Food-Restricted Alcohol Consumption: Relation to Psychopathology in College Students

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Abstract

Objective: Food-restricted alcohol consumption (FRAC) is a growing concern among college students. We investigated demographic and lifestyle characteristics and psychiatric symptoms associated with FRAC.

Participants: College students (*n*=561) at a large southeastern university in the United States.

Methods: Participants completed online self-reported questionnaires assessing past-year FRAC, demographic and lifestyle characteristics, and psychiatric symptoms.

Results: The past-year prevalence of FRAC was 23.89%. In the bivariate analyses, students engaging in FRAC had higher mean scores of multiple psychiatric symptoms, reported more harmful or hazardous drinking and suicidality, and were more likely to report a history of an eating disorder than their peers without FRAC. In a hierarchical regression model, binge eating, cognitive restraint, self-reported history of an eating disorder, and harmful or hazardous drinking were significantly associated with FRAC ($ps<0.05$) after other psychiatric symptoms were included in the model.

Conclusion: Our findings stress the importance of heightened awareness of FRAC in college.

Keywords

food restriction; alcohol; psychopathology; drunkorexia

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Introduction

Alcohol misuse and disordered eating frequently co-occur,[1] and this comorbidity is associated with high morbidity and mortality.[2,3] Both conditions are common health concerns among college students.[4,5] In previous studies, 18% of college students in the United States experience clinically significant alcohol-related problems,[5] and 12% of students are at increased risk for eating disorders.[4] Both conditions are associated with other psychiatric symptomatology, including anxiety disorders, depression, other forms of substance use, and self-harm,[6–8] which are also common in college students.[9,10] Additional research indicates that 17% of male and 19% of female college students have co-occurring problematic alcohol use and disordered eating, which includes symptoms of an eating disorder.[11] Importantly, a unique pattern of alcohol consumption and disordered eating in college students has been observed, where individuals intentionally restrict their food intake prior to alcohol consumption. Colloquially, this behavior has been labeled "drunkorexia"; however, the term incorrectly implies anorexia nervosa symptomology.[12] We therefore recommend the alternative term, "food-restricted alcohol consumption" (FRAC).[13]

The prevalence of FRAC has been estimated to range from 14% in first-year United States college students to 79% in female Australian university students.[14–21] Findings have shown that more women than men engaged in FRAC during their lifetime,[22] and women reported more days per month of engaging in FRAC than men.[17] However, no sex differences in past-30-day FRAC have also been reported.[14,23] Previous studies have suggested that two common motives for FRAC exist—rapid intoxication (i.e., to get drunk faster) and weight management (i.e., to offset the calories in alcohol).[14,16,17,24] Sex differences appear to exist for motives for engaging in FRAC. For example, a previous study found that women had a greater desire for weight management than men, which explained why women were more likely to engage in FRAC.[17] However, no evidence has shown whether rapid intoxication accounts for sex differences in FRAC. Indeed, drinking on an empty stomach causes a rapid rise in blood alcohol concentration, which further increases the risk of partial or complete blackouts (i.e., periods of memory loss for events that transpired while a person was drinking).[25] These effects are a greater concern for women, who generally have lower body weight, less alcohol metabolizing enzymes, and less total body water to dilute alcohol in the blood than men.[25] Thus, it is important to better understand whether FRAC motives are related to frequency of engaging in FRAC and sex because this information could aid in developing more refined intervention approaches that target individuals with different levels of severity and sex.

Given the high prevalence of food-restricted alcohol consumption (FRAC) among college students and the serious health issues it may cause, it is critical to identify other demographic and lifestyle characteristics associated with FRAC besides sex. Previous studies found that Greek-affiliated students (i.e., fraternity and sorority members) may be at higher risk for restrictive eating on alcohol consumption days,[19,26] consistent with previous literature suggesting that Greek members were more likely to engage in alcohol use and disordered eating than their non-Greek peers.[27,28] Moreover, non-Hispanic white students and students with a body mass index (BMI) < 25 were more likely to restrict food consumption before drinking alcohol to avoid weight gain, compared with students who

identified with other racial/ethnic groups, and students with a BMI > 25.[19] Importantly, one relevant characteristic that has received little attention is year in school. The first year of college is a unique transition period, as many individuals move away from home and become independent for the first time. This transition is often accompanied by academic rigor, financial constraints, family pressure, and mental health problems such as depression and anxiety.[29,30] The one study that did examine year in school, however, found no significant differences in FRAC among first-year students, sophomores, juniors, and seniors.[19] Additional research is needed to understand the association between academic year and FRAC because it can help school administrators and parents recognize FRAC to provide necessary support for students at high risk.

Previous studies have also shown differences in psychiatric symptoms in college students who do and do not engage in food-restricted alcohol consumption (FRAC). For example, alcohol misuse[18,24,31] and disordered eating, including cognitive restraint, excessive exercise, purging, and binge eating,[24] as well as body weight and shape concerns,[31,32] have been associated with FRAC in college students. Although both alcohol misuse and disordered eating added incremental validity to the prediction of FRAC, FRAC was more strongly related to disordered eating, especially for women.[24] Examining such associations in additional samples can provide further evidence of the importance for investigating FRAC within the alcohol and eating disorders fields.

