Modeling the distinct negative-reinforcement mechanisms associated with alcohol misuse and unhealthy snacking

Danielle L. Reaves, Paul Christiansen, Emma J. Boyland & Jason C. G. Halford

University of Liverpool

Clare H. Llewellyn

University College London

Charlotte A. Hardman

University of Liverpool

Author Note

Danielle L. Reaves, Department of Psychological Sciences, University of Liverpool.

Paul Christiansen, Department of Psychological Sciences, University of Liverpool.

Emma J. Boyland, Department of Psychological Sciences, University of Liverpool.

Jason C. G. Halford, Department of Psychological Sciences, University of Liverpool.

Clare H. Llewellyn, Department of Behavioural Science and Health, University College London.

Charlotte A. Hardman, Department of Psychological Sciences, University of Liverpool.

Correspondence concerning this article should be addressed to Danielle L. Reaves,

Department of Psychological Sciences, University of Liverpool, Liverpool, United Kingdom,

L69 7ZA. Email: Dreaves@liverpool.ac.uk .

Abstract

Background: Negative personality characteristics have been implicated in promoting

overconsumption of both alcohol and food. Furthermore, positive motivations (enhancement)

and negative motivations (coping) may mediate the association between personality and

alcohol or food (over)consumption. Objectives: The present study hypothesised that i.)

drinking to cope and ii.) eating to cope would mediate the association between

hopelessness/anxiety sensitivity and hazardous drinking/unhealthy snacking, respectively,

and iii.) eating and drinking to cope would represent separate strategies. Methods:

Participants were recruited via opportunity sampling through university schemes, social

media, email and web page advertisements. Questionnaires included the Alcohol Use

Disorders Identification Test, Substance Use Risk Profile Scale, Modified Drinking Motives

Questionnaire Short Form, Palatable Eating Motives Scale and Snack/Meal Food Intake

Measure. Results: Participants were 198 undergraduates, weight-related research volunteers

and the public (83% female; 90% university educated). The hypothesised structural model fit

the data well. As predicted, there were significant indirect associations between negative

personality characteristics, hazardous drinking and unhealthy snacking via coping;

specifically, individuals higher in anxiety sensitivity/hopelessness used food or alcohol to

cope which, in turn, significantly predicted unhealthy snacking, and hazardous drinking,

respectively. Importantly, drinking and eating to cope represented outcome-specific

strategies, indicated by no significant association between eating to cope and hazardous drinking, or between drinking to cope and snacking. <u>Conclusions:</u> The current study demonstrates that coping motivations are critical to the relationship between negative personality characteristics and unhealthy behaviors and highlights the distinct negative-reinforcement pathways associated with hazardous drinking and unhealthy snacking in majority university-educated females from the U.K.

Keywords: Personality, Hopelessness, Anxiety Sensitivity, Motivation, Positive and Negative Reinforcement, Coping, Unhealthy Snacking

Background

Nearly 30% of the global population is now classified as overweight or obese and it is estimated that this figure could increase to nearly 50% by 2030 (Dobbs et al., 2014). The causes of obesity are complex, with strong biological and environmental determinants. However, over-consumption, particularly in the absence of physiological need, is a behavioral phenomenon. One such behavior is emotional eating, which is the tendency towards eating in response to negative emotions (Arnow, Kenardy, & Agras, 1995; Bennett, Greene, & Schwartz-Barcott, 2013; Oliver, Wardle, & Gibson, 2000). Consuming calorie-dense 'comfort foods' is a key feature of emotional eating, and individuals with high rates of emotional eating tend to have a higher body mass index (Greene et al., 2011; Ozier et al., 2008).

After obesity, alcohol use disorders represent the fourth largest worldwide social burden, and it is currently estimated that treating alcohol use disorder costs the UK National Health Service £3.5 billion each year (Public Health England, 2014). The number of individuals affected by alcohol use disorder appears to be steadily increasing (Balakrishnan, Allender, Scarborough, Webster, & Rayner, 2009). Notably a key behavioral risk factor for developing alcohol use disorder is drinking alcohol to regulate negative affect, which is

linked to both greater alcohol consumption, and more drinking problems (Carpenter & Hasin, 1999; Holahan, Moos, Holahan, Cronkite, & Randall, 2001; 2003). In addition, alcohol is also a source of calories with little impact on satiety and it also disinhibits eating behavior - promoting over consumption (Christiansen, Rose, Randall-Smith, & Hardman, 2016; Rose, Hardman, & Christiansen, 2015). It is therefore critical to understand the common behavioral underpinnings of over-consumption of food and alcohol.

There are multiple psychological characteristics that have been implicated in the over-consumption of both alcohol and food. Notably, there is a robust association between negative affect, hazardous drinking and obesity. For example, anxiety sensitivity (distress resulting from the awareness of anxiety symptoms) and hopelessness (the expectation of negative events, and pervasive feelings of despondency) are related to patterns of substance use (e.g. Woicik, Stewart, Pihl, & Conrod, 2009). Moreover, related personality characteristics are also implicated in overconsumption of food and obesity (Davis et al., 2008; Gerlach, Herpertz, & Loeber, 2015). Indeed, several studies have revealed an association between a lifetime diagnosis of mood disorders and obesity or overweight, particularly in women (Anderson, Cohen, Naumova, & Must, 2006; Gariepy, Nitka, & Schmitz, 2010). This relationship is reciprocal in nature, with depression being predictive of developing obesity, and obesity also increasing the risk of depression (for a systematic review and meta-analysis see Luppino et al., 2010). Taken together, this suggests that certain personality characteristics represent risk factors for over-consumption of alcohol, and obesity.

Although anxiety and depression may represent key risk factors for alcohol misuse and obesity, it is unlikely that they have a simple direct association. Interestingly there are examples where both are associated with *decreased* body mass index (BMI) and alcohol use (for example Skogen, Harvey, Henderson, Stordal, & Mykletun, 2009; Zhao et al., 2009). Motivational models of alcohol use argue that although personality characteristics are risk

factors for alcohol misuse, their influence is exerted indirectly via drinking motivations, due to motivations being shaped by individual differences in sensitivity to alcohol's negative (e.g., to decease negative affect) or positive (e.g., to increase positive affect) reinforcing qualities (Cooper, 1994; Stewart & Devine, 2000). This is drawn from Gray's Reinforcement Sensitivity Theory (RST; see Corr, 2008), and evidence suggests that individual differences in reward sensitivity may be distal predictors of the drive to over-consume food or alcohol for some individuals (Franken, 2002; Hasking, 2006; Tapper, Baker, Jiga-Boy, Haddock, & Maio, 2015). Cooper (1994) argues that drinking motivations can be divided into positive motives; social (e.g., drinking alcohol to enjoy social gatherings, external reinforcement) and enhancement (e.g., because one enjoys the feeling, internal reinforcement), as well as counterpart negative motives; conformity (e.g., to not feel left out), and coping (e.g., to forget about negative emotions) (Cooper, 1994; Stewart & Devine, 2000). Critically, these motivations underpinning alcohol use have also been shown to map directly upon the motivations for hedonic eating (Burgess, Turan, Lokken, Morse & Boggiano, 2014).

