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The Drunchies Hangover: Heavy Episodic Drinking and Dietary Choices while Drinking and on the Following Day

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Abstract

Background and Purpose: Alcohol intoxication affects college students' eating patterns. Yet, little is known about dietary habits on the day after heavy alcohol consumption. The purpose of this study was to examine college students' dietary choices during alcohol consumption and on the following day by gender and level of alcohol consumption (including none). **Methods:** Ethnically diverse undergraduates ($N = 286$; 52% male, 48% female, M age = 19, SD age = 1) at a public university in the Midwest completed an anonymous on-line survey. The survey included Behavioral Risk Factor Surveillance System nutrition items, items on consumption of "empty calorie foods," and open-ended response items on dietary choices that were coded by a nutritionist. **Results:** Participants reported differences in the likelihoods of consuming non-nutrient dense foods after drinking alcohol both before sleeping and the next day compared to at other times when they were not consuming alcohol. **Conclusion:** College students are more likely to eat after drinking alcohol and tend to consume less healthy foods. These dietary practices necessitate the need for customized interventions focusing on the dietary influences of alcohol consumption.

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Introduction

Given that 65% of the US student population reports regularly drinking alcohol (Johnston, O'Malley, Bachman, & Schulenberg, 2012), researchers and practitioners need to address the risks and consequences associated with these behaviors. In addition to the immediate consequences of alcohol intoxication, such as increased risk of vehicle accidents (e.g., National Center for Statistics and Analysis, 2016), there are behavioral consequences posing longer-term health risks. Weight gain is one longer-term unhealthy outcome associated with frequent alcohol consumption. Although alcohol is not a nutrient, it yields seven kilocalories for every gram consumed. Consequently, alcoholic

beverages are a source of empty calories, as they offer significant energy without offering

nutritional value. The 2015-2020 Dietary Guidelines for Americans, (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015), recommends that if people drink alcohol, they should do so in moderation, no more than one drink per day for women and two drinks per day for men. Moreover, if alcohol is consumed it should be incorporated into one's daily energy goal to avoid weight gain (Dietary Guidelines for Americans, 2015).

The average beer contains approximately 150 calories (Federal Register, 2005). If an individual has five beers, he or she will have

consumed 750 calories, which comprises over a third (37.5%) of the daily value (DV) for a 2000-calorie diet, increasing the potential for energy imbalance. A significant portion of the population consumes more than five drinks in one sitting and some drinks contain substantially more than 150 calories, thus for some the calories consumed from alcohol represents an even greater risk for weight gain.

Indeed, among young adults, including those in college, alcohol consumption has been correlated with weight gain (Adams & Rini, 2007; Bodenlos; Gengarely, & Smith, 2015; Kasperek et al., 2008; Nikolaou, Hankey, & Lean, 2015) and lower levels of physical activity (Dinger, Brittain, & Hutchinson, 2014). These behaviors may help explain the so-called “freshmen 15,” the weight gains that college students experience beyond that of their non-student peers (Mihalopoulos et al., 2008). Changes in weight are associated with a myriad of lifestyle and developmental changes young adults experience while attending university (Vadeboncoeur, Townsend, & Foster, 2015).

Obesity rates among Americans continue to concern researchers and practitioners. Indeed, one-third of Americans are overweight and another third are obese (Hales, Carroll, Fryar, & Ogdon, 2017), these figures are among the highest obesity rates in developed countries (Popkin & Gordon-Larsen, 2004). By comparison 22.5% and 12.5% of college students are overweight and obese, respectively (American College Health Association - National College Health Assessment II, 2014). Emerging adulthood is a critical time to prevent weight gain and encourage healthy behaviors for weight management; a study by Waring and colleagues (2010) found that those who were obese or overweight in middle age were more likely to have been overweight or obese by the age of 25. Despite sustained prevention and treatment efforts, obesity rates have been increasing since the 1970s (U.S. Department of Health and Human Services, 2010). These rates reflect a nation’s inability to meet the *Healthy People 2020* and *Healthy Campus 2020 National Health Objectives* — to reduce the prevalence of obesity among adults by 10%

