

Problem Drinking, Gambling and Eating Among Undergraduate University Students. What are the Links?

David C. Hodgins¹ · Kristin M. von Ranson¹ ·
Carlie R. Montpetit¹

Published online: 20 October 2015
© Springer Science+Business Media New York 2015

Abstract Problematic drinking, gambling and eating are elevated among undergraduate university students but our understanding of how they are linked is limited. In this study, drinking, gambling and eating were assessed across a number of dimensions: drinking and gambling involvement, associated negative consequences, impairment of control, and motives; and disordered eating concerns and behaviours, loss of control over eating, and eating expectancies (N = 301). Canonical correlation analysis revealed that drinking and gambling were linked through a factor of general problematic involvement (R = 0.43): students who drank more, experienced more negative consequences and stronger social and coping motives for drinking, also had greater gambling involvement, impaired control, negative consequences, and stronger motives for gambling. These results are broadly consistent with a general problem syndrome model of underlying vulnerabilities. Results showed that there was also a small relationship between the alcohol and the eating variables (R = 0.40), reflecting a negative relationship between problematic alcohol involvement and a dimension of eating attitudes and behaviors. These results are not fully consistent with a problem syndrome model and instead suggest eating and alcohol serve different purposes among students, and that there is not a unitary relationship between eating attitudes and behaviors and alcohol involvement and motives. Finally, we observed no link between eating and gambling variables, which suggests these behaviors, are distinct. Men reported more alcohol and gambling-related involvement and concerns and women more eating-related concerns but principal component analysis suggested that, despite different levels of involvement, associations among these variables were similar for both genders.

Keywords Gambling · Disordered eating · Alcohol · College students · Comorbidity · Addiction

✉ David C. Hodgins
dhodgins@ucalgary.ca

¹ Department of Psychology, University of Calgary, 2500 University Drive NW, Calgary, AB T2N1N4, Canada

Introduction

There is increasing interest in the commonalities among addictive behaviours (Mudry et al. 2011; Potenza 2009; Shaffer 2012), including substance use disorders and behavioural addictions such as gambling. Because they share etiologic and phenomenological features, substance use disorders and gambling disorder are now classified together in the Substance-related and Other Addictive Disorders section of the Diagnostic and Statistical Manual (DSM-5) (American Psychiatric Association 2013). Disordered eating, such as binge eating disorder, is often conceptualized from an addiction perspective (Mudry et al. 2011; Cassin and von Ranson 2007; Wilson 2010). We previously explored the links between drinking and gambling among university students (Hodgins and Racicot 2013). Consistent with a problem syndrome model (Jessor and Jessor 1977), we found that drinking and gambling were most strongly linked through general dimensions of problematic involvement, specifically through coping motives. Students who drink and gamble were most likely to describe engaging in both these behaviours as ways of coping with negative affect. In this paper we attempt to replicate these findings and extend this examination to disordered eating in a new sample of university students.

Problematic drinking, gambling and eating behaviors are particularly frequent among university students (Dancyger and Garfinkel 1995; Wechsler et al. 2002; Neighbors et al. 2002; Martens et al. 2005; Ferrier and Martens 2008) and have been the focus of specially designed interventions (e.g. Crouce and Larimer 2011; Taylor et al. 2006; Manwaring et al. 2008). However, data on whether these behaviors co-occur at rates greater than chance among university and college student populations are inconsistent, with some studies showing moderate links and others not (Dunn et al. 2002; Fischer et al. 2008; Piran and Robinson 2011). Understanding whether and how these behaviors are linked may have implications for effective prevention and treatment.

In our previous study we assessed students on a number of alcohol and gambling-related domains, including level of involvement, consequences, impairment of control, and motives (Hodgins and Racicot 2013). Impairment of control refers to a reduced ability to resist an urge to drink or gamble (Leeman et al. 2013, 2009). Alcohol impaired control typically emerges as an early indicator of student heavy drinking (Chung and Martin 2002, 2002) and is prospectively linked to alcohol dependence (Leeman et al. 2009). Similarly, gambling impaired control is linked to severity of gambling problems (Dickerson and O'Connor 2006), although prospective data are lacking. Drinking motives have been conceptualized in a four factor model as social, enhancement, coping and conformity motives (Cooper et al. 1995), and this model has been validated in describing gambling motives (Stewart and Zack 2008). Specific motives are differentially related to different aspects of drinking and gambling. For example, coping motives have generally been linked with heavier and more problematic drinking (Lyvers et al. 2010).

In the eating disorder literature, similar constructs exist, although specific labels and conceptualizations differ (Mudry et al. 2014). For example, the term “dietary restraint” is frequently used, with low restraint implying lack of control in some definitions (Stice et al. 2004). The reason that this concept differs from alcohol and gambling is that the desire to eat is biologically adaptive and recovery from anorexia nervosa and often bulimia nervosa, albeit not binge eating disorder, requires a reduction in dietary restraint (Wardle 1987). Whereas in the gambling and drinking domains, negative consequences of those behaviours are often measured, they are not typically assessed for disordered eating. In terms of eating motives,

Cooper's (1994) alcohol motives model has been applied to students with eating disorder symptoms (Jackson et al. 2003). As with alcohol and gambling, specific motives were found to be associated with different patterns of eating behaviour, such that coping motives were positively associated with restrictive eating, binge eating, and purging; and social motives were negatively associated with restrictive eating, but were positively associated with binge eating and purging. The relationship between eating disorders and drinking motives has been investigated, whereby coping drinking motives in female students were linked with probable bulimia nervosa or binge eating disorder (Luce et al. 2007) and eating pathology more generally (Anderson et al. 2006). These studies did not assess eating motives.

The goal of the present study was to assess links among drinking, gambling and eating among university students, using a variety of commonly assessed constructs. Based upon our earlier study, we hypothesized that drinking and gambling would be linked by overall problematic involvement but more strongly linked as a way of coping with negative affect. We expected similar relationships among eating pathology and drinking and gambling.

Methods

Participants

The sample ($N = 301$) was comprised of 212 women (70.4 %) and 89 men (29.6 %) with a mean age of 20.7 years (17–49, $SD = 3.5$). Of the sample, 78 % were born in Canada, with 39 % identifying as Caucasian, 24 % as Asian, 8 % as European, and the remaining 29 % as other. Almost all the participants (94 %) were single and 64 % currently lived at a family residence, 20 % lived in an independent residence and 13 % lived in a university residence. In terms of major, 38 % were enrolled in Psychology, 20 % in Sciences, 12 % in Business and 30 % in other fields.