It is possible that other psychiatric symptoms may be associated with food-restricted alcohol consumption (FRAC) given their association with alcohol misuse and disordered eating. For example, students who have depression symptoms may engage in FRAC to achieve more rapid alcohol intoxication because they are more sensitive to negative mood induced alcohol-seeking.[33] Food restriction may also negatively influence individuals' feelings and mood,[34] which in turn may negatively influence depressive symptoms, anxiety, and stress. Previous literature only compared students engaging in FRAC with students who ate more food prior to drinking and found that students engaging in FRAC scored higher on depressive and anxiety symptoms.[16] Thus, it is also important to examine whether the risk of depression and anxiety in students who engage in FRAC is different than their peers who do not engage in FRAC. Negative urgency—the tendency to act rashly when distressed—is associated with both problematic alcohol consumption and eating disorder symptoms.[35,36] Students with high levels of negative urgency are more likely to have low self-control and high affective lability, which affect risk-taking behaviors.[37] Other psychiatric symptoms associated with higher risks of both alcohol misuse and disordered eating, such as childhood trauma (e.g., maltreatment)[38,39] and suicidality,[7,8] may also be associated with FRAC. In summary, a more comprehensive evaluation of psychiatric symptoms associated with FRAC is needed to inform prevention and intervention efforts.

Therefore, the aims of this study were to: 1) evaluate the past-year prevalence of food-restricted alcohol consumption (FRAC), and examine FRAC frequencies and sex differences by motives for engaging in FRAC; 2) assess differences in demographic and lifestyle (i.e., Greek-affiliation) characteristics, as well as psychiatric symptoms, between individuals who do and do not engage in FRAC; and 3) investigate both separate and joint effects that these characteristics and symptoms had on FRAC in college students. We hypothesized that

college students who: 1) were female; 2) had a Greek affiliation; 3) were non-Hispanic white; 4) were in their first year of college; and 5) reported alcohol misuse, disordered eating, internalizing symptoms (i.e., depression, anxiety, and stress), negative urgency, childhood trauma, suicidality, or history of an alcohol use disorder or eating disorder would be more likely to engage in FRAC than their peers without these features and/or symptoms. Findings from this study can inform researchers with the importance of further investigating FRAC on college campuses and assist healthcare workers in developing targeted prevention and intervention approaches based on characteristics and symptoms associated with FRAC.

Methods

Participants and Procedure

Data were from the Carolina College Assessment for Research and Education in Science (Carolina *C.A.R.E.S.*), which examined mental health and well-being in college students who were at least 18 years old at a large southeastern university in the United States (*N*=776). The university's Institutional Review Board approved the study. All participants provided consent online. Students were recruited from a psychology subject pool and completed online questionnaires via Qualtrics. Overall, 721 students finished this study. Only individuals who indicated they had at least one drink of alcohol during the past year (*n*=569) were included in the analysis. We excluded students with missing values on food-restricted alcohol consumption (FRAC) (*n*=3), sex (*n*=2), and ethnicity (*n*=1), or those with implausible values on age (*n*=2). The final sample size was 561. Students had a mean age of 19.34 years (*SD* = 1.73), with a range from 18 years to 35 years. Nearly half of the participants were first-year students (43.85%; *n*=246). The majority of sample was female (59.71%, *n*=335), Caucasian (70.77%, *n*=397), non-Hispanic (92.34%, *n*=518), and not affiliated with Greek life (78.43%, *n*=440). The demographic and lifestyle characteristics of our study sample were consistent with the demographic and lifestyle characteristics of the larger university sample from which it was drawn.

Measures

Food-restricted alcohol consumption (FRAC)—Food-restricted alcohol consumption (FRAC) was defined as "purposefully restricting food intake prior to alcohol consumption within the past year". Four items were developed based on a previous FRAC measure[14] to ascertain whether participants engaged in FRAC, and, if so, the frequency of engaging in FRAC for two reasons. The four items were: (1) "In the past year, have you eaten less food than normal for a day or more before you knew you were going to drink alcohol to save on calories or to prevent weight gain?", and response options were *yes* or *no*. (2) (If yes to question 1) "In the past year, how many times have you eaten less food than normal when you were going to drink alcohol to save on calories or to prevent weight gain?". The response options were *"1–2 times," "3–5 times," "6–10 times," "more than 10 times,"* and *"every time drink alcohol"*. (3) "In the past year, have you eaten less food than normal for a day or more before you knew you were going to drink alcohol to get drunk faster?", with response options of *yes* or *no*. (4) (If yes to question 3) "In the past year, how many times have you eaten less food than normal to get drunk faster?" The response options included *"1–2 times," "3–5 times," "6–10 times," "more than 10 times,"* and *"every time*

drink alcohol". Participants who indicated they restricted food intake before drinking alcohol (either to get drunk faster or to save calories/prevent weight gain) one or more times in the past year were classified as engaging in FRAC. All participants who had one or more standard drinks of alcohol but did not indicate FRAC in the past year were classified as not engaging in FRAC.

