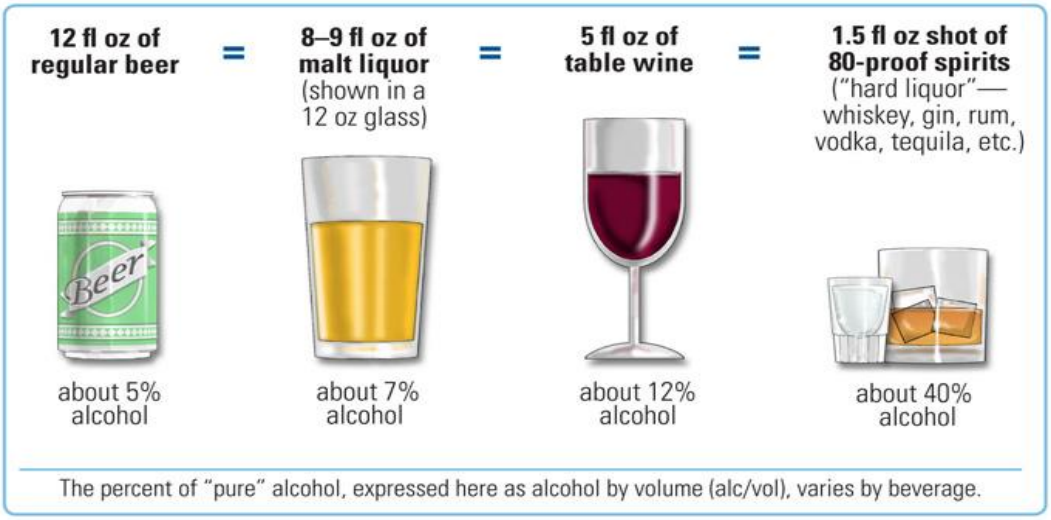
Appendix B

Daily Drinking Questionnaire

ALCOHOL USE

Please think about your typical drinking over the **PAST 3 MONTHS**. On a typical day, how many drinks would you have, and over how many hours would you have them? That is, how many drinks would you typically have on each day in the 3 months? How long (in hours) would a typical drinking occasion last on that day? Use any applicable number, starting with 0, and please note that each space must be filled in.

NOTE: 1 drink = 1 Beer (12 oz.) = 1 Wine Cooler (12 oz.) = 1 Glass of Wine (5 oz.) = 1 Shot of Liquor (1-1.5 oz.) = 1 Mixed Drink (1-1.5 oz. of liquor)



Over the **PAST 3 MONTHS**, on a….

	TYPICAL MONDAY	TYPICAL TUESDAY	TYPICAL WEDNESDAY	TYPICAL THURSDAY	TYPICAL FRIDAY	TYPICAL SATURDAY	TYPICAL SUNDAY
NUMBER OF DRINKS							
NUMBER OF HOURS							

8. What is the maximum number of standard alcoholic drinks you have had in one sitting in the **past 30 days**? _____

8a. Think of the one occasion during the **past 30 days** when you drank the most:

8a1. How many standard drinks did you consumed? ____ drinks

8a2. Over how many hours did you consume this drinks (i.e., how long did it take for you to consume those drinks? ____ hours

9. At what age did you FIRST DRINK alcohol? _____

10. At what age did you FIRST get DRUNK on alcohol? _____

11. At what age did you begin regularly drinking alcohol (at least one drink per month)? If you have never been a regular drinker, please place an X in the blank. _____

Appendix C

Young Adult Alcohol Consequences Questionnaire

Below is a list of things that sometimes happen to people either during, or after they have been drinking alcohol. Next to each item below, please mark an "X" in either the YES or NO column to indicate whether that item describes something that has happened to you **IN THE PAST YEAR.**

