**Title:** Distress tolerance and special alcohol metacognitions behave differently in the association of negative affect with alcohol-related patterns in men with problematic alcohol use in the abstinence phase

**Heading:** Distress tolerance and special alcohol metacognitions …

**Abstract**

Negative affect may be related to alcohol-related patterns (e.g., craving and problematic alcohol use). Distress intolerance and positive and negative alcohol-related metacognitions may be underlying mechanisms in this link. This study aimed to evaluate the effect of negative affect including depressive, anxious and stress symptoms on alcohol craving and problematic alcohol use via the paths of distress tolerance, and both positive and negative alcohol-related metacognitions. Three hundred men with problematic alcohol use during the abstinence phase completed psychological and clinical measures. Results showed that craving and negative alcohol metacognitions mediated the relationship between negative affect and problematic alcohol use. Negative affect had a direct and positive effect on craving and indirect effect via distress intolerance and positive alcohol metacognitions. In turn, distress intolerance and positive alcohol metacognitions indirectly and positively affected problematic alcohol use via craving. The study indicates that distress tolerance and distinct alcohol metacognitions may be differently related to various patterns of alcohol-related problems, such that alcohol drinkers with high levels of negative affect, distress intolerance and positive alcohol metacognitions show higher levels of craving; while high negative affect in relation to high negative alcohol metacognitions and alcohol craving is related to the perpetuation of alcohol use or problematic alcohol use.

**Keywords:** Negative affect, Distress tolerance, Alcohol metacognitions, Craving, Problematic alcohol use, Abstinence phase.

**Key Practitioner Message**

* Negative affect, distress tolerance, alcohol metacognitions, and alcohol-related patterns were examined in alcohol users.
* Negative affect had a positive and direct effect on craving, but not on problematic alcohol use.
* Negative affect indirectly and positively affected problematic alcohol use via negative metacognitions and craving.
* Negative affect had an indirect effect on craving via distress intolerance and positive metacognitions.
* Distress intolerance and positive metacognitions indirectly affected problematic alcohol use via craving.

**Introduction**

Alcohol craving is characterized by an obsessive urge to consume alcohol (Kavanagh & Connor, 2012) and is associated with problematic alcohol use (Khosravani, Ardestani, Bastan, Mohammadzadeh, & Amirinezhad, 2019a). According to metacognitive models of alcohol use (Janssen, 2019; Spada & Wells, [2009](https://www.sciencedirect.com/science/article/pii/S0306460315001495#bb0115)), high levels of negative affect, distress tolerance, and alcohol metacognitions may be important factors concerning alcohol use. Negative affect refers to a board variety of negative emotions such as anger, fear, depression, anxiety, and stress and generally a feeling of emotional distress (Watson, Clark, & Tellegen, 1988). Distress tolerance is one's ability to cope with negative affect (Leyro, Zvolensky, & Bernstein, 2010). Alcohol metacognitions described by Spada and Wells (2008) have different aspects, such as positive alcohol metacognitions (i.e., people's expectations that alcohol use is a strategy to regulate cognitions and feelings) and negative alcohol metacognitions (i.e., one's belief regarding the uncontrollability and risk of alcohol use) (Spada and Wells, 2008).

Negative affect has been positively associated with alcohol craving, problematic alcohol use, drinking to cope, and relapse (Lyons, Haller, Rivera, & Norman, 2020; Paulus et al., 2016; Schlauch, Gwynn-Shapiro, Stasiewicz, Molnar, & Lang, 2013; Simons, Hahn, Simons, & Murase, 2017; Treeby & Bruno, 2012; Veilleux, Skinner, Reese, & Shaver, 2014; Witkiewitz & Villarroel, 2009), especially during treatment (Khosravani, Bastan, Ghorbani, & Kamali, 2017). Also, individuals with high distress intolerance are more likely to relapse and also to use alcohol in dealing with their negative affect (Kraemer, McLeish, & O'Bryan, 2015; Williams, Vik, & Wong, 2015; Zvolensky, Feldner, Eifert, & Brown, 2001). In addition, positive and negative alcohol-related metacognitions were positively associated with alcohol use, craving and problematic alcohol use (Dragan, 2015; Dragan, Domozych, Czerski, & Dragan, 2018; Gierski et al., 2015; Janssen et al., 2020; Khosravani et al., 2019b; Spada, Caselli, & Wells, 2009; Spada & Wells, 2008, 2010).