Alcohol Misuse—Alcohol misuse was measured using the Alcohol Use Disorders Identification Test (AUDIT).[40] The AUDIT includes 10 items about past-year alcohol consumption, including alcohol intake, alcohol dependence, and adverse reactions to drinking and alcohol-related problems. Each item is scored 0 to 4. Items are summed to create a total score ranging from 0 to 40. A score of 8 or more is recommended as an indicator of harmful or hazardous drinking.[40] In a college sample, the Cronbach's alpha coefficient was 0.75, and a cutoff score of 8 demonstrated a sensitivity of 0.95 and a specificity of 0.93 in the detection of high-risk drinkers.[41] In this study, the Cronbach's alpha of the AUDIT total score was 0.80.

Disordered Eating—The Eating Pathology Symptoms Inventory (EPSI) is a 45-item measure that assesses disordered eating in the last four weeks.[42] It includes eight subscales: body dissatisfaction, binge eating, cognitive restraint, purging, restricting, excessive exercise, negative attitudes toward obesity, and muscle building. Each item is scored on a 5-point Likert scale, and the relevant subscale items are summed; higher scores indicate greater disordered eating. The EPSI subscales had Cronbach's alpha coefficients ranging from 0.77 to 0.91, and most of the subscales had moderate to strong positive correlations (correlation coefficients ranged from 0.30 to 0.72) with other established scales measuring disordered eating, indicating good convergent and discriminant validity.[42] In this study, Cronbach's alphas were 0.89 for body dissatisfaction, 0.87 for binge eating, 0.76 for cognitive restraint, 0.83 for purging, 0.87 for restricting, 0.89 for excessive exercise, 0.88 for negative attitudes toward obesity, and 0.78 for muscle building.

Depression, Anxiety, and Stress—The Depression Anxiety Stress Scales (DASS) is a 42-item scale that assesses three internalizing symptoms—depression, anxiety, and stress—experienced in the past week.[43] Each question is scored from 0 to 3 based on symptom frequency, with domains derived from summing the scores of relevant items. Higher scores indicate greater symptom severity. In a college sample, the DASS-42 scale demonstrated good psychometric properties. The Cronbach's alphas were 0.92 for depression, 0.86 for anxiety, and 0.88 for stress; the Pearson's correlation coefficients between DASS subscales and another well-established scale to measure internalizing symptoms are 0.64 for depression, 0.58 for anxiety, and 0.59 for stress.[44] In this study, the Cronbach's alphas were 0.96 for depression, 0.90 for anxiety, and 0.92 for stress.

Childhood Trauma—Using the Childhood Traumatic Events Scale (CTES),[45] participants were asked whether they had experienced any of the following prior to age 17: death of a very close friend or family member; a major upheaval between parents (e.g., divorce or separation); a traumatic sexual experience (e.g., being raped or molested); other violence (e.g., child abuse, mugged, or assaulted – other than sexual); extreme illness or injury;

and any other major upheaval that may have significantly shaped the participant's life or personality. In the current study, participants who answered "Yes" to any of the above questions were categorized as having childhood trauma, whereas those who answered "No" were categorized as having "no childhood trauma".

Negative Urgency—Negative urgency was assessed from the UPPS-P Impulsive Behavior Scale (UPPS-P).[46] Twelve questions were used, with responses on a 4-point scale ranging from *1=Strongly agree* to *4=Disagree strongly*. The mean of available items was calculated to obtain a final score. Higher scores indicate more impulsive behaviors. The negative urgency subscale of the UPPS-P had a Cronbach's alpha of 0.87 and demonstrated good convergent and discriminant validity, with Pearson correlation coefficients between conceptually related constructs ranging from 0.28 to 0.49.[47] In this study, the Cronbach's alpha for negative urgency was 0.88.

Suicidality, History of Psychiatric Disorders, and Psychiatric Treatment—Using a self-report checklist, we collected information on history of suicidality, psychiatric disorders, and psychiatric treatment. To assess suicidality, students were asked if they had ever experienced: thoughts of hurting oneself, but would never carry them out; intentionally hurting oneself; or had attempted suicide. Students who indicated one or more of these experiences were coded as endorsing suicidality. Those who selected "none of the above" were coded as not endorsing suicidality. For a history of psychiatric disorders, students were asked whether they had ever struggled with multiple psychiatric disorders, including an eating disorder (e.g., anorexia nervosa, bulimia nervosa, binge-eating disorder, purging disorder) and an alcohol use disorder (i.e., alcohol abuse, alcohol dependence). Participants could check all options that applied to them. Subsequent questions asked participants to report whether they had received treatment by a professional (e.g., psychologist, psychiatrist, social worker, physician, or dietitian) for these psychiatric disorders, including an eating disorder and an alcohol use disorder, again checking all options that were applicable to them. Those who selected the disorder of interest (i.e., eating disorder or alcohol use disorder) or indicated a history of treatment for the disorder were coded yes for the disorder of interest. Those who did not select either disorder of interest were coded as having no psychiatric disorder history or no treatment history.

Demographic and Lifestyle Information—The survey asked participants about sex assigned at birth, age, race, ethnicity, year in school, and Greek affiliation. Students were asked to report their current height and weight (excluding pregnancy). BMI was calculated as (weight in pounds/[height in inches × height in inches]) × 703. Three individuals with implausible current BMI values (BMI<6) were recoded as missing.