There is evidence that drinking to cope (drinking to regulate negative affect) is one of the greatest predictors of increased alcohol consumption and alcohol-related problems (Holahan et al., 2003; Kuntsche, Knibbe, Gmel, & Engels, 2005; Merrill & Thomas, 2013). Anxiety sensitivity or hopelessness have been observed as influential to the development of hazardous drinking in multiple studies (Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007; Stewart, Zvolensky, & Eifert, 2001; Woicik et al., 2009). This could be through the pathway of coping motives and alcohol outcomes expectancies predicting alcohol use (Baines, Jones, & Christiansen, 2016), see also (Blume & Guttu, 2015; Carrigan, Ham, Thomas, & Randall, 2008). Drinking for enhancement (drinking to prolong a positive feeling) also predicts increased alcohol use and alcohol problems (Hasking, Lyvers, & Carlopio, 2011; Tobin, Loxton, & Neighbors, 2014). However those who drink to cope have

a heightened risk for developing alcohol dependence, compared to those who drink for enhancement (Cooper, Frone, Russell, & Mudar, 1995; Holahan et al., 2001; Kassel, Jackson, & Unrod, 2000; Merrill & Read, 2010). Similar evidence has been found in a study exploring the impact of motives on obesity, with stress positively associated with eating to cope and a higher BMI (Boggiano et al., 2015). Negative emotions may underscore coping motivations; individuals with elevated anxiety, stress, and depression symptoms reported having a 'food addiction,' and subsequently eating more confectionery, fast foods and unhealthy snacks (Burrows, Hides, Brown, Dayas, & Kay-Lambkin, 2017). Conversely, eating for enhancement (eating to experience the pleasure of tasty food) has also been associated with binge eating behavior (Boggiano et al., 2014). But the literature appears equivocal, as although obesity has been associated with increased motivation to eat, it is not necessarily associated with more pleasure experienced from eating (Mela, 2006). Therefore, being motivated to seek enhancement from food may not be as strong a predictor of long term over-consumption and obesity as eating to cope.

Taken together, there is considerable evidence to suggest that the personality characteristics (i.e. anxiety sensitivity, hopelessness) that predispose individuals to development of alcohol use disorders could also predict excessive food consumption through their relationships with motivational schema. Behavior-informed learning may also offer insight into the separate mediators of drinking or eating to excess. Fischer (2004) found that positive eating and alcohol expectancies were predictive of unhealthy eating and alcohol use respectively. However these expectancies were specific to the outcome – alcohol expectancies correlated with alcohol-related problems, but not binge eating, and vice versa. Similarly, coping motives may also be related to specific behavioral outcomes (e.g. eating to cope predicts unhealthy eating but not alcohol use, and vice versa). Critically, no study to date has examined whether personality risk factors predispose individuals to common eating

and drinking motives, or whether these pathways are used inter-changeably or exclusively (e.g., drinking to cope, but not also eating to cope).

The present study aimed to examine the motivational pathways by which anxiety sensitivity and hopelessness may contribute to hazardous drinking and unhealthy snacking. It was hypothesised that (i) the relationship between anxiety sensitivity/hopelessness and hazardous drinking would be mediated by drinking to cope, and not by drinking for enhancement. Further, it was hypothesised that (ii.) the relationship between anxiety sensitivity/hopelessness and unhealthy snacking would be mediated by eating to cope, and not by eating for enhancement. Finally, it was hypothesised that (iii.) eating and drinking to cope would represent independent coping strategies.

Subjects and Methods

Participants

Participants were recruited from several sources, which included opportunity sampling through the University of Liverpool and University College London research participation schemes. Non-university related participants were recruited via an online panel of participants with registered interest in weight-related research, and members of the general community through advertisements on social media, email and public web pages. Inclusion criteria involved consumption of alcohol on at least one occasion in an average week and eating palatable, high calorie foods at least once a week, and participants were screened for these criteria based on their responses on two consumption frequency questions (e.g., 'How often do you consume tasty foods?' with responses ranging from 'Never' to 'Daily'). Individuals on a weight loss programme or actively calorie restricting, or those who had been advised by a medical professional to stop drinking were excluded. All participants provided

informed consent before completing the survey, which was approved by the University of Liverpool's Research Ethics Committee.

Measures

The Alcohol Use Disorders Identification Test

The Alcohol Use Disorders Identification Test (AUDIT) was used to assess hazardous drinking (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The AUDIT consists of 10 fixed response questions regarding alcohol consumption and consequences of drinking, such as 'how often during the last year have you found that you were not able to stop drinking once you had started?' Scores on the AUDIT range from 0 to 40, with scores of 8 or above indicating hazardous or harmful alcohol use. The AUDIT is a valid measurement tool for alcohol use in university settings and in the general population (Atwell, Abraham, & Duka, 2011), with good internal reliability within the dataset (Cronbach's α) of .82.

The Substance Use Risk Profile Scale

This 23 item Likert scale questionnaire is based on a model of four personality risk factors for substance misuse – hopelessness (7 items), anxiety sensitivity (5), impulsivity (5) and sensation seeking (6) (Woicik et al., 2009). Responses on items such as *'I like doing things that frighten me a little,'* range on a four-point scale from strongly disagree (1) to strongly agree (4). Scores for each personality characteristic are analysed using reverse coding for selected items and computing the mean score for the relevant response items. Reliability and construct validity of the SURPS has been well established in the substance use literature (Krank et al., 2011), and the present study focused on the Hopelessness and Anxiety Sensitivity subscales which both had an internal reliability within the dataset of α = .84 and α = .60 respectively.

Modified Drinking Motives Questionnaire Short Form:

This 12 item self-report scale asks participants to endorse statements such as *'in the last 12 months, how often did you drink because it helps you enjoy a party?'* which relate to different motivations to drink on a Likert scale (Kuntsche & Kuntsche, 2009). Responses range from 1 (never/almost never) to 5 (always/almost always). The mean of the relevant items is calculated to compute a score for each motive subscale. The two subscales included in this study were Enhancement (drinking for the pleasant taste experience, 3 items) and Coping (drinking to reduce negative affect, 3 items). The Modified Drinking Motives Questionnaire Short Form (MDMQ-R SF) showed good to excellent test-retest reliability in a sample of undergraduates who were relatively frequent drinkers *(*intraclass correlation coefficients at T1 and T2, *ps* <.001) (Grant et al., 2007; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2009) and Cronbach's α scores from the present study were .74 (Enhancement) and .87 (Coping).

Palatable Eating Motives Scale

This 19-item self-report questionnaire is similar to the DMQ-R, in that participants endorse statements relating to different motivations to eat palatable foods, such as *'how often would you say that you ate tasty foods for the following reasons: to forget your worries?'* (Burgess et al., 2014). Responses are listed on a 5-point Likert scale, which ranges from 1 (never/almost never) to 5 (always/almost always). The mean of the relevant items is calculated to compute a score for each motive subscale. Similarly to the MDMQ-R SF, the present study focused on the motivational subscales Enhancement (5 items) and Coping (5). This scale demonstrates good convergent, discriminant and incremental validity with related measures of eating pathology, and good internal reliability in the present dataset with Cronbach's α from .77 (Enhancement) to .89 (Coping).

