

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

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21 **ABSTRACT**

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

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

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

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

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

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66 **Introduction**

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

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

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

91 and more specifically in *interoception* (Herbert *et al.*, 2011). Interoception is the processing of internal
92 bodily signals, including states of physiological arousal. Interoception informs emotional feelings
93 (Cameron, 2001) and guides social interaction (Singer *et al.*, 2009). Individual differences in
94 interoception can be quantified using behavioural tests ('interoceptive *accuracy*'), and self-report
95 measures ('*sensitivity to bodily sensations*') (Garfinkel *et al.*, 2015). Good interoceptive abilities are
96 associated with stable body representations and are involved in emotional Theory-of-Mind processing
97 (Tsakiris *et al.*, 2011, Shah *et al.*, 2017). A multi-dimensional failure of interoception is suggested to be
98 a very important contributor of alexithymia (Brewer *et al.*, 2016, Murphy *et al.*, 2017). Correspondingly,
99 Alexithymia is associated with poorer interoceptive accuracy (Herbert *et al.*, 2011, Shah *et al.*, 2016),
100 yet an over-reporting of subjective physical symptoms (Nakao *et al.*, 2002) including a hypersensitivity
101 to touch (Sivik, 1993). These latter findings demonstrate a mismatch between objective and subjective
102 aspects of body awareness, possibly impacting emotional processing and 'sense of self'. Indeed,
103 alexithymic subjects show reduced emotional awareness (Lane *et al.*, 2015) and higher malleability of
104 body representation in illusions of body-ownership (Georgiou *et al.*, 2016).

105 As mentioned earlier, people suffering from substance and alcohol use disorders show higher
106 prevalence of alexithymia and impaired social cognition. This evidence suggests that the processing
107 bodily sensations is disrupted in people with substance use disorders (May *et al.*, 2013, Berk *et al.*,
108 2015). Moreover, poorer interoceptive accuracy correlates with higher alexithymia scores (Sönmez *et*
109 *al.*, 2016) and an enhanced craving for alcohol (Ates Çöl *et al.*, 2016) in alcohol-dependent individuals.
110 Nevertheless, despite the growing literature highlighting the association between addictions and
111 interoceptive impairments, the relationship between abnormal sensitivity to bodily sensations and
112 alexithymia in social drinking has never previously been investigated.

113 In summary, an emergent theory suggests that interoception is central to alexithymia (Brewer *et al.*,
114 2016, Murphy *et al.*, 2017). Additionally, an established literature describes alexithymia as a
115 contributing factor to the development and maintenance of alcohol use disorders (Loas *et al.*, 1997,

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

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137 **Methods**

138 **Participants**

139 Participants were recruited from students and staff at the Universities of Brighton and Sussex via
140 posters, social networks, and via online advertisements. The study was a computerised survey,
141 distributed via an online data collection platform (Qualtrics, Provo, UT, USA;
142 <http://www.qualtrics.com>). A total of 779 participants consented and 600 individuals completed all
143 questions and provided full data. To avoid the pitfalls of missing datasets, we used a conservative
144 approach (case deletion), and confined all analyses to the 600 individuals who provided full data (Kang,
145 2013). The study was approved by the local research ethics committee (BSMSRGEC). Participation was
146 encouraged by the chance to win a £20 prize.

147 **Measures and procedure**

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

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

155 *The Toronto Alexithymia Scale (TAS-20)*

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

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

163 Alcohol Use Questionnaire (AUQ)

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

168 Body Perception Questionnaire (BPQ)

169 Individual differences in *sensitivity to bodily sensations* were assessed using the Body Perception
170 Questionnaire BPQ (Porges, 1993). Participants completed the *awareness* subscale as it is the most
171 relevant and widely used subscale to assess sensibility (Garfinkel *et al.*, 2015). The *awareness* subscale
172 (BPQ_A) incorporates 45 statements about different bodily sensations (e.g. stomach and gut pains,
173 facial twitches, mouth being dry, urge to urinate) and participants indicated their awareness of each
174 sensation, using a five point scale ranging from 'never' to 'always' (1 = never; 2 = sometimes; 3 = often;
175 4 = very often; 5= always). The internal consistency within the current sample was very good with
176 Cronbach's $\alpha = 0.974$.