Statistical Analysis

Prevalence Estimate and Motives of food-restricted alcohol consumption (FRAC)—Statistical analyses were conducted in SAS version 9.4.[48] The prevalence of past-year food-restricted alcohol consumption in this sample was determined. Frequencies of engaging in past-year FRAC were calculated for each FRAC motive. Sex differences by motive were obtained by a chi-square test.

Initial T-Test and Chi-Square Test—Differences in demographic and lifestyle characteristics, as well as psychiatric symptoms, between individuals who did and did not engage in food-restricted alcohol consumption (FRAC) were examined using *t*-tests and chi-square tests.

Hierarchical Multiple Regression—Our primary analysis was to further explore whether the significant ($p<0.05$) demographic and lifestyle characteristics, as well as psychiatric symptoms, obtained from *t*-tests and chi-square tests were associated with past-year food-restricted alcohol consumption (FRAC), after the other significant characteristics and symptoms were included in the model. Hierarchical regression was conducted to examine both the separate and combined effects of characteristics and symptoms that were significant in the bivariate analysis of past-year FRAC. Only significant variables from *t*-tests and chi-square tests were grouped based on their similarities and entered into a logistic regression model. Whether a variable set could be retained in the final model depended on whether it contributed to a significant improvement in R^2 to the model. Odds ratios for FRAC, standardized regression coefficients, chi-square statistics, and *p*-values for each independent variable in each model were reported to quantify the separate association between each characteristic/symptom and FRAC. A significance level of 0.05 was used in all analysis.

Results

Prevalence Estimate and Motives of Food-Restricted Alcohol Consumption (FRAC)

The prevalence of past-year food-restricted alcohol consumption (FRAC) was 23.89%. Of these 134 individuals who engaged in FRAC, 31.34% (*n*=42) did so for more rapid intoxication, 33.58% (*n*=45) did so to prevent weight gain, and 35.07% (*n*=47) indicated both motivations. Nearly half of students who engaged in FRAC for more rapid intoxication or weight management did so 1–2 times during the past year (48.31%, *n*=43 and 34.07%, *n*=31, respectively) (Table 1). No significant sex differences were observed in the proportions of individuals who indicated more rapid intoxication (41.30% of men, *n*=19 vs. 26.14% of women, *n*=23; X^2=3.23, df=1, *p*=0.07), weight management motive (28.26% of men, *n*=13 vs. 36.36% of women, *n*=32; X^2=0.89, df=1, *p*=0.35), or who indicated both motives (30.43% men, *n*=14 vs. 37.50% of women, *n*=33; X^2=0.66, df=1, *p*=0.42) of FRAC.

Initial T-Test and Chi-Square Test Results

Demographic and lifestyle characteristics, as well as psychiatric symptoms, are summarized both for the total study sample and by whether participants did or did not engage in past-year food-restricted alcohol consumption (FRAC) in Table 2. No significant differences emerged for any demographic or lifestyle characteristic between individuals who did and did not engage in FRAC. Compared with students who did not engage in FRAC, those who reported FRAC had significantly higher mean scores for all eight disordered eating symptoms (*p*s from <0.0001 to 0.03), indicating they had greater disordered eating. Students who reported FRAC also had higher mean scores for depression, anxiety, stress, and negative urgency than those who did not engage in FRAC (*p*s from 0.0001 to <0.01). Individuals who engaged in FRAC also reported more harmful or hazardous drinking

(50.00% vs. 29.74%, $p<0.001$), suicidality (48.12% vs. 33.73%, $p<0.01$), and were more likely to have a self-reported history of an eating disorder (22.39% vs. 6.79%, $p<0.0001$) than their peers who did not report FRAC in the past year. We did not find a significant difference for childhood trauma between individuals who did and did not engage in past-year FRAC.

Hierarchical Multiple Regression Results

A three-step hierarchical multiple regression model was used to analyze the individual and cumulative effects of significant variables from *t*-tests and chi-square tests on past-year food-restricted alcohol consumption (FRAC) (Table 3). Because no demographic or lifestyle characteristic was significantly associated with FRAC in the bivariate analysis, only significant psychiatric symptoms were entered into the hierarchical regression models. Independent variables were grouped into three variable sets and entered into a logistic regression model in the following steps: 1) variables assessing participants' disordered eating, including eight symptoms (i.e., body dissatisfaction, binge eating, cognitive restraint, purging, restricting, excessive exercise, negative attitudes toward obesity, and muscle building) and self-reported eating disorders; 2) harmful or hazardous drinking; 3) internalizing symptoms (i.e., depression, anxiety, and stress), negative urgency, and suicidality. Due to the nature of FRAC—a pattern of co-occurrence of alcohol misuse and disordered eating—these two hierarchies were entered first prior to entering other psychiatric symptoms. Since previous findings suggest that FRAC is more strongly related to disordered eating,[14] variables assessing participants' disordered eating were entered prior to harmful or hazardous drinking.