In the **PAST YEAR…**

		NO	YES
1.	While drinking, I have said or done embarrassing things.		
2.	The quality of my work or schoolwork has suffered because of my drinking.		
3.	I have felt badly about myself because of my drinking.		
4.	I have driven a car when I knew I had too much to drink to drive safely.		
5.	I have had a hangover (headache, sick stomach) the morning after I had been drinking.		
6.	I have passed out from drinking.		
7.	I have taken foolish risks when I have been drinking.		
8.	I have felt very sick to my stomach or thrown up after drinking.		
9.	I have gotten into trouble at work or school because of drinking.		
10.	I often drank more than I originally had planned.		
11.	My drinking has created problems between myself and my boyfriend/girlfriend/spouse, parents, or other near relatives.		
12.	I have been unhappy because of my drinking.		
13.	I have gotten into physical fights because of drinking.		
14.	I have spent too much time drinking.		
15.	I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.		
16.	I have felt like I needed a drink after I'd gotten up (that is, before breakfast).		
17.	I have become very rude, obnoxious or insulting after drinking.		
18.	I have felt guilty about my drinking.		
19.	I have damaged property, or done something disruptive such as setting off a false fire alarm, or other things like that after I had been drinking.		
20.	Because of my drinking, I have not eaten properly.		
21.	I have been less physically active because of drinking.		
22.	I have had "the shakes" after stopping or cutting down on drinking (eg., hands shake so that coffee cup rattles in the saucer or have trouble lighting a cigarette).		

23.	My boyfriend/girlfriend/spouse/parents have complained to me about my drinking.		
24.	I have woken up in an unexpected place after heavy drinking.		
25.	I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.		
26.	As a result of drinking, I neglected to protect myself or my partner from a sexually transmitted disease (STD) or an unwanted pregnancy.		
27.	I have neglected my obligations to family, work, or school because of drinking.		
28.	I often have ended up drinking on nights when I had planned not to drink.		
29.	When drinking, I have done impulsive things that I regretted later.		
30.	I have often found it difficult to limit how much I drink.		
31.	My drinking has gotten me into sexual situations I later regretted.		
32.	I've not been able to remember large stretches of time while drinking heavily.		
33.	While drinking, I have said harsh or cruel things to someone.		
34.	Because of my drinking I have not slept properly.		
35.	My physical appearance has been harmed by my drinking.		
36.	I have said things while drinking that I later regretted.		
37.	I have awakened the day after drinking and found that I could not remember a part of the evening before.		
38.	I have been overweight because of drinking.		
39.	I haven't been as sharp mentally because of my drinking.		
40.	I have received a lower grade on an exam or paper than I ordinarily could have because of my drinking.		
41.	I have tried to quit drinking because I thought I was drinking too much.		
42.	I have felt anxious, agitated, or restless after stopping or cutting down on drinking.		
43.	I have not had as much time to pursue activities or recreation because of drinking.		
44.	I have injured someone else while drinking or intoxicated.		
45.	I often have thought about needing to cut down or stop drinking.		
46.	I have had less energy or felt tired because of my drinking.		
47.	I have had a blackout after drinking heavily (i.e., could not remember hours at a time).		
48.	Drinking has made me feel depressed or sad.		

Appendix D

Eating and Alcohol Use Questionnaire

Research note: This measure is modified. Response options are expanded.

INSTRUCTIONS: We are interested in examining the ways in which alcohol and eating patterns are related. Please think about the <u>past 30 days</u> when responding.

1. Do you know how many calories are in alcoholic drinks?
_____ Definitely yes
_____ Mostly yes
_____ Somewhat
_____ Mostly no
_____ Definitely no

2. Do you **<u>limit the number of alcoholic drinks</u>** you have because you are concerned about the calories?
_____ Definitely yes
_____ Mostly yes
_____ Somewhat
_____ Mostly no
_____ Definitely no

3. Have you had at least 1 alcoholic drink in the past 30 days?
_____ Yes
_____ No, not in the past 30 days
_____ I never drink alcohol → Skip questions 4 to 9

4. How much do you exercise **<u>before starting to drink alcohol that day</u>**?
_____ **Much more** than usual
_____ **Somewhat more** than usual
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My exercise habits do not change
_____ I usually do not exercise

5. How much food do you eat **<u>before starting to drink</u>** alcohol that day?
_____ **Much more** than usual → Skip to question 7
_____ **Somewhat more** than usual→ Skip to question 7
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My eating habits do not change.→ Skip to question 8

6. Why do you **<u>eat LESS food before drinking</u>**?
_____ You want to minimize your caloric intake

_____ You want to get drunk faster
_____ Both (1 & 2)
_____ Other:_____

7. Why do you **eat MORE food before drinking**?
_____ You want to get drunk less quickly
_____ Other:_____

8. How much food do you eat **while you are drinking** that night?
_____ **Much more** than usual
_____ **Somewhat more** than usual
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My eating habits do not change.