Procedure

Ethics approval was obtained through the University of Calgary and students received course credit for participation. Students completed questionnaires in groups of 3 to 12, taking an average of 30 min.

Measures

Students completed a demographic questionnaire (Adlaf et al. 2005) to gather information on gender, age, ethnicity, income, place of residence, year of study, program of study, grade point average, and engagement in various campus activities.

Gambling Measures

Students rated their last six months involvement in gambling activities including lottery or raffle tickets, slot machines, betting on sports, cards, and dice, internet betting, casino gambling, etc. (Adlaf et al. 2005). An index of gambling involvement was provided from the summed total ($\alpha = 0.79$). Additional questions (Adlaf and Ialomiteranu 2000; Neighbors

et al. 2002) were used to measure overall gambling frequency and money spent/lost and won for descriptive purposes.

The Gambling Motives Questionnaire (GMQ) was used to measure gambling motives (Stewart and Zack 2008). The GMQ's three scales, social, coping, and enhancement motives, have demonstrated high internal consistency and adequate test-retest reliability (Stewart and Zack 2008). In Hodgins and Racicot (2013), additional items designed to measure monetary and charitable gambling motives were developed. Cronbach's alpha in the present sample were 0.86 for social; 0.78 for coping; 0.90 for enhancement; 0.95 for charity; and 0.85 for monetary.

The short version of the Scale of Gambling Choices (SGC) measured level of impaired control (O'Connor and Dickerson 2003; Dickerson and O'Connor 2006). The SGC has high internal reliability ($\alpha = 0.88$ this sample), adequate test-retest reliability and has demonstrated modest to strong correlations with measures of gambling (O'Connor and Dickerson 2003). Gambling-related consequences were measured using the Gambling Problems Index (GPI), 20 items measuring consequences such as missing class, neglecting responsibilities, and arguing with friends or family (Neighbors et al. 2002). Six items measuring impairment of control were removed to provide a more conceptually pure measure of gambling-related consequences ($\alpha = 0.89$ for the complete and $\alpha = 0.87$ for the revised scale).

Drinking Measures

Students completed the Timeline Followback (TLFB) to assess drinking over the past 30 days (Sobell et al. 1985). The self-report version has been shown to have good test-retest reliability with college students (Sobell et al. 1986). Mean number of drinks per drinking day and number of drinking days per month were multiplied to provide an Alcohol Involvement Index. The Drinking Motives Questionnaire (DMQ) measured coping, enhancement, social and conformity (Cooper et al. 1992; Cooper 1994). In the current sample $\alpha = 0.93$ for social; $\alpha = 0.87$ for coping; $\alpha = 0.90$ for enhancement and $\alpha = 0.85$ for conformity. The Impaired Control Scale (ICS) measured impaired control over drinking with three scales, attempted control (AC), failed control (FC) and predicted control (PC) over the past six months (Heather et al. 1998). The recommended substitution method of scoring the FC scale was used. The ICS has demonstrated high test-retest reliability and internal consistency (Marsh et al. 2002; Adamson et al. 2010; Nagoshi 1999; Heather et al. 1993). In the current sample ICS-AC, $\alpha = 0.90$; ICS-FC, $\alpha = 0.71$ and ICS-PC, $\alpha = 0.86$. The Young Adult Alcohol Problems Screening Test (YAAPST) measured adverse drinking consequences (Devos-Comby and Lange 2008) ($\alpha = 0.85$).

Disordered Eating Behavior Measures

The Eating Disorder Examination-Questionnaire (EDE-Q, version 6.0) assessed disordered eating attitudes and behaviours over the past 28 days (Fairburn and Beglin 1994). The EDE-Q provides a total and four subscale scores: Restraint, Eating Concern, Weight Concern, and Shape Concern (Restraint $\alpha = 0.90$; Eating Concern: $\alpha = 0.74$; Shape Concern: $\alpha = 0.92$; Weight Concern: $\alpha = 0.83$; Total: $\alpha = 0.89$).

Eating Expectancies were measured with four of the Eating Expectancy Inventory (EEI) scales (Hohlstein et al. 1998), Eating Alleviates Negative Affect ($\alpha = 0.95$), Eating is Pleasurable and Useful as a Reward ($\alpha = 0.75$), Eating Alleviates Boredom ($\alpha = 0.83$), and Eating Enhances Cognitive Competence ($\alpha = 0.82$). These scales have been shown to have

good internal reliability and validity in a number of adolescent samples (Simmons et al. 2002). An eight-item version of the Uncontrolled Eating Scale from the Three Factor Eating Questionnaire-R18 (TFEQ) measured the tendency to overeat with the feeling of being out of control (Angle et al. 2009). Cronbach's alpha in this sample was 0.85.

Data Analysis

Following Hodgins and Racicot (2013), canonical correlation analysis was conducted to examine the relationship among the set of alcohol, set of gambling, and set of disordered eating variables. Canonical correlation assesses the relationship between two sets of variables in terms of dimensions (referred to as canonical variates) that are common between the sets. It is a useful method of exploring relationships among theoretically related domains. Rather than looking at a large number of pairs of variables separately, linear combinations of the variables within the sets are examined for correlation. Because canonical correlation is designed to compare two sets of variables, three separate analyses were conducted, comparing alcohol and gambling, alcohol and eating, and eating and gambling.

Finally, principal component analysis of the drinking, gambling and eating variables was conducted to examine further their patterns of associations and to determine whether these patterns varied according to gender. Number of factors was determined through examination of the eigenvalue distribution and parallel analysis (Horn 1965; O'Connor 2000) and gender differences in the factor structure were assessed using Tucker's Test of Congruence of the Varimax rotated factor loadings (Lorenzo-Seva and Ten Berge 2006).

Results

Sample Characteristics

Table 1 displays the alcohol, gambling, and disordered eating variables separated by gender. Men gambled more frequently than women and consumed a greater mean number of drinks per month, but did not drink more frequently. Gambling activities in the past six months included lottery tickets (34.6 %), playing dice, cards or other games for money (27.6 %), casino table games (22.6 %), and electronic gaming machines (19.9 %). The majority of the *total* sample (81.4 %) indicated that they had lost less than \$25 in the last year and the second largest group (10.6 %) reported losing \$25 to \$100, with 7.7 % reporting losing more than \$100. Mean EDE-Q global and subscale scores for women in this sample fell within the 55th to 60th percentile of norms for US female undergraduate students (Luce et al. 2008) Raw scores for men were lower but fell at the 55th to 70th percentile compared with US norms (Lavender et al. 2010). Overall, two out of five participants reported overeating or excessive exercising in the last month, with a small proportion reporting self-induced vomiting and laxative use. There were no significant gender differences in frequency of disordered eating behaviours.

