

Alcohol Use and Exercise Dependence: Co-Occurring Behaviors Among College Students?

Jessica L. Martin

University at Albany, State University of New York

Matthew P. Martens

University of Memphis

Holly F. Serrao and Tracey L. Rocha

University at Albany, State University of New York

Heavy alcohol consumption is a well-known health compromising addictive behavior. A lesser known addictive behavior that may cause physical and psychological harm is exercise dependence. Research has shown that heavy drinking co-occurs with other addictive behaviors, but until recently little was known about the co-occurrence of alcohol use and exercise dependence. The purpose of the current study was to examine this relationship and assess whether the co-occurrence could be accounted for by personality characteristics. Participants were 283 undergraduate students at a large, Northeastern university. All students reported consuming alcohol in the past 30 days and the majority (95.9%) reported exercising at least occasionally. Results indicated that alcohol use and alcohol-related problems co-occurred with exercise dependence and that personality characteristics did not fully account for the relationship. These findings have implications for clinicians and prevention specialists working with college students and provide several avenues for future research in an innovative area. **Keywords:** alcohol consumption, exercise dependence, college drinking

Approximately 80% of college students report using alcohol at least once in the preceding year (Johnston, O'Malley, & Bachman, 2000). More alarming are the findings of national studies that have indicated that approximately 40% of college students report engaging in heavy episodic drinking, or "binge" drinking (defined as at least 4+ drinks for women or 5+ drinks for men in one sitting) at least once in the preceding two weeks (Wechsler et al., 2002). In addition, a

Jessica Martin, Holly Serrao, and Tracey Rocha are with the Department of Educational and Counseling Psychology at the University at Albany, SUNY, Albany, NY. E-mail: jm613456@albany.edu. Matthew Martens is with the Department of Counseling, Educational Psychology, and Research at the University of Memphis.

national epidemiological study found that approximately 20% of college students met diagnostic criteria for alcohol abuse or dependence in the preceding 12 months (Dawson, Grant, Stinson, & Chou, 2004). Research has also estimated that each year approximately 1,400 deaths, 500,000 unintentional injuries, and 600,000 assaults can be attributed to college students' heavy drinking (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). These findings have led many to consider excessive drinking among college students to be a major public health concern (Hingson, Heeren, Winter, & Wechsler, 2005; Windle, 2003).

In addition to the above mentioned public health concerns associated with heavy drinking among college students, college student drinking has also been shown to co-occur with other addictive behaviors such as illicit drug use and smoking cigarettes (Mohler-Kuo, Lee, & Wechsler, 2003), and health-compromising behaviors such as impaired driving and unplanned and/or unprotected sexual activity (Hingson et al., 2002; Windle, 2003). Alcohol abuse and dependence also frequently co-occur with mood disorders such as depression and anxiety (Kranzler & Rosenthal, 2003), as well as eating disorders such as anorexia and bulimia (Franko et al., 2005; Holderness, Brooks-Gunn, & Warren, 1994). Another health compromising behavior, exercise dependence, has been shown in recent years to be similar to and associated with eating disorders (Zmijewski & Howard, 2003) and related to depression and anxiety (Klein et al., 2004; Ogden, Veale, & Summers, 1997; Rosa et al., 2004). However, studies have not yet examined whether exercise dependence is associated with alcohol use and related problems within the college population. Therefore, the purpose of the current study was to determine if there is a relationship between alcohol use and exercise dependence and if so, whether underlying personality characteristics could account for the relationship.

Exercise Dependence

Exercise is generally considered to be a healthy behavior because it is positively associated with enhanced cognitive, physiological, and social functioning (Shepherd & Bouchard, 1994) and is often recommended for the prevention and treatment of physical disorders such as obesity and coronary heart disease (Ogden et al., 1997) and psychological disorders such as depression and anxiety (Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Despite these documented benefits, empirical studies suggest that excessive amounts of exercise can have harmful effects on one's physical and psychological well-being (Hausenblas & Downs, 2002). Excessive exercise resulting in negative consequences such as exacerbated physical injuries and mental distress has been referred to as *exercise dependence* (Adams & Kirkby, 2002).