9. How much food do you eat **after you have been drinking before you go to sleep**?
_____ **Much more** than usual
_____ **Somewhat more** than usual
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My eating habits do not change.

10. How often do you eat junk food (pizza, burgers, chips) **after drinking before going to sleep?**
_____ Always or almost always
_____ Much of the time
_____ About half of the time
_____ Some of the time
_____Never or hardly ever

11. How often are you less healthy about your food choices (onion rings instead of yogurt, etc.) when eating **after drinking before going to sleep**?
_____ Always or almost always
_____ Much of the time
_____ About half of the time
_____ Some of the time
_____ Never or hardly ever

12. How often do you continue to **eat later that night** (drunk munchies) after drinking?
_____ Always or almost always
_____ Much of the time
_____ About half of the time
_____ Some of the time
_____ Never or hardly ever

13. How much food do you eat the **following day after a night of drinking**?

_____ **Much more** than usual
_____ **Somewhat more** than usual
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My eating habits do not change

14. How much do you exercise the **following day after a night of drinking**?
_____ **Much more** than usual
_____ **Somewhat more** than usual
_____ **Somewhat less** than usual
_____ **Much less** than usual
_____ My exercise habits do not change
_____ I do not exercise

15. Do you **know how many calories** are in the alcoholic drinks that **you typically drink**?
_____ Definitely yes
_____ Mostly yes
_____ Somewhat
_____ Mostly no
_____ Definitely no

16. How does drinking **alcohol affect your appetite**?
_____ Definitely increases
_____ Somewhat increases
_____ Somewhat decreases
_____ Definitely decreases
_____ No effect

Appendix E

Brief Self-Control Scale

Directions: Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	Not at All 1	2	3	4	Very Much 5
1. I am good at resisting temptation	1	2	3	4	5
2. I have a hard time breaking bad habits	1	2	3	4	5
3. I am lazy	1	2	3	4	5
4. I say inappropriate things	1	2	3	4	5
5. I do certain things that are bad for me, if they are fun	1	2	3	4	5
6. I refuse things that are bad for me	1	2	3	4	5
7. I wish I had more self-discipline	1	2	3	4	5
8. People would say that I have iron self-discipline	1	2	3	4	5
9. Pleasure and fun sometimes keep me from getting work done	1	2	3	4	5
10. I have trouble concentrating	1	2	3	4	5
11. I am able to work effectively toward long-term goals	1	2	3	4	5
12. Sometimes I can’t stop myself from doing something, even if I know it is wrong	1	2	3	4	5
13. I often act without thinking through all the alternatives	1	2	3	4	5

Note: Scaled continuously. #2, 3, 4, 5, 7, 9, 10, 12, and 13 are reverse coded.

Appendix F

Emotion Regulation Questionnaire

Instructions and Items

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1----------2----------3----------4----------5----------6----------7

strongly **neutral** **strongly**

disagree **agree**

1. ____ When I want to feel more positive emotion (such as joy or amusement), I *change what I'm thinking about.*
2. ____ I keep my emotions to myself.
3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change what I'm thinking about.*
4. ____ When I am feeling *positive* emotions, I am careful not to express them.
5. ____ When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.
6. ____ I control my emotions by *not expressing them*.
7. ____ When I want to feel more *positive* emotion, I *change the way* I'm thinking about the situation.
8. ____ I control my emotions by *changing the way* I think about the situation I'm in.
9. ____ When I am feeling *negative* emotions, I make sure not to express them.
10. ____ When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

Note

Do not change item order, as items 1 and 3 at the beginning of the questionnaire define the terms "positive emotion" and "negative emotion".

Scoring (no reversals)

Reappraisal Items: 1, 3, 5, 7, 8, 10; Suppression Items: 2, 4, 6, 9.