(*Healthy People 2020*, n.d.; *Healthy Campus 2020*, n.d.). There are numerous studies demonstrating the relationship of weight status with mortality and risk for chronic diseases such as diabetes, heart disease, hypertension, and cancer among others (see for example, Borrell & Samuel, 2014; Crawford et al., 2010; Gregg et al., 2007; Waring, Eaton, Lasater, & Lapane, 2010; Zhao et al., 2014).

Excessive drinking among college students is a well-studied phenomenon. Among young adults who drink alcohol, those who tend to drink beer are not likely to consume it in moderation (Paschall & Lipton, 2005; Whitney & Froiland, 2015). “Binge drinking” or “heavy episodic drinking” is the consumption of a large number (four or more for women, five or more for men) of alcoholic drinks in succession (Wechsler, & Nelson, 2001), typically causing blood alcohol concentration rates to exceed .08 grams percent (National Institute on Alcohol Abuse and Alcoholism, 2004). Approximately 40% of the college students regularly engage in heavy episodic drinking (Substance Abuse and Mental Health Services Administration, 2014). The deleterious outcomes associated with this pattern of drinking include drunk driving, traffic fatalities, alcohol related injuries, sexual assault and rape, violence, vandalism, sexually transmitted infections, unplanned pregnancy, poor academic performance, suicide, and homicide (Hingson, Zha, & Weitzman, 2009; White, & Hingson, 2014).

Weight gain is another deleterious outcome associated with drinking alcohol, especially with younger populations, however research on the effects of alcohol consumption and diet is scarce (Lloyd-Richardson, Lucero, DiBello, Jacobson, & Wing, 2008). In an exploratory study, researchers reported that students’ food cravings increased and that they tended to eat fewer fruits and vegetables and more junk foods when drinking alcohol, compared to other times (Kruger & Kruger, 2015). Perhaps these choices were the result of altered glucose metabolism in the presence of alcohol. Soon after consuming alcohol, blood glucose levels begin to rise, though this rise in glucose is often followed by hypoglycemia, due to alcohol detoxification and

the inhibition of glycogenolysis and gluconeogenesis (Van De Wiel, 2004). Glycogenolysis is the biochemical breakdown of glycogen to glucose and glycogenesis is the opposite, the formation of glycogen from glucose. A study among fasting men demonstrated that within 5 hours of consuming 48 grams of alcohol, glucose output from the liver decreased by 45% (Siler, Neese, Christiansen, & Hellerstein, 1998), thus exacerbating potential for hypoglycemia. Of relevance to this topic, both hypoglycemia and hyperglycemia can induce feelings of hunger. This is partially due to regulation of glucose within the bloodstream, in response to the consumption of alcohol, which can lead to wide variations of blood glucose, resulting in feelings of hunger (Knudsen, Karstoft, & Solomn, 2013; Lemmens, Martens, Kester, & Westerterp-plantenga, 2012).

Therefore, the effects of alcohol on glucose metabolism may encourage eating behaviors known as the “drunchies,” a colloquial term for excessive food consumption when intoxicated, particularly foods high in fat, sodium, and sugar (UrbanDictionary, n.d.). Although biological explanations exist to help explain this behavior, there are also psychosocial issues which merit consideration. For example, for some, eating after consuming alcohol is part of the drinking ritual or this may be an extended opportunity to socialize among friends and significant others. The current study extends previous work (e.g., Kruger & Kruger, 2015) by examining dietary choices both on the night of alcohol consumption and in the first meal of the day following alcohol consumption, compared to other times. Also, we compare the dietary choices both male and female heavy episodic drinkers to social (i.e., non-heavy) drinkers. Eating a large breakfast that includes multiple types of breakfast meats the day after drinking is sometimes considered a “hangover cure.” It is important to better understand what food people are consuming and when they are consuming this food to better formulate intervention strategies.