Snack/Meal Food Intake Measure:

Snacking behavior was assessed using a 22-item snack food subscale of the Snack/Meal Food Intake Measure (Brown, Ogden, Vögele, & Gibson, 2008). This questionnaire asks participants how often they have a serving of the snacks from the provided list in between breakfast, lunch and evening meals. On the list, there are 11 unhealthy snacks (e.g., cakes and crisps). Participants used an 8 point Likert scale (Never/Less than once a month; less than once a week; once a week; 2-4 days a week; 5-6 days a week; once a day, every day; 2-3 times a day, every day; more than 3 times a day, every day). Scores on the identified 'unhealthy' items were summed to create a subscale for unhealthy snacks. All items on this measure were developed using the World Health Organisation 2001/2002 protocol (Currie, Samdal, Boyce & Smith, 2001), the Inchley et al. (2001) food frequency questionnaires, the 7 day food diary (Gregory et al., 2000) and consumer market research report data (Mintel, 2003). A version of this measure has been used to assess snacking behavior in both adults and children, and has been shown as consistently reliable, with a Cronbach's α of .81 for unhealthy snacking in the present dataset (Brown, Ogden, Vögele, & Gibson, 2008; Brown & Ogden, 2004; Ogden, Dalkou, Kousantoni, Ventura, & Reynolds, 2016).

Procedure

The questionnaires were hosted using Qualtrics online software. Participants were provided with a generic link, where clicking upon the link directed them to an information sheet and a consent form. Participants were asked to confirm that they met the eligibility criteria by ticking a box, and eligible participants were then provided with the main surveys to complete. The order of the questionnaires was as follows: Demographics *(age, gender, marital status, ethnic group defined using pre-specified categories and open response option, height and weight, and highest level of qualification represented by pre-specified categories)*, SURPS, MDMQ-R SF, AUDIT, PEMS, and Snack/Meal Food Intake Measure. When the participants had finished completing the surveys, they were thanked and debriefed regarding the study's

aims. Undergraduate participants from the University of Liverpool were offered

compensation in the form of research credits to fulfil the requirement of their psychology

course. For non-UoL undergraduate participants there was a prize draw incentive of £25 and

£50 for two winners.

Statistical Analyses

Structural Equation Modelling

The first analysis used a structural model to examine the motivational pathways by which

anxiety sensitivity and hopelessness may contribute to hazardous drinking and unhealthy

snacking. To reduce the skewness of the data affecting regression coefficients, generated

variables were square root transformed prior to structural equation modelling (see Figure 1).

Multiple indices of model fit were calculated to assess that the model represented a good fit

for the data. Normed χ^2 values were calculated (χ^2/df). χ^2/df values between 1 and 5 are

indicative of an acceptable model fit (Schumacker & Lomax, 2004). The Standardized Root

Mean Square Residual (SRMR) absolute fit index was also used to assess model fit, as it is a

more robust measure that deals well with non-normal distribution and kurtosis (Hu & Bentler,

1998). SRMR values under 0.08 are representative of a good model fit. Model fit was also

estimated using non-centrality based indices; the comparative fit index (CFI) and root mean

square error of approximation (RMSEA). CFI values equal to, or greater than, 0.95 were used

as cut offs for good model fit and greater than .90 for acceptable model fit. RMSEA values

equal to, or lower than, 0.06, were used as cut offs for good model fit, with lower than .08 as

acceptable model fit (Hu & Bentler, 1999). To describe specific relationships within the

structural model, standardised regression coefficients are reported (See Figure 1, Tables 2 and

3). Bias-corrected bootstrapping was used to test the hypothesised indirect associations

between personality, hazardous drinking and unhealthy snacking via drinking/eating motivations, and gender was controlled for in the model.

Mediation Analyses

To investigate the hypotheses that i.) the relationship between anxiety sensitivity/ hopelessness and hazardous drinking would be mediated by coping and not an enhancement motivation, and ii.) the relationship between anxiety sensitivity/ hopelessness and unhealthy snacking would be mediated by coping and not an enhancement motivation, and iii.) to examine whether alcohol represents a specific coping strategy, PROCESS (Hayes, 2012) was used to explore the indirect associations within the square root transformed variables. PROCESS computes regression coefficients to conduct a mediation regression analysis, and bootstraps confidence intervals for the hypothesised indirect associations.

Results

The present study aimed to examine the motivational pathways by which anxiety sensitivity and hopelessness may contribute to hazardous drinking and unhealthy snacking through constructing a structural model and examining specific relationships within the model through mediation analyses.

Participants

The sample (n = 198) consisted of 32 males, 164 females and 2 who did not disclose their gender, aged 18 to 65 years (M= 29.09 SD ± 13.09) with 36.86% of participants classified as overweight or obese by calculating their BMI using the weight and height information given in the online questionnaire. This was compared to the definition given by the World Health Organisation (WHO, 2006) where a person with a BMI of 25kg/m² to 29.9 kg/m² has overweight, and 30kg/m² or higher indicates a person with obesity (See table 1. for full descriptive statistics).

Table 1. Descriptive statistics of the sample (*n* = 198; Participants had the option to tick all the ethnicity categories they felt applied to them, which yielded a final *n* = 217 responses).

Item	Category	Frequency	Percentage
Gender	Male	32	16.16
	Female	164	82.83
	Undisclosed	2	1.01
Marital Status	Single	141	71.21
	Married or Domestic Partnership	51	25.76
	Widowed, Divorced or Separated	6	3.03
Ethnicity*	Welsh/ English / Scottish / Northern Irish / British	155	71.43
	Irish	7	3.23
	White and Black African	4	1.84
	White and Asian	7	3.23
	Chinese	5	2.30
	Other (White and Black Caribbean, Indian, Arab, American, African, Australian, Dutch, German, Greek)	32	14.75
Education	Current postgraduate university student	17	8.59
	Current undergraduate university student	94	47.47
	University or college degree	58	29.29
	University qualification below degree	9	4.55
	Upper secondary school qualification	12	6.06
	Lower secondary school qualification	5	2.53
	None	3	1.52
Age Category	18 - 29 years	129	65.15

	30 - 39 years	15	7.58
	40 - 49 years	19	9.60
	50 - 59 years	15	7.58
	60 +	9	4.55
	Not Reported	11	5.56
BMI Category	Underweight (<.18.5)	10	5.05
	Healthy Weight (18.5 - 24.9)	112	56.56
	Overweight (25.0 - 29.9)	37	18.68
	Obese Class I (30.0 - 34.9)	14	7.07
	Obese Class II (35.0 - 39.9)	13	6.57
	Obese Class III (> 40.0)	9	4.55
	Not Reported	3	1.01

Structural Model (Figure 1): The structural model was found to be an excellent fit for the data on all model fit indices ($\chi^2/df = 1.03$; SRMR = .02; RMSEA = .01; CFI = 1.00). As depicted in Figure 1, anxiety sensitivity was directly associated with drinking and eating to cope. Similarly, hopelessness was directly associated with drinking and eating to cope. In regards to alcohol use, direct associations were observed between drinking to cope, drinking for enhancement and hazardous drinking. Further, eating for enhancement and eating to cope were directly associated with unhealthy snacking. As hypothesised, no direct associations were observed between drinking to cope and unhealthy snacking, nor for eating to cope and hazardous drinking. Interestingly, there were no direct associations between anxiety sensitivity, hopelessness and enhancement motivations (for both eating and drinking). For this reason, bootstrapped mediation analyses for indirect associations on over-consumption involving enhancement motivations were not conducted (as there can be no evidence for mediation if the independent variable – mediator association is non-significant). Instead, mediation analyses were performed and reported below to examine the relationships between anxiety sensitivity, hopelessness, coping

motivations, hazardous drinking and unhealthy snacking, (with enhancement motives included as covariates).