177 **Data Analysis**

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

182 Correlations

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

185 Figure 1

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187 Mediation Analysis

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

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

197 Models were tested using the approach proposed by Preacher and Hayes that allows simple and
198 multiple mediators to be included in the analysis (Preacher and Hayes, 2008). The model was specified
199 and estimated using the PROCESS macro in SPSS 22 (Hayes, 2013). First, classic mediation criteria were
200 tested : (1) *The predictor predicts the outcome - path c* ; (2) *The predictor predicts the mediator - path*
201 *a* ; (3) *The mediator predicts the outcome while controlling for the predictor - path b* (Baron and Kenny,
202 1986). Finally, statistical significances of the indirect effects were estimated using a bootstrapping
203 method. To avoid biased estimations under conditions of non-normality, bias-corrected confidence
204 intervals (95%) were obtained with 5000 bootstrap resamples. Models were corrected for age, gender
205 and education.

206 **Results**

207 **Sample**

208 Table 1

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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).

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214 **Correlations**

215 Table 2

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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

228 Prior to analysing the mediation model, the total effect of sensitivity to bodily sensations on alcohol
229 consumption was estimated (i.e. path c). With no mediators in the model, the regression coefficient
230 was statistically significant (path c; $b = 2.06$, $t(585) = 2.46$, $p = 0.014$, 95% CI = 0.4191, 3.7098).

231 Model "TAS Total" - Indirect and direct effects

232 Results indicated that sensitivity to bodily sensations was a significant predictor of alexithymia (path
233 a; $b = 2.39$, $t(585) = 4.60$, $p < 0.001$, 95% CI = 1.3675, 3.4053). Alexithymia was also a significant
234 predictor of alcohol consumption, controlling for sensitivity to bodily sensations (path b; $b = 0.23$, t
235 $(585) = 3.39$, $p = 0.007$, 95% CI = 1.3675, 3.4053). The indirect effect was estimated (i.e., path ab) and
236 was statistically significant (path ab; bootstrapped estimate = 0.5360, SE = 0.2135, 95% CI = 0.1993,
237 1.0779).

238 The direct effect of sensitivity to bodily sensations on alcohol consumption with alexithymia as
239 mediator was also estimated (i.e., path c'_1). The regression coefficient was not statistically significant
240 (path c'_1 ; $b = 1.53$, $t(585) = 1.81$, $p = 0.07$, 95% CI = -0.1315, 3.1884).

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

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247 Model "TAS Subscales" - Indirect and direct effects

248 Results indicated that sensitivity to bodily sensations significantly predicted the "Difficulty Identifying
249 Feelings" subscale (path a1; $b = 1.59$, $t(585) = 5.58$, $p < 0.001$, 95% CI = 1.0326, 2.1557), as well as the
250 "Difficulty Describing Feelings" subscale (path a2; $b = 0.80$, $t(585) = 3.92$, $p < 0.001$, 95% CI = 0.3985,

251 1.2001). The “Externally Oriented Thinking” subscale was not predicted by sensitivity to bodily
252 sensations (path a3; $b = -0.007$, $t(585) = -0.03$, $p = 0.972$, 95% CI = -0.4113, 0.3971).