The study design includes both responses to pre-defined dietary categories, consistent with

previous work (e.g., Kruger & Kruger, 2015) as well as categorization of open-ended responses. In the previous study, participants indicated dietary choices on the night of alcohol consumption (compared to other nights) using the Behavioral Risk Factor Surveillance System (BRFSS) nutrition items and items on specific junk foods. We felt that these items may not have properly captured the full range of foods consumed by students (e.g., a wide variety of ethnic foods are available). In the current study, participants use these items to indicate dietary choices on first meal of the day, depending on whether alcohol was consumed on the previous night. The classification system in the dietary intake component of the National Health and Nutrition Examination Survey (NHANES) was used to code open-ended responses. This system differentiates foods by type (e.g., vegetable, grain). Food items were also coded by their nutrient density, such as whole wheat bread is considered more nutrient dense than white bread. The More nutrient dense food provides vitamins, minerals, and other substances that benefit health (Dietary Guidelines, 2015).

Methods

Participants

The University of Michigan’s Institutional Review Board for Health and Behavioral Sciences reviewed and approved this study prior to data collection. A sample of ethnically diverse undergraduates ($N = 363$; 52% male, 48% female, M age = 19, SD age = 1) was recruited at a large public university in the Midwestern United States to complete an anonymous on-line survey at their convenience. Participants were recruited from a study posting in the Introductory Psychology Subject Pool, which includes all students enrolled in Introductory Psychology courses. As part of course requirements, these students participate in research projects or complete alternative assignments (e.g., write a review of a published research article). The sample represents the participant pool allocation for two academic terms (Fall 2015 and Winter 2016). The demographic characteristics of the sample (see Table 1) was similar to the Fall 2015 undergraduate student profile at the university:

51% men, 49% women; mean age in years = 20; 62% White, 13% Asian American, 5% Hispanic American, 4% African American, 3% two or more races, 7% international, and 7% unknown (Regents of the University of Michigan, 2016).

Participants who reported ever using alcohol were retained for the current study ($N = 286$; see Table 1), excluding 49 participants who reported not ever drinking alcohol.

Table 1
Demographic Characteristics of the Sample ($N = 363$)

	Alcohol Status		Type of Drinker	
	Drinker (286) 79.2%	Non-Drinker (75) 20.8%	Heavy Episodic (156) 84%	Non-Episodic (38) 19.6%
Age in years ($M \pm SD$)	19 \pm 1	19 \pm 1	19 \pm 1	18 \pm 1
Gender				
Male (n, %)	148, 52%	38, 51%	75, 48%	9, 24%
Female (n, %)	138, 48%	37, 49%	81, 52%	29, 76%
Heavy Episodic Drinkers (n, %)	156, 80.4%	0, 0%	156, 100%	0, 0%
Race/Ethnicity				
Western European	47.2%	41.3%	52.6%	42.1%
Eastern European	42.7%	26.7	43.6%	42.1%
African-American	8.3%	12.0%	7.1%	10.5%
East Asian	8.3%	18.7%	4.5%	5.3%
Latino/a/Hispanic	7.6%	5.3%	8.3%	0%
Arab/Middle-Eastern	6.3%	4.0%	9.0%	2.6%
South Asian	4.5%	9.3%	3.8%	2.6%
Native American/Alaskan Native	3.5%	8.0%	3.2%	2.6%
Pacific Islander	0%	0%	0%	0%
Other	5.9%	2.7%	5.1%	13.2%

Survey

Participants completed anonymous on-line surveys hosted by Qualtrics™ at their convenience. The survey began with questions on general diet: "What do you typically eat for your first meal of the day?," [open-ended text response]; "How often do you eat something before you go to bed?," [Response options: Never, Rarely, Sometimes, Most of the Time, Always]; "What do you typically eat before you go to bed? Please answer with specific foods, rather than places where you would eat." [open-ended text response]. Participants indicated gender at the beginning of the survey in order to facilitate item skip patterns; all other demographic items were completed at the end of the questionnaire.