Disordered eating and self-reported eating disorders in step 1 accounted for 12.38% of the variation in the outcome. Binge eating, cognitive restraint, and self-reported eating disorders were significantly associated with food-restricted alcohol consumption (FRAC) after adjusting for other symptoms (βs range from 0.13 to 0.28, *p*s range from <0.001 to 0.02). After entering the second variable set—harmful or hazardous drinking—the two-step model contributed to 15.10% of the overall variation in past-year FRAC, with a significant R^2 added of 0.0272. Binge eating, cognitive restraint, self-reported eating disorders, and harmful or hazardous drinking were significantly associated with FRAC, after adjusting for other variables (βs range from 0.13 to 0.29, *p*s range from <0.0001 to 0.02). After entering the last variable set, which included internalizing symptoms (i.e., depression, anxiety, and stress), negative urgency, and suicidality, the final model explained 15.54% of the variation in the outcome, with only a R^2 added of 0.0044, indicating that the addition of variables in this step did not explain significantly more variance in FRAC. None of the variables entered in step 3 were significantly associated with FRAC after adjusting for other variables. These results suggest that a significant proportion of variation in past-year FRAC was explained jointly by disordered eating and self-reported eating disorders, as well as harmful or hazardous drinking. The final model indicated that binge eating ($\beta=0.20$, $p=0.01$), cognitive restraint ($\beta=0.30$, $p<0.001$), self-reported eating disorders ($\beta=0.12$, $p=0.03$), and harmful or hazardous drinking ($\beta=0.25$, $p<0.0001$) were significantly associated with past-year FRAC even after other psychiatric symptoms were included in the model.

Comment

Our findings suggest that nearly one in four college students engaged in food-restricted alcohol consumption (FRAC) in the previous year. Based on our bivariate analysis results, students engaging in FRAC reported significantly higher mean scores for or higher frequencies of multiple psychiatric symptoms than their peers who did not engage in FRAC. In a three-step hierarchical regression model, binge eating, cognitive restraint, a self-reported history of an eating disorder, and harmful or hazardous drinking were significantly associated with FRAC after adjusting for internalizing symptoms, negative urgency, and suicidality. These findings indicate that FRAC is a concerning health issue in college students that is associated with multiple mental health symptoms.

In our study, the prevalence of past-year food-restricted alcohol consumption (FRAC) was nearly 24%, which is within the range of estimates reported previously (14% to 79%).[14–21] Most students who engaged in FRAC driven by either more rapid intoxication motives or weight management motives did so with a relatively low frequency of 1–2 times during the past year. Notably, 83% of our sample was under the legal drinking age (21 years), highlighting the need for increased awareness of FRAC, especially for students beginning college.

In our sample, the proportion of students who engaged in food-restricted alcohol consumption (FRAC) for either motive did not differ significantly by sex. This finding was inconsistent with a previous study where sex was a significant predictor of weight management motivation, and weight management motivation in turn explained why women were more likely to endorse FRAC than men.[17] Indeed, we had limited power to examine sex differences by motive, especially for the more rapid intoxication motive, which had a nearly twofold difference (41.30% of men vs. 26.14% of women). Still, that no significant sex difference by motive existed suggests that problematic alcohol use and disordered eating may be prevalent among both male and female students. It is possible that male college students are paying more attention to their body image and becoming more likely to manage weight. Particularly, male youth who consume alcohol have a higher risk of fasting and steroid use than their peers who do not consume alcohol.[49] These findings could provide insight about the importance of education on both alcohol misuse and eating disorders for college students regardless of their sex, as they are equally vulnerable to such risky behaviors.

In the bivariate analysis, no significant difference emerged for sex between individuals who did and did not engage in food-restricted alcohol consumption (FRAC), which corroborates previous reports indicating no significant difference in the prevalence of FRAC between men and women.[14] However, some studies suggested that women were more likely to engage in FRAC than men.[17,22] This inconsistency may be due to a lack of sex differences by FRAC motive in our sample, whereas another study found that female students were more likely to engage in FRAC because they had a greater desire for the weight management motive.[17] We also did not find a significant difference in the proportion of students who engaged in FRAC across academic years, corroborating other research,[19] suggesting that college students in different years in school are equally vulnerable to FRAC. Previous

studies have identified common stressors among college students, such as "doing poorly on exams or worrying about exams", "not enough money", "poor grades or worrying about poor grades", and "problems in personal life make it hard to study",[29] each of which may be associated with FRAC. However, which specific stressors are present for individuals may vary across academic years. Future studies should measure more specific sources of stress among college students, as well as how those stressors may affect FRAC throughout college.

Students who engaged in past-year food-restricted alcohol consumption (FRAC) had significantly higher mean scores for depression, anxiety, stress, and negative urgency, and reported more suicidality, which was consistent with our hypotheses. These psychiatric symptoms have been associated with higher risks of both alcohol misuse and disordered eating.[6–8,36] Individuals with both an alcohol use disorder and an eating disorder have also exhibited depressive and anxious dispositions.[50] Contrary to our hypothesis, we did not find differences in childhood trauma among individuals who did and did not engage in FRAC. It is possible that specific types of trauma (e.g., childhood physical abuse), rather than a general presence of any childhood trauma as assessed here, is associated with engaging in FRAC. A larger sample is needed to capture the distinct effect of different types of trauma on FRAC.