Appendix G

Perceived Weight Item

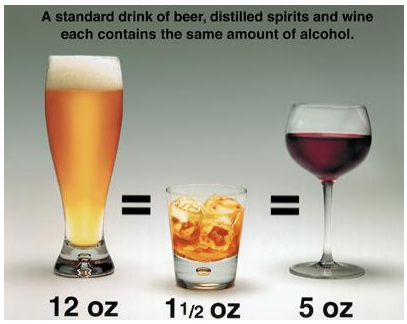
What of the following do you believe best describes your current weight?

❑ underweight ❑ normal weight ❑ overweight ❑ obese

Appendix H

Alcohol Use – Daily

Now, we would like for you to think about your behaviors YESTERDAY. Keep in mind, with respect to alcohol consumption, 1 standard drink is equivalent to 12 oz beer OR 5 oz wine OR 1.5 oz shot of liquor straight or in a mixed drink.



1. How many standard drinks did you consume YESTERDAY? (drop down menu)
2. How many hours did you spend consuming alcohol YESTERDAY?
3. At approximately what time did you **START** drinking yesterday?
4. At approximately what time did you **STOP** drinking yesterday?
5. On a scale from 0 to 100, how drunk did you get with 0 meaning *not drunk at all* and 100 meaning *extremely drunk*?

Appendix I

Brief Young Adult Alcohol Consequences Questionnaire – Daily

Below is a list of things that sometimes happen to people either during, or after they have been drinking alcohol. Next to each item below, please mark an "X" in either the YES or NO column to indicate whether that item describes **something that has happened to you as a result of YESTERDAY'S drinking.**

As a result of **yesterday's drinking**…

		NO	YES
1.	While drinking, I said or done embarrassing things.		
2.	The quality of my work or schoolwork suffered because of my drinking.		
3.	I felt badly about myself because of my drinking.		
4.	I drove a car when I knew I had too much to drink to drive safely.		
5.	I had a hangover (headache, sick stomach) the morning after I had been drinking.		
6.	I passed out from drinking.		
7.	I took foolish risks when I have been drinking.		
8.	I felt very sick to my stomach or thrown up after drinking.		
9.	My drinking created problems between myself and my boyfriend/girlfriend/spouse, parents, or other near relatives.		
10.	I spent too much time drinking.		
11.	I did not go to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.		
12.	I felt like I needed a drink after I'd gotten up (that is, before breakfast).		
13.	I became very rude, obnoxious or insulting after drinking.		
14.	I woke up in an unexpected place after heavy drinking.		
15.	I found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.		
16.	I neglected my obligations to family, work, or school because of drinking.		
17.	I ended up drinking when I had planned not to drink.		
18.	When drinking, I did impulsive things that I regretted later.		
19.	I found it difficult to limit how much I drink.		
20.	My drinking got me into sexual situations I later regretted.		
21.	I wasn't able to remember large stretches of time while drinking heavily.		
22.	My physical appearance was harmed by my drinking.		
23.	I was overweight because of drinking.		
24.	I had less energy or felt tired because of my drinking.		

Appendix J

Drinking Related Eating Survey

Research Note: Loosely adapted from the EAUQ.

INSTRUCTIONS: We are interested in examining the ways in which alcohol and eating patterns are related. Please think about the <u>YESTERDAY</u> when responding.

1. Did you **<u>limit the number of alcoholic drinks</u>** you had yesterday because you were concerned about the calories?

1. Definitely yes
2. Mostly yes
3. Somewhat
4. Mostly no
5. Definitely no
6. I didn't drink yesterday

2. How much did you exercise yesterday **<u>before starting to drink alcohol</u>**?

1. **Much more** than usual
2. **Somewhat more** than usual
3. **Somewhat less** than usual
4. **Much less** than usual
5. My exercise habits did not change
6. I usually do not exercise
7. I didn't drink yesterday

<u>Prior</u>

3. How much food did you eat yesterday **<u>before starting to drink</u>** alcohol?

1. Much **more** than usual (skip to question 5)
2. Somewhat **more** than usual (skip to question 5)
3. Somewhat **less** than usual
4. Much **less** than usual
5. My eating habits did not change (skip questions 4 and 5)
6. I didn't drink yesterday (skip questions 4 and 5)

