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Heavy Drinking in Young Adulthood Increases Risk of Transitioning to Obesity

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Abstract

Introduction—Heavy episodic alcohol use during young adulthood may contribute to excess weight gain and transition from healthy weight to overweight/obesity. This study is the first to evaluate the association between heavy episodic drinking during early adulthood and transition to overweight/obese status 5 years later using data from the U.S. National Longitudinal Study of Adolescent to Adult Health.

Methods—The study used data from Waves III and IV, when participants were aged 18–26 and 24–32 years, respectively. The final sample consisted of 7,941 participants with measured height/weight who reported ever drinking alcohol. Multinomial logistic regression models tested the association between heavy episodic drinking and risk of transitioning to an unhealthy weight class.

Results—Heavy episodic drinking was associated with 41% higher risk of transitioning from normal weight to overweight (relative risk ratio, 1.41; 95% CI=1.13, 1.74; $p=0.002$) and 36% higher risk of transitioning from overweight to obese by Wave IV (relative risk ratio, 1.36; 95% CI=1.09, 1.71; $p=0.008$), compared with individuals not drinking heavily, while accounting for covariates. Heavy episodic drinking was associated with 35% higher risk of maintaining obesity (relative risk ratio, 1.35; CI=1.06, 1.72; $p=0.016$) and gaining excess weight (OR=1.20, 95% CI=1.03, 1.39, $p=0.02$).

Conclusions—Regular heavy episodic drinking in young adulthood is associated with higher risk of gaining excess weight and transitioning to overweight/obesity. Obesity prevention efforts

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should address heavy drinking as it relates to caloric content and risk of transitioning to an unhealthy weight class.

INTRODUCTION

The majority of adults in the U.S. are overweight or obese (65%) and most gain weight throughout adulthood.^{1,2} Weight gain occurs most rapidly during young adulthood (age 18–35 years). Nationally representative cohort studies of U.S. adults have observed substantial 10-year weight gain from age 18 to 28 years (mean, 6.9–11.9 kg)² and a significant increase in BMI (mean, 4 points) from age 18 to 32 years.³ Accordingly, risk for overweight/obesity substantially increases during this period and levels off by mid adulthood (around age 35–40 years).^{4,5} Weight gain, overweight, and obesity during early adulthood increase current and long-term risk for chronic diseases, multiple cancers, and premature mortality.^{1,6,7}

Research on contributing factors to weight gain and obesity among young adults has largely been focused on decreased energy expenditure from physical activity and increased caloric intake from fast food and sugar-sweetened beverages.⁸ Alcohol has a high energy density of 7 kcal/g,⁹ second only to fat, and heavy drinking peaks during young adulthood.¹⁰ Despite this, the role of alcohol as a potential contributing factor to weight gain and overweight/obesity among young adults has generally been overlooked in both the obesity and alcohol literatures.

Alcohol use is most prevalent among young adults aged 18–24 years¹⁰ and many young adults drink episodically, with a goal of intoxication.¹¹ In a nationally representative sample of U.S. adults, 40% of young adults reported drinking heavily (five or more drinks in one episode) at least once in the last month.¹⁰ Many young adults' typical approach to drinking is one of excess. More than 40% of young adults report that when they do drink, they usually drink heavily,¹¹ defined by NIH's National Institute on Alcohol Abuse and Alcoholism (NIAAA) as consuming four or more drinks for women and five or more drinks for men in a single episode, thus exceeding NIAAA's low-risk drinking guidelines.¹² Based on these national prevalence estimates, more than 40% of young adults may consume an excess of 600 calories from alcohol in a typical drinking episode.

The extant literature on the effects of alcohol use on weight gain/obesity has typically focused on the general adult population, where heavy episodic drinking prevalence is low.¹⁰ Whereas research on the association of light to moderate drinking levels with weight gain and obesity have produced conflicting results, limited research on the effects of heavy episodic alcohol use on weight gain and obesity is largely consistent.^{13–15} Preliminary evidence from cross-sectional studies and those with short-term follow up periods of 6–12 months suggest a similar risk among adolescent and young adult samples.^{16,17}

The ostensible long-term association among heavy episodic drinking in early adulthood, excess weight gain, and transition from healthy weight to overweight/obesity are currently unknown. This potential effect may persist into later adulthood and thereby increase risk for development of chronic diseases such as diabetes and cardiovascular disease. This is the first study to evaluate the long-term association of heavy episodic alcohol use during early

adulthood with likelihood of transitioning to overweight/obesity and gaining excess weight in later adulthood using a nationally representative sample of U.S. adolescents/young adults.