BRFSS Alcohol Consumption Items. Initial items were followed by the Behavioral Risk Factor Surveillance System (BRFSS) (2016) items on alcohol consumption. "Do you ever drink alcohol?" acted as a screening item, only those responding affirmatively viewed subsequent questions related to alcohol consumption. Heavy episodic drinking behavior was defined by gender; four drinks at one time for women, five drinks at one time for men. All items referring to heavy episodic drinking included the description "*One drink is 12 ounces of regular beer, which is usually about 5% alcohol, 5 ounces of wine, which is typically about 12% alcohol, or 1.5 ounces of distilled spirits, which is about 40% alcohol." Participants were asked, "Have you ever drank at least four/five drinks* of alcohol in one

night?" The remaining questions were based on heavy episodic drinking status, social drinkers read the item "On the nights when you drank alcohol, how often do you eat something before you go to bed?," [Response options: Never, Rarely, Sometimes, Most of the Time, Always]; whereas heavy episodic drinkers read "On the nights when you drank at least four/five drinks* of alcohol, how often did you eat something before you went to bed?" This was followed by the open-ended text response item, "On the nights when you drank [at least four/five drinks* of] alcohol, what did you typically eat before you went to bed? Please answer with specific foods, rather than places where you would eat." Participants then completed the open-ended text response item, "What did you typically eat for your first meal on the next day after a night when you drank [at least four/five drinks* of] alcohol? Please answer with specific foods, rather than places where you would eat."

Dietary Consumption Items. Open-ended items were followed by specific items on foods and beverages comparing consumption in the first meal of the day after a night of drinking alcohol to typical consumption patterns in the first meal of the day when not drinking alcohol on the previous night. These items included the Behavioral Risk Factor Surveillance System (BRFSS) (2016) fruit and vegetable consumption items and parallel items on empty calorie foods (including salted snack foods, candy, sweet desserts, fried fast food, hamburgers, pizza, tacos, and soda/pop with sugar). The question stem was "Please think about the next day after the nights when you drank [at least four/five drinks* of] alcohol. Were you more or less likely to eat or drink the following kinds of foods on the day following when you drank alcohol, compared to other times?" [Response options: Much less likely, Somewhat less likely, About the same, Somewhat more likely, Much more likely].

Analyses

Qualitative dietary data obtained from open-ended responses were coded by a registered dietitian/nutritionist on the study team (KLL) using the mutually exclusive categories from What We Eat in America (WWEIA), the dietary

intake component of the National Health and Nutrition Examination Survey (NHANES). This classification system categorizes foods and beverages based on both usage in the diet and nutrient content. This coding scheme was selected as all categories and subgroups contain discrete items and ingredient content is not required. Data was further stratified using the subcategories from WWEIA to classify foods into their respective food groupings (i.e. type of mixed dish, type of vegetable, type of grain). Food and beverage items were further classified by "nutrient density" using the definition from the Dietary Guidelines for Americans, 2015-2020. Food behaviors were also identified if participants recorded consuming "fast food/eating out" or "skipping meals/not eating" after consuming alcohol.

Alcohol Consumption Status. Participants were categorized into three groups: male heavy episodic drinkers ($n = 136$), female heavy episodic drinkers ($n = 104$), and non-heavy episodic or social drinkers ($n = 48$). Those who reported never drinking alcohol were excluded from analyses. The analyses compared equivalent items with a 2 (After alcohol consumption vs. not after alcohol consumption) x 3 (Group: male heavy episodic drinkers vs. female heavy episodic drinkers vs. all social drinkers) ANOVAs for mixed designs. Items where participants indicated likelihoods of consuming specifically listed foods after drinking alcohol compared to at other times were analyzed with one-sample *t*-tests comparing scores to the scale midpoint ("About the same") and one-way ANOVAs with Tukey B post-hoc comparisons between groups. Effect sizes were reported when available.