Figure 1. The structural model with unstandardized regression weights reported

All listed indirect associations for hazardous drinking are displayed in **Table 2**, and unhealthy snacking in **Table 3.**

Mediation Analyses:

The mediating effect of drinking to cope on the association between anxiety sensitivity, hopelessness and hazardous drinking (Hypothesis i.).

There was no significant total effect of anxiety sensitivity on AUDIT scores (b = .11, SE = .17, p = .521, 95% CI = -.23 to .45). However, as hypothesised, there was an indirect association of elevated anxiety sensitivity on AUDIT scores through increased drinking to cope (b = .17, SE = .07, 95% CI = .07 to .34). There was a non-significant negative direct association between anxiety sensitivity and AUDIT scores after controlling for the indirect associations, indicating a suppression effect (Rucker, Preacher, Tormala, & Petty, 2011). A similar pattern of results was found for hopelessness, where there was no total effect of hopelessness on AUDIT scores (b = .18, SE = .13, p = .165, 95% CI = -.07 to .43), and no direct effect (b = .09, SE = .13, p = .484, 95% CI = -.17 to .36). However, an indirect association was found between elevated hopelessness and AUDIT scores through increased drinking to cope (b = .12, SE = .05, 95% CI = .04 to .25), indicating an indirect-only mediation effect. These indirect associations are detailed in Table 2.

Table 2. The indirect associations via coping motivations between anxiety sensitivity and hopelessness and AUDIT scores *(Bootstrapped SE and CI)*

	Effect	SE	LL 95%CI	UL95%CI
Anxiety Sensitivity				
Drinking to Cope	.17*	.07	.07	.34
Eating to Cope	-.03	.07	-.17	.09
Hopelessness				
Drinking to Cope	.12*	.05	.04	.25
Eating to Cope	-.04	.05	-.15	.04

* indicates a p value of < .05, Standard Error = SE, Confidence Interval = CI, Lower Level CI = LL, Upper Level CI = UL

The mediating effect of eating to cope on the association between anxiety sensitivity, hopelessness and unhealthy snacking (Hypothesis ii.).

There was no significant total effect of anxiety sensitivity on unhealthy snacking (b = .11, SE = .19, p = .547, 95% CI = -.26 to .48). However, as hypothesised, there was an indirect association between elevated anxiety sensitivity and unhealthy snacking through increased eating to cope (b = .11, SE = .07, 95% CI = .00 to .27). There was no total effect of hopelessness on unhealthy snacking (b = .13, SE = .14, p = .344, 95% CI = -.14 to .41), but an indirect association between elevated hopelessness and unhealthy snacking through increased eating to cope (b = .09, SE = .05, 95% CI = .01 to .22). There were non-significant negative direct associations between anxiety sensitivity, hopelessness and unhealthy eating after controlling for indirect associations, indicating a suppression effect in both analyses.

Eating and drinking as independent coping strategies (Hypothesis iii.)

As hypothesised, there was no association observed between AUDIT scores and unhealthy

snacking, suggesting that there are distinct pathways, via coping strategies, to these two

outcome variables (b = .10, SE = .08, p = .189). To further investigate whether drinking or

eating coping motivations were specific to hazardous drinking or unhealthy snacking

behaviours, the indirect associations between eating or drinking to cope and over-

consumption of food and alcohol were compared. Importantly, there were no indirect

associations between anxiety sensitivity/hopelessness and hazardous drinking via eating to

cope (see Table 2). Similarly, there were no indirect associations between anxiety

sensitivity/hopelessness and unhealthy snacking via drinking to cope (see Table 3).

Table 3. The indirect associations via coping motivations between anxiety sensitivity and hopelessness and unhealthy snacking *(Bootstrapped SE and CI)*

	Effect	SE	LL95%CI	UL95%CI
Anxiety Sensitivity				
Drinking to Cope	.07	.07	-.04	.24
Eating to Cope	.11*	.07	.00	.27
Hopelessness				
Drinking to Cope	.05	.05	-.02	.19
Eating to Cope	.09*	.05	.01	.22

* indicates a p value of < .05, Standard Error = SE, Confidence Interval = CI, Lower Level

CI = LL, Upper Level CI = UL

Discussion

The current study explored the motivational pathways by which anxiety sensitivity and hopelessness contribute to hazardous drinking and unhealthy snacking. It was hypothesised i.) the relationship between anxiety sensitivity, hopelessness and hazardous drinking would be mediated by coping and not enhancement motives, and ii.) the relationship between anxiety sensitivity, hopelessness and unhealthy snacking would be mediated by coping and not enhancement motives, and iii.) that drinking alcohol or unhealthy snacking would represent distinct coping strategies. In a majority female, university-educated group of participants from the United Kingdom, it was found that both anxiety sensitivity and hopelessness had a significant indirect association with hazardous drinking through drinking to cope. This significant association was also observed for unhealthy snacking through eating to cope. Finally, results from the mediation analysis indicated that the two coping strategies (drinking alcohol and unhealthy snacking) had distinct pathways (e.g., there were no indirect associations between anxiety sensitivity or hopelessness and unhealthy snacking via drinking to cope). This suggests that participants who reported drinking to cope did so specifically and did not also increase their unhealthy snacking. Similarly, participants who reported eating to cope did so specifically and did not also increase hazardous drinking.

Unlike some previous research linking anxiety sensitivity or hopelessness to increased alcohol consumption or alcohol use disorder (Comeau, Stewart, & Loba, 2001; Schmidt, Buckner, & Keough, 2007; Woicik et al., 2009), the present study observed no significant direct associations between anxiety sensitivity, hopelessness and hazardous drinking. This supports the motivational model of alcohol use (Cooper, Frone, Russell & Mudar, 1995), in that personality characteristics did not positively influence hazardous drinking directly, but instead through a pathway of drinking to cope. As predicted in hypotheses i., the indirect association between elevated anxiety sensitivity and hazardous drinking through drinking to

cope was significant. Moreover, a suppression effect was observed, which occurs when an opposing indirect effect with one sign (negative) obscures a total effect with an opposite one (positive), and omitting the suppressor (e.g., drinking to cope) would lead to a total effect appearing small or insignificant (Rucker et al., 2011). In this way, the relationship between anxiety sensitivity and hazardous drinking was strengthened by including drinking to cope. The significant indirect association between hopelessness and hazardous drinking through increased drinking to cope further supports hypothesis i. Here, an indirect-only mediation was identified, as the total and direct effects between hopelessness and hazardous drinking were non-significant (Zhao, Lynch, & Chen, 2010). In both cases, the hypothesis can be accepted, as accounting for drinking to cope significantly improved the predictive validity of anxiety sensitivity and hopelessness on hazardous drinking.