High negative affect has also been positively associated with high levels of distress intolerance (Magidson et al., 2013) and alcohol-related metacognitions (Spada & Wells, 2006, 2009). So, distress intolerance and both positive and negative alcohol-related metacognitions may underlie the link between negative affect and alcohol-related patterns. To the best of our knowledge, no research has assessed the direct effects of negative affect on craving and problematic alcohol use and its indirect effects through distress tolerance and metacognitions in individuals with problematic alcohol use using structural equation modeling (SEM). However, some studies, through the use of SEM, have shown the mediating roles of high distress intolerance (Akbari, 2017; Duranceau, Fetzner, & Carleton, 2014; Himmerich and Orcutt, 2019; Holliday, Pedersen, & Leventhal, 2016; Buckner, Keough, & Schmidt, 2007; Gorka, Ali, & Daughters, 2012), high alcohol metacognitions (Dragan, 2015; Dragan et al., 2018) or high metacognitions about problematic Internet use (Akbari, 2017; Casale, Caplan, & Fioravanti, 2016) in association with different variables with respect to alcohol use or other addictive behaviors. Other studies have found an indirect effect of high negative affect on problematic alcohol use via alcohol craving (Thorberg et al., 2019) and lapse to alcohol use during treatment (Law et al., 2016).

The current study aimed to examine direct effects of negative affect on craving and problematic alcohol use and its indirect effects via distress tolerance, positive and negative alcohol-related metacognitions in men with problematic alcohol use in the abstinence phase. Since craving is high in the abstinence phase, high negative affect and its intolerance may affect the duration of alcohol abstinence (Daughters, Lejuez, Kahler, Strong, & Brown, 2005) and increase craving (Veilleux et al., 2014), especially during the abstinence phase (Witkiewitz & Villarroel, 2009). Also, each of alcohol-related metacognitions has been highly associated with different patterns of alcohol use, such as alcohol craving and problematic use, respectively (Caselli & Spada, 2010, 2015; Gierski et al., 2015; Khosravani et al., 2019b; Spada & Wells, [2009](https://www.sciencedirect.com/science/article/pii/S0306460315001495#bb0115), 2010); especially when experiencing negative affect. So, we hypothesized that negative affect would affect craving (via distress tolerance and positive alcohol metacognitions) and problematic alcohol use (via negative alcohol metacognitions and craving) (see Fig 1).

""""" INSERT Fig. 1 HERE """"""

**2. Methods**

2.1. Participants

Three hundred treatment-seeking males with problematic alcohol use were selected for this study. Inclusion criteria were: 1) having problematic alcohol use according to the criteria set out in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000), 2). A cut of score of 20 on the Alcohol Use Disorders Identification Test (AUDIT) prior to detoxification was used to indicate problematic alcohol use (Babor, de la Fuente, Saunders, & Grant, 1992), and 3) the absence of intellectual disabilities, other substance use, and neurological, medical and psychotic illnesses. All participants were assessed after two weeks of detoxification, when they were in the abstinence phase. An experienced clinical psychologist conducted all diagnoses. They were evaluated based on 1989 revision of the Helsinki Declaration. The data were extracted from a research project supported by Alborz University of Medical Sciences (Code of Medical Ethics: IR.ABZUMS.REC. 1398.039).

2.2. Self-report tools

*The Negative Alcohol Metacognitions Scale (NAMS; Spada & Wells, 2008).* The Persian version of the NAMS (Persian-NAMS) validated by Khosravani et al. (2019b) was used in this study. Similar to the original scale, the Persian-NAMS assesses negative alcohol metacognitions in the form of two subscales of uncontrollability (3 items) and cognitive harm (3 items) on a 4-point Likert scale from 1=do not agree to 4=agree very much. Cronbach's alpha for the Persian-PAMS was 0.73 (Khosravani et al., 2019b). In the current study, Cronbach's alpha was 0.76.