In a hierarchical regression analysis, disordered eating and harmful or hazardous drinking jointly explained a significant proportion of variance of past-year food-restricted alcohol consumption (FRAC). Specifically, harmful or hazardous drinking, binge eating, cognitive restraint, and a self-reported history of an eating disorder were positively associated with engaging in FRAC even when internalizing symptoms, negative urgency, and suicidality were included in the model, corroborating previous findings that both problematic alcohol use and disordered eating were positively associated FRAC.[18,24,31,32] Our findings emphasize the importance of investigating how the co-occurrence of alcohol misuse and disordered eating are expressed in and impact college students. For example, the prevalence of binge drinking was higher in college students with disordered eating compared with those without disordered eating; students with disordered eating also engaged in more risky and fewer protective drinking behaviors than their peers.[11] Importantly, alcohol misuse and disordered eating can interfere with students' college performance and educational attainment.[51,52] In college, co-occurring alcohol misuse and disordered eating could present as an additional and unique challenge that is expressed as FRAC. In turn, FRAC may predict the future development of both alcohol misuse and disordered eating.[24] For example, FRAC increases the risk of alcohol-induced blackouts, which have been found to be predictive of alcohol-related injury[53] over time among college students. Thus, FRAC could be a specific form of comorbid alcohol misuse and disordered eating observed in college students that should be addressed to prevent additional negative consequences associated with the development of alcohol use disorder and eating disorders.

Further, a self-reported history of an eating disorder contributed to an increased risk for food-restricted alcohol consumption (FRAC) after adjusting for disordered eating and harmful or hazardous drinking. It is possible that individuals who self-reported they were recovered from an eating disorder have lingering body image issues and disordered eating; they may have engaged in alcohol misuse after recovering from an eating disorder,

as an underlying tendency of "substance substitution". Therefore, education on healthy body image and reduction of other harmful behaviors, such as alcohol misuse, should be continued even if eating disorder symptoms are reduced.

Contrary to our hypotheses, depression, anxiety, stress, negative urgency, and suicidality did not contribute significant variance to food-restricted alcohol consumption (FRAC) after including disordered eating, a self-reported history of an eating disorder, and harmful or hazardous drinking in the model. Since FRAC is a pattern of co-occurrence of alcohol misuse and eating disorders, most of the variance of past-year FRAC was explained by harmful or hazardous drinking and variables assessing disordered eating in the model. On the other hand, these null findings may also be attributed to some measurement issues during study conduct, which can be improved upon in and avoided by future studies. For example, we assessed past-week depression, anxiety, and stress, which might not be associated with past-year FRAC. Thus, future research should capture a wider time frame (e.g., past-year or lifetime) for psychiatric symptoms to determine the impact these symptoms have on FRAC.

To our knowledge, this is one of the first studies to assess differences on several demographic characteristics (e.g., year in school) and psychiatric symptoms (e.g., depression, anxiety, stress, negative urgency, childhood trauma, and suicidality) between college students who do and do not report past-year food-restricted alcohol consumption (FRAC). We assessed multiple motives for FRAC and examined sex differences by motives, which could provide insights for education on risky behaviors for college students.

Although our findings extend current literature by identifying differences in psychiatric symptoms by whether individuals do or do not engage in food-restricted alcohol consumption (FRAC), some limitations exist. First, a standard definition of FRAC has not been determined by researchers. As such, multiple scales to evaluate FRAC have been developed and used across different samples. The scale to assess FRAC in our analysis was derived from a previous FRAC measure and has not yet been validated. Thus, it is important to note that these results may not generalize to other populations. Second, we used self-report measures rather than diagnostic interviews for assessing psychiatric symptoms and childhood trauma, which allows for retrospective bias that may affect the reliability of the results. However, previous studies have found increased accuracy in self-report questionnaires versus interviews, including of eating pathology.[54] Thus, we used well-validated questionnaires to collect responses. Third, due to the limitation of our sample size, we could not conduct additional analysis to examine the differences in characteristics and symptoms of students who did and did not engage in past-year FRAC based on their motives. We also could not calculate such differences based on frequency of engaging in FRAC within the past year due to limited statistical power. Finally, the cross-sectional design of this study limited our ability to examine the time sequence of associations between psychiatric symptoms and FRAC. Whether FRAC is triggered by or contributes to other psychiatric symptoms is unknown.

Conclusions

This study suggests that harmful or hazardous drinking, binge eating, cognitive restraint, and self-reported history of an eating disorder are significantly associated with past-year food-restricted alcohol consumption (FRAC) after other psychiatric symptoms were included in the model. Collegiate health providers should be aware of FRAC and its associated health implications. For students presenting with problematic alcohol use and disordered eating, treatment teams should consider screening for FRAC. Knowing that FRAC occurs in college students, college administrators and student health services should address FRAC in prevention and intervention services for alcohol misuse, eating disorder symptoms, and their comorbidity. Finally, future studies should use a larger sample to capture potential differences in participants' FRAC motives and frequency of engaging in FRAC, which can provide a more comprehensive understanding of FRAC. A longitudinal design would inform research on the temporal sequence and factors that may trigger FRAC, as well as investigate its long-term effects. Additional psychological and social factors that are associated with higher risks of both alcohol misuse and eating disorders, such as self-esteem, peer influences, and use of social media,[55–60] need to be examined for better prevention and intervention.