Results

Alcohol consumption influenced dietary behaviors before going to bed. All alcohol drinkers were more likely to eat something before they went to bed after drinking alcohol than in general before they go to bed, $F_{(1, 284)} = 4.97$, $p = .027$, Partial $\eta^2 = .017$. There were no significant differences between male heavy episodic drinkers, female heavy episodic drinkers, and all social drinkers in likelihood of

eating something before bed in general, $F_{(2, 284)} = 1.43$, $p = .240$, Partial $\eta^2 = .010$, or interactions between group and occasion, $F_{(2, 284)} = 0.31$, $p = .735$, Partial $\eta^2 = .002$. All alcohol drinkers were less likely to eat nutrient dense foods before going to bed after drinking alcohol than in general, $F_{(2, 269)} = 59.22$, $p < .001$, Partial $\eta^2 = .180$. Male heavy episodic drinkers were less likely to eat nutrient dense foods before going to bed when not drinking alcohol compared to the other groups, so this effect was larger for female heavy episodic drinkers and social drinkers, $F_{(2, 269)} = 3.45$, $p = .033$, Partial $\eta^2 = .025$. There was no overall difference between groups, $F_{(2, 269)} = 1.06$, $p = .347$, Partial $\eta^2 = .008$. There were no significant effects for eating out at a fast food restaurant or skipping meals.

Dietary Behaviors on the Night of Alcohol Consumption. Compared to nights without alcohol consumption, when drinking alcohol participants were less likely to consume milk

and dairy products (Partial $\eta^2 = .028$), sweets and snacks (Partial $\eta^2 = .371$), fruit, and non-alcoholic beverages (Partial $\eta^2 = .026$), and were more likely to consume protein and mixed dishes (Partial $\eta^2 = .050$; See Table 2). Independent of alcohol consumption, male heavy episodic drinkers were most likely to eat mixed dishes, social drinkers were least likely to eat mixed dishes. Independent of alcohol consumption, female heavy episodic drinkers were more likely to eat grains than male heavy episodic drinkers and social drinkers. The effect of alcohol intake for increasing consumption of fruit was strongest for female heavy episodic drinkers. Male heavy episodic drinkers were less likely to eat snacks and sweets when not drinking alcohol, thus the reduction in consumption of sweets and snacks following alcohol consumption was stronger for female heavy episodic drinkers and social drinkers than for male heavy episodic drinkers. No participants reported consuming infant formula or baby food.

Table 2

Comparisons of Food Consumption Prior to Sleeping by Alcohol Consumption Status and Type of Drinker

	Alcohol consumed?			Type of drinker			Type of drinker x Alcohol consumed?		
	$F_{(1, 285)}$	p	partial- η^2	$F_{(2, 285)}$	p	partial- η^2	$F_{(2, 285)}$	p	partial- η^2
Milk and Dairy	10.49	.001	.028	0.59	.557	.004	0.11	.365	.007
Protein	14.92	.001	.050	0.49	.614	.003	2.41	.092	.017
Mixed Dishes	15.08	.001	.120	20.58	.001	.126	1.94	.146	.013
Grains	0.62	.432	.002	5.47	.005	.037	1.64	.196	.011
Snacks and Sweets	113.75	.001	.371	1.63	.198	.011	4.37	.014	.030
Fruit	42.25	.001	.129	4.86	.008	.033	5.63	.004	.038
Vegetables	0.41	.423	.001	0.02	.983	.000	1.39	.249	.010
Non-alcoholic Beverages	7.60	.006	.026	0.03	.974	.000	0.33	.717	.002
Water	1.08	.301	.004	1.21	.299	.008	0.42	.658	.003
Fats and Oils	0.82	.775	.000	0.52	.596	.004	0.111	.895	.001
Condiments and Sauces	0.70	.402	.002	0.70	.402	.002	0.88	.414	.006
Sugars	0.41	.522	.001	0.411	.522	.001	0.56	.573	.004