Canonical Correlation

Seven outliers for alcohol involvement (2 SDs above the mean) were recoded to one greater than the next highest value. Log transformations improved the distribution of the following

Table 1 Summary of Responses to alcohol, gambling, and disordered eating variables by gender (N = 301)

	Males(<i>n</i> = 89)		Females (<i>n</i> = 212)		Total		<i>t</i> (300)/ χ^2	<i>P</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Drinking Frequency								
Total number of drinks consumed per month	25.7	33.0	18.4	22.1	20.5	25.9	2.2	0.025
Total number of days consumed alcohol per month	4.7	4.7	4.4	4.5	4.5	4.5	0.5	0.595
Gambling Frequency (%) ^a								
Never	34		68		58		48.2	0.0001
Once a year	12		16		15			
2–3 times per year	30		12		18			
Every other month	9		1		4			
Once a month or more	15		3		6			
Disordered Eating Behaviors (%)								
Over-eating	37		45		43		1.7	0.19
Self-induced vomiting	2		3		3		0.7	0.72
Laxative use	2		1		2		0.3	0.60
Excessive exercise	34		42		40		2.0	0.16
Drinking Consequences (YAAPST)	33.6	8.3	31.4	7.5	32.1	7.8	2.5	0.025
Gambling Consequences (GPI)	16.3	3.9	14.8	2.7	15.3	3.1	3.4	0.001
Drinking Impaired Control								
Attempted (ICS-ac)	2.1	1.2	2.0	1.0	2.0	1.1	1.3	0.188
Failed (ICS-fc)	1.6	0.6	1.5	0.6	2		1.4	0.155
Predicted (ICS-pc)	1.6	0.7	1.4	0.5			2.3	0.020
Gambling Impaired Control (SGC)	16.5	6.2	13.2	3.6			5.9	0.000
Disordered Eating								
Restraint (EDEQ-Restraint)	1.2	1.3	1.8	1.4	1.6	1.4	3.2	0.001
Eating Concerns (EDEQ-Eating)	0.4	0.7	1.0	1.1	-0.8	1.0	4.4	0.000
Shape Concerns (EDEQ-Shape)	1.4	1.3	2.7	1.8	2.2	1.6	6.7	0.000
Weight Concerns (EDEQ-Weight)	1.1	1.1	2.1	1.5	1.9	1.6	5.9	0.000
Global (EDEQ-Global)	1.0	1.0	1.9	1.2	1.6	1.3	6.0	0.000
Uncontrolled Eating (TFEQ)	11.3	2.2	11.1	2.2	0.8	11.2	0.8	0.410
Drinking Motives (DMQ)								
Coping	6.4	2.0	5.7	1.7			0.9	0.389
Enhancement	8.2	3.8	5.4	1.4			1.4	0.165
Social	6.4	2.4	5.9	2.2			0.9	0.38
Conformity	7.8	3.2	6.9	2.5			2.7	0.008
Gambling Motives (GMQ)								
Coping	5.7	1.6	5.2	0.9	5.4	1.1	3.4	0.001
Enhancement	8.0	3.7	5.9	2.2	6.7	2.7	6.4	0.000
Social	7.4	3.1	6.0	1.8	6.4	2.4	4.9	0.000
Win Money	6.8	2.9	5.2	2.1	5.6	2.5	5.5	0.000
Charity	3.6	1.4	3.8	1.6	3.7	1.6	0.6	0.518

Table 1 (continued)

	Males(<i>n</i> = 89)		Females (<i>n</i> = 212)		Total		<i>t</i> (300)/ χ^2	<i>P</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Eating Expectancies (EEI)								
Eating Alleviates Negative Affect	2.6	1.1	3.0	1.1	2.8	1.3	2.1	0.038
Eating Is Pleasurable and Useful as a Reward	4.8	1.2	5.0	1.2	4.9	1.2	0.7	0.471
Eating Alleviates Boredom	4.2	1.7	4.4	1.6	4.3	1.7	1.1	0.260
Eating Enhances Cognitive Competence	3.8	0.8	3.9	0.7	3.9	1.4	1.0	0.315

All drinking and gambling variables refer to the last six months except total number of drinks and days consumed alcohol per month. The disordered eating frequency variables refer to the last 28 days and the disordered eating motives and impaired control variables do not specify a timeframe

JCS Impaired Control Scale, *SGC* Scale of Gambling Choices, *AC* Attempted Control, *FC* Failed Control *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *GMQ* Gambling Motives Questionnaire *EDEQ* Eating Disorder Examination Questionnaire, *EEI* Eating Examination Inventory, *TFEQ* Three Factor Eating Questionnaire

^a Categories collapsed due to small cell sizes

^b Eating Disorder Examination Questionnaire items

variables: alcohol involvement, alcohol impaired control (failed and predicted), gambling involvement, gambling impaired control, and gambling coping and winning motives. Table 2 presents the within set correlations for each of the drinking, gambling and eating variables and Table 3 presents the between set correlations. Bivariate correlations between the alcohol and gambling variables were generally stronger than correlations between the eating and gambling or eating and alcohol variables.

The canonical analysis for the alcohol and gambling variables yielded three significant canonical variates, $R = 0.43$, $\chi^2(72) = 167.7$, $p < 0.001$, $R = 0.35$, $\chi^2(56) = 110.4$, $p < 0.001$, $R = 0.32$, $\chi^2(42) = 73.5$, $p = 0.002$. Table 4 displays results for the first pair of alcohol and gambling canonical variates, including standardized coefficients, loadings and cross loadings, within set variance accounted for and redundancies. Loadings, which are commonly emphasized in the interpretation of canonical analysis results (Tabachnick and Fidell 2007), represent the correlation of individual variables with the canonical variate. For the first variate of drinking, all variables loaded significantly (> 0.30) except for the failure of impaired control, and particularly high loadings were evident for drinking involvement, consequences, drinking to cope and for social reasons. The canonical variate accounted for 28 % of the variance of the drinking variables. The first variate of gambling showed moderate correlations with involvement, impairment of control, and social, enhancement and winning motives, with an especially strong correlation for gambling for social motives. The canonical variate accounted for 29 % of the variance of the gambling variables.

Cross loadings show the correlation between specific variables and the opposite canonical variate (see Table 4). Drinking for social motives was related to the gambling variate and gambling for social reasons was related to the alcohol variate. The redundancy coefficient indicated that only 5 % of the variance in the first alcohol covariate was accounted for by the gambling variate and 5 % of the variance of the first gambling variate was accounted for by the alcohol variate.