 *The Positive Alcohol Metacognitions Scales (PAMS; Spada & Wells, 2008).* We used the Persian version of the PAMS (Persian-PAMS; Khosravani et al., 2019b) to assess positive alcohol metacognitions including emotional (8 items) and cognitive (4 items) self-regulation on a 4-point Likert scale from 1=do not agree to 4=agree very much. Cronbach's alpha for the Persian-PAMS was 0.89 (Khosravani et al., 2019b) and it was 0.90 in the current study.

*The AUDIT (Babor et al., 1992).* This 10-item scale examines the severity of problematic alcohol use. We used the Persian version of the AUDIT developed by Zavar, Jarahi, Alimoradi, and Khosravi (2015) with good reliability in past studies (α= 0.92; Ghorbani, Khosravani, Bastan, & Ardakani, 2017) and in the present research (α= 0.86).

*The Obsessive Compulsive Drinking Scale (OCDS; Anton, Moak, & Latham, 1995).* The OCDS evaluates alcohol craving on the obsessive thoughts (6 items) and compulsive behaviors (8 items) subscales. Each item can indicate the absence (0) or the presence (4) of severe symptoms. In this study, the Persian version of the scale with a good internal consistency (α=0.96; Khosravani et al., 2017) was used. Cronbach's alpha for the scale was 0.80 in this research.

*The Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995).* The Persian version of the DASS-21 evaluated by Asghari, Saed and Dibajnia (2008) was used in the present research to assess negative affect consisting of depressive (7 items), anxious (7 items) and stress (7 items) symptoms. All 21 items are scored from 0 to 3. Cronbach's alpha for the Persian scale was good in previous studies (Ghorbani et al., 2019; Khosravani et al., 2020) and in the present research (0.66 and 0.76).

*The Distress Tolerance Scale (DTS: Simons & Gaher, 2005).* The scale examines four subscales of tolerance, appraisal, absorption and regulation on 15 items scored on a 5-point Likert scale from 1=strongly agree to 5=strongly disagree. High scores on this scale show high distress tolerance. We used the Persian scale assessed by Azizi (2010) with good Cronbach's alphas for tolerance (α=0.75), absorption (α=0.77), appraisal (α=0.70), and regulation (α=0.75). In the present study, Cronbach's alpha was 0.92.

2.3. Statistical analyses

Pearson’s correlation analyses in were conducted to assess zero-order associations between negative affect, positive alcohol-related metacognitions, negative alcohol-related metacognitions, distress tolerance, alcohol craving and problematic alcohol use by using SPSS (Version 22; IBM Corp., 2013). The direct relationships among negative affect, distress tolerance, metacognitions, craving, and problematic alcohol use were evaluated in the form of a SEM model using maximum likelihood estimation (MLE) in AMOS 21.0 (Chicago, USA). In the SEM model, negative affect (composed of depression, anxiety and stress) was an independent variable, while positive alcohol-related metacognitions, negative alcohol-related metacognitions, distress tolerance were mediators, and problematic alcohol use (as measured on the AUDIT) was an outcome variables and craving was both a mediator and an outcome variable. In the SEM model, chi-square index (χ2), χ2 divided by degrees of freedom (CMIN/DF), the goodness of fit index (GFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA) were assessed to determine the model fit. The model will have good fit if CMIN/DF < 2, CFI and GFI > 0.95, AGFI > 0.90, and RMSEA ≤ 0.05. Also, acceptable fit is considered if CMIN/DF < 3, CFI and GFI > 0.90, AGFI > 0.85, and RMSEA is between 0.05 and 0.08 (Browne, Cudeck, Bollen, & Long, 1993; Kline, 2015; MacCallum, Browne, & Sugawara, 1996; Schermelleh-Engel, Moosbrugger, & Müller, 2003).Bootstrapping with 5000 resamples in AMOS 21.0 was also performed to examine direct and indirect effects. These effects are significant if the 95% confidence interval (CI) does not include zero.

**3. Results**

Demographic and clinical factors are presented in Table 1. Age range of participants was between 19-69 years with mean age of 34 years. Some participants had comorbid psychiatric disorders (n=121, 40.3%), including major depressive disorder (MDD; n=54, 18%), bipolar disorder (BD; n=29, 9.7%), obsessive-compulsive disorder (OCD; n=6, 2%), borderline personality disorder (BPD; n=13, 4.3%), and anxiety disorders (n=19, 6.3%) (see Table 1 for more details).