Consistent with hypothesises i. and ii., there was no evidence to support enhancement motivations mediating the relationship between personality characteristics and over-consumption due to personality characteristics and enhancement motivations being non-significantly associated in the structural equation model. Specifically, neither anxiety sensitivity nor hopelessness had a positive association with eating or drinking for enhancement. However, both eating and drinking for enhancement were positively associated with unhealthy snacking and hazardous drinking, respectively. This adds to the increasingly equivocal literature regarding the association between enhancement motivation and alcohol use outcomes (Cooper, Russell, Skinner, & Windle, 1992; Tobin et al., 2014). In light of these findings, it is possible that other personality characteristics, such as impulsivity, may drive enhancement motives and subsequent consumption, although these were not included in the analysis.

The current results support the critical role of motivation in drinking (Cooper, 1994; Stewart & Devine, 2000) and eating behaviour (Boggiano et. al., 2015), as no direct

associations between anxiety sensitivity or hopelessness and unhealthy snacking or hazardous drinking were observed, whereas accounting for a negative reinforcement motive – coping – revealed both direct and indirect relationships between personality characteristics, motivations and over-consumption. Therefore, experiencing higher levels of anxiety sensitivity and depression appears key to shaping negative reinforcement motivations for engaging in over-consumption of alcohol, and further underscores that coping motives play a key mediating role between hopelessness and alcohol use (Baines et al., 2016; Mackinnon, Kehayes, Clark, Sherry, & Stewart, 2014). Regulating negative affect via drinking to cope has been observed as a risk factor for alcohol use disorder (Carpenter & Hasin, 1999), and the present study offers theoretical support that interventions teaching alternative methods of coping with negative affect could be effective in reducing alcohol use (Stasiewicz et al., 2013).

As predicted in hypothesis ii., there was no direct association between anxiety sensitivity, hopelessness and unhealthy snacking, but accounting for the negative motivation - coping - improved the predictability of both personality characteristics on unhealthy snacking. Both anxiety and neuroticism (a tendency towards psychological distress encompassing both anxiety and depression) have been named as emotional eating risk factors for persons with obesity in other studies with majority female participants (Elfhag & Morey, 2008; Schneider, Appelhans, Whited, Oleski, & Pagoto, 2010). The present study offers further support that eating to cope with negative affect inherent to these personality characteristics may be a key motivational pathway to understanding the development of unhealthy snacking patterns in similar populations, potentially leading to the development of obesity.

Importantly, the results support hypothesis iii., which suggests that there are distinct pathways to hazardous drinking and unhealthy snacking. This is evident from there being no

indirect associations between anxiety sensitivity, hopelessness and hazardous drinking via eating to cope, nor were there indirect associations between anxiety sensitivity, hopelessness and unhealthy snacking via drinking to cope. Therefore, participants did not have broad maladaptive coping strategies, which illustrates the key role that behaviour-specific learning plays in the development of over-consumption patterns. Moreover, while Fischer (2004) found that positive eating and alcohol expectancies were separately predictive of binge eating and alcohol-related problems, respectively, the present study highlights that specific coping motives can also be key to driving over-consumption of food or alcohol, but not both together. This becomes important for clinical populations who are seeking to avoid alcohol or can no longer use food to cope, as is the case for bariatric surgery patients, another population with a female majority (Fuchs et al., 2015; Santry, Gillen & Lauderdale, 2005). Indeed, the rate of alcohol use disorder increases following the second post-operative year in patients who have received bariatric surgery, which dramatically limits the size of their stomach (King et al., 2012). This could indicate a possible shift between coping strategies from food to alcohol if non-consumption based strategies for regulating negative affect are not implemented, where the patient previously relied on eating as a coping strategy (Hardman & Christiansen, 2018). Future research to explore why some individuals specifically choose food to cope over alcohol, and *vice versa*, would contribute further understanding to the development of expectancies and motivations and their role in over-consumption. Further, as this was a predominantly university educated female sample from the U.K., future studies with population representative samples are needed to assess the applicability of the findings.

Strengths and Limitations

There remains much to understand regarding the complicated relationship between anxiety sensitivity and alcohol use, but it is possible that age could be a factor. The present study's recruitment strategy included undergraduates, but also included older individuals

from an online panel and the general population, which revealed an indirect association between anxiety sensitivity and hazardous drinking. Other literature using older populations has found similar support for indirect associations between anxiety sensitivity and hazardous drinking via drinking to cope, while studies using undergraduate populations did not (Allan, Albanese, Norr, Zvolensky, & Schmidt, 2015; Baines, Jones, & Christiansen, 2016; Paulus et al., 2017). Younger adults may have specific reasons for avoiding alcohol when anxious, such as not wanting to be embarrassed by alcohol-induced disinhibition. Although gender was controlled for in the analysis, future research in additional community samples could expand upon the findings and illuminate whether age is an important factor to address. Additionally, recruiting participants with a wide range of BMIs increased the likelihood of capturing coping motivations and over-eating behaviour, as over-eating has been observed to improve mood in persons with obesity (Leehr et al., 2015).

Also, there were notably fewer male (31) than female participants (167), which limits the generalisability of the results, as evidence has suggested there might be gender differences in high volume drinking (Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, & Gmel, 2009) and emotional eating (Adriaanse, Evers, Verhoeven, & de Ridder, 2016), with females being more likely to report emotional eating. Further, although there is evidence that emotion-related motivations such as eating to cope can predict unhealthy snacking, this study did not examine the association between eating to cope and binge eating behaviour, which has also been associated with specific affective disorders, such as depression and anxiety (Peterson, Latendresse, Bartholome, Warren, & Raymond, 2012; Rosenbaum & White, 2015; Swendsen et al., 2000). Examining unhealthy snacking rather than binge eating behaviour, however, captures sub-clinical problematic eating patterns that also contribute to obesity. Also, the cross-sectional nature of the study is a limitation as the relationships between variables were correlational, and inferences about specific causation cannot be made. Finally,

the sample was largely comprised of participants from the UK, either pursuing or having obtained a degree in higher education, which restricts the generalisation of findings to populations from other countries and the UK as well.

Conclusion

The current study found that coping motivations mediate the relationships between anxiety sensitivity/hopelessness, and hazardous drinking and unhealthy snacking. Although these findings are drawn from a population with a range of BMI and ages, generalisability is limited due to participants being majority female, university educated and from the UK. Individuals high in both anxiety sensitivity and hopelessness and who are motivated to drink to cope to attenuate negative affect are at increased risk for hazardous drinking. Similarly, individuals high in both anxiety sensitivity and hopelessness and who eat to cope may have a heightened risk for obesity due to greater consumption of unhealthy snacks. Interventions seeking to reduce drinking or unhealthy eating would do well to recognise that teaching alternative coping methods would be of significant value towards behavior change.