Although the second and third canonical correlations were significant, the proportion of variance accounted for by the set of alcohol and gambling variables was small

Table 2 Within set alcohol, gambling and eating pearson correlations

Alcohol										
	Involvement	Consequences	ICS _{AC}	ICS _{FC}	ICS _{PC}	DMQ- Cope	DMQ- Enhance	DMQ- Social	DMQ- Conform	
Involvement	–	0.63	0.22	0.52	0.45	0.39	0.57	0.59	0.16	
Consequences		–	0.37	0.65	0.55	0.56	0.70	0.63	0.29	
ICS _{AC}			–	0.79	0.61	0.37	0.39	0.43	0.30	
ICS _{FC}				–	0.79	0.61	0.62	0.58	0.36	
ICS _{PC}					–	0.54	0.52	0.44	0.32	
DMQ-Cope						–	0.64	0.58	0.36	
DMQ-Enhance							–	0.79	0.27	
DMQ-Social								–	0.40	
DMQ-Conform									–	
Gambling										
	Involvement	Consequences	SGC	GMQ-Cope	GMQ-Enhance	GMQ-Social	GMQ- Money	GMQ- Charity		
Involvement	–	0.46	0.60	0.37	0.69	0.71	0.61	0.19		
Consequences		–	0.58	0.46	0.54	0.50	0.42	0.09		
SGC			–	0.47	0.71	0.62	0.56	0.06		
GMQ-Cope				–	0.64	0.53	0.46	0.10		
GMQ-Enhance					–	0.75	0.77	0.18		
GMQ-Social						–	0.66	0.15		
GMQ-Money							–	0.20		
GMQ-Charity								–		
Disordered Eating										
	EDEQ Restraint	EDEQ Eating	EDEQ Shape	EDEQ Weight	EI Neg. Affect	EI Pleas.	EI Cog.	EI Bored.	TFEQ	
EDEQ Restraint	–	0.60	0.67	0.58	0.20	0.06	0.12	0.13	0.18	
EDEQ Eating		–	0.74	0.66	0.40	0.10	0.23	0.20	0.34	
EDEQ Shape			–	0.83	0.33	0.08	0.19	0.24	0.26	

Table 2 (continued)

	Alcohol					
EDEQ Weight	–	0.36	0.04	0.18	0.20	0.24
EEI Neg. Affect	–	–	0.53	0.72	0.45	0.48
EEI Pleas.	–	–	–	0.47	0.38	0.42
EEI Cog.	–	–	–	–	0.32	0.38
EEI Bored	–	–	–	–	–	0.42
TFEQ	–	–	–	–	–	–

N = 30.1 *JCS* Impaired Control Scale, *SGC* Scale of Gambling Choices, *AC* Attempted Control, *FC* Failed Control, *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *GMQ* Gambling Motives Questionnaire, *EDEQ* Eating Disorder Examination Questionnaire, *EEI* Eating Examination Inventory, *TFEQ* Three Factor Eating Questionnaire

Table 3 Between set alcohol, gambling and eating pearson correlations

	Alcohol:	Involvement	Consequences	ICS _{AC}	ICS _{FC}	ICS _{PC}	DMQ-Cope	DMQ-Enhance	DMQ-Social	DMQ- Conform
Gambling:										
Involvement		0.21	0.20	0.04	0.16	0.13	0.13	0.07	0.14	0.11
Consequences		0.12	0.22	0.11	0.16	0.15	0.17	0.17	0.12	0.18
SGC		0.24	0.21	0.10	0.23	0.21	0.16	0.16	0.22	0.20
GMQ-Cope		0.01	0.05	-0.01	0.02	0.07	0.13	0.04	0.03	0.17
GMQ-Enhance		0.22	0.21	0.02	0.11	0.09	0.13	0.18	0.18	0.16
GMQ-Social		0.26	0.27	0.04	0.15	0.14	0.24	0.17	0.27	0.24
GMQ- Money		0.17	0.23	0.03	0.12	0.11	0.16	0.17	0.19	0.17
GMQ- Charity		0.07	-0.09	0.03	-0.01	-0.04	0.01	-0.05	-0.01	0.06
	Alcohol:	Involvement	Consequences	ICS _{AC}	ICS _{FC}	ICS _{PC}	DMQ-Cope	DMQ-Enhance	DMQ-Social	DMQ- Conform
Disordered Eating:										
EDEQ Rest.		0.01	0.07	.06	0.07	0.06	0.15	0.06	0.12	0.10
EDEQ Eating		-0.00	0.01	-0.07	0.03	0.08	0.15	0.03	0.03	0.08
EDEQ Shape		0.02	0.04	0.01	0.09	0.09	0.17	0.06	0.08	0.09
EDEQ Weight		0.03	0.03	0.05	0.09	0.11	0.14	0.05	0.08	0.08
EEI Negr. Affect		-0.23	-0.10	-0.03	-0.05	0.05	0.06	-0.11	-0.14	0.15
EEI Pleas.		-0.06	-0.03	-0.05	-0.03	0.03	0.04	-0.00	-0.08	0.14
EEI Cog.		-0.14	-0.04	-0.04	-0.01	0.07	0.01	-0.09	-0.10	0.13
EEI Bored.		0.02	0.06	0.01	0.05	0.10	0.08	0.02	0.06	0.15
TFEQ		0.10	0.17	0.07	0.14	0.16	0.17	0.07	0.04	0.16
	Gambling:	Involvement	Consequences	SGC	GMQ-Cope	GMQ-Enhance	GMQ-Social	GMQ- Money	GMQ- Charity	
Disordered Eating:										
EDEQ Rest.		0.01	-0.06	-0.06	-0.04	-0.07	-0.04	-0.04	0.05	
EDEQ Eating		-0.05	0.03	-0.06	-0.06	-0.08	-0.02	-0.08	0.10	
EDEQ Shape		-0.11	-0.08	-0.13	-0.14	-0.15	-0.11	-0.13	0.04	
EDEQ Weight		-0.04	0.00	-0.03	-0.07	-0.06	-0.03	-0.02	0.06	

Table 3 (continued)

EEI Neg. Affect	-0.08	0.03	-0.03	-0.02	-0.10	-0.07	-0.08	0.14
EEI Pleas.	-0.03	-0.01	0.03	0.02	0.00	0.03	0.04	0.14
EEI Cog.	-0.08	-0.01	-0.05	-0.05	-0.11	-0.06	-0.06	0.07
EEI Bored.	0.03	0.03	0.11	0.04	0.06	0.07	0.07	0.12
TFEQ	0.09	0.14	0.18	0.02	0.11	0.12	0.07	0.09