4. If you ate **<u>less</u>** than usual yesterday before you drank, why?

_____ You want to minimize your caloric intake
_____ You want to get drunk faster
_____ Both (1 & 2)
_____ Other:_____

5. If you ate **more** than usual yesterday before you drank, why?
_____ You want to get drunk less quickly
_____ Other:_____

During

6. How much food did you eat yesterday **while you were drinking**?
    1. Much **more** than usual
    2. Somewhat **more** than usual
    3. My eating habits did not change (skip to question 9)
    4. Somewhat **less** than usual (skip to question 8)
    5. Much **less** than usual (skip to question 8)
    6. I didn't drink yesterday (skip questions 7 and 8)

7. Why did you eat **more**? (mark all that applies)
    1. To not get drunk or as drunk
    2. Drinking increases my appetite
    3. To try to "sober up"
    4. Other: _____

8. Why did you eat **less**? (mark all that applies)
    1. To get drunk faster
    2. To not ruin the "buzz"
    3. Drinking decreases my appetite
    4. Other: _____

After

9. How much food did you eat **after you had been drinking before you went to sleep yesterday**?
    1. Much **more** than usual
    2. Somewhat **more** than usual
    3. My eating habits did not change
    4. Somewhat **less** than usual
    5. Much **less** than usual
    6. I didn't drink yesterday

10. How much junk food (pizza, burgers, chips) did you eat **after drinking before going to sleep yesterday?**

    1. A large amount
    2. A Moderate amount
    3. A little
    4. None
    5. I didn't drink yesterday

11. Were you less healthy about your food choices (onion rings instead of yogurt, etc.) when eating **after drinking before going to sleep yesterday**?

    1. **Definitely was less** healthy about food choices
    2. **Somewhat/moderately** less healthy
    3. **Slightly** less healthy
    4. **Was not less healthy** about food choices
    5. I didn't drink yesterday

Intentions

12. Do you intend to eat **less** food, fat, or calories before drinking tonight?

    1. Definitely yes
    2. Mostly yes
    3. Maybe
    4. Mostly no
    5. Definitely no
    6. I don't plan to drink tonight

13. If you intend to eat **less** before drinking tonight, what is your reason for doing so?

    1. _____ You want to minimize your caloric intake
    2. _____ You want to get drunk faster
    3. _____ Both (1 & 2)
    4. _____ Other:_____
    5. _____ Not applicable

14. Do you intend to eat **more** before drinking tonight?

    1. Definitely yes
    2. Mostly yes
    3. Maybe
    4. Mostly no
    5. Definitely no
    6. I don't plan to drink tonight

15. If you intend to eat **more** before drinking tonight, what is your reason for doing so?

    1. You want to get drunk less quickly
    2. Other:_____
    3. Not applicable

VITA

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Psychology, 2011; Political Science, 2011

Background

Peter D. Preonas is currently a fifth year graduate student at the Virginia Consortium Program in Clinical Psychology, which is composed of Old Dominion University, Norfolk State University, and Eastern Virginia Medical School. During graduate school, he has served as lab coordinator for Dr. Cathy Lau-Barraco. His research interests include alcohol use as it relates emotional functioning, general health psychology, and substance use interventions. He is completing his clinical interest at Edward Hines, Jr. Veterans Affairs Hospital, with clinical interests in substance use and PTSD.

Select Publications

Preonas, P. D., & Lau-Barraco, C. (2019). Affective factors explaining the association between depressive functioning and alcohol outcomes. *Journal of American College Health, Nov,* 1-7. doi: 10.1080/07448481.2019.1683565.

Stamates, A. L., Linden-Carmichael, A. N., **Preonas, P. D.,** & Lau-Barraco, C. (2019). Testing daily associations between impulsivity, affect, and alcohol use outcomes: A pilot study. *Addiction Research & Theory, 27,* 242-248. doi: 10.1080/16066359.2018.1498846.

Lau-Barraco, C., Linden-Carmichael, A. N., Stamates, A. L., **Preonas, P. D.**, & Braitman, A. L., (2019). The influence of a brief alcohol intervention on alcohol use trajectories in nonstudent emerging adult drinkers. *Substance Use and Misuse, 54,* 2025-2032. doi: 10.1080/10826084.2019.1626434.