Note: Analyses were 2 (alcohol consumption? Y/N) x 3 (male heavy episodic drinkers vs. female heavy episodic drinkers vs. all social drinkers) ANOVAs for mixed designs. Effect sizes (partial- η^2): .01 = small, .06 = medium, and .14 = large (Cohen, Miles, & Shevlin, 2001).

Dietary Behaviors on the Day after Alcohol Consumption. Participants were less likely to skip first meals on the day after a night of drinking alcohol (14%) compared to mornings not following alcohol consumption (3%), $F_{(1, 178)} = 15.56, p < .001, \text{Partial } \eta^2 = .054$. There was no difference in likelihood to skip meals by group or interaction between group and alcohol consumption. There were no significant effects for eating nutrient dense choices or eating out at a fast food restaurant. Compared to after nights without alcohol consumption, participants were less likely to consume milk and dairy products (Partial $\eta^2 = .088$), grains (Partial $\eta^2 = .038$), sweets and snacks (Partial $\eta^2 = .060$), fruit (Partial $\eta^2 = .078$), non-alcoholic beverages (Partial $\eta^2 = .021$), fats and oils (Partial $\eta^2 = .028$), and sugars (Partial $\eta^2 = .014$), and were

more likely to consume protein (Partial $\eta^2 = .033$) and mixed dishes (Partial $\eta^2 = .026$) in the first meal of the day following a night of alcohol consumption (See Table 3). Across days after nights with and without alcohol consumption, male heavy episodic drinkers were more likely to consume protein and mixed dishes than female heavy episodic drinkers and social drinkers, and female heavy episodic drinkers were more likely to consume sweets and snacks than male heavy episodic drinkers and social drinkers. Female heavy episodic drinkers appeared less likely to consume vegetables on a typical day than the day after a night with alcohol consumption, than at other times, whereas the other groups did not appear to be differ in likelihood.

Table 3

Comparisons of Food Consumption in the First Meal of the Next Day by Alcohol Consumption Status and Type of Drinker

	Alcohol consumed?			Type of drinker			Type of drinker x Alcohol consumed?		
	$F_{(1, 191)}$	p	partial- η^2	$F_{(2, 191)}$	p	partial- η^2	$F_{(2, 191)}$	p	partial- η^2
Milk and Dairy	27.52	.001	.088	0.70	.499	.005	0.443	.642	.008
Protein	9.70	.002	.033	5.74	.004	.057	1.41	.245	.010
Mixed Dishes	7.56	.006	.026	3.28	.039	.022	0.80	.449	.006
Grains	11.14	.001	.038	2.59	.077	.018	0.50	.608	.003
Snacks and Sweets	18.32	.001	.060	5.02	.007	.034	4.44	.013	.030
Fruit	24.05	.001	.078	2.30	.102	.016	0.64	.527	.004
Vegetables	2.88	.091	.010	2.79	.063	.019	3.76	.024	.026
Non-alcoholic Beverages	6.15	.014	.021	0.25	.778	.002	0.30	.743	.002
Water	0.01	.975	.000	.51	.604	.004	0.42	.657	.003
Fats and Oils	8.21	.004	.028	0.88	.417	.006	0.89	.414	.006
Condiments and Sauces	0.35	.557	.001	0.96	.386	.010	1.01	.365	.007
Sugars	4.12	.043	.014	1.36	.259	.009	1.36	.259	.009

Note: Analyses were 2 (alcohol consumption? Y/N) x 3 (male heavy episodic drinkers vs. female heavy episodic drinkers vs. all social drinkers) ANOVAs for mixed designs. Effect sizes (partial- η^2): .01 = small, .06 = medium, and .14 = large (Cohen, Miles, & Shevlin, 2001).