Exercise dependence has been referred to as a compulsion to exercise or an exercise addiction (Blaydon & Lindner, 2002) and is defined using criteria similar to that used to diagnose substance and behavioral addictions (Ogden et al., 1997). Specifically, exercise dependence is often described using traditional biomedical criteria for addiction (i.e., tolerance and withdrawal) and psychosocial factors such as an interference in other areas of life (Ogden et al., 1997). Although exercise dependence appears to be most frequently documented among athletes and

heavy exercisers (Blaydon & Lindner, 2002), it has also been found among non-athlete college students (Zmijewski & Howard, 2003). The degree to which exercise dependence co-occurs with other unhealthy behaviors like substance abuse, as well as potential explanations for such co-occurrences, is still poorly understood (Blaydon & Lindner, 2002).

The Role of Personality Traits

Numerous studies have found different dimensions of personality to be associated with alcohol use, including conscientiousness, extraversion, agreeableness, and neuroticism (Martin & Sher, 1994; Read & O'Connor, 2006; Ruiz, Pincus, & Dickinson, 2003). Several personality traits have also been found to be related to exercise dependence. Hausenblas and Giacobbi (2004) found that among college students, extraversion, neuroticism, and agreeableness predicted exercise dependence symptoms. Since alcohol consumption and exercise dependence are related to similar personality traits, it is plausible that the same personality traits that predispose individuals to engage in heavy drinking may also predispose individuals to engage in excessive exercising. For example, an extraverted person may engage in exercise and drinking as means of socializing. Alternatively, someone whose personality is characterized by a high level of neuroticism may exercise excessively and consume large quantities of alcohol to cope with negative emotional states.

With this in mind, the purpose of the current study was to examine the relationship between excessive exercise and alcohol consumption among a sample of college students. We hypothesized that there would be a significant positive correlation between alcohol use and exercise dependence. We also sought to determine if the relationship between alcohol use and exercise dependence could be accounted for by personality traits alone.

Method

Participants

Data were collected from a sample of 283 undergraduate students at a large university in the northeastern United States. The mean age for the sample was 20.12 years ($SD = 1.95$). Gender was evenly distributed (50% female). The majority of participants were Caucasian (78.7%). Other ethnic identities included African-Americans (8.5%), Asian Americans (4.6%), Hispanics (5.5%), and "other" (2.7%). Nearly 8% of the sample (7.4%) reported participating in a varsity sport and 95.9% of participants reported exercising at least occasionally.

Measures

Alcohol Use. We calculated several indices of alcohol consumption. The Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) asks participants to estimate the number of drinks typically consumed on each day of the week over the 30 days before completing the survey. These estimates were used to calculate

participants' average number of drinks per week and typical weekend consumption. We assessed peak drinking by asking participants to estimate the most number of drinks they had consumed on any one drinking occasion in the past 30 days. We calculated heavy episodic drinking or "binge" drinking by asking participants to estimate the number of times they had consumed 5+ drinks (for men) or 4+ drinks (for women) over the past two weeks. Participants were provided the definition of a standard drink before calculating their estimates.

Alcohol-Related Problems. The number of problems experienced as a result of alcohol use were estimated using the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler, Strong, & Read, 2005). The BYAACQ is a 24-item self-report questionnaire that asks participants to indicate whether a series of negative alcohol-related consequences has happened to them during or after drinking alcohol in the previous year. Example items include, "I have taken foolish risks when I have been drinking," "My drinking has gotten me into sexual situations I later regretted," and "The quality of my work or school work has suffered because of my drinking." Internal consistency for the present sample was excellent ($\alpha = .90$).