""""" INSERT TABLE 1 HERE """"""

Pearson’s correlation analyses showed that the measures of negative affect were significantly and positively associated with positive alcohol metacognitions, negative alcohol metacognitions, craving and problematic alcohol use as well as negatively and significantly with distress tolerance (*p* < 0.01). Positive alcohol-related metacognitions and negative alcohol-related metacognitions and distress tolerance were positively and negative significantly correlated, respectively, with craving and problematic alcohol use (*p* < 0.01) (Table 2).

""""" INSERT TABLE 2 HERE """"""

Before evaluating the mediation model, the direct associations of negative affect with craving and problematic alcohol use require confirmation. The results supported the positive and significant direct relation of negative affect to craving (*β* = 0.53, p<0.001) with good model fit (χ2 = 14.02, df = 9, CMIN/DF = 1.6, *p* < 0.001, GFI = 0.96, AGFI = 0.93, CFI = 0.96, RMSEA = 0.047) as well as positive and significant direct relation of negative affect to problematic alcohol use (*β* = 0.40, p<0.001) with good model fit (χ2 = 14.02, df = 9, CMIN/DF = 1.6, *p* < 0.001, GFI = 0.96, AGFI = 0.94, CFI = 0.97, RMSEA = 0.045).

The findings of the SEM indicated good fit (χ2=502.20, *df*=264, CMIN/DF=1.9, p=0.000, GFI=0.96, AGFI=0.94, CFI=0.98, RMSEA=0.045). Negative affect had no direct effect on problematic alcohol use, but it was significantly and negatively associated with distress tolerance, as well as significantly and positively associated with both positive and negative alcohol-related metacognitions and craving. Alcohol craving showed a significant and negative relationship to distress tolerance and a significant and positive association with positive alcohol metacognitions. In turn, alcohol craving showed a significant and positive association with problematic alcohol use. Distress tolerance and positive alcohol metacognitions had no significant associations with problematic alcohol use, while negative alcohol metacognitions had. This model explained 45% of the total variance of problematic alcohol use (see Fig. 2).

""""" INSERT Fig. 2 HERE """"""

The results of bootstrapping with 5000 resamples indicated that negative affect had a direct and positive effect on craving, but not on problematic alcohol use. Negative alcohol metacognitions had direct and positive effects on problematic alcohol use, but distress intolerance and positive alcohol metacognitions did not. Negative affect had significant and positive indirect effects on craving through distress intolerance and positive metacognitions, but not negative metacognitions. Distress tolerance (negatively) and positive alcohol metacognitions (positively) had indirect effects on problematic alcohol use via alcohol craving, negative metacognitions did not. Negative affect indirectly and positively affected problematic alcohol use via negative metacognitions and craving, but neither via positive alcohol metacognitions nor distress tolerance (see Table 3). According to these results, the study hypothesis was supported regarding indirect effect of negative affect on craving (via positive metacognitions and distress tolerance) and problematic alcohol use (via negative metacognitions and craving).

""""" INSERT Table 3 HERE """"""

**4. Discussion**

This research evaluated the different effects of distress tolerance and both positive and negative alcohol-related metacognitions on the associations between negative affect, craving and problematic alcohol use in a cross-sectional design. Results showed that distress intolerance and positive metacognitions affected the positive relationship between negative affect and craving. Also, negative metacognitions and craving affected the positive relationship between negative affect and problematic alcohol use. These findings are in-line with previous studies reporting indirect effects of high negative affect states on alcohol use through low distress tolerance (Buckner et al., 2007; Gorka et al., 2012; Ali, Ryan, Beck, & Daughters, 2013) and high alcohol-related metacognitions (Dragan, 2015; Dragan et al., 2018). Also, two studies have reported an indirect effect of negative mood on problematic alcohol use via alcohol craving (Law et al., 2016; Thorberg et al., 2019).