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Table 1.

Frequencies of past-year food-restricted alcohol consumption (FRAC) by motive.

	To get drunk faster (*n*=89)	Weight management (*n*=91)
	n (%)	*n* (%)
1 or 2 times	43 (48.31)	31 (34.07)
3–5 times	17 (19.10)	27 (29.67)
6–10 times	15 (16.85)	11 (12.09)
>10 times	12 (13.48)	16 (17.58)
Every time	2 (2.25)	6 (6.59)

Note: Participants could select both motives.

Table 2.

Demographic and lifestyle characteristics, as well as psychiatric symptoms, for the study sample; and comparison of characteristics and symptoms between individuals who do versus do not engage in food-restricted alcohol consumption (FRAC).

Demographic and lifestyle characteristics	Total Sample (n=561)	FRAC (n=134)	No FRAC (n=427)	t (df)	p
	Mean (SD)	Mean (SD)	Mean (SD)		
Age	19.34 (1.73)	19.47 (1.75)	19.30 (1.73)	−1.01 (559)	0.32
BMI (kg/m^2)	23.19 (3.73)	23.64 (4.17)	23.04 (3.57)	−1.48 (195.62)	0.14
	n (%)	n (%)	n (%)	χ^2 (df)	p
Sex (Female)	335 (59.71)	88 (65.67)	247 (57.85)	2.60 (1)	0.11
Year in School					
First-year	246 (43.85)	46 (34.33)	200 (46.84)	Referent	Referent
Sophomore	166 (29.59)	44 (32.84)	122 (28.57)	0.002 (1)	0.96
Junior	105 (18.72)	32 (23.88)	73 (17.10)	0.003 (1)	0.96
Senior	43 (7.66)	12 (8.96)	31 (7.26)	0.003 (1)	0.96
Graduate School*	1 (0.18)	0 (0)	1 (0.23)	---	---

Demographic and lifestyle characteristics	Total Sample (n=561)	FRAC (n=134)	No FRAC (n=427)	χ^2 (df)	p
	n (%)	n (%)	n (%)		
Race					
White	397 (70.77)	95 (70.90)	302 (70.73)	Referent	Referent
African American	44 (7.84)	6 (4.48)	38 (8.90)	0.001 (1)	0.98
Asian	71 (12.66)	17 (12.69)	54 (12.65)	0.002 (1)	0.96
Pacific Islander*	1 (0.18)	0 (0)	1 (0.23)	---	---
Multiracial	25 (4.46)	6 (4.48)	19 (4.45)	0.002 (1)	0.96
Other	23 (4.10)	10 (7.46)	13 (3.04)	0.01 (1)	0.94
Hispanic	43 (7.66)	11 (8.21)	32 (7.49)	0.07 (1)	0.79
Greek Affiliation	121 (21.57)	36 (26.87)	85 (19.91)	2.92 (1)	0.09

Psychiatric symptoms	Total Sample (n=561)	FRAC (n=134)	No FRAC (n=427)	t (df)	p
	Mean (SD)	Mean (SD)	Mean (SD)		
Disordered Eating					

Psychiatric symptoms	Total Sample (n=561)	FRAC (n=134)	No FRAC (n=427)	t (df)	p
	Mean (SD)	Mean (SD)	Mean (SD)		
Body Dissatisfaction	8.80 (6.87)	11.84 (7.55)	7.85 (6.36)	−5.54 (195.82)	**<0.0001**
Binge Eating	6.76 (5.83)	9.62 (6.96)	5.86 (5.11)	−5.77 (180.14)	**<0.0001**
Cognitive Restraint	4.64 (3.07)	6.19 (3.20)	4.15 (2.86)	−7.01 (559)	**<0.0001**
Purging	0.75 (2.16)	1.28 (2.91)	0.58 (1.84)	−2.62 (167.72)	**<0.01**
Restricting	4.24 (4.92)	5.25 (5.39)	3.92 (4.72)	−2.58 (200.98)	**0.01**
Excessive Exercise	6.04 (5.45)	7.50 (5.84)	5.58 (5.25)	−3.60 (559)	**<0.001**
Negative Attitudes toward Obesity	5.23 (4.85)	6.38 (4.86)	4.87 (4.79)	−3.17 (559)	**<0.01**
Muscle Building	3.00 (3.70)	3.66 (4.25)	2.79 (3.50)	−2.14 (192.92)	**0.03**
Depression	5.08 (7.28)	7.17 (8.40)	4.42 (6.77)	−3.45 (190.31)	**<0.001**
Anxiety	4.57 (5.83)	6.54 (7.08)	3.95 (5.24)	−3.91 (180.93)	**0.0001**
Stress	7.53 (7.20)	9.83 (8.13)	6.81 (6.73)	−3.90 (193.53)	**0.0001**