Exercise Dependence. The Exercise Dependence Questionnaire (EDQ; Ogden, Veale, & Summers, 1997) was used to assess symptoms of exercise dependence. The EDQ addresses key components of exercise dependence such as tolerance and withdrawal; excessive, rigid, and repetitive behavior; positive feelings following exercise; a desire for social contact; negative effects on interpersonal relationships; a desire for physical health; and control over weight and body shape. It consists of 29 exercise-related items that are rated on a 7-point Likert type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). It has no indicative cut-off point, and scores may range from 29 (low exercise dependence symptoms) to 203 (high exercise dependence symptoms). The EDQ is comprised of eight subscales: Interference with Social/Family/Work Life (e.g., "My pattern of exercise interferes with my social life"), Positive Reward (e.g., "After an exercise session I feel more positive about myself"), Withdrawal Symptoms (e.g., "If I cannot exercise I feel agitated"), Exercise for Weight Control (e.g., "I exercise to control my weight"), Insight into the Problem (e.g., "I feel guilty about the amount I exercise"), Exercise for Social Reasons (e.g., "I exercise to meet other people"), Exercise for Health Reasons (e.g., "I exercise to feel fit"), and Stereotyped Behavior (e.g., "I exercise for the same amount of time each week"; Ogden et al., 1997). The entire EDQ has demonstrated acceptable internal consistency with a coefficient alpha of 0.84 (Ogden et al., 1997). The alpha levels of the subscales range from $\alpha = 0.52$ (Stereotyped Behavior) to $\alpha = 0.81$ (Interference with Social/Family/Work Life; Ogden et al., 1997). The internal consistency for the entire measure in the current study was good ($\alpha = 0.86$).

Personality Characteristics. The Ten Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003) was used to assess the Big-Five personality domains. The TIPI is a 10-item, self-report instrument that assesses Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience via two items for each of the five domains. Participants are asked to indicate

on a 7-point Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*) how much they see themselves as the two descriptors provided for each item. For example, one item asks participants to rate how much they see themselves as “Extraverted, Enthusiastic.” The TIPI has demonstrated convergent validity with other measures of the five factor model and six-week test-retest correlations on the factors are acceptable (mean $r = 0.72$; Gosling et al., 2003). For the purposes of the current study, we only included scores on the Conscientiousness and Extraversion subscales in our regression analyses (described below).

Demographics. Participants also completed a brief demographics questionnaire that included information such as gender, ethnicity, and age.

Procedure

Participants were recruited from intramural/club sport teams, university fitness centers, and undergraduate classrooms. Research assistants explained the nature of the study to participants and those who volunteered for the study were asked to provide their e-mail addresses so that an electronic link for the study could be provided. Participants then received an e-mail explaining the nature of the study, including participants’ rights to confidentiality and withdrawal from the study without penalty at any time and were provided a link to the study with directions for entering to receive compensation for participation. As compensation for their time, all participants were given the option to enter into a drawing to win one of two 50-dollar prizes. All data were collected via online questionnaires. Neither participants’ names nor e-mail addresses were in any way linked to the survey so that data provided could remain completely anonymous.

Results

Correlations Between Alcohol Use/Alcohol Problems and Exercise Dependence

Correlation analyses were used to assess for the relationship between alcohol use and alcohol-related problems and total scores on the Exercise Dependence Questionnaire (EDQ), as well as each of the eight EDQ subscales. The typical amount of alcohol consumed on weekends and alcohol-related problems were significantly associated with total scores on the EDQ ($r = 0.16$, $p < 0.01$ and $r = 0.23$, $p < 0.01$, respectively). Examination of each of the subscale correlations indicated that only three of the eight EDQ subscales, Positive Reward (PR), Exercise for Weight Control (EWC), and Stereotyped Behavior (SB) were consistently associated with alcohol outcome variables. Correlations among alcohol use, alcohol-related problems, and the EDQ subscales are presented in Table 1. Correlations for the PR subscale ranged from $r = 0.13$, $p < 0.05$ (drinks per week) to $r = 0.19$, $p < 0.01$ (alcohol-related problems). For the EWC subscale, correlations ranged from $r = 0.15$, $p < 0.01$ (drinks per week) to $r = 0.28$, $p < 0.01$ (alcohol-related problems). Correlations for the SB subscale ranged from $r = 0.13$, $p < 0.05$ (drinks per week) to $r = 0.17$, $p < 0.01$ (typical weekend).