References

Adriaanse, M. A., Evers, C., Verhoeven, A. A., & de Ridder, D. T. (2016). Investigating sex differences in psychological predictors of snack intake among a large representative sample. *Public Health Nutrition*, *19*(4), 625–632. http://doi.org/10.1017/S136898001500097X

Allan, N. P., Albanese, B. J., Norr, A. M., Zvolensky, M. J., & Schmidt, N. B. (2015). Effects of anxiety sensitivity on alcohol problems: evaluating chained mediation through generalized anxiety, depression and drinking motives. *Addiction*, *110*(2), 260–268. http://doi.org/10.1111/add.12739

Anderson, S. E., Cohen, P., Naumova, E. N., & Must, A. (2006). Association of depression and anxiety disorders with weight change in a prospective community-based study of children followed up into adulthood. *Archives of Pediatrics & Adolescent Medicine*, *160*(3), 285–291. https://doi.org/10.1001/archpedi.160.3.285

Arnow, B., Kenardy, J., & Agras, W. S. (1995). The Emotional Eating Scale: the development of a measure to assess coping with negative affect by eating. *The International Journal of Eating Disorders*, *18*(1), 79–90. https://doi.org/10.1002/1098-108X(199507)18:1<79::AID-EAT2260180109>3.0.CO;2-V

Atwell, K., Abraham, C., & Duka, T. (2011). A parsimonious, integrative model of key psychological correlates of UK university students' alcohol consumption. *Alcohol and Alcoholism*, *46*(3), 253–260. https://doi.org/10.1093/alcalc/agr016

Baines, L., Jones, A., & Christiansen, P. (2016). Hopelessness and alcohol use: The mediating role of drinking motives and outcome expectancies. *Addictive Behaviors Reports*, *4*, 65–69. https://doi.org/10.1016/j.abrep.2016.11.001

Balakrishnan, R., Allender, S., Scarborough, P., Webster, P., & Rayner, M. (2009). The burden of alcohol-related ill health in the United Kingdom. *Journal of Public Health*, *31*(3), 366–373. https://doi.org/10.1093/pubmed/fdp051

Bennett, J., Greene, G., & Schwartz-Barcott, D. (2013). Perceptions of emotional eating behavior. A qualitative study of college students. *Appetite*, *60*(1), 187–192. https://doi.org/10.1016/j.appet.2012.09.023

Blume, A. W., & Guttu, B. L. (2015). Categories of alcohol outcome expectancies and their relationships to alcohol related consequences. *Addictive Behaviors Reports*, *1*, 64–67. https://doi.org/10.1016/j.abrep.2015.04.005

Boggiano, M. M., Burgess, E. E., Turan, B., Soleymani, T., Daniel, S., Vinson, L. D., … Morse, A. (2014). Motives for eating tasty foods associated with binge-eating. Results from a student and a weight-loss seeking population. *Appetite*, *83*, 160–166. https://doi.org/10.1016/j.appet.2014.08.026

Boggiano, M. M., Wenger, L. E., Turan, B., Tatum, M. M., Sylvester, M. D., Morgan, P. R., … Burgess, E. E. (2015). Real-time sampling of reasons for hedonic food consumption: further validation of the Palatable Eating Motives Scale. *Frontiers in Psychology*, *6:*744. doi: 10.3389/fpsyg.2015.00744

Brown, K. A., Ogden, J., Vögele, C., & Gibson, E. L. (2008). The role of parental control practices in explaining children's diet and BMI. *Appetite*, *50*(2–3), 252–259. https://doi.org/10.1016/j.appet.2007.07.010

Brown, R., & Ogden, J. (2004). Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health Education Research*, *19*(3), 261–271. https://doi.org/10.1093/her/cyg040

Burgess, E. E., Turan, B., Lokken, K. L., Morse, A., & Boggiano, M. M. (2014). Profiling motives behind hedonic eating. Preliminary validation of the Palatable Eating Motives Scale. *Appetite*, *72*, 66–72. https://doi.org/10.1016/j.appet.2013.09.016

Burrows, T., Hides, L., Brown, R., Dayas, C., & Kay-Lambkin, F. (2017). Differences in Dietary Preferences, Personality and Mental Health in Australian Adults with and without Food Addiction. *Nutrients*, *9*(3), 285. https://doi.org/10.3390/nu9030285

Carpenter, K. M., & Hasin, D. S. (1999). Drinking to cope with negative affect and DSM-IV alcohol use disorders: a test of three alternative explanations. *Journal of Studies on Alcohol*, *60*(5), 694–704. http://doi.org/10.15288/jsa.1999.60.694

Carrigan, M. H., Ham, L. S., Thomas, S. E., & Randall, C. L. (2008). Alcohol Outcome Expectancies and Drinking to Cope with Social Situations. *Addictive Behaviors*, *33*(9), 1162–1166. https://doi.org/10.1016/j.addbeh.2008.04.020

Christiansen, P., Rose, A., Randall-Smith, L., & Hardman, C. A. (2016). Alcohol's acute effect on food intake is mediated by inhibitory control impairments. *Health Psychology*, *35*(5), 518–522. https://doi.org/10.1037/hea0000320

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors*, *26*(6), 803–825. https://doi.org/10.1016/S0306-4603(01)00238-6

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment*, *6*(2), 117–128. https://doi.org/10.1037/1040-3590.6.2.117

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*(5), 990–1005. https://doi.org/10.1037/0022-3514.69.5.990

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*(2), 123–132. https://doi.org/10.1037/1040-3590.4.2.123

Corr, P. J. (2008). Reinforcement Sensitivity Theory (RST): Introduction. In P. J. Corr (Ed.), *The Reinforcement Sensitivity Theory of Personality.* (pp. 1–43). New York, NY: Cambridge University Press.

Currie, C. Samdal, O., Boyce, W., Smith, R. (2001). Health behaviour in school-aged children: A WHO cross-national study. Research protocol for the 2001/2002 survey. Edinburgh: University of Edinburgh.