Psychiatric symptoms	Total Sample (n=561)	FRAC (n=134)	No FRAC (n=427)	t (df)	p
	Mean (SD)	Mean (SD)	Mean (SD)		
Negative Urgency	25.77 (7.19)	27.40 (7.68)	25.25 (6.97)	−3.04 (559)	**<0.01**
	n (%)	n (%)	n (%)	χ^2 (df)	p
Harmful or Hazardous Drinking	194 (34.58)	67 (50.00)	127 (29.74)	18.50 (1)	**<0.0001**
Childhood Trauma	351 (62.57)	87 (64.93)	264 (61.83)	0.42 (1)	0.52
Suicidality	207 (37.16)	64 (48.12)	143 (33.73)	8.98 (1)	**<0.01**
Self-Reported Alcohol Use Disorder	11 (1.96)	4 (2.99)	7 (1.64)	---	---
Self-Reported Eating Disorder	59 (10.52)	30 (22.39)	29 (6.79)	26.36 (1)	**<0.0001**
Alcohol Use Disorder Treatment [*]	8 (1.43)	3 (2.24)	5 (1.17)	---	---
Eating Disorder Treatment [*]	20 (3.57)	14 (10.45)	6 (1.41)	---	---

Note: SD=standard deviation; df=degrees of freedom. Variables with significant differences are bolded.

[*] Could not compute due to small sample size.

Table 3.

Three-step hierarchical regression models for variables predicting past-year food-restricted alcohol consumption (FRAC).

Variable	R^2	R^2 added	OR (95% CI)	β	χ^2	*p*
Step 1	0.1238	---				
Body Dissatisfaction			1.02 (0.98, 1.06)	0.06	0.65	0.42
Binge Eating			1.07 (1.03, 1.12)	0.22	10.68	**<0.01**
Cognitive Restraint			1.18 (1.07, 1.29)	0.28	11.88	**<0.001**
Purging			0.98 (0.88, 1.08)	−0.03	0.23	0.63
Restricting			1.00 (0.96, 1.05)	0.01	0.03	0.86
Excessive Exercise			0.97 (0.93, 1.02)	−0.08	1.12	0.29
Negative Attitudes toward Obesity			1.00 (0.96, 1.05)	0.004	0.004	0.95
Muscle Building			1.06 (0.99, 1.13)	0.12	2.91	0.09
Self-Reported Eating Disorders			2.11 (1.12, 3.98)	0.13	5.36	**0.02**
Step 2	0.1510	0.0272				
Body Dissatisfaction			1.03 (0.99, 1.07)	0.11	1.90	0.17
Binge Eating			1.06 (1.02, 1.11)	0.19	7.96	**<0.01**
Cognitive Restraint			1.19 (1.08, 1.31)	0.29	12.60	**<0.001**
Purging			0.98 (0.88, 1.08)	−0.03	0.23	0.63
Restricting			1.00 (0.95, 1.05)	−0.002	0.002	0.97
Excessive Exercise			0.98 (0.93, 1.03)	−0.07	0.90	0.34
Negative Attitudes toward Obesity			1.00 (0.95, 1.05)	−0.008	0.02	0.90
Muscle Building			1.04 (0.97, 1.11)	0.07	1.18	0.28
Self-Reported Eating Disorders			2.10 (1.11, 3.98)	0.13	5.14	**0.02**
Harmful or Hazardous Drinking			2.61 (1.67, 4.10)	0.25	17.47	**<0.0001**
Step 3	0.1554	0.0044				
Body Dissatisfaction			1.02 (0.98, 1.06)	0.07	0.69	0.41
Binge Eating			1.06 (1.02, 1.11)	0.20	7.54	**0.01**
Cognitive Restraint			1.19 (1.08, 1.31)	0.30	12.72	**<0.001**
Purging			0.98 (0.88, 1.09)	−0.03	0.15	0.70
Restricting			0.99 (0.95, 1.04)	−0.02	0.11	0.74
Excessive Exercise			0.98 (0.93, 1.03)	−0.07	0.69	0.41

Variable	R^2	R^2 added	OR (95% CI)	β	χ^2	p
Negative Attitudes toward Obesity			1.00 (0.95, 1.05)	−0.01	0.01	0.92
Muscle Building			1.04 (0.97, 1.11)	0.07	1.04	0.31
Self-Reported Eating Disorders			2.04 (1.06, 3.92)	0.12	4.56	**0.03**
Harmful or Hazardous Drinking			2.57 (1.62, .4.08)	0.25	16.10	**<0.0001**
Depression			1.01 (0.97, 1.06)	0.06	0.39	0.53
Anxiety			1.02 (0.96, 1.08)	0.05	0.26	0.61
Stress			1.00 (0.95, 1.05)	−0.01	0.004	0.95
Negative Urgency			0.99 (0.96, 1.02)	−0.04	0.35	0.55
Suicidality			1.15 (0.70, 1.89)	0.04	0.32	0.57

Note: R^2= R-squared; OR=odds ratio; CI=confidence interval; β=standardized regression coefficient; χ^2=chi-square. R^2 added represents the additional variance the model explains compared with the former model. Variables that are significantly (p<0.05) associated with FRAC, after adjusting for other variables, are bolded.