N = 30.1

ICS Impaired Control Scale, *SGC* Scale of Gambling Choices, *AC* Attempted Control, *FC* Failed Control, *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *GMQ* Gambling Motives Questionnaire, *EDEQ* Eating Disorder Examination Questionnaire, *EEI* Eating Examination Inventory, *TFEQ* Three Factor Eating Questionnaire

Table 4 Canonical coefficients and loadings of first canonical variate: alcohol and gambling

	Coefficient	Loadings	Cross loadings
Alcohol			
Involvement	0.33	0.64	0.27
Consequences	0.41	0.64	0.27
ICS _{AC}	0.21	0.16	0.07
ICS _{FC}	0.17	0.45	0.15
ICS _{PC}	0.12	0.43	0.18
DMQ-Cope	0.36	0.57	0.24
DMQ-Enhance	0.92	0.37	0.16
DMQ-Social	0.80	0.71	0.30
DMQ-Conform	0.28	0.57	0.24
Percent of Variance	0.28		
Redundancy	0.05		
Gambling			
Involvement	0.04	0.60	0.26
Consequences	0.15	0.33	0.14
SGC	-0.42	0.62	0.27
GMQ-Cope	0.16	0.26	0.11
GMQ-Enhance	0.67	0.51	0.22
GMQ-Social	-1.20	0.89	0.38
GMQ-Money	0.22	0.56	0.24
GMQ-Charity	0.03	0.06	0.03
Percent of Variance	0.29		
Redundancy	0.05		

ICS Impaired Control Scale, *SGC* Scale of Gambling Choices, *AC* Attempted Control, *FC* Failed Control, *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *GMQ* Gambling Motives Questionnaire

(0.07 and 0.10 for alcohol; 0.09 and 0.05 for gambling respectively), and therefore, were not interpreted.

The canonical analysis between alcohol and eating variables yielded one significant canonical variate, $R = 0.40$, $\chi^2(81) = 128.6$, $p < 0.001$ (see Table 5). For the drinking variate, involvement, failure of impaired control, enhancement and social motives, and consequences correlated greater than 0.30. The canonical variate accounted for 20 % of the variance of the drinking variables. For the set of eating variables, eating to decrease negative affect and for the purpose of pleasure and cognitive control were moderately negatively correlated with the variate, which accounted for 15 % of the variance of the eating variables overall. Cross loadings suggested alcohol involvement was related to the disordered eating covariate and that eating to decrease negative affect was negatively related to the alcohol covariate. The redundancy coefficient indicated that only 3 % of the variance in the first alcohol covariate was accounted for by the disordered eating covariate and 2 % of the variance in the first disordered eating covariate was accounted for by the alcohol covariate.

Because the gambling variables were largely unrelated to the disordered eating variables, the canonical analysis did not yield a significant canonical variate, $R = 0.36$, $\chi^2(72) = 91.3$, $p = 0.064$.

Table 5 Canonical coefficients and loadings of first canonical variate: alcohol and eating

	Coefficient	Loadings	Cross loadings
Alcohol			
Involvement	0.67	0.81	0.32
Consequences	0.30	0.57	0.23
ICS _{AC}	0.17	0.30	0.12
ICS _{FC}	0.28	0.39	0.15
ICS _{PC}	0.37	0.15	0.06
DMQ-Cope	0.35	0.08	0.03
DMQ-Enhance	-0.26	0.43	0.17
DMQ-Social	0.48	0.57	0.23
DMQ-Conform	-0.38	-0.16	-0.06
Percent of Variance	0.20		
Redundancy	0.03		
Disordered Eating			
EDEQ Restraint	0.10	-0.03	-0.01
EDEQ Eating	-0.22	-0.26	-0.10
EDEQ Shape	-0.19	-0.14	-0.05
EDEQ Weight	0.43	-0.07	-0.03
EEI Neg. Affect	-1.18	-0.82	-0.33
EEI Pleas.	-0.16	-0.47	-0.19
EEI Cog.	0.12	-0.55	-0.22
EEI Bored.	0.21	-0.13	-0.05
TFEQ	0.50	-0.02	-0.01
Percent of Variance	0.15		
Redundancy	0.02		

ICS Impaired Control Scale, *AC* Attempted Control, *FC* Failed Control, *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *EDEQ* Eating Disorder Examination Questionnaire, *EEI* Eating Examination Inventory, *TFEQ* Three Factor Eating Questionnaire

Principal Component Analysis

A principal component analysis (PCA) was conducted on the 25 alcohol, gambling and eating variables. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.83, which suggests good factorability. Not all variables loaded at 0.3 or greater on the first unrotated component, which suggests that more than one factor exists. Five eigenvalues were greater than one but distribution showed a sharp discontinuity after four factors. Parallel analysis also indicated four factors (O'Connor 2000). The four factors accounted for 62 % of the variance and varimax rotation revealed a clear factor loading pattern (see Table 6). The alcohol variables all loaded >0.6 on the first rotated factor and the gambling variables, with the exception of gambling for charity motives, loaded >0.67 on the second rotated factor. The disordered eating variables were split between third and fourth factors, with each variable loading strongly on only one factor. Examining the content of these scales, it appears that factor 3 tapped into symptoms of eating pathology, whereas factor 4 reflected more normative attitudes, expectancies and behaviours (e.g., overeating).

The PCA was repeated for males and females separately and similar results were uncovered in terms of number of factors and rotated factor loadings. Tucker's Test of Congruency

Table 6 Principal components analyses varimax rotated factor loadings for alcohol, gambling and eating variables

Alcohol, Gambling and Eating Variables	Component Loadings			
	Factor 1	Factor 2	Factor 3	Factor 4
ICS _{FC}	0.867			
DMQ- Enhance	0.847			
Alcohol Consequences	0.823			
DMQ- Social	0.807			
ICS _{PC}	0.762			
DMQ- Cope	0.741			
Drinking involvement	0.692			
ICS _{AC}	0.608			
GMQ- Enhance		0.918		
GMQ- Social		0.851		
GMQ- Money		0.801		
Gambling involvement		0.796		
Gambling Impaired Control		0.784		
GMQ Coping		0.694		
Gambling Consequences		0.671		
GMQ- Charity		0.242		
EDEQ- Shape			0.909	
EDEQ Weight			0.868	
EDEQ Eating			0.839	
EDEQ Restraint			0.807	
EEI Neg. Affect				0.842
EEI Cog.				0.787
EEI Pleas.				0.763
TFEQ				0.664
EEI Bored.				0.634

Only loadings >0.3 are presented, with the exception of Gambling for Charitable Motives

ICS Impaired Control Scale, *SGC* Scale of Gambling Choices, *AC* Attempted Control, *FC* Failed Control, *PC* Predicted Control, *DMQ* Drinking Motives Questionnaire, *GMQ* Gambling Motives Questionnaire, *EDEQ* Eating Disorder Examination Questionnaire, *EEI* Eating Examination Inventory, *TFEQ* Three Factor Eating Questionnaire

indicated that the alcohol ($CC = 0.98$) and gambling factors ($CC = 0.97$) could be considered equal in men and women (on the basis of rotated factor loadings) and that the two eating factors were “fairly similar” ($CC = 0.94$ and 0.93).