Consumption of BRFSS Food Items on the Day after Alcohol Consumption

Participants reported differences in the likelihoods of consuming specifically listed foods in the first meal of the day following a night with alcohol consumption compared to

days not following alcohol consumption (See Table 4). Compared to other times, on days following alcohol consumption, participants reported being more likely to eat salted snack foods ($d = .14$), and pizza ($d = .22$). Participants were less likely to eat candy ($d = .45$), sweet

desserts ($d = .38$), soda/pop with sugar ($d = .27$), cooked or canned beans ($d = .45$), dark green vegetables ($d = .24$), orange colored vegetables ($d = .28$), and other vegetables ($d = .17$), and energy drinks ($d = .45$; See Table 2). Groups differed somewhat in their tendencies: social drinkers were more likely to eat salted snack foods and sweet desserts than male heavy episodic drinkers were, male heavy episodic drinkers and social drinkers were more likely to

eat hamburgers than female heavy episodic drinkers were, male heavy episodic drinkers were more likely to eat tacos than female heavy episodic drinkers and social drinkers were, male heavy episodic drinkers were more likely to eat cooked or canned beans than social drinkers were, female heavy episodic drinkers were more likely to eat dark green vegetables and all other vegetables than social drinkers were.

Table 4

Comparisons of Foods Consumed in the First Meal of the Next Day by Alcohol Consumption Status on the Previous Night and Type of Drinker

	Alcohol consumed?			Type of drinker	
	$t_{(287)}$	p	d	$F_{(2, 287)}$	p
Salted snack foods	2.25	.025	.14	3.31	.038
Candy	-7.64	.001	-.45	1.16	.315
Sweet desserts	-6.44	.001	-.38	2.26	.106
Fried fast food	1.40	.164	.08	1.94	.145
Hamburgers	0.75	.452	.05	6.22	.002
Pizza	3.66	.001	.22	2.71	.068
Tacos	-1.34	.183	-.08	5.20	.006
Soda/pop with sugar	-4.54	.001	-.27	2.28	.104
Fresh, frozen or canned fruit	-0.25	.802	-.01	0.84	.431
Cooked/canned beans	-7.49	.001	-.45	5.82	.003
Dark green vegetables	-4.14	.001	-.24	2.67	.071
Orange colored vegetables	-4.70	.001	-.28	2.94	.055
Other vegetables	-2.91	.004	-.17	5.70	.004
Energy drinks	-7.56	.001	-.45	2.63	.074

Note: One-sample t -tests examined whether or not alcohol consumption affected foods consumed, one-way ANOVAs examined differences between male heavy episodic drinkers, female heavy episodic drinkers, and all social drinkers. Effect sizes (d): .20 = small, .50 = medium, and .80 = large (Cohen, 1988).

Discussion

This study found that alcohol consumption affects college students' dietary behaviors, both during the night of drinking (prior to going to bed) as well as in the first meal of the next day. College students' consumption of alcoholic beverages can lead to other adverse health behaviors. One such behavior, often overlooked in traditional addiction research, is greater intake of unhealthy food following alcohol consumption. The focus of this study was to determine, to what extent college students eat differently during and after a night of "binge" drinking than they would ordinarily. This is an important facet of behavior, as the Substance

Abuse and Mental Health Service Agency (2015) has found that on average 33% of college students aged 18-22 engage in high-risk alcohol drinking. Students who drink alcohol excessively are at an increased risk for not only death and injuries related to alcohol consumption, assault, sexual assault, academic consequences, but unwanted weight gain as well.