Davis, C., Levitan, R. D., Carter, J., Kaplan, A. S., Reid, C., Curtis, C., … Kennedy, J. L. (2008). Personality and eating behaviors: a case–control study of binge eating disorder. *International Journal of Eating Disorders*, *41*(3), 243–250. https://doi.org/10.1002/eat.20499

Dobbs, R., Sawers, C., Thompson, F., Manyika, J., Woetzel, J., Child, P., … Spatharou. (2014). *How the world could better fight obesity*. McKinsey Global Institute. Retrieved from http://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/how-the-world-could-better-fight-obesity

Elfhag, K., & Morey, L. C. (2008). Personality traits and eating behavior in the obese: poor self-control in emotional and external eating but personality assets in restrained eating. *Eating Behaviors*, *9*(3), 285–293. http://doi.org/10.1016/j.eatbeh.2007.10.003

Fischer, S., Anderson, K. G., & Smith, G. T. (2004). Coping with distress by eating or drinking: role of trait urgency and expectancies. *Psychology of Addictive Behaviors*, *18*(3), 269–274. https://doi.org/10.1037/0893-164X.18.3.269

Franken, I. H. A. (2002). Behavioral approach system (BAS) sensitivity predicts alcohol craving. *Personality and Individual Differences, 32*(2), 349-355. https://doi.org/10.1016/S0191-8869(01)00030-7

Fuchs, H. F., Broderick, R. C., Harnsberger, C. R., Chang, D. C., Sandler, B. J., Jacobsen, G. R., & Horgan, S. (2015) Benefits of bariatric surgery do not reach obese men. *Journal of Laparoendoscopic & Advanced Surgical Techniques, 25*(3), 196-201. https://doi.org/10.1089/lap.2014.0639

Gariepy, G., Nitka, D., & Schmitz, N. (2010). The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. *International Journal of Obesity*, *34*(3), 407–419. https://doi.org/10.1038/ijo.2009.252

Gerlach, G., Herpertz, S., & Loeber, S. (2015). Personality traits and obesity: A systematic review. *Obesity Reviews*, *16*(1), 32–63. https://doi.org/10.1111/obr.12235

Grant, V. V, Stewart, S. H., O'Connor, R. M., Blackwell, E., & Conrod, P. J. (2007). Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire--Revised in undergraduates. *Addictive Behaviors*, *32*(11), 2611–2632. https://doi.org/10.1016/j.addbeh.2007.07.004

Grant, V. V, Stewart, S. H., O'Connor, R. M., Blackwell, E., & Conrod, P. J. (2009). Corrigendum to "Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire--Revised in undergraduates" [Addictive Behaviors 32/11 (2007) 2611-2632]. *Addictive Behaviors*, *34*(12), 1073–1075. https://doi.org/10.1016/j.addbeh.2007.07.016

Greene, G. W., Schembre, S. M., White, A. A., Hoerr, S. L., Lohse, B., Shoff, S., …
Blissmer, B. (2011). Identifying clusters of college students at elevated health risk based on
eating and exercise behaviors and psychosocial determinants of body weight. *Journal of the
American Dietetic Association*, *111*(3), 394–400. https://doi.org/10.1016/j.jada.2010.11.011

Gregory, J. R., Lowe, S., Bates, C. J., Prentice, A., Jackson, L. V., Smithers, G., Wenlock, R.
& Farron, M. (2000). *National diet and nutrition survey: Young people aged 4–18 years. Vol
1: Report of the diet and nutrition survey*. TSO London (ISBN 0-11-621265-9).

Hardman, C. A., & Christiansen, P. (2018). Psychological issues and alcohol misuse
following bariatric surgery. *Nature Reviews Endocrinology*, *14*(7), 377–378.
https://doi.org/10.1038/s41574-018-0006-4

Hasking, P. A. (2006). Reinforcement sensitivity, coping, disordered eating and drinking
behaviour in adolescents. *Personality and Individual Differences, 40*(4), 677-688.
https://doi.org/10.1016/j.paid.2005.07.017

Hasking, P., Lyvers, M., & Carlopio, C. (2011). The relationship between coping strategies,
alcohol expectancies, drinking motives and drinking behaviour. *Addictive Behaviors*, *36*(5),
479–487. https://doi.org/10.1016/j.addbeh.2011.01.014

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable
mediation, moderation, and conditional process modeling. *White Paper*. https://doi.org/978-
1-60918-230-4

Holahan, C. J., Moos, R. H., Holahan, C. K., Cronkite, R. C., & Randall, P. K. (2001).
Drinking to cope, emotional distress and alcohol use and abuse: a ten-year model. *Journal of
Studies on Alcohol*, *62*(2), 190–198. https://doi.org/10.1037/0021-843X.112.1.159

Holahan, C. J., Moos, R. H., Holahan, C. K., Cronkite, R. C., & Randall, P. K. (2003). Drinking to cope and alcohol use and abuse in unipolar depression: A 10-year model. *Journal of Abnormal Psychology*, *112*(1), 159–165. https://doi.org/10.1037/0021-843X.112.1.159

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hu, L. T., & Bentler, P. M. (1998). Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037/1082-989X.3.4.424

Inchley, J., Todd, J., Bryce, C., & Currie, C. (2001). Dietary trends among Scottish schoolchildren in the 1990s. *Journal of Human Nutrition and Dietetics*, *14*(3), 207–216. https://doi.org/10.1046/j.1365-277X.2001.00285.x

Kassel, J. D., Jackson, S. I., & Unrod, M. (2000). Generalized expectancies for negative mood regulation and problem drinking among college students. *Journal of Studies on Alcohol*, *61*(2), 332-340. https://doi.org/10.15288/jsa.2000.61.332

King, W. C., Chen, J.-Y., Mitchell, J. E., Kalarchian, M. A., Steffen, K. J., Engel, S. G., … Yanovski, S. Z. (2012). Prevalence of alcohol use disorders before and after bariatric surgery. *JAMA*, *307*(23), 2516–2525. https://doi.org/10.1001/jama.2012.6147

Krank, M., Stewart, S. H., O'Connor, R., Woicik, P. B., Wall, A. M., & Conrod, P. J. (2011). Structural, concurrent, and predictive validity of the Substance Use Risk Profile Scale in early adolescence. *Addictive Behaviors*, *36*(1–2), 37–46. https://doi.org/10.1016/j.addbeh.2010.08.010

Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*, 25(*7),* 841-861. https://doi.org/10.1016/j.cpr.2005.06.002

Kuntsche, E., & Kuntsche, S. (2009). Development and validation of the Drinking Motive Questionnaire Revised Short Form (DMQ-R SF). *Journal of Clinical Child & Adolescent Psychology*, *38*(6), 899–908. https://doi.org/10.1080/15374410903258967

Leehr, E. J., Krohmer, K., Schag, K., Dresler, T., Zipfel, S., & Giel, K. E. (2015). Emotion regulation model in binge eating disorder and obesity - a systematic review. *Neuroscience and Biobehavioral Reviews*, *49,* 125-134. https://doi.org/10.1016/j.neubiorev.2014.12.008

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W., & Zitman, F. G. (2010). Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry, 67*(3), 220-229. https://doi.org/10.1001/archgenpsychiatry.2010.2

Mackinnon, S. P., Kehayes, I.-L. L., Clark, R., Sherry, S. B., & Stewart, S. H. (2014). Testing the four-factor model of personality vulnerability to alcohol misuse: A three-wave, one-year longitudinal study. *Psychology of Addictive Behaviors*, *28*(4), 1000–1012. https://doi.org/10.1037/a0037244

Mela, D. J. (2006). Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite*, *47*(1), 10-17. https://doi.org/10.1016/j.appet.2006.02.006

Merrill, J. E., & Read, J. P. (2010). Motivational pathways to unique types of alcohol consequences. *Psychology of Addictive Behaviors*, *24*(4), 705–711. https://doi.org/10.1037/a0020135

Merrill, J. E., & Thomas, S. E. (2013). Interactions between adaptive coping and drinking to cope in predicting naturalistic drinking and drinking following a lab-based psychosocial stressor. *Addictive Behaviors, 38*(3), 1672-1678. https://doi.org/10.1016/j.addbeh.2012.10.003

Mintel Market Intelligence Food and Drink, M. I. (2003). *UK Market Intelligence Standard Children's Snacking Habits*. UK.