Discussion

There is an increasing interest in understanding the commonalities and differences among addictive behaviours among university students and in the general population. Although there is some amount of maturing out of involvement in these behaviours as younger people move

into different adult roles, involvement as a student does predict chronic difficulties for drinking and gambling. Our results replicate previous findings showing a significant but small link between alcohol and gambling problematic involvement (Hodgins and Racicot 2013; Fischer et al. 2008). At the bivariate level, alcohol and gambling frequency were correlated $r = 0.21$ as were negative consequences, $r = 0.22$ (Table 3). The multivariate analyses showed that a general dimension of problematic involvement had the strongest link ($R = 0.43$). Students who drank more heavily, had more negative consequences, and higher social and coping motives for drinking in particular also had greater gambling involvement, impaired control, negative consequences, and stronger motives for gambling. These results are very similar to our previous sample and are consistent with a general problem syndrome model (Jessor and Jessor 1977; Barnes et al. 2010).

In our previous report we found that alcohol and gambling were strongly linked in their use as ways of coping with negative affect. That finding was not replicated in the present sample, although motives for gambling involvement and alcohol use were particularly strong aspects of the alcohol-gambling link. In this case, drinking and gambling for social motives seemed to have a relatively strong connection. Given that both alcohol and gambling among young people are very socially focused activities, this connection is not surprising. However, it does suggest that environmental factors may be a larger role than individual factors in commonalities among these behaviours. Drinking for social reasons also tends to be less predictive of future drinking problems than coping and enhancement motives (Merrill et al. 2014).

There was also a small significant relationship between the alcohol and eating variables ($R = 0.40$) reflecting a negative relationship between problematic alcohol involvement and eating attitudes and behaviors. Results suggested that problematic alcohol involvement was inversely related to eating to decrease negative affect, and for the purpose of pleasure and cognitive control – heavier drinkers tended not to eat for these reasons. The latter results are inconsistent with limited previous research with college women that found a positive link between eating pathology and drinking to cope motives (Anderson et al. 2006; Luce et al. 2007). They instead suggest that eating and alcohol serve different purposes among students. Because affect regulation is a central concept in treatment of these disorders, future research clarifying these relationships is crucial. It is also important to note that within the drinking literature, a conceptual difference is recognized between drinking expectancies and drinking motives wherein expectancies are more distal predictors of drinking and motives are more proximal (Cooper et al. 1995). As far as we are aware, a distinction between eating expectancies and motives has not been as carefully drawn in the eating pathology literature. In this study we used an expectancy measure, and not a motive measure, which may have implications for our results.

In contrast to significant links between alcohol and both gambling and problematic eating, gambling and problematic eating were unrelated. This finding suggests that symptoms of and motives for problematic eating and gambling tend to be distinct addictive behaviours. These behaviours tend to be undertaken by different people, with individuals tending to endorse either gambling or disordered eating but not both. A recent study of a Spanish sample of individuals in treatment for eating disorders also did not find elevated rates of gambling disorder compared to the general population (Jimenez-Murcia et al. 2013). A study of university students (Fischer et al. 2008), however, found that although eating and gambling pathologies were not correlated, both were related to the tendency to react in a rash manner when upset (negative urgency). This finding is consistent with the model that underlying processes can have different behavioral expressions in different individuals (Shaffer 2012).

As expected, generally men reported more alcohol and gambling involvement and women more eating concerns. It is interesting that although men drank more than women and reported more negative consequences, they did not drink more frequently. Men and women also reported similar motives for drinking with the exception of drinking to conform to group norms, which was more frequently reported by men. Lack of gender differences in drinking motives and expectancies have been found in other student samples (e.g., Fischer et al., 2008; Merrill et al. 2014) and may reflect how socially embedded drinking is for undergraduate students generally. With gambling, however, men who gamble reported stronger coping, enhancement, social motives for gambling and more gambling to win money. Men and women were equally likely to report gambling to support charities. Men and women tended to endorse similar motives for eating, although women were more likely than men to endorse the use of eating to manage negative affect. Unexpectedly, men and women did not report statistically different frequencies of eating disorder behaviours such as overeating, self-induced vomiting, use of laxatives to manage weight or excessive exercise. Women, however, did report far greater dietary restraint and concerns about eating, weight, and shape than men.

Although men and women differed in their level of involvement in each of the three behaviours, the PCA suggested that the overall association of the different features such as suffering negative consequences, impairment of control, and motives for involvement were similar across gender, in particular for alcohol and gambling. The finding that the eating-related measures formed two factors instead of one, unlike drinking and gambling, highlights the complexity of eating behaviours and motives. Attitudes symptomatic of eating disorders tended to cluster together, whereas eating expectancies combined with overeating to form a second factor. It is worth noting that the overeating scale was derived for use with obese individuals whereas the eating disorder attitudes scales were developed for use with individuals with eating disorders, and, as such, the conceptualizations of eating behaviors differed somewhat (Karlsson et al. 2000; Fairburn and Beglin 1994). The former scale emphasizes extreme hunger and overeating, whereas the latter measures a wider range of attitudes and behaviours symptomatic of eating disorders, including food restriction, over concern with weight and shape, fear of weight gain, and body dissatisfaction. We speculate that the factor that included eating motives with overeating reflects behaviours and attitudes that are more normally distributed in a nonclinical population than eating disorder symptoms, which are more aberrant and tend to affect fewer individuals. Further research is necessary to understand the relationship of overeating to diagnostic symptoms of eating disorders.

Although this study is useful as expanding our understand of the specific nature of links between additive behaviors in undergraduate students, important limitations exist including the use of a cross-sectional, convenience sample and self-report methodology. The sample size was adequate for the analyses although the use of volunteer recruitment provides a sample that is not necessarily representative of university students in general. Future research should attempt to achieve representative samples. Studies that assess motivations through the use of implicit methods would also overcome the potential of shared method variance with assessing motives only with self-report scales.