The results from this study indicate that college students do eat differently after drinking alcohol both before and after going to bed. One issue of particular concern is that participants did not report drinking more water or other non-alcoholic beverages before bed after drinking

alcohol. Failure to consume enough fluids may exacerbate the dehydration effect associated with excessive alcohol consumption, which may additionally lead to unhealthy food choices. One type of educational intervention based on harm reduction principals could be to encourage college students to consume water between alcoholic drinks as way to potentially limit their alcohol consumption and minimize dehydration issues.

After drinking alcohol, participants reported being more likely to eat salted snack foods and pizza, and being less likely to eat healthy foods such as cooked or canned beans, dark green vegetables, orange colored vegetables, other vegetables, than they would ordinarily. This could be due to the decreased availability of these foods during episodes of drinking or thereafter. Overall, when participants drank, they were more likely to eat something before they went bed than compared to when they abstained. They were also less likely to eat nutrient dense foods after drinking alcohol. Public health professions could utilize advocacy efforts to ensure dining halls that are open late not only offer, but also promote nutrient dense options during these late night or early morning timeframes. One study found that marketing strategies highlighting healthy food options such as signs or healthy option indicators were effective at improving students eating behaviors (Peterson, Duncan, Null, Roth, & Gill, 2010). These same strategies could be used during late night or morning hours to promote nutrient dense food options if they were made available for students.

The next day after drinking alcohol, participants varied from dietary patterns from the night before. Participants were less likely to skip meals the morning after a night of drinking alcohol compared to other mornings. During this first meal of the day, compared to nights without alcohol consumption, participants were less likely to consume milk and dairy products, grains, sweets and snacks, fruit, non-alcoholic beverages, fats and oils, and sugars, and were more likely to consume protein and mixed dishes. These choices could be explained by the fluctuations in blood glucose levels from the

previous night's alcohol consumption (Van De Wiel, 2004). This could be related to hangover cure lore or "hangover cures" which often entail eating foods to "soak-up" or rid the body of alcohol (Paulsen, 1961). One way to promote a healthy diet even after a night of drinking could be to help dispel some of these myths which are passed down from student to student to reduce hangover effects.

Limitations for this study include the chosen sampling procedure, differential sample sizes among groups reducing statistical power in comparisons, and the issues inherent in self-reported measures. Because this study was only conducted at one Midwestern university using a convenience sample, the findings from this study may not be representative of other colleges or universities. The food purchases in this study were not systematically documented and are subject to recall bias. The majority of the sample was underage; thus, some respondents may have been reluctant to acknowledge illegal activity even though all responses were anonymous. Finally, because of social desirability some participants may have underreported their less healthy dietary habits.

With obesity rates on the rise, it is important to address not only alcohol consumption, but also the dietary behaviors associated with alcohol consumption. Researchers should examine the other factors that affect calories consumed during and after episodes of drinking. These factors include access to dining halls, the food environment, motivation to eat healthy, and the social norms associated with food consumption before, during, and after consuming alcohol.

Interventions should be designed to reduce the prevalence of students who engage in excessive alcohol consumption and ensure that healthier foods are offered on college campuses late at night. Furthermore, students should be taught to think about their dietary choices in the same way they should plan their transportation, that is, before they take their first drink.

Indeed, from a substance abuse and a dietary perspective, students should plan what they will eat before, during, and after drinking. In other

words, rather than discussing alcohol risk reduction strategies in isolation, educators should be more holistic and include nutrition, sexual health, sexual assault, and other wellness related topics as all these issues are interrelated. Based on the finding of this study, possible interventions could include information about healthy diets during all hours and situations during the universities alcohol education course or during college orientation. Many existing programs that focus on alcohol use in college

students are based on harm reduction techniques, such as ways to diminish the negative effects if they do engage in alcohol use (Dimeff, 1999). In addition to educating students about the importance of harm reduction techniques such as eating prior to drinking it would be helpful to discuss what to eat. By adding this information into existing courses, it could help to reduce the number of calories students are consuming prior to going to bed or the morning after consuming alcohol.

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