As we had hypothesized in this study, negative affect had an indirect effect on craving via distress intolerance and positive alcohol-related metacognitions; as well as on problematic alcohol use via negative alcohol-related metacognitions and alcohol craving. Thus, the idea of the current study, that distress tolerance, positive metacognitions and negative metacognitions behave differently with respect to the relationship between negative affect and the continuum of drinking patterns, was confirmed. Simply put, distress intolerance and positive metacognitions are positively related to urgency states (i.e., alcohol craving), while negative alcohol metacognitions and alcohol craving are positively linked to long-term problematic alcohol use in users experiencing high negative affect. Evidence also has reported that positive and negative alcohol-related metacognitions were the strongest predictors of problematic alcohol use (Spada & Wells, [2010](https://www.sciencedirect.com/science/article/pii/S0306460315001495#bb0115)) and alcohol craving (Khosravani et al., 2020), respectively. Other studies have also shown different associations between metacognitions and a continuum of drinking behaviors, including urgency states (craving) and problematic alcohol use, respectively (Caselli & Spada, 2010, 2015; Gierski et al., 2015; Khosravani et al., 2019b; Spada & Wells, [2009](https://www.sciencedirect.com/science/article/pii/S0306460315001495%22%20%5Cl%20%22bb0115), 2010), especially in the presence of negative affect (Nikčević et al., 2017).

According to metacognitive models of problem drinking (Janssen, 2019; Spada & Wells, [2009](https://www.sciencedirect.com/science/article/pii/S0306460315001495#bb0115)), high positive metacognitions increase short-term and compulsive patterns, such as alcohol craving, to regulate negative affect. On the other hand, after a period of alcohol use, drinkers think that alcohol use is uncontrollable and dangerous and this can lead to increased levels of negative metacognitions; at which point negative affect results in prolonged and problematic alcohol use. Therefore, the relationship between negative affect and alcohol craving (through positive alcohol metacognitions and distress tolerance) and problematic alcohol use (through negative alcohol metacognitions and alcohol craving) is expected.

Drawing some theoretical and clinical implications may be possible based on the current study. Theoretically, this study added to our knowledge about different roles of distress tolerance and metacognitions in the relationship between negative affect and both momentary/impulsive patterns (i.e., craving) and continuous long-term patterns (i.e., problematic alcohol use). In this respect, distress tolerance and positive metacognitions have more important roles in relation to craving, whereas negative alcohol metacognitions have more important roles in relation to problematic alcohol use. Thus, metacognitive process and distress tolerance are important factors to understand problem drinking (Caselli et al., 2015) and this study adds to the evidence that supports the metacognitive model of alcohol use (Spada & Wells. 2009).

However, this study was conducted on men with problematic alcohol use in the abstinence phase. So, future studies should replicate this study on men with problematic alcohol use, who actively use alcohol in order to clarify and compare the effect of distress tolerance and metacognitions on craving and problematic alcohol use in the abstinence and active phases. Also, future studies are warranted to clarify the role of gender in this regard. In addition, in this study participants were tested two weeks after detoxification. With such a short period of time from active alcohol use to abstinence, this may have a more negative effect on mood, distress tolerance, metacognitions, and alcohol craving than those who are in a longer period of time from alcohol use to avoid it. Therefore, future research should consider this issue.

Clinically, it would be important to pay attention to distress intolerance and positive alcohol metacognitions in treatment programs for alcohol craving, as well as to negative metacognitions in the treatment of problematic alcohol use, particularly with respect to individuals in the abstinence phase with high negative affect. Thus, treatment programs, such as metacognitive therapy (MCT), skills for improving distress intolerance (SIDI), cognitive-behavioral therapy (CBT), and combined programs may be helpful. Empirically, MCT and its core method, Detached Mindfulness, reduced alcohol use and metacognitions (Caselli et al., 2018, 2016). SIDI treatments are designed for individuals with substance use disorders and has improved distress tolerance, even in the presence of negative affect (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012). CBT, particularly involving emotion regulation strategies, were useful to decrease distress intolerance (McHugh et al., 2014) and to teach individuals with problematic alcohol use to regulate their craving and negative affect effectively (Suzuki et al., 2020). Changing negative affect by combining medication and behavioral interventions, as well as a rehabilitation treatment program (combining medical, nursing and CBT interventions), were found to be effective in reducing problematic alcohol use (Witkiewitz, Bowen, & Donovan, 2011) and emotional (psychological distress), metacognitive (alcohol-related metacognitions) and cognitive (alcohol craving) factors in alcohol users during the abstinence phase (Ottonello, Fiabane, Pistarini, Spigno, & Torselli, 2019). Accordingly, future studies could focus on the effects of CBT, MCT and SIDI and combined treatments on negative affect, alcohol-related metacognitions, distress intolerance, craving and problematic alcohol use in alcohol users in the abstinence and active phases.