Conclusions

Problematic alcohol and gambling are significantly but not strongly linked among university students as are problematic alcohol and disordered eating. Problematic

alcohol involvement was linked to eating attitudes and behaviors reflecting mostly specific eating expectancies, suggesting that alcohol and eating serve different purposes among undergraduates and that there is not a straightforward relationship between eating attitudes and behaviors and alcohol involvement and motives. Results did not find a link between the eating and gambling variables, which suggests these behaviours are distinct.

Future research needs to clarify how different types of motives for different behaviours are linked. If specific motives (e.g., coping) represent a common link for students who engage in multiple addictive behaviours, it is possible that altering these motives may lead to simultaneous improvements across behaviours. Targeting motives in prevention and treatment interventions may be an efficacious approach given that motives are considered very proximal predictors of behaviour as they are likely directly linked to the decision to engage in a specific behaviour.

Defining concepts that are parallel across these three types of addictive problems is difficult, perhaps because these behaviours play different roles in students' lives. Eating is not optional, whereas other addictive behaviours are optional, or at least start that way. As a result of constant interactions with and choices about food, we speculate that relationships with eating are more complex and imbued with subtle meanings and motives than with non-essential behaviours such as drinking and gambling.

Acknowledgments We would like to thank Valerie Panjalingam and Erin Lowden, undergraduate Psychology students at the University of Calgary, for assisting with data entry of the completed questionnaire packages. Kristy Kowatch and Rodney Steadman helped with manuscript preparation.

References

- Adamson, S. J., Heather, N., Morton, V., & Raistrick, D. (2010). Initial preference for drinking goal in the treatment of alcohol problems: II. Treatment outcomes. *Alcohol and Alcoholism*, *45*, 136–142.
- Adlaf, E. M., & Ialomiteranu, A. (2000). Prevalence of problem gambling in adolescents: findings from the 1999 Ontario drug use survey. *Canadian Journal of Psychiatry*, *45*, 752–755.
- Adlaf, E. M., Begin, P., & Sawka, E. (2005). *Canadian Addiction Survey (CAS): A national survey of Canadians' use of alcohol and other drugs*. Ottawa: Canadian Centre on Substance Abuse.
- Anderson, D. A., Simmons, A. M., Martens, M. P., Ferrier, A. G., & Sheehy, M. J. (2006). The relationship between disordered eating behavior and drinking motives in college-age women. *Eating Behaviors*, *7*, 419–422.
- Angle, S., Engblom, J., Eriksson, T., Kautiainen, S., Saha, M. T., Lindfors, P., et al. (2009). Three factor eating questionnaire-R18 as a measure of cognitive restraint, uncontrolled eating and emotional eating in a sample of young Finnish females. *International Journal of Behavioral Nutrition and Physical Activity*, *6*, 41.
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.,). Washington, DC: Author.
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Tidwell, M. C. (2010). Comparisons of gambling and alcohol use among college students and noncollege young people in the United States. *Journal of American College Health*, *58*, 443–452.
- Cassin, S. E., & von Ranson, K. M. (2007). Is binge eating experienced as an addiction? *Appetite*, *49*, 687–690.
- Chung, T., & Martin, C. S. (2002). Concurrent and discriminant validity of DSM-IV symptoms of impaired control over alcohol consumption in adolescents. *Alcoholism, Clinical and Experimental Research*, *26*, 485–492.
- Cooper, M. L. (1994). Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychological Assessment*, *6*, 117–128.
- Cooper, M. L., Russell, M., Skinner, J. B., & Windle, M. (1992). Development and validation of a three-dimensional measure of drinking motives. *Psychological Assessment*, *4*, 123–132.

- Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *Journal of Personality and Social Psychology*, *69*, 990–1005.
- Cronce, J. M., & Larimer, M. E. (2011). Individual-focused approaches to the prevention of college student drinking. *Alcohol Research & Health*, *34*, 210–221.
- Dancyger, I. F., & Garfinkel, P. E. (1995). The relationship of partial syndrome eating disorders to anorexia nervosa and bulimia nervosa. *Psychological Medicine*, *25*, 1019–1025.
- Devos-Comby, L., & Lange, J. E. (2008). Standardized measures of alcohol-related problems: a review of their use among college students. *Psychology of Addictive Behaviors*, *22*, 349–361.
- Dickerson, M., & O'Connor, J. (2006). *Gambling as an addictive behaviour: Impaired control, harm minimisation, treatment and prevention*. Cambridge: Cambridge University Press.
- Dunn, E. C., Larimer, M. E., & Neighbors, C. (2002). Alcohol and drug-related negative consequences in college students with bulimia nervosa and binge eating disorder. *International Journal of Eating Disorders*, *32*, 171–178.
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: interview or self-report questionnaire? *International Journal of Eating Disorders*, *16*, 363–370.
- Ferrier, A. G., & Martens, M. P. (2008). Perceived incompetence and disordered eating among college students. *Eating Behaviors*, *9*, 111–119.
- Fischer, S., Smith, G. T., & Cyders, M. A. (2008). Binge eating, problem drinking, and pathological gambling: linking behavior to shared traits and social learning. *Personality and Individual Differences*, *44*, 789–800.
- Heather, N., Tebbutt, J. S., Mattick, R. P., & Zamir, R. (1993). Development of a scale for measuring impaired control over alcohol consumption - a preliminary report. *Journal of Studies on Alcohol*, *54*, 700–709.
- Heather, N., Booth, P., & Luce, A. (1998). Impaired control scale: cross-validation and relationships with treatment outcome. *Addiction*, *93*, 761–771.
- Hodgins, D. C., & Racicot, S. (2013). The link between drinking and gambling among undergraduate students. *Psychology of Addictive Behaviors*, *27*, 885–892.
- Hohlstein, L. A., Smith, G. T., & Atlas, J. G. (1998). An application of expectancy theory to eating disorders: development and validation of measures of eating and dietary expectancies. *Psychological Assessment*, *10*, 49–58.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*, 179–185.
- Jackson, B., Cooper, M., Mintz, L., & Albino, A. (2003). Motivations to eat: scale development and validation. *Journal of Research in Personality*, *37*, 297–318.
- Jessor, R., & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. New York: Academic Press.
- Jimenez-Murcia, S., Steiger, H., Israel, M., Granero, R., Prat, R., Santamaria, J. J., et al. (2013). Pathological gambling in eating disorders: prevalence and clinical implications. *Comprehensive Psychiatry*, *54*, 1053–1060.
- Karlsson, J., Persson, L. O., Sjostrom, L., & Sullivan, M. (2000). Psychometric properties and factor structure of the three-factor eating questionnaire (TFEQ) in obese men and women. Results from the Swedish obese subjects (SOS) study. *International Journal of Obesity and Related Metabolic Disorders*, *24*, 1715–1725.
- Lavender, D. M., De Young, K. P., & Anderson, D. A. (2010). Eating disorder examination questionnaire (EDE-Q): norms for undergraduate men. *Eating Behaviors*, *11*, 119–121.
- Leeman, R. F., Toll, B. A., Taylor, L. A., & Volpicelli, J. R. (2009). Alcohol-induced disinhibition expectancies and impaired control as prospective predictors of problem drinking in undergraduates. *Psychology of Addictive Behaviors*, *23*, 553–563.
- Leeman, R. F., Hoff, R. A., Krishnan-Sarin, S., Patock-Peckham, J. A., & Potenza, M. N. (2013). Impulsivity, sensation-seeking, and part-time job status in relation to substance use and gambling in adolescents. *Journal of Adolescent Health*, *54*(4), 460–466.
- Lorenzo-Seva, U., & Ten Berge, J. M. (2006). Tucker's congruence coefficient as a meaningful index of factor similarity. *Methodology*, *2*, 57–64.
- Luce, K. H., Engler, P. A., & Crowther, J. H. (2007). Eating disorders and alcohol use: group differences in consumption rates and drinking motives. *Eating Behaviors*, *8*, 177–184.
- Luce, K. H., Crowther, J. H., & Pole, M. (2008). Eating disorder examination questionnaire (EDE-Q): norms for undergraduate women. *The International Journal of Eating Disorders*, *41*, 273–276.
- Lyvers, M., Hasking, P., Hani, R., Rhodes, M., & Trew, E. (2010). Drinking motives, drinking restraint and drinking behaviour among young adults. *Addictive Behaviors*, *35*, 116–122.
- Manwaring, J. L., Bryson, S. W., Goldschmidt, A. B., Winzelberg, A. J., Luce, K. H., Cunniff, D., et al. (2008). Do adherence variables predict outcome in an online program for the prevention of eating disorders? *Journal of Consulting and Clinical Psychology*, *76*, 341–346.
- Marsh, A., Smith, L., Saunders, B., & Pick, J. (2002). The impaired control scale: confirmation of factor structure and psychometric properties for social drinkers and drinkers in alcohol treatment. *Addiction*, *97*, 1339–1346.
- Martens, M. P., Ferrier, A. G., Sheehy, M. J., Corbett, K., Anderson, D. A., & Simmons, A. (2005). Development of the protective behavioral strategies Survey5. *Journal of Studies on Alcohol*, *66*, 698–705.