Table 1 Correlations Between EDQ Subscales and Alcohol Use/Alcohol-Related Problems

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Peak Drinks													
2. Bingeing	0.70**												
3. Per Week	0.83**	0.78**											
4. Weekend	0.84**	0.71**	0.93**										
5. Problems	0.56**	0.56**	0.57**	0.53**									
6. ISF	-0.06	-0.03	-0.08	-0.07	0.20**								
7. PR	0.06	0.09	0.13*	0.16**	0.19**	0.21**							
8. WS	0.01	0.00	0.02	0.06	0.14*	0.50**	0.53**						
9. EWC	0.09	0.15**	0.15**	0.17**	0.28**	0.19**	0.39**	0.26**					
10. ESR	0.06	0.01	0.05	0.10	0.08	0.50**	0.20**	0.47**	0.13*				
11. IIP	-0.09	-0.09	-0.07	-0.08	0.16**	0.49**	-0.01	0.12*	0.22**	0.21**			
12. EHR	0.05	0.05	0.05	0.10	0.05	0.10	0.50**	0.44**	0.33**	0.27**	-0.13*		
13. SB	0.17**	0.14*	0.13*	0.17**	0.05	0.25**	0.26**	0.38**	0.08	0.26**	-0.20**	0.34**	
14. EDQ Total	0.08	0.11	0.10	0.16**	0.23**	0.62**	0.64**	0.78**	0.56**	0.59**	0.25**	0.64**	0.59**

Note. Peak Drinks = the highest number of drinks consumed during any one drinking occasion during the past 30 days; Bingeing = number of binge drinking episodes in the past two weeks; Per Week = average number of drinks per week; Weekend = number of drinks consumed over a typical weekend; Problems = number of alcohol-related problems experienced in the past year; ISF = interference with social/family/work life; PR = positive reward; WS = withdrawal symptoms; EWC = exercise for weight control; ESR = exercise for social reasons; IIP = insight into problem; EHR = exercise for health reasons; SB = stereotyped behavior; EDQ Total = total score on the Exercise Dependence Questionnaire. ** $p < .01$; * $p < .05$.

Relationships Among Alcohol Use/Alcohol Problems, Personality, and Exercise Dependence

Based on the results of the correlation analyses, separate hierarchical regression analyses were used to determine the relationships between the EWC, PR, and SB subscales of the EDQ and alcohol use/problems after controlling for relevant demographic and personality variables. Research has shown that gender is significantly associated with the amount and frequency of drinking among college students (Chen, Dufour, & Yi, 2004–2005; O'Malley & Johnston, 2002). In addition, prior studies have shown that conscientiousness and extraversion are associated with alcohol use among college students (e.g., Kashdan, Vetter, & Collins, 2005; Martin & Sher, 1994; Read & O'Connor, 2006; Ruiz, Pincus, & Dickinson, 2003). In the current study, conscientiousness was associated with alcohol-related problems while extraversion was associated with multiple alcohol use measures. Agreeableness, neuroticism, and openness were not significantly correlated with alcohol use or alcohol-related problems. Hence, we entered gender as a covariate in Step 1, extraversion and conscientiousness as covariates in Step 2, and the three EDQ subscales in Step 3.

Results of the hierarchical regression analyses indicated that after controlling for gender and personality variables, the three EDQ subscales accounted for significant increases in variance for drinks per week, $\Delta F(6, 283) = 4.83, p < .01, \Delta R^2 = 0.05$; heavy episodic drinking, $\Delta F(6, 283) = 5.40, p < .01, \Delta R^2 = 0.05$; typical weekend drinking $\Delta F(6, 283) = 6.79, p < .001, \Delta R^2 = 0.06$; peak drinking, $\Delta F(6, 283) = 4.16, p < .01, \Delta R^2 = 0.04$; and alcohol-related problems, $\Delta F(6, 275) = 10.44, p < .001, \Delta R^2 = 0.10$. The amount of unique variance accounted for in alcohol consumption and alcohol problems by the EDQ subscales is presented in Table 2. The findings indicate that exercise dependence predicts alcohol use and alcohol-related problems even after controlling for the effects of relevant demographic and personality variables.