Ogden, J., Dalkou, M., Kousantoni, M., Ventura, S. S., & Reynolds, R. (2016). Body Weight, the Home Environment, and Eating Behaviour Across Three Generations of Women: A Quasi-Longitudinal Study in Four Mediterranean and Non-Mediterranean Countries. *Australian Psychologist*. *52*(6), 442-452. https://doi.org/10.1111/ap.12224

Oliver, G., Wardle, J., & Gibson, E. L. (2000). Stress and food choice: a laboratory study. *Psychosomatic Medicine*, *62*(6), 853–865. https://doi.org/10.1097/00006842-200011000-00016

Ozier, A. D., Kendrick, O. W., Leeper, J. D., Knol, L. L., Perko, M., & Burnham, J. (2008). Overweight and obesity are associated with emotion- and stress-related eating as measured by the eating and appraisal due to emotions and stress questionnaire. *Journal of the American Dietetic Association*, *108*(1), 49–56. https://doi.org/10.1016/j.jada.2007.10.011

Paulus, D. J., Valadka, J., Businelle, M. S., Gallagher, M. W., Viana, A. G., Schmidt, N. B., & Zvolensky, M. J. (2017). Emotion dysregulation explains associations between anxiety sensitivity and hazardous drinking and drinking motives among adult treatment-seeking smokers. *Psychology of Addictive Behaviors*, *31*(2), 189–199. https://doi.org/10.1037/adb0000252

Peterson, R. E., Latendresse, S. J., Bartholome, L. T., Warren, C. S., & Raymond, N. C. (2012). Binge eating disorder mediates links between symptoms of depression, anxiety, and

caloric intake in overweight and obese women. *Journal of Obesity*, *2012*. Article ID 407103, 8 pages. https://doi.org/10.1155/2012/407103

Public Health England. (2014). *Alcohol treatment in England 2013-14*. Retrieved from http://www.nta.nhs.uk/uploads/adult-alcohol-statistics-2013-14-commentary.pdf

Rose, A. K., Hardman, C. A., & Christiansen, P. (2015). The effects of a priming dose of alcohol and drinking environment on snack food intake. *Appetite*, *95*, 341–348. https://doi.org/10.1016/j.appet.2015.07.016

Rosenbaum, D. L., & White, K. S. (2015). The relation of anxiety, depression, and stress to binge eating behavior. *Journal of Health Psychology*, *20*(6), 887–898. https://doi.org/10.1177/1359105315580212

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation Analysis in Social Psychology: Current Practices and New Recommendations. *Social and Personality Psychology Compass*, *5*(6), 359–371. https://doi.org/10.1111/j.1751-9004.2011.00355.x

Santry, H. P., Gillen, D. L., & Lauderdale, D. S. (2005). Trends in bariatric surgical procedures. *JAMA, 294*(15), 1909-1917. https://doi.org/10.1097/01.AOG.0000190366.59277.12

Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction*, *88*(6), 791–804. doi:10.1111/j.1360-0443.1993.tb02093.x

Schmidt, N. B., Buckner, J. D., & Keough, M. E. (2007). Anxiety sensitivity as a prospective predictor of alcohol use disorders. *Behavior Modification*, *31*(2), 202–219. https://doi.org/10.1177/0145445506297019

Schneider, K. L., Appelhans, B. M., Whited, M. C., Oleski, J., & Pagoto, S. L. (2010). Trait anxiety, but not trait anger, predisposes obese individuals to emotional eating. *Appetite*, *55*(3), 701–706. https://doi.org/10.1016/j.appet.2010.10.006

Schumacker, R. E., & Lomax, R. G. (2004). A Beginner's Guide to Structural Equation Modeling (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Skogen, J. C., Harvey, S. B., Henderson, M., Stordal, E., & Mykletun, A. (2009). Anxiety and depression among abstainers and low-level alcohol consumers. the Nord-Trøndelag Health Study. *Addiction*, *104*(9), 1519–1529. https://doi.org/10.1111/j.1360-0443.2009.02659.x

Stasiewicz, P. R., Bradizza, C. M., Schlauch, R. C., Coffey, S. F., Gulliver, S. B., Gudleski, G. D., & Bole, C. W. (2013). Affect regulation training (ART) for alcohol use disorders: development of a novel intervention for negative affect drinkers. *Journal of Substance Abuse Treatment*, *45*(5), 433–443. https://doi.org/10.1016/j.jsat.2013.05.012

Stewart, S. H., & Devine, H. (2000). Relations between personality and drinking motives in young adults. *Personality and Individual Differences*, *29*(3), 495–511. https://doi.org/10.1016/S0191-8869(99)00210-X

Stewart, S. H., Zvolensky, M. J., & Eifert, G. H. (2001). Negative-reinforcement drinking motives mediate the relation between anxiety sensitivity and increased drinking behavior. *Personality and Individual Differences*, *31*(2), 157–171. https://doi.org/10.1016/S0191-8869(00)00213-0

Swendsen, J. D., Tennen, H., Carney, M. A., Affleck, G., Willard, A., & Hromi, A. (2000). Mood and alcohol consumption: an experience sampling test of the self-medication hypothesis. *Journal of Abnormal Psychology*, *109*(2), 198-204. https://doi.org/10.1037/0021-843X.109.2.198

Tapper, K., Baker, L., Jiga-Boy, G., Haddock, G., & Maio, G. R.. (2015). Sensitivity to reward and punishment: Associations with diet, alcohol consumption, and smoking. *Personality and Individual Differences, 72*, 79-84. https://doi.org/10.1016/j.paid.2014.08.025

Tobin, S. J., Loxton, N. J., & Neighbors, C. (2014). Coping with causal uncertainty through alcohol use. *Addictive Behaviors*, *39*(3), 580–585. https://doi.org/10.1016/j.addbeh.2013.11.009

Wilsnack, R. W., Wilsnack, S. C., Kristjanson, A. F., Vogeltanz-Holm, N. D., & Gmel, G. (2009). Gender and alcohol consumption: patterns from the multinational GENACIS project. *Addiction*, *104*(9), 1487–1500. https://doi.org/10.1111/j.1360-0443.2009.02696.x

Woicik, P. A., Stewart, S. H., Pihl, R. O., & Conrod, P. J. (2009). The Substance Use Risk Profile Scale: a scale measuring traits linked to reinforcement-specific substance use profiles. *Addictive Behaviors*, *34*(12), 1042–1055. https://doi.org/10.1016/j.addbeh.2009.07.001

World Health Organization (2006). *BMI Classification.* Retrieved from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

Zhao, G., Ford, E. S., Dhingra, S., Li, C., Strine, T. W., & Mokdad, A. H. (2009). Depression and anxiety among US adults: associations with body mass index. *International Journal of Obesity*, *33*(2), 257–266. https://doi.org/10.1038/ijo.2008.268

Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research*, *37*(2), 197–206. http://doi.org/10.1086/651257