- Merrill, J. E., Wardell, J. D., & Read, J. P. (2014). Drinking motives in the prospective prediction of unique alcohol-related consequences in college students. *Journal of Studies on Alcohol and Drugs*, *75*, 93–102.
- Mudry, T. E., Hodgins, D. C., el-Guebaly, N., Wild, T. C., Colman, I., Patten, S. B., et al. (2011). Conceptualizing excessive behaviour syndromes: a systematic review. *Current Psychiatry Reviews*, *138–151*.
- Mudry, T. E., Stea, J. N., & Hodgins, D. C. (2014). The Psychological Underpinnings of Behavioral Addictions. In N.El-Guebaly (Ed.), *Textbook of Addiction Treatment: International Perspectives* (Heidelberg: Springer-Verlag).
- Nagoshi, C. T. (1999). Perceived control of drinking and other predictors of alcohol use and problems in a college sample. *Addiction Research*, *7*, 291–306.
- Neighbors, C., Lostutter, T. W., Larimer, M. E., & Takushi, R. Y. (2002). Measuring gambling outcomes among college students. *Journal of Gambling Studies*, *18*, 339–360.
- O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and velicer's MAP test. *Behavior Research Methods, Instruments, & Computers*, *32*, 396–402.
- O'Connor, J., & Dickerson, M. (2003). Impaired control over gambling in gaming machine and off-course gamblers. *Addiction*, *98*, 53–60.
- Piran, N., & Robinson, S. R. (2011). Patterns of associations between eating disordered behaviors and substance use in two non-clinical samples: a university and a community based sample. *Journal of Health Psychology*, *16*, 1027–1037.
- Potenza, M. N. (2009). Non-substance and substance addictions. *Addiction*, *104*, 1016–1017.
- Shaffer, H. J. (2012). *Addiction syndrome handbook*. (vols. 1. Foundations, influences, and expressions of addiction) Washington, DC: American Psychological Association.
- Simmons, J. R., Smith, G. T., & Hill, K. K. (2002). Validation of eating and dieting expectancy measures in two adolescent samples. *International Journal of Eating Disorders*, *31*, 461–473.
- Sobell, L. C., Sobell, M. B., Maisto, S. A., & Cooper, A. M. (1985). Time-line follow-back assessment method. In D. J. Lettieri, M. A. Sayers, & J. E. Nelson (Eds.), *NIAAA treatment handbook series: Vol. 2 Alcoholism treatment assessment research instruments* (pp. 530–534). Washington, DC: National Institute on Alcoholism and Alcohol Abuse.
- Sobell, M. B., Sobell, L. C., Klajner, F., Pavan, D., & Basian, E. (1986). The reliability of a timeline method for assessing normal drinker college students' recent drinking history: utility for alcohol research. *Addictive Behaviors*, *11*, 149–161.
- Stewart, S. H., & Zack, M. (2008). Development and psychometric evaluation of a three-dimensional gambling motives questionnaire. *Addiction*, *103*, 1110–1117.
- Stice, E., Fisher, M., & Lowe, M. R. (2004). Are dietary restraint scales valid measures of acute dietary restriction? Unobtrusive observational data suggest not. *Psychological Assessment*, *16*, 51–59.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (Fifth ed.,). Boston: Allyn & Bacon.
- Taylor, C. B., Bryson, S., Luce, K. H., Cunnig, D., Doyle, A. C., Abascal, L. B., et al. (2006). Prevention of eating disorders in at-risk college-age women. *Archives of General Psychiatry*, *63*, 881–888.
- Wardle, J. (1987). Compulsive eating and dietary restraint. *British Journal of Clinical Psychology*, *26*, 47–55.
- Wechsler, H., Lee, J. E., Nelson, T. F., & Kuo, M. (2002). Underage college students' drinking behavior, access to alcohol, and the influence of deterrence policies. Findings from the Harvard School of Public Health College Alcohol Study. *Journal of American College Health*, *50*, 223–236.
- Wilson, G. T. (2010). Eating disorders, obesity and addiction. *European Eating Disorders Review*, *18*, 341–351.