253 Only the “Difficulty Identifying Feelings” subscale predicted alcohol consumption when controlling for
254 sensitivity to bodily sensations (path b1; $b = 0.46$, $t(585) = 3.24$, $p < 0.01$, 95% CI = 0.1811, 0.7369 ; path
255 b2; $b = -0.10$, $t(585) = -0.47$, $p = 0.635$, 95% CI = -0.4934, 0.3014 ; path b3; $b = 0.19$, $t(585) = 1.12$, $p =$
256 0.262, 95% CI = -0.1453, 0.5326)

257 Estimated indirect effects for path a1b1, a2b2 and a3b3 further demonstrated that the “Difficulty
258 Identifying Feelings” subscale (path a1b1) was the only significant mediator between sensitivity to
259 bodily sensations and alcohol consumption (path a1b1; bootstrapped estimate = 0.7317, SE = 0.2723,
260 95% CI = 0.2889, 1.3785; path a2b2; bootstrapped estimate = -0.0767, SE = 0.1629, 95% CI = -0.4495,
261 0.2153; path a3b3; bootstrapped estimate = -0.0014, SE = 0.0623, 95% CI = -0.1526, 0.1123).

262 We estimated the direct effect of sensitivity to bodily sensations on alcohol consumption, controlling
263 for the three alexithymia subscales as mediators (i.e., path c'_2). The regression coefficient was not
264 statistically significant (path c'_2 ; $b = 1.41$, $t(585) = 1.12$, $p = 0.099$, 95% CI = -0.2642, 3.0859).

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

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272 Discussion

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

275 First, alexithymia, and more precisely, difficulty in identifying feelings, mediated the relationship
276 between sensitivity to bodily sensations and alcohol consumption. This finding provides fresh insight
277 into the possible causality of this relationship: Sensitivity to bodily sensations might influence the
278 ability to identify feelings, which thus might influence alcohol consumption. Although caution is
279 required when discussing causation, recent research supports a causal interaction between
280 interoceptive skills and alexithymia. Bornemann and Singer tested whether nine months of
281 contemplative mental training could modulate interoceptive accuracy and emotional awareness (i.e.
282 alexithymia, as measured by TAS-20), in healthy subjects (Bornemann and Singer, 2017). In the first
283 three months of training, subjects were trained in breathing and body scan, which resulted in improved
284 interoceptive accuracy and lowered alexithymia scores. Moreover, early changes in interoceptive
285 accuracy predicted overall change (over the entire nine-month training period) in alexithymia,
286 suggesting that a good reading of bodily sensations influences the ability to interpret one's emotion,
287 rather than the opposite. Moreover, alcohol withdrawal in alcoholic patients does not affect
288 alexithymia scores (de Timary *et al.*, 2008) whereas, alexithymia and poor emotional regulation ability
289 predict relapse (Loas *et al.*, 1997, Berking *et al.*, 2011). Despite the difficulty to differentiate genetic
290 from shared environmental impacts, a family history of alcohol dependence increases the risk of being
291 alexithymic (Finn *et al.*, 1987, de Haan *et al.*, 2013). While alexithymia is not widely recognised as causal
292 to addictive behaviours, it is interesting to note that alexithymic features such as "denial", "lack of
293 insight" or "reduced self-awareness" are commonly described as underlying factors (Goldstein *et al.*,
294 2009). Taken together, our findings suggest that an inaccurate interpretation of bodily sensations
295 (including bodily arousal) may increase the propensity towards alexithymic characteristics (such as
296 difficulty identifying feelings), and potentially represent a risk factor for alcohol use disorders.

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

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

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

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

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

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

367

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373 **Conflict of interest**

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

375

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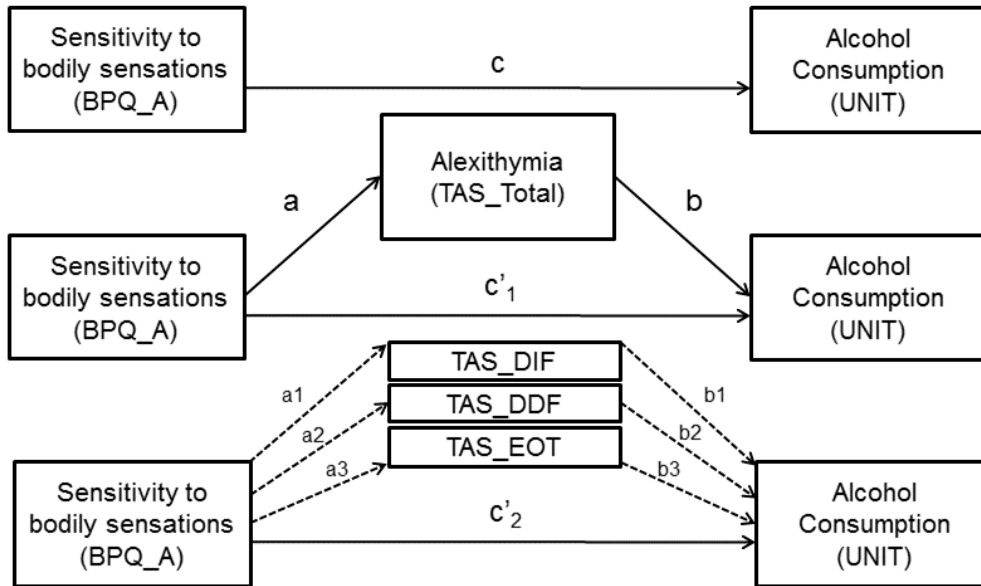
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526 Figure 1

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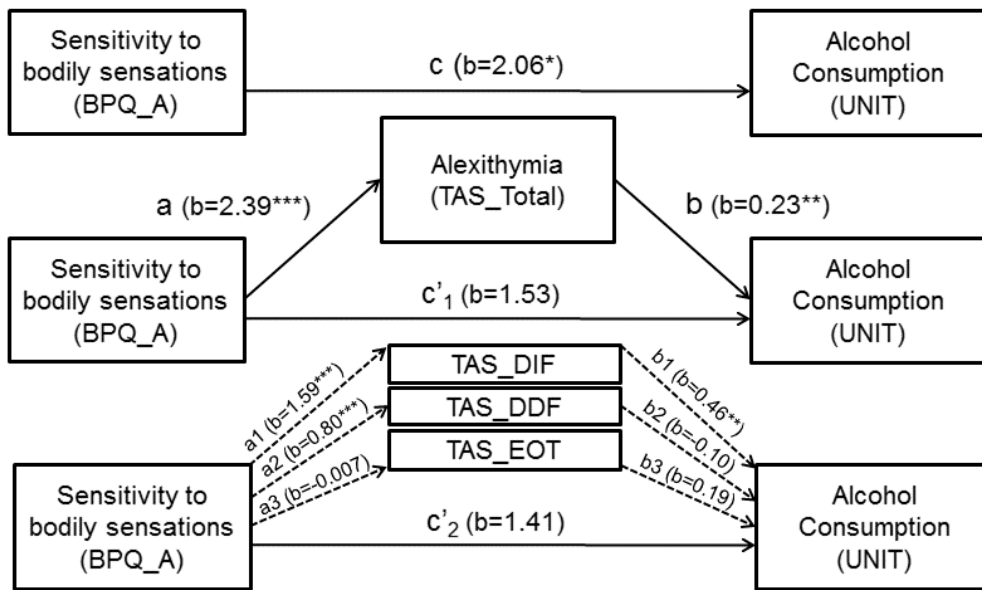
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546 Figure 2



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560 **Figure Legends**

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

568 Figure 2: Schematic showing unstandardized regression coefficients (b) for total, indirect and direct
569 effects of models 1 and 2. Age, gender and education level were used as covariates (*p*-value: **p* <
570 0.05; ***p* < 0.01; ****p* < 0.001).

Table 1

Measure	Type	N (%) or Mean \pm SD (Range)
Age (years)		27.44 \pm 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 \pm 10.57 (20-77)
	Difficulty Identifying Feelings (TAS_DIF)	16.20 \pm 5.77(7-34)
	Difficulty Describing Feelings (TAS_DDF)	13.43 \pm 4.09 (5-25)
	External Oriented Thinking (TAS_EOT)	17.16 \pm 4.03 (8-30)
AUQ	Drunk Alcohol units by week (UNIT)	18.32 \pm 16.57 (0-101)
BPQ	Awareness Subscale (BPQ_A)	2.30 \pm 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: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$)