METHODS

Study Sample

The current study used data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a study of a nationally representative sample of U.S. adolescents surveyed during four waves about health and risk behaviors as they entered adulthood.^{18,19} Participants were randomly sampled from 80 high schools and 52 corresponding middle schools that were stratified by region, urbanicity, type of school (public, private, parochial), ethnic mix, and size. The first wave of data collection occurred during the 1994–1995 school year with 20,745 participants who were in seventh to 12th grade, and consisted of an in-home and in-school assessment (Wave I). Informed consent was obtained from both parents and adolescents. A second wave of collection occurred the following year in 1996 (Wave II; $n=14,738$; response rate, 88.6%), and a third wave assessment occurred in 2001–2002, when participants were aged 18–26 years (Wave III; $n=15,197$; response rate, 77.4%). The final assessment was conducted in 2007–2008 with participants who were then aged 24–32 years (Wave IV; $n=15,701$; response rate, 80.3%). Data were collected in 2001–2002 (Wave III) and 2008 (Wave IV) and analyzed in 2016.

The sample consisted of participants who provided alcohol use data, had measured height and weight data at both time points, and reported ever drinking alcohol. Participants were excluded from the sample because of missing alcohol use data ($n=1,154$), refusing to provide height/weight measurements ($n=1,618$), and for lifetime abstinence from alcohol ($n=1,152$). Additionally, a small number of cases ($n=432$) were excluded due to pregnancy at Wave III or IV. The final sample consisted of 7,941 participants with valid data who completed both Waves III and IV. In comparing the study analytic sample with the overall sample from Wave IV, the authors found the two were not substantially different on weight and key demographic variables including age (28.6 vs 29.1 for analytic versus full sample), proportion of male participants (48% vs 47%), and proportion of participants who were overweight or obese at Wave IV (65% vs 66%).

Measures

Alcohol use was measured in standard drinks, defined by NIAAA as a drink containing 14 g of pure alcohol, equivalent to about 12 oz of beer, 5 oz of wine, and 1.5 oz of liquor.²⁰ Alcohol use was assessed using an audio computer-assisted self-interview for collection of sensitive information.²¹ Questions assessed typical quantity and frequency of drinking in the past 12 months, drinking in excess of NIAAA-defined low-risk alcohol use guidelines (no more than three drinks/day for women or four for men),²⁰ NIAAA-defined binge drinking (four or more drinks for women, five or more for men in 2 hours),²² and alcohol-related consequences.

Typical quantity and frequency variables were used to compute a dichotomous variable indicating the presence or absence of heavy episodic drinking one or more times per month.

Individuals were classified as heavy episodic drinkers if they reported their typical quantity of alcohol consumption was in excess of NIAAA low-risk drinking guidelines for single episodes (four or more drinks for women, five or more for men), and reported drinking once per month or more in the past year. This measure was chosen over an aggregated drinks per day/year because it is more representative of typical young adult alcohol consumption patterns.¹¹ Furthermore, it was expected that small amounts of daily alcohol would be less likely to substantially influence energy balance and weight gain.¹³ Thus, a variable was chosen that is more clearly indicative of regular (one or more times per month) heavy episodic use in the past year, which has been shown to be associated with obesity cross-sectionally.¹⁵ Using this once or more/month definition of regular heavy episodic drinking, 35% of participants were classified as regular heavy episodic drinkers at Wave III.

At both Waves III and IV, weight and height were measured by the Add Health mobile research unit. The authors identified individuals with overweight/obese BMIs at Wave IV, and also those who gained ≥ 5 kg as a measure of excess weight gain.²²

Statistical Analysis

Analyses were conducted using Mplus, version 7.31. Add Health provides sampling weights to account for the unequal probability of participant selection. First, a multinomial logistic regression model (Model 1) was constructed to evaluate the association between heavy episodic drinking at Wave III and risk of having an overweight or obese BMI at Wave IV, while accounting for Wave III weight class and covariates (detailed below). A logistic regression model was used to evaluate the association between heavy episodic drinking and odds of gaining ≥ 5 kg at Wave IV (Model 2). To examine the association between heavy episodic drinking and transition to overweight and obesity, a multinomial logistic regression model was used to evaluate the association between heavy episodic drinking and risk of transitioning from normal weight to overweight, overweight to obese, and sustained obesity at both Waves III and IV (Model 3).

The following variables were available in the data and included in all models: Demographic variables included age; binary-coded race variables, with white as the reference category (owing to traditionally higher heavy episodic drinking rates compared with minority races²⁵): black (yes/no), Native American (yes/no), Asian/Pacific Islander (yes/no), Hispanic (yes/no); sex (with female as the reference category); full time college attendance at Wave III; and interim birth between Waves III and IV.

These variables included frequency of fast food consumption (past 7 days), number of times exercised (past 7 days), and average sedentary hours per week.

Weight class at Wave III (not overweight/obese, overweight, obese; Model 1), BMI at Wave III (Model 2), and self-report of trying to lose weight at Wave III (yes/no) as an indication of weight control behaviors were included as weight variables.

Age started drinking alcohol (to indicate age started consuming alcohol calories), smoked cigarettes in the last 30 days (yes/no), smoked marijuana in the past 30 days (yes/no), beer

as beverage of choice (yes/no) given higher caloric content and association with central adiposity.²⁶

The majority of the sample (80%) reported that they did not know their household income at Wave III; therefore, this variable was unavailable for use in the analyses as a measure of SES. Additionally, most of the sample (93%) reported their personal income was <\$30,000/year in Wave III, which limited its utility in the analytic models. Adding the personal income variable as a measure of SES to the models as a covariate did not change the results and was not significant in any of the models. Therefore, it was not included in the final models.

RESULTS

Participant demographic characteristics are presented in Table 1. At baseline, 50% of the sample was normal weight, 28% was overweight, and 22% was obese (mean BMI, 26.13; SD=5.91). Corresponding prevalence rates at follow-up were 35.0% normal weight, 30.8% overweight, and 34.2% obese (mean BMI, 28.6; SD=7.10).

At Wave IV, 52% of the sample gained excess weight, 16% transitioned from normal to overweight, 12% transitioned from overweight to obese, and 32% maintained the same overweight/obese status at both Waves. Appendix Table 1 summarizes weight transitions from Wave III to IV stratified by heavy drinking status. At Wave III, regular heavy episodic drinking in the past year was positively correlated with BMI ($r=0.03$, $p=0.01$).

Multinomial logistic regression results from Model 1 are presented in Table 2. Heavy episodic drinking at Wave III was significantly associated with 34% higher risk of being overweight (relative risk ratio [RRR]=1.34, 95% CI=1.12, 1.61, $p=0.002$) and 43% higher risk of being obese (RRR=1.43, 95% CI=1.13, 1.81, $p=0.003$) at Wave IV, compared with those not regularly drinking heavily, while accounting for the aforementioned demographic, weight, nutrition/physical activity, interim birth, and substance use covariates. Logistic regression results from Model 2 evaluating excess weight gain are presented in Table 3. Heavy episodic drinking at Wave III was significantly associated with higher odds of excess weight gain at Wave IV (OR=1.20, 95% CI=1.03, 1.39, $p=0.02$), compared with those not regularly drinking heavily, while accounting for covariates.

Results from Model 3 examining weight class transitions revealed that heavy episodic drinking was associated with 41% higher risk of transitioning from normal weight to overweight at Wave IV (RRR=1.41, 95% CI=1.13, 1.74, $p=0.002$), and 36% higher risk of transitioning from overweight to obese at Wave IV (RRR=1.36, 95% CI=1.09, 1.71, $p=0.008$), compared with those not regularly drinking heavily, while accounting for the effects of the aforementioned covariates (Table 4). Heavy episodic drinking was also significantly associated with higher risk of sustaining obese status at both Waves III and IV (RRR=1.35, 95% CI=1.06, 1.72, $p=0.016$).

Tables presenting the full models with all covariates are presented in the Appendix.

DISCUSSION

This study evaluated the long-term association between heavy episodic alcohol use during young adulthood and transition to overweight/obesity 5 years later using a U.S. national sample. The results suggest that heavy episodic alcohol use should be considered a potentially important contributor to excess weight gain and transition to overweight/obese status among young adults. The findings are relevant to a large portion of young adults who regularly drink heavily,¹⁰ and this problem should be considered as a potential target in obesity research and prevention efforts.

The results are in accordance with studies that tracked weight change over shorter periods of time that found typical drinks/week was significantly associated with overweight/obesity (OR=1.86)¹⁷ and 1-year BMI increase among at-risk drinking college students.¹⁶ However, the current findings show a substantially stronger association compared with some previous research,^{27,28} which may be due to methodologic differences. Specifically, the current study used measured height and weight to avoid self-report bias,²⁹ used national guidelines to inform the measure heavy episodic alcohol use, and accounted for a variety of individual difference variables known to be associated with both heavy episodic drinking and weight outcomes and could serve to confound bivariate associations.

It is possible that regular heavy episodic drinking contributes to transition to overweight and obesity directly through calories consumed from alcohol, as well as by potentially increasing food intake during drinking episodes. Alcohol use may temporarily increase the rewarding value of food⁹ and decreases cognitive restraint for eating,³⁰ which may lead to disinhibited eating while drinking.³¹ Preliminary cross-sectional research has demonstrated that alcohol-related eating is associated with overweight/obesity among college students,³¹ and the authors are currently examining this longitudinally in a sample of young adults. Alcohol-related eating patterns may also vary based on individual differences in restrained and disinhibited eating habits, motivation to eat palatable foods and drink alcohol, and traits such as impulsivity. Further investigation of these potentially nuanced patterns is warranted.

Limitations

This study had several limitations. First, participants who did not provide measured height and weight were excluded. However, a very small percentage of individuals (6%) refused to provide these measurements, thus data from this small number of individuals likely would not substantially alter the results. Second, the physical activity questions were not previously validated and the diet measure was limited to fast food consumption, which prohibited a more nuanced examination of possible mediation effects between heavy drinking, diet, physical activity, and weight gain. Third, alcohol assessment was based on self-report, which may be subject to social desirability or memory bias and can result in underestimation of alcohol use.³² However, alcohol use was assessed via computer interview, which has been shown to substantially decrease bias in reporting.³³ Finally, the data for Wave III were collected more than a decade ago. Though the prevalence of heavy episodic drinking among young adults has not significantly changed since then,¹⁰ a significant minority (~15%) of young adults have increased the number of drinks per episode of heavy drinking.³⁴ Thus, it is possible that the effects identified in the current study may be more pronounced among

this subgroup, requiring further investigation with data that capture this emerging heavy drinking subgroup.

CONCLUSIONS

The findings have significant implications for weight gain prevention among young adults and suggest that interventions should address heavy episodic alcohol use as it relates to caloric intake, excess weight gain, and risk of transitioning to overweight/obesity. A comprehensive obesity prevention intervention that targets all relevant factors affecting young adult weight change is needed to address the existing obesity epidemic. Additionally, information about risk of excess weight gain and overweight/obesity could be included in alcohol prevention and treatment interventions targeting young adults. One brief online alcohol intervention program for college students highlights caloric intake from alcohol by presenting the caloric equivalent of a heavy drinking episode converted to cheeseburgers,³⁵ thus implying potential negative effects of alcohol use on caloric consumption. The current findings could be presented during alcohol brief interventions as evidence of a potentially strong and direct relationship between heavy episodic drinking during young adulthood, excess weight gain, and risk of transitioning to overweight/obesity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of the Study Sample (N=7,941)

Variable	Total sample (n=7,941)	Heavy drinking (n=2,748)	Non-heavy drinking (n=5,193)
	Mean (SD) or N (%)		
Sex (% male)	3,924 (49.4)	1,546 (56.3)	2,378 (45.8)
Age (years)	21.9 (1.75)	21.78 (1.78)	21.96 (1.73)
Race ^a			
White, non-Hispanic	4,682 (59.0)	1,932 (70.3)	2,750 (53.0)
Black	1,448 (18.2)	220 (8.0)	1,155 (22.2)
Native American	697 (8.8)	65 (2.4)	127 (2.4)
Asian/Pacific Islander	1,079 (13.6)	136 (4.9)	367 (7.1)
Ethnicity (% Hispanic)	1,155 (14.5)	363 (13.2)	792 (15.3)
Interim birth (between Waves III and IV)	1,928 (32.1)	527 (19.2)	2,221 (42.8)
Current full time college attendance	3,039 (38.3)	1,057 (38.5)	1,691 (32.6)
Substance use variables			
Age first drank alcohol	16.57 (3.10)	15.72 (2.73)	17.01 (3.20)
Beer is drink of choice	3,143 (39.6)	1,620 (58.9)	1,523 (29.3)
Smoked tobacco (past 30 days)	2,603 (32.8)	1,247 (45.3)	1,356 (26.1)
Smoked marijuana (past 30 days)	1,991 (25.1)	1,045 (38.0)	946 (18.2)
Diet and physical activity			
Number of days ate fast food in the past 7	2.42 (2.07)	2.55 (2.16)	2.36 (2.02)
Number of times exercised in past 7 days	4.64 (5.40)	5.23 (5.60)	4.33 (5.26)
Sedentary hours/week	37.15 (24.15)	38.44 (24.65)	36.47 (23.86)
Weight variables			
Wave III			
BMI	26.1 (5.91)	26.25 (5.75)	26.07 (6.00)
Normal/Underweight (BMI<25)	4,062 (51.1)	1,372 (49.9)	2,690 (51.8)
Overweight (BMI 25–29.9)	2,215 (27.9)	790 (28.7)	1,425 (27.4)
Obese (BMI 30.0)	1,664 (21.0)	586 (21.3)	1,078 (20.8)
Wave IV			
BMI	28.6 (7.10)	28.8 (6.91)	28.5 (7.20)
Normal/Underweight (BMI<25)	2,776 (35.0)	886 (32.2)	1,890 (36.4)
Overweight (BMI 25–29.9)	2,444 (30.8)	886 (32.2)	1,558 (30.0)
Obese (BMI 30.0)	2,721 (34.2)	976 (35.6)	1,745 (33.6)

^aParticipants could select more than one race.

Table 2

Multinomial Logistic Regression With Heavy Episodic Drinking at Wave III Predicting Overweight and Obese Status at Wave IV

Variable	DV: Overweight ^a (BMI 25.0 and <30)		DV: Obese (BMI 30) ^a	
	RRR	95% CI	RRR	95% CI
Heavy episodic drinking at least monthly ^b	1.34	1.12, 1.61	1.43	1.13, 1.81
Sex ^c	2.93	2.33, 3.69	2.96	2.32, 3.76
Age	1.00	0.95, 1.06	0.94	0.88, 1.003

Notes: Outcome reference category was normal weight (BMI 8 and <25).

^a Models adjusted for age, race, ethnicity, full time college attendance at Wave III, interim birth between Waves III and IV, fast food consumption, physical activity, sedentary hours/week, Wave III weight class, trying to lose weight, age started drinking alcohol, smoke cigarettes, smoke marijuana, beer as beverage of choice.

^b Heavy drinking less than monthly was coded as the reference category.

^c Reference category was female sex.

DV, dependent variable; RRR, relative risk ratio

Table 3

Logistic Regression With Heavy Episodic Drinking at Wave III Predicting Excess Weight Gain

Variable	DV: Excess (5 kg) weight gain at Wave IV ^a	
	OR	95% CI
Heavy episodic drinking at least monthly ^b	1.20	1.03, 1.39
Sex ^c	1.59	1.34, 1.89
Age	0.93	0.90, 0.96

Notes: Outcome reference category was <5 kg weight gain.

^a Models adjusted for age, race, ethnicity, full time college attendance at Wave III, interim birth between Waves III and IV, fast food consumption, physical activity, sedentary hours/week, BMI at Wave III, trying to lose weight, age started drinking alcohol, smoke cigarettes, smoke marijuana, beer as beverage of choice.

^b Heavy drinking less than monthly was coded as the reference category.

^c Reference category was female sex.

DV, dependent variable; kg, kilogram

Table 4

Multinomial Logistic Regression With Heavy Episodic Drinking Predicting Transition to Overweight and Obese Status

Variable	DV: Transition from normal weight to overweight ^a		DV: Transition from overweight to obese ^a	
	RRR	95% CI	RRR	95% CI
Heavy episodic drinking at least monthly ^b	1.41	1.13, 1.74	1.36	1.09, 1.71
Sex	2.52	2.02, 3.14	4.17	3.25, 5.35
Age	0.95	0.90, 1.01	1.05	0.99, 1.12

Notes: Outcome reference category was maintaining normal weight at Waves III and IV, coded as 0 in the analyses.

^aModels adjusted for age, race, ethnicity, full time college attendance at Wave III, interim birth between Waves III and IV, fast food consumption, physical activity, sedentary hours/week, trying to lose weight, age started drinking alcohol, smoke cigarettes, smoke marijuana, beer as beverage of choice.

^bHeavy episodic drinking less than monthly was coded as the reference category.

^cReference category was female sex.

DV, dependent variable; RRR, relative risk ratio