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How do self-assessment of alexithymia and sensitivity to bodily sensations relate to alcohol consumption?

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ABSTRACT

Background Alexithymia describes an abnormality of emotional experience that is commonly expressed among individuals with addiction and alcohol abuse disorders. Alexithymic individuals are characterized by difficulties in identifying and describing their emotions. This impairment is linked to the development and maintenance of addiction. Moreover, an emergent theory suggests alexithymia is itself secondary to a failure of interoception (sensitivity to internal bodily signals, including physiological arousal states).

Methods The present study tested for hypothesized contributory roles of alexithymia and dysfunctional interoception in the expression of binge drinking. Alexithymia, subjective sensitivity to bodily sensations, and alcohol consumption scores were quantified using the Toronto Alexithymia Scale, the Body Perception Questionnaire and the Alcohol Use Questionnaire respectively, in a normative sample (N=600). Regression and bootstrapping mediation analyses were used to test the hypothesis that alexithymia mediated the association between sensitivity to bodily sensations and alcohol consumption.

Results Alexithymia was positively correlated with sensitivity to bodily sensations and with alcohol consumption. Mediation analysis revealed that alexithymia, and more precisely, difficulty in identifying feelings, mediated the relationship between sensitivity to bodily sensations and alcohol consumption, such that the predictive effect of sensitivity to bodily sensations on alcohol intake became non-significant when controlling for alexithymia.

Conclusions These results indicate that alexithymia is associated with subjective hypersensitivity to bodily sensations. Moreover, our findings support the theoretical proposal that alexithymia is an expression of impaired processing of bodily sensations including physiological arousal, which underpin the development of maladaptive coping strategies, including alcohol use disorders. Our observations extend a growing literature emphasizing the importance of interoception and alexithymia in addiction, which can inform the development of new therapeutic strategies.

Key words: Addiction, Alcohol Consumption, Alexithymia, Interoception, Bodily Sensations

Introduction

Emotional dysregulation is associated with alcohol use disorders. Childhood deficits in emotional and interpersonal skills are associated with risky alcohol consumption and drug use in adolescence (Hessler and Katz, 2010), while lower measures of emotional intelligence increase the likelihood of relapse in detoxified patients (Kopera *et al.*, 2015). Impairments in recognising emotional expressions (Kornreich *et al.*, 2002, Townshend and Duka, 2003) alongside deficits in empathy and emotional awareness (Maurage *et al.*, 2011) are reported in alcoholic patients. Even after cognitive behavioural therapy, emotion regulation skills still significantly predict future alcohol use in alcohol dependent patients (Berking *et al.*, 2011). Moreover, emotional impairments are linked to interpersonal problems and thus represent a relapse factor in alcoholism (Kornreich *et al.*, 2002). Consequently, emotional dysregulation is proposed to be a major factor in both the development and maintenance of alcohol disorders (Loas *et al.*, 1997, Kun and Demetrovics, 2010, Kopera *et al.*, 2015).

Alexithymia, i.e. the difficulty in identifying one's own emotions (Taylor, 2000), may underpin emotional deficits in alcohol use disorders (Haviland *et al.*, 1988) and is associated with interpersonal trauma during development (Berenbaum, 1996). Parenting style, notably poor maternal care (Thorberg *et al.*, 2011), and avoidant attachment, predict the later expression of alexithymia across patient groups (De Rick and Vanheule, 2006). High alexithymia scores predict earlier age of alcohol consumption, duration of alcohol misuse and amount of alcohol consumed in people with alcohol dependence (Kopera *et al.*, 2015). Moreover, alexithymia is negatively related to an ability to remain abstinent (Loas *et al.*, 1997) and is inversely correlated with measures of emotional intelligence (Fukunishi *et al.*, 2001). Thus, alexithymia may specifically increase the likelihood of alcohol use disorders (Uzun *et al.*, 2003).

Alexithymia is typically associated with anxiety problems (Lyvers *et al.*, 2014) and poor stress-management skills (Fukunishi and Rahe, 1995), which are reflected in lower-level psycho-physiological abnormalities (Bogdanov *et al.*, 2013). This suggests a deeper-rooted impairment in body awareness

and more specifically in *interoception* (Herbert e*t al.,* 2011*)*. Interoception is the processing of internal bodily signals, including states of physiological arousal. Interoception informs emotional feelings (Cameron, 2001) and guides social interaction (Singer *et al.*, 2009). Individual differences in interoception can be quantified using behavioural tests ('interoceptive *accuracy'*), and self-report measures ('*sensitivity to bodily sensations*') (Garfinkel *et al.*, 2015). Good interoceptive abilities are associated with stable body representations and are involved in emotional Theory-of-Mind processing (Tsakiris *et al.*, 2011, Shah *et al.*, 2017). A multi-dimensional failure of interoception is suggested to be a very important contributor of alexithymia (Brewer *et al.*, 2016, Murphy *et al.*, 2017). Correspondingly, Alexithymia is associated with poorer interoceptive accuracy (Herbert *et al.*, 2011, Shah *et al.*, 2016), yet an over-reporting of subjective physical symptoms (Nakao *et al.*, 2002) including a hypersensitivity to touch (Sivik, 1993). These latter findings demonstrate a mismatch between objective and subjective aspects of body awareness, possibly impacting emotional processing and 'sense of self'. Indeed, alexithymic subjects show reduced emotional awareness (Lane *et al.*, 2015) and higher malleability of body representation in illusions of body-ownership (Georgiou *et al.*, 2016).

As mentioned earlier, people suffering from substance and alcohol use disorders show higher prevalence of alexithymia and impaired social cognition. This evidence suggests that the processing bodily sensations is disrupted in people with substance use disorders (May *et al.*, 2013, Berk *et al.*, 2015). Moreover, poorer interoceptive accuracy correlates with higher alexithymia scores (Sönmez *et al.*, 2016) and an enhanced craving for alcohol (Ates Çöl *et al.*, 2016) in alcohol-dependent individuals. Nevertheless, despite the growing literature highlighting the association between addictions and interoceptive impairments, the relationship between abnormal sensitivity to bodily sensations and alexithymia in social drinking has never previously been investigated.

In summary, an emergent theory suggests that interoception is central to alexithymia (Brewer *et al.*, 2016, Murphy *et al.*, 2017). Additionally, an established literature describes alexithymia as a contributing factor to the development and maintenance of alcohol use disorders (Loas *et al.*, 1997,

Kopera *et al.*, 2015). It is therefore plausible that disturbed representation of bodily states can lead to difficulty in interpreting emotional states (i.e. conventional definition of alexithymia), which in turn may foster the expression of risky behaviours, including heavy drinking. We therefore sought to characterise relationships between subjective measures of alexithymia, sensitivity to bodily sensations and alcohol consumption, using mediation analyses to infer likely causality. We hypothesised that alexithymia, sensitivity to bodily sensations and alcohol consumption will be positively correlated, and that alexithymia will mediate the relationship between bodily sensations and alcohol consumption.

Methods

Participants

Participants were recruited from students and staff at the Universities of Brighton and Sussex via posters, social networks, and via online advertisements. The study was a computerised survey, distributed via an online data collection platform (Qualtrics, Provo, UT, USA; http://www.qualtrics.com). A total of 779 participants consented and 600 individuals completed all questions and provided full data. To avoid the pitfalls of missing datasets, we used a conservative approach (case deletion), and confined all analyses to the 600 individuals who provided full data (Kang, 2013). The study was approved by the local research ethics committee (BSMSRGEC). Participation was encouraged by the chance to win a £20 prize.

Measures and procedure

Participants were invited to take part in the study through advertisements. Potential participants were given a link to the online platform. This provided information on the study and what would be expected of them. Participants consented by agreeing to the first statement of the survey and 'clicking' continue. The online data collection platform did not allow block randomisations, therefore all participants completed the following measures in the same order:

Socio-demographic information. This collected information including age, gender, and level of education.

The Toronto Alexithymia Scale (TAS-20)

The TAS-20 (Bagby *et al.*, 1994) consists of 20 items rated on a five-point Likert scale (from 1 "strongly disagree" to 5 "strongly agree"). The TAS-20 is composed of three factors. The first factor measures *difficulties in identifying feelings* (DIF), the second factor measures *difficulties in describing feelings* (DDF) and the third factor measures the way the participant uses *externally oriented thoughts* (EOF). The total alexithymia score is the sum of responses across all 20 items. Cronbach's α=0.722 indicated

acceptable internal consistency in the current sample. However, we only considered the total score in our mediation analysis.

Alcohol Use Questionnaire (AUQ)

The AUQ (Mehrabian and Russell, 1978) is a 15-item scale measuring the frequency and quantity of alcohol consumption (a*lcohol units drunk per week)*. For the previous six months, participants were asked to estimate the number of drinking days, the usual quantity consumed and drinking pattern. The AUQ is a reliable measure of drinking quantity and drinking pattern (Townshend and Duka, 2002).

Body Perception Questionnaire (BPQ)

Individual differences in *sensitivity to bodily sensations* were assessed using the Body Perception Questionnaire BPQ (Porges, 1993). Participants completed the *awareness* subscale as it is the most relevant and widely used subscale to assess sensibility (Garfinkel *et al.*, 2015). The *awareness* subscale (BPQ_A) incorporates 45 statements about different bodily sensations (e.g. stomach and gut pains, facial twitches, mouth being dry, urge to urinate) and participants indicated their awareness of each sensation, using a five point scale ranging from 'never' to 'always' (1 = never; 2 = sometimes; 3 = often; 4 = very often; 5= always). The internal consistency within the current sample was very good with Cronbach's α= 0.974.

Data Analysis

A database of the anonymised scores of each participant was compiled for subsequent analysis. The normality of the data distribution was checked for each variable. The data were examined for multivariate outliers using Mahalanobis distance ($p<0.001$; Tabachnick and Fidell, 2012) . Ten cases were identified and removed from the data set.

Correlations

Exploratory non parametric correlations were initially conducted due to the non-normality of data distributions.

Figure 1

Mediation Analysis

The two models of interest were computed (Figure 1). The first model tested whether the total alexithymia score on the TAS-20 questionnaire score ("TAS_Total") mediated the relationship between sensitivity to bodily sensations on alcohol consumption. A second model investigated the mediating effect of the TAS-20 three subscales ("TAS_Subscales") on the same relationship.

Analyses estimated: (1) the total effect of sensitivity to bodily sensations on alcohol consumption (path c; figure 1); (2) the indirect effect of model "TAS_Total" (path ab); (3) the direct effect of model "TAS_Total" that was mediated by the Tas-20 total score (path c'_1); (4) the indirect effect of model "TAS_Subscales" (paths a1b1, a2b2, a3b3); and (5) the direct effect of model "TAS_Subscales" that was mediated by the Tas-20 subscales scores (path c'_2).

Models were tested using the approach proposed by Preacher and Hayes that allows simple and multiple mediators to be included in the analysis (Preacher and Hayes, 2008). The model was specified and estimated using the PROCESS macro in SPSS 22 (Hayes, 2013). First, classic mediation criteria were tested : *(1) The predictor predicts the outcome - path c; (2) The predictor predicts the mediator - path a; (3) The mediator predicts the outcome while controlling for the predictor - path b* (Baron and Kenny, 1986). Finally, statistical significances of the indirect effects were estimated using a bootstrapping method. To avoid biased estimations under conditions of non-normality, bias-corrected confidence intervals (95%) were obtained with 5000 bootstrap resamples. Models were corrected for age, gender and education.

Results

Sample

208 Table 1

209

210 Five hundred and ninety participants (n= 438 females) were enrolled in the study. Means, standard
211 deviations, absolute numbers and percentages were calculated for all the socio-demographic
212 characteristics and questionnaire scores (Table 1).

213

214 **Correlations**

215 Table 2

216

217 Relationships between alexithymia, subjective sensitivity to bodily sensations and alcohol consumption
218 were examined using Kendall's tau rank correlation coefficient (Table 2). Alexithymia total score
219 showed a significant positive correlation with both sensitivity to bodily sensations and alcohol
220 consumption. All alexithymia subscales were positively correlated with alcohol consumption. However,
221 sensitivity to bodily sensations was not correlated with alcohol consumption nor the "Externally
222 Oriented Thinking subscale" of the TAS.

223 Figure 2

224 **Mediation analyses**

225 A schematic representation of the results showing unstandardized regression coefficients is depicted
226 on Figure 2.

227 *Total effect*

Prior to analysing the mediation model, the total effect of sensitivity to bodily sensations on alcohol consumption was estimated (i.e. path c). With no mediators in the model, the regression coefficient was statistically significant (path c; b= 2.06, *t* (585) = 2.46, *p* = 0 .014, 95% CI= 0.4191, 3.7098).

Model "TAS_Total" - Indirect and direct effects

Results indicated that sensitivity to bodily sensations was a significant predictor of alexithymia (path a; b= 2.39, *t* (585) = 4.60, *p* < 0 .001, 95% CI= 1.3675, 3.4053). Alexithymia was also a significant predictor of alcohol consumption, controlling for sensitivity to bodily sensations (path b; b= 0.23, *t* (585) = 3.39, *p* = 0 .007, 95% CI= 1.3675, 3.4053). The indirect effect was estimated (i.e., path ab) and was statistically significant (path ab; bootstrapped estimate = 0.5360, SE= 0.2135, 95% CI= 0.1993, 1.0779).

The direct effect of sensitivity to bodily sensations on alcohol consumption with alexithymia as mediator was also estimated (i.e., path c'_1). The regression coefficient was not statistically significant (path c'_1; b= 1.53, *t* (585) = 1.81, *p* = 0 .07, 95% CI= -0.1315, 3.1884).

These results support the mediational hypothesis; sensitivity to bodily sensations was no longer a significant predictor of alcohol consumption after controlling for total score of alexithymia, consistent with mediation. In order to explore the mediation role for each factor of alexithymia specifically, we included the three subscales of the TAS-20 as mediators in the "TAS_Subscales" model.

Model "TAS_Subscales" - Indirect and direct effects

Results indicated that sensitivity to bodily sensations significantly predicted the "Difficulty Identifying Feelings" subscale (path a1; b= 1.59, *t* (585) = 5.58, *p* < 0 .001, 95% CI= 1.0326, 2.1557), as well as the "Difficulty Describing Feelings" subscale (path a2; b= 0.80, *t* (585) = 3.92, *p* < 0 .001, 95% CI= 0.3985,

1.2001). The “Externally Oriented Thinking” subscale was not predicted by sensitivity to bodily sensations (path a3; b= - 0.007, *t* (585) = -0.03, *p*= 0.972, 95% CI= -0.4113, 0.3971).

Only the “Difficulty Identifying Feelings” subscale predicted alcohol consumption when controlling for sensitivity to bodily sensations (path b1; b= 0.46, *t* (585) = 3.24, *p* < 0 .01, 95% CI= 0.1811, 0.7369 ; path b2; b= -0.10, *t* (585) = -0.47, *p*= 0 .635, 95% CI= -0.4934, 0.3014 ; path b3; b= 0.19, *t* (585) = 1.12, *p* = 0.262, 95% CI= -0.1453, 0.5326)

Estimated indirect effects for path a1b1, a2b2 and a3b3 further demonstrated that the “Difficulty Identifying Feelings” subscale (path a1b1) was the only significant mediator between sensitivity to bodily sensations and alcohol consumption (path a1b1; bootstrapped estimate = 0.7317, SE= 0.2723, 95% CI= 0.2889, 1.3785; path a2b2; bootstrapped estimate = -0.0767, SE= 0.1629, 95% CI= -0.4495, 0.2153; path a3b3; bootstrapped estimate = -0.0014, SE= 0.0623, 95% CI= -0.1526, 0.1123).

We estimated the direct effect of sensitivity to bodily sensations on alcohol consumption, controlling for the three alexithymia subscales as mediators (i.e., path c'_2). The regression coefficient was not statistically significant (path c'_2; b= 1.41, *t* (585) = 1.12, *p* = 0 .099, 95% CI= -0.2642, 3.0859).

These results support a mediation effect of the “Difficulty Identifying Feelings” subscale; sensitivity to bodily sensations was no longer a significant predictor of alcohol consumption after controlling “Difficulty Identifying Feelings” subscale. No mediation effect was observed for the difficulty describing feelings and “Externally Oriented Thinking”.

Discussion

The present study examined the relationship between subjective measures of alexithymia, sensitivity to bodily sensations and alcohol consumption. We observed three key results.

First, alexithymia, and more precisely, difficulty in identifying feelings, mediated the relationship between sensitivity to bodily sensations and alcohol consumption. This finding provides fresh insight into the possible causality of this relationship: Sensitivity to bodily sensations might influence the ability to identify feelings, which thus might influence alcohol consumption. Although caution is required when discussing causation, recent research supports a causal interaction between interoceptive skills and alexithymia. Bornemann and Singer tested whether nine months of contemplative mental training could modulate interoceptive accuracy and emotional awareness (i.e. alexithymia, as measured by TAS-20), in healthy subjects (Bornemann and Singer, 2017). In the first three months of training, subjects were trained in breathing and body scan, which resulted in improved interoceptive accuracy and lowered alexithymia scores. Moreover, early changes in interoceptive accuracy predicted overall change (over the entire nine-month training period) in alexithymia, suggesting that a good reading of bodily sensations influences the ability to interpret one's emotion, rather than the opposite. Moreover, alcohol withdrawal in alcoholic patients does not affect alexithymia scores (de Timary *et al.*, 2008) whereas, alexithymia and poor emotional regulation ability predict relapse (Loas *et al.*, 1997, Berking *et al.*, 2011). Despite the difficulty to differentiate genetic from shared environmental impacts, a family history of alcohol dependence increases the risk of being alexithymic (Finn *et al.*, 1987, de Haan *et al.*, 2013). While alexithymia is not widely recognised as causal to addictive behaviours, it is interesting to note that alexithymic features such as "denial", "lack of insight" or "reduced self-awareness" are commonly described as underlying factors (Goldstein *et al.*, 2009). Taken together, our findings suggest that an inaccurate interpretation of bodily sensations (including bodily arousal) may increase the propensity towards alexithymic characteristics (such as difficulty identifying feelings), and potentially represent a risk factor for alcohol use disorders.

Our second main finding was that difficulties in identifying feelings, rather than difficulties describing feelings or externally oriented thinking, mediated the relationship between subjective bodily sensations and alcohol intake. These results are coherent with other studies of alcohol and substance users indicating a specific relationship between interoceptive accuracy and difficulties in identifying emotions (Sönmez *et al.*, 2016). Moreover, poor interoceptive accuracy is associated with a reduced representation of other's affective mental states (Shah *et al.*, 2017) and a poorer recognition of emotional facial expressions (Terasawa *et al.*, 2014). This dovetails with the hypothesis of an 'interoceptive simulation mechanism' in which the understanding of affective states of others arises from the top-down simulation (interoceptive prediction) of likely bodily state and the integration of subsequent interoceptive afferent signals into affective representation of both self and other (Singer *et al.*, 2009, Ainley *et al.*, 2014).This finding has important implications on current definitions of alexithymia: Alexithymia is conventionally defined as a personality construct, whereby characteristic difficulties in emotion labelling are a possible outcome of interoceptive failure. The relationship between interoception and alexithymia might reflect a conceptual overlap. An extended definition of alexithymia, however, might thus describe the disorder on a broad spectrum of interoceptive dysfunction. The latter definition presents alexithymia on a continuum. Nevertheless, focused studies are still needed to understand better the mechanisms through which interoception contributes to alexithymia.

Our third main finding was that alexithymia was positively correlated with sensitivity to bodily sensations and alcohol consumption. We found that the more participants were alexithymic, the more they were drinking alcohol. This observation adds to growing evidence for the relationship between alexithymia and alcohol dependence (Uzun *et al.*, 2003, Craparo *et al.*, 2014) and social drinking (Bruce *et al.*, 2012). We additionally found that the more participants were alexithymic, the greater their subjective sensitivity to bodily states. These findings might appear contradictory, as it has been previously emphasized that alexithymic individuals have poor interoceptive accuracy. However, poor ability to feel or interpret bodily sensations, which is typically assessed using objective interoceptive

measures (e.g. Sönmez *et al.*, 2016) could explain an overstatement at the subjective level. Indeed, interoceptive objective measures of accuracy (e.g. being accurate or inaccurate detecting heart rate) do not always align with interoceptive subjective measures of interoception as subjective data can be inaccurately overestimated or underestimated. Moreover, our data extend a previously observed association between subjective somatosensory overestimation and physical symptoms over-reporting in alexithymia (Nakao *et al.*, 2002). Finally, we found that sensitivity to bodily sensations was not correlated with alcohol consumption. This finding is coherent with our mediation effect result suggesting no direct relationship between subjective report of body sensations and alcohol intake.

Our findings build upon a growing neuroscientific understanding of brain mechanisms implicated in substance and alcohol use disorders. For example, neuroimaging studies of alcohol-dependent adolescents relate the structural integrity of white matter around right insula to obsessions and craving for alcohol (Chung and Clark, 2014). Since the right insular cortex is particularly implicated as a key interoceptive hub within the brain, that has a preeminent role in the representation of internal bodily state (Medford and Critchley, 2010), these findings can be regarded as an indirect demonstration of a relationship between interoception and alcohol-related behaviours. This notion adds to converging evidence for insular cortex dysfunction in drug abuse and addiction (Naqvi and Bechara, 2010, May *et al.*, 2013, Migliorini *et al.*, 2013, Berk *et al.*, 2015, Senatorov *et al.*, 2015). Sensitivity to bodily sensations appears impaired across different populations of substance misusers, from methamphetamine users (May *et al.*, 2013), to adolescent cannabis users (Migliorini *et al.*, 2013, Berk *et al.*, 2015). Related patient groups with compulsive 'addictive' behaviours, including anorexia nervosa (Kerr *et al.*, 2016) and internet gaming disorder show similar patterns (Zhang *et al.*, 2016). Our results therefore extend this broader literature beyond alcohol addiction, by showing that social drinkers might also display abnormal bodily sensitivity. However, the relationship between bodily sensations and alcohol intake seems to be expressed through the ability to identify emotional feelings. Finally, we recognise limitations of our study. The main limitation of this study was our (pragmatic) use of self-report questionnaires to assess alexithymia, alcohol consumption, and especially sensitivity to bodily

sensations: We postulate that alexithymia is characterized by a mismatch between subjective and objective dimensions of interoception, hence future studies need to quantify pure interoceptive sensibility and interoceptive accuracy together. However, a stable cohesion around the definition of interoception, and the development of a robust tool assessing the subjective dimension of interoception are still crucially needed. The measurement of alexithymia using self-report was not optimal either, given that alexithymic subjects, by definition, show biased insights into their bodily and emotional states. Future studies should lead to the development of an objective measure of alexithymia (e.g. inferred from multi-dimensional interoceptive accuracy). A second limitation was the use of cross-sectional design which restricted our interpretations in term of causation. Prospective cohort studies could clarify the nature of relationships between interoception, alexithymia and risk taking behaviours such as alcohol use disorders.

Despites these limitations, this study is the first to suggest that alexithymia, as a possible outcome of aberrant bodily sensations processes, may play a role in social drinking. Our observations motivate the need to take equally into account interoceptive processes alongside regulation impairments in the treatment of compulsive and addictive behaviour. Therapeutic modulation of interoception can potentially reduce alexithymic features and consequently decrease the likelihood of alcohol use disorders. More broadly, further research is needed to investigate the role of interoception in addiction, which may inform the development of new therapies targeting interoceptive processes.

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Conflict of interest

Authors have no conflicts or other disclosures beyond funding information provided.

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526 Figure 1

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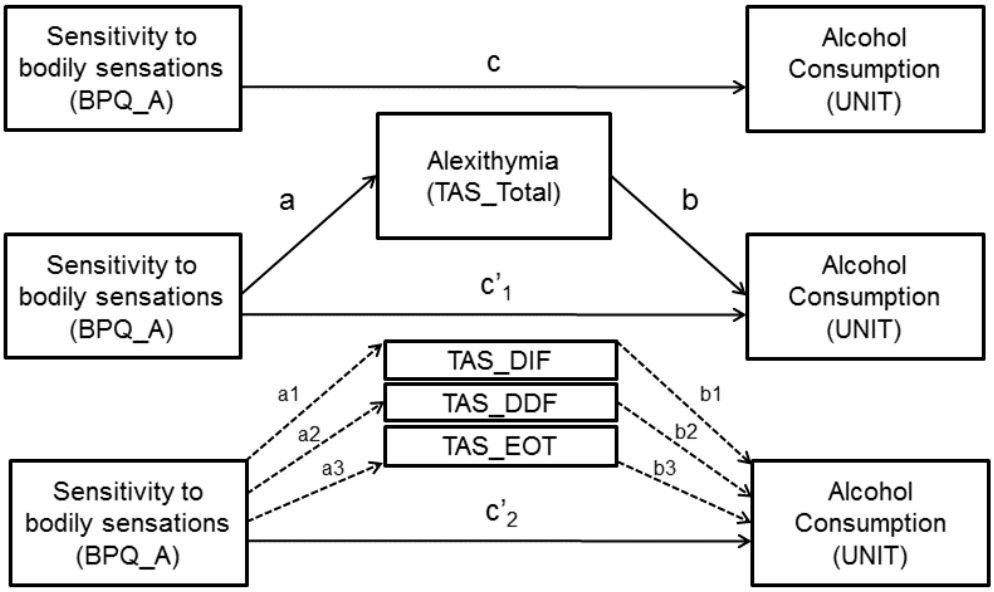

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Figure 2

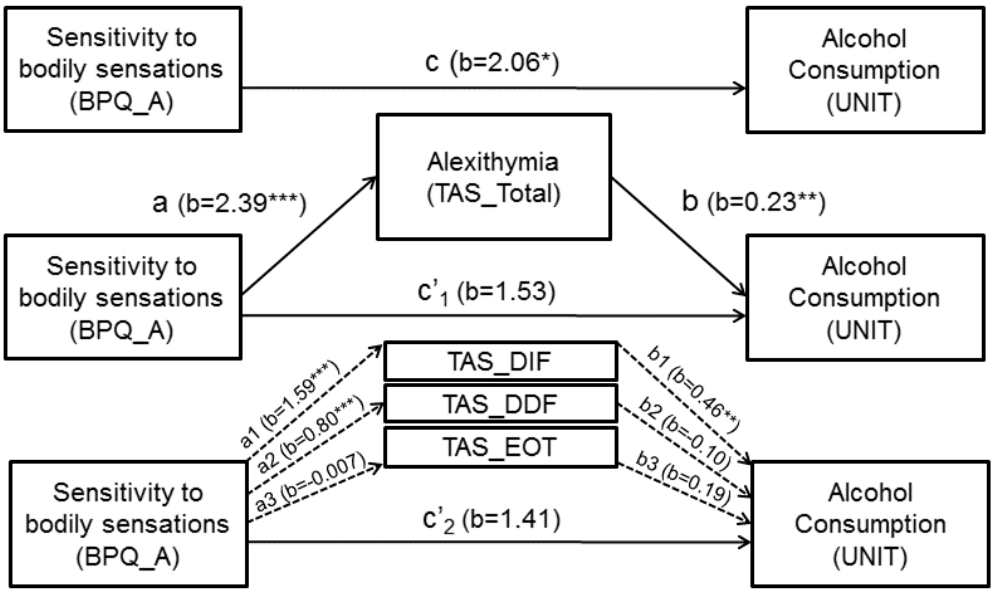
Sensitivity to bodily sensations (BPQ_A)
c (b=2.06*)
Alcohol Consumption (UNIT)
Alexithymia (TAS_Total)
a (b=2.39***)
b (b=0.23**)
Sensitivity to bodily sensations (BPQ_A)
c'1 (b=1.53)
Alcohol Consumption (UNIT)
TAS_DIF
TAS_DDF
TAS_EOT
a1 (b=1.59***)
a2 (b=0.80***)
a3 (b=-0.007)
b1 (b=0.46**)
b2 (b=-0.10)
b3 (b=0.19)
Sensitivity to bodily sensations (BPQ_A)
c'2 (b=1.41)
Alcohol Consumption (UNIT)

Figure Legends

Figure 1: Schematic representations of the mediation models of interest. The top panel shows the total effect of sensitivity to bodily sensation on alcohol consumption; The intermediary panel depicts indirect and direct effects of model "TAS_Total" (i.e. *testing for mediation effect of TAS-20 total score on the relationship between sensitivity to bodily sensations and alcohol consumption*); The bottom panel depicts indirect and direct effects of model "TAS_Subscales" (i.e. *testing for mediation effect of TAS-20 subscale scores on the relationship between sensitivity to bodily sensations and alcohol consumption*).

Figure 2: Schematic showing unstandardized regression coefficients (b) for total, indirect and direct effects of models 1 and 2. Age, gender and education level were used as covariates (*p*-value: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$).

Table 1

Measure	Type	N (%) or Mean ± SD (Range)
Age (years)		27.44 ± 12.18 (18-69)
Gender	Male	151 (25.6%)
	Female	438 (74.2%)
	Other	1 (0.2%)
Education level	Less than high school	2 (0.3%)
	High School/GED	172 (29.2%)
	Some college	89(15.1%)
	2-year College Degree	81 (13.7%)
	4-year College Degree	58 (9.8%)
	Master Degree	86 (14.6%)
	PhD Degree	33 (5.6%)
	Professional Degree	10 (1.7%)
	Other	59 (10%)
TAS-20	Alexithymia total score (TAS_Total)	46.79 ± 10.57 (20-77)
	Difficulty Identifying Feelings (TAS_DIF)	16.20 ± 5.77(7-34)
	Difficulty Describing Feelings (TAS_DDF)	13.43 ± 4.09 (5-25)
	External Oriented Thinking (TAS_EOT)	17.16 ± 4.03 (8-30)
AUQ	Drunk Alcohol units by week (UNIT)	18.32 ± 16.57 (0-101)
BPQ	Awareness Subscale (BPQ_A)	2.30 ± 0.82 (1-5)

Table 2

	1	5	6
1. Alexithymia (TAS_Total)	-	.102 ***	.199 ***
2. Difficulty Identifying Feelings (TAS_DIF)	.665***	.112***	.230***
3. Difficulty Describing Feelings (TAS_DDF)	.624***	.077*	.157***
4. External Oriented Thinking (TAS_EOT)	.437***	.057*	.035
5. Drunk Alcohol Units by week (UNIT)	.102***	-	.034
6. BPQ Awareness Subscale (BPQ_A)	.199***	.034	-

Table Legends

Table 1: Socio-demographic characteristics and questionnaires scores of the sample

Table 2: Kendall's tau correlation (2-tailed) matrix for each variable (Uncorrected *p*-value: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$)