Although the present study had interesting results, it also had limitations. The use of self-report measures to collect data may be a constraint because of the likelihood of bias in participants' responses to these scales. Thus, using physiological or visual tools to measure alcohol craving or urine sampling to measure problematic alcohol use may be more appropriate than self-report measures. Results relying on a sample with problematic alcohol use during the abstinence phase limit the generalization of results to individuals with problematic alcohol use in the active phase or those not included in treatment. In relation to the previous limitation, the generalizability of the results to women with problematic alcohol use is impossible at this time, due to the exclusive inclusion of males in this study. The presence of possible dual diagnoses may also affect generalizability. We did not control for the effects of comorbid psychiatric disorders. Future studies are warranted to assess their effects. Most importantly, the nature of this study, namely its cross-sectional nature and the lack of longitudinal data, makes it impossible to draw any causal statements. Longitudinal studies are therefore warranted for any causal inferences from the relationships found in this study.

**5. Conclusions**

This study indicates that distress tolerance, positive alcohol-related metacognitions and negative alcohol-related metacognitions are different regarding their effect on the continuum of alcohol use, such that high negative affect, along with increased positive alcohol-related metacognitions and distress intolerance are positively associated with craving, whereas high negative affect, along with elevated negative alcohol-related metacognitions, are positively related to problematic alcohol use.

**Contributors**

All authors collaborated at all stages of the study and approved the final paper.

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**Conflict of interest**

No conflict declared.

References

Akbari, M. (2017). Metacognitions or distress intolerance: the mediating role in the relationship between emotional dysregulation and problematic internet use. Addictive Behaviors Reports, 6, 128-133. <https://doi.org/10.1016/j.abrep.2017.10.004>

Ali, B., Ryan, J. S., Beck, K. H., & Daughters, S. B. (2013). Trait aggression and problematic 6 alcohol use among college students: the moderating effect of distress tolerance. Alcoholism: 7 Clinical and Experimental Research, 37(12), 2138-2144. https://doi.org/10.1111/acer.12198

Alma, L., Spada, M. M., Fernie, B. A., Yilmaz-Samanci, A. E., Caselli, G., & Nikčević, A. V. (2018). Metacognitions in smoking: Evidence from a cross-cultural validation of the metacognitions about smoking questionnaire in a Turkish sample. Psychiatry Research, 259, 160-168. <https://doi.org/10.1016/j.psychres.2017.10.015>

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders (4th ed.) (Washington, DC: Author text rev.)

Anton, R. F., Moak, D. H., & Latham, P. (1995). The Obsessive Compulsive Drinking Scale: a self-rated instrument for the quantification of thoughts about alcohol and drinking behavior. Alcoholism: Clinical and Experimental Research, 19(1), 92-99. http://dx.doi.org/ 10.1111/j.1530-0277.1995.tb01475.x

Asghari, A., Saed, F., & Dibajnia, P. (2008). Psychometric properties of the Depression Anxiety Stress Scales-21 (DASS-21) in a non-clinical Iranian sample. International Journal of Psychology, 2(2), 82-102.

Azizi, A. R. (2010). Reliability and validity of the Persian version of distress tolerance scale. Iranian Journal of Psychiatry, 5(4), 154-158.

Babor, T.F., de la Fuente, J.R., Saunders, J., & Grant, M. (1992). The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Healthcare. World Health Organization, Geneva.