Discussion

The purpose of this study was to examine the relationship between alcohol use and exercise dependence and determine whether the association between the two could be accounted for by personality characteristics. Results indicated that exercise dependence was associated with alcohol use and alcohol-related problems, and personality characteristics did not fully account for the relationship.

The search for a tendency toward addiction that can be explained by an "addictive personality" has been generally unsuccessful (Nathan, 1988). The findings of the current study suggest that the relationship between alcohol use and exercise dependence may be explained by something other than personality characteristics. Examination of the subscales of the Exercise Dependence Questionnaire provides some insight into the specific components of exercise dependence related to alcohol use and may help explain why the two may co-occur among college students.

The three EDQ subscales most consistently associated with alcohol outcome variables were Positive Reward, Exercise for Weight Control, and Stereotyped Behavior. Items on the EDQ indicate that the Positive Reward component of

Table 2 Summary of Multiple Regression Analyses After Controlling for Demographic and Personality Variables

DV	PV	B	95% CI		SE B	β	s_r	s_r^2
			Lower	Upper				
Per Week	EWC	1.47	0.39	2.54	0.55	0.17**	0.15	0.02
	SB	0.59	-.17	1.35	0.39	0.09	0.09	0.00
	PR	0.35	0.98	1.69	0.69	0.03	0.03	0.00
Weekend	EWC	1.22	0.45	2.00	0.39	0.20**	0.17	0.03
	SB	0.56	0.01	1.10	0.28	0.12*	0.11	0.01
	PR	0.28	-.68	1.24	0.49	0.04	0.03	0.00
Bingeing	EWC	0.30	0.10	0.51	0.10	0.19**	0.17	0.03
	SB	0.16	0.02	0.30	0.07	0.13**	0.13	0.02
	PR	-.04	-.29	0.21	0.13	-.02	-.02	0.00
Peak	EWC	0.72	0.21	1.23	0.26	0.17**	0.15	0.02
	SB	0.37	0.01	0.73	0.19	0.12*	0.11	0.01
	PR	-.29	-.93	0.34	0.32	-.06	-.05	0.00
Problems	EWC	1.06	0.57	1.55	0.25	0.27***	0.24	0.06
	SB	0.08	-.26	0.43	0.18	0.03	0.03	0.00
	PR	0.41	-.19	1.02	0.31	0.09	0.08	0.00

Note. DV = Dependent Variable; PV = Predictor Variable; CI = Confidence Interval; EWC = Exercise for Weight Control; SB = Stereotyped Behavior; PR = Positive Reinforcement; Per Week = average number of drinks per week; Weekend = number of drinks consumed over a typical weekend; Bingeing = number of binge drinking episodes in the past two weeks; Peak = the highest number of drinks consumed during any one drinking occasion; Problems = number of alcohol-related problems experienced in the past year; s_r = semipartial correlation. s_r^2 = the unique variance accounted for by that variable. $\Delta R^2 = 0.05$ for Per Week; $\Delta R^2 = 0.06$ for Weekend; $\Delta R^2 = 0.05$ for Bingeing; $\Delta R^2 = 0.04$ for Peak; $\Delta R^2 = 0.10$ for Problems. *** $p < .001$; ** $p < .01$; * $p < .05$.

exercise dependence involves exercising to feel more positive about oneself, less anxious, happier about life, and to feel like a better person. It may be that individuals who exercise to decrease anxiety and feel happier about life also consume alcohol for the same reasons. It is also possible that those who engage in excessive exercise to feel better about themselves do so because of the negative feelings they have about consuming alcohol. This possibility may be especially true for those individuals who experience alcohol-related problems. Those who exercise excessively for weight control may do so to prevent weight gain from consuming alcohol or to lose weight they may have gained as a result of drinking. Finally, the Stereotyped Behavior subscale of the EDQ explores the repetitive nature of exercise and the structure it can provide. The structure provided either externally (e.g., set classes or practices to attend) or internally (e.g., self-imposed

workout schedules or routines) from exercise may provide individuals with the stability, predictability, and consistency they lack in other areas of their lives. For example, individuals who are heavy drinkers may experience unpredictable consequences or be inconsistent academically as a result of their drinking. Structured exercise routines may help mitigate potential anxiety caused by a lack of stability and consistency. Alternatively, it may be that individuals who engage in structured exercise routines, also engage in consistent drinking routines. For example, an individual may routinely drink with friends on certain days of the week at certain places or certain times. While each of these are open empirical questions in need of further investigation, consideration of the underlying factors of exercise dependence and their association with alcohol use and alcohol-related problems sheds some light on potential reasons why the two behaviors co-occur among college students.

Another potential reason why exercise dependence and alcohol use and alcohol-related problems co-occur may be related to the use of alcohol to cope with injuries incurred as a result of excessive exercise. Individuals who meet criteria for exercise dependence may continue their strenuous exercise regimen despite experiencing physical illness or injury (De Coverley Veale, 1987). Continued exercise may exacerbate existing illness or injuries, causing the individual further damage and more pain. Alcohol may be used under such circumstances to help manage the pain. Heavy alcohol consumption used to cope with pain may lead to alcohol-related problems. Again, these possible relationships are in need of further scientific inquiry.

Limitations

The present study has several limitations. First, the study is based on self-report data. Although prior research has concluded that self-report data regarding alcohol consumption is valid (e.g., Babor, Steinberg, Anton, & del Boca, 2000), participants may have a tendency to report their behavior inaccurately due to reasons such as social desirability, response biases, or poor memory of past events. Second, the results of this study cannot explain the *causal* determinants of heavy alcohol use and exercise dependence, nor can it explain how the relationship between these two behaviors may develop. Future research may clarify these relationships through longitudinal designs. Finally, this study was conducted with college students in the northeastern United States. Results may not generalize to other age groups or geographic areas; hence, future research may wish to explore the co-occurrence of heavy alcohol use and exercise dependence among other populations and age groups.

Implications

The present results extend existing research on addictive behaviors by revealing that alcohol use may co-occur with “healthy addictions” such as exercise dependence in addition to other well-known, health-compromising addictions such as smoking and drug use. While Greenberg et al. (1999) examined college students’ tendencies toward consuming alcohol and exercising, it appears that the current study is the first to assess the relationship between exercise dependence

and alcohol consumption among this population. In addition, the current study controlled for personality variables, which allows one to conclude that the co-occurrence of these two addictive behaviors is not entirely due to an innate tendency toward addiction.

There are several clinical implications of these findings. First, since it is believed that athletes tend to be more likely to become exercise dependent than nonathletes (Blaydon & Lindner, 2002), coaches and athletic trainers may want to assess for athletes' use of alcohol as a coping mechanism to deal with the pressure of competition or pain caused by injury or illness. In addition, since research has shown that decreases in one addictive behavior may be associated with increases in an associated addictive behavior (Christo et al., 2003), clinicians and prevention professionals presented with problematic drinkers may wish to discuss excessive exercise as a compensatory behavior and assess for the presence of exercise dependence. Treating both the presenting addictive behavior and any associated addictive behaviors simultaneously may enhance therapeutic gains. Hence, the focus of treatment should be on both overlapping addictions and uncovering their underlying causes.

Future Directions

The dearth of literature examining the relationship between exercise dependence and alcohol use and the findings of the current study suggest numerous areas in need of further scientific exploration. First, future researchers may wish to replicate and extend this exploratory study to further assess the underlying causes of co-occurring "healthy" and "unhealthy" addictive behaviors. The current findings would be strengthened by additional studies utilizing diverse samples and a longitudinal design. We also encourage future researchers to examine potential mediators and moderators of the relationship.

Conclusion

The relationship between exercise dependence and other addictive behaviors such as substance abuse has been seldom studied and is poorly understood. Hence, the aim of the current study was to examine the relationship between exercise dependence and alcohol use and determine whether personality traits could account for the association between the two. Results indicated that exercise dependence was associated with alcohol use and alcohol-related problems even after controlling for personality characteristics. These findings suggest that in addition to personality, other factors may exist to help explain the relationship between alcohol use and exercise dependence among college students. This study extends existing sport psychology and addictive behavior literature, has numerous clinical implications for clinicians and other professionals working with college students and athletes, and illuminates several areas in need of additional research.

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