Bornovalova, M. A., Gratz, K. L., Daughters, S. B., Hunt, E. D., & Lejuez, C. W. (2012). Initial RCT of a distress tolerance treatment for individuals with substance use disorders. Drug and Alcohol Dependence, 122(1-2), 70-76. <https://doi.org/10.1016/j.drugalcdep.2011.09.012>

Browne, M. W., Cudeck, R., Bollen, K. A., & Long, J. S. (1993). Alternative ways of assessing model fit. Sage Focus Editions. 154, 136.

Buckner, J. D., Keough, M. E., & Schmidt, N. B. (2007). Problematic alcohol and cannabis use among young adults: the roles of depression and discomfort and distress tolerance. Addictive Behaviors, 32(9), 1957-1963. <https://doi.org/10.1016/j.addbeh.2006.12.019>

Casale, S., Caplan, S. E., & Fioravanti, G. (2016). Positive metacognitions about Internet use: the mediating role in the relationship between emotional dysregulation and problematic use. Addictive Behaviors, 59, 84-88. <https://doi.org/10.1016/j.addbeh.2016.03.014>

Caselli, G., & Spada, M. M. (2015). Desire thinking: What is it and what drives it? Addictive Behaviors, 44, 71–79. <http://dx.doi.org/10.1016/j.addbeh.2014.07.021>

Caselli, G., & Spada, M.M. (2010). Metacognitions in desire thinking: A preliminary investigation. Behavioural and Cognitive Psychotherapy, 38(05), 629–637. <http://dx.doi.org/10.1017/S1352465810000317>

Caselli, G., Canfora, F., Ruggiero, G. M., Sassaroli, S., Albery, I. P., & Spada, M. M. (2015). Desire thinking mediates the relationship between emotional intolerance and problem drinking. International Journal of Mental Health and Addiction, 13(2), 185-193. <https://doi.org/10.1007/s11469-014-9520-3>

Caselli, G., Gemelli, A., Spada, M. M., & Wells, A. (2016). Experimental modification of perspective on thoughts and metacognitive beliefs in alcohol use disorder. Psychiatry Research, 244, 57-61. <https://doi.org/10.1016/j.psychres.2016.07.029>

Caselli, G., Martino, F., Spada, M. M., & Wells, A. (2018). Metacognitive therapy for alcohol use disorder: a systematic case series. Frontiers in Psychology, 9, 2619. <https://doi.org/10.3389/fpsyg.2018.02619>

Daughters, S. B., Lejuez, C. W., Kahler, C. W., Strong, D. R., & Brown, R. A. (2005). Psychological distress tolerance and duration of most recent abstinence attempt among residential treatment-seeking substance abusers. Psychology of Addictive Behaviors, 19(2), 208-211. [http://dx.doi.org/10.1037/0893-164X.19.2.208](https://psycnet.apa.org/doi/10.1037/0893-164X.19.2.208)

Dragan, M. (2015). Difficulties in emotion regulation and problem drinking in young women: The mediating effect of metacognitions about alcohol use. Addictive Behaviors, 48, 30-35. <https://doi.org/10.1016/j.addbeh.2007.01.012>

Dragan, W. Ł., Domozych, W., Czerski, P. M., & Dragan, M. (2018). Positive metacognitions about alcohol mediate the relationship between FKBP5 variability and problematic drinking in a sample of young women. Neuropsychiatric Disease and Treatment, 14, 2681-2688. https://doi.org/[10.2147/NDT.S169514](https://dx.doi.org/10.2147/NDT.S169514)

Duranceau, S., Fetzner, M. G., & Carleton, R. N. (2014). Low distress tolerance and hyperarousal posttraumatic stress disorder symptoms: a pathway to alcohol use?. Cognitive Therapy and Research, 38(3), 280-290. <https://doi.org/10.1007/s10608-013-9591-7>

Ghorbani, F., Khosravani, V., Bastan, F. S., & Ardakani, R. J. (2017). The alexithymia, emotion regulation, emotion regulation difficulties, positive and negative affects, and suicidal risk in alcohol-dependent outpatients. Psychiatry Research, 252, 223-230. http://dx.doi.org/10.1016/j.psychres.2017.03.005

Ghorbani, F., Khosravani, V., Mohammadzadeh, A., & Shadnia, S. (2019). The role of emotion dysregulation in the relation of childhood trauma to heroin craving in individuals with heroin dependence. Drug and Alcohol Dependence, 195, 132-139. <https://doi.org/10.1016/j.drugalcdep.2018.12.008>

Gierski, F., Spada, M. M., Fois, E., Picard, A., Naassila, M., & Van der Linden, M. (2015). Positive and negative metacognitions about alcohol use among university students: Psychometric properties of the PAMS and NAMS French versions. Drug and Alcohol Dependence, 153, 78-85. <https://doi.org/10.1016/j.drugalcdep.2015.06.003>

Gorka, S. M., Ali, B., & Daughters, S. B. (2012). The role of distress tolerance in the relationship between depressive symptoms and problematic alcohol use. Psychology of Addictive Behaviors, 26(3), 621-626. [http://dx.doi.org/10.1037/a0026386](https://psycnet.apa.org/doi/10.1037/a0026386)

Himmerich, S., & Orcutt, H. (2019). Alcohol expectancies and distress tolerance: potential mechanisms in the relationship between posttraumatic stress and alcohol use. Personality and Individual Differences, 137, 39-44. <https://doi.org/10.1016/j.paid.2018.08.004>

Holliday, S. B., Pedersen, E. R., & Leventhal, A. M. (2016). Depression, posttraumatic stress, and alcohol misuse in young adult veterans: the transdiagnostic role of distress tolerance. Drug and Alcohol Dependence, 161, 348-355. <https://doi.org/10.1016/j.drugalcdep.2016.02.030>

IBM Corp. (2013). IBM Statistics for Windows, Version 22. Armonk, NY: IBM Corp.

Janssen, A. G. (2019). A metacognitive model of alcohol use: A cross-sectional study examining the role of metacognitions and desire thinking (Master's thesis, NTNU).

Janssen, A. G., Kennair, L. E. O., Hagen, R., Hjemdal, O., Havnen, A., & Solem, S. (2020). Positive and negative metacognitions about alcohol: Validity of the Norwegian PAMS and NAMS. Addictive Behaviors, 108, 106466. <https://doi.org/10.1016/j.addbeh.2020.106466>

Kavanagh, D. J., & Connor, J. P. (2012). Craving: a research update [Editorial to a special issue]. Addictive Behaviors, 38(2), 1499-1500. https://doi.org/10.1016/j.addbeh.2012.08.001

Khosravani, V., Ardestani, S. M. S., Bastan, F. S., Mohammadzadeh, A., & Amirinezhad, A. (2019a). Childhood maltreatment, cognitive emotion regulation strategies, and alcohol craving and dependence in alcohol-dependent males: direct and indirect pathways. Child Abuse & Neglect, 98, 104197. <https://doi.org/10.1016/j.chiabu.2019.104197>

Khosravani, V., Bastan, F. S., Ghorbani, F., & Kamali, Z. (2017). Difficulties in emotion regulation mediate negative and positive affects and craving in alcoholic patients. Addictive Behaviors, 71, 75-81. <https://doi.org/10.1016/j.addbeh.2017.02.029>

Khosravani, V., Samimi Ardestani, S. M., Alvani, A., & Amirinezhad, A. (2020). Alexithymia, empathy, negative affect and physical symptoms in patients with asthma. Clinical Psychology & Psychotherapy, 1–13. https://doi.org/10.1002/cpp.2458

Khosravani, V., Zandifar, A., Bastan, F. S., Kolubinski, D. C., & Amirinezhad, A. (2019b). Psychometric properties of the Persian versions of the Positive Alcohol Metacognitions Scale (Persian-PAMS) and the Negative Alcohol Metacognitions Scale (Persian-NAMS) in alcohol-dependent individuals. Addictive Behaviors, 101, 106113. <https://doi.org/10.1016/j.addbeh.2019.106113>

Kline, R. B. (2015). Principles and practice of structural equation modeling. Guilford publications. NY.

Kraemer, K. M., McLeish, A. C., & O'Bryan, E. M. (2015). The role of intolerance of uncertainty in terms of alcohol use motives among college students. Addictive Behaviors, 42, 162-166. <https://doi.org/10.1016/j.addbeh.2014.11.033>

Law, B., Gullo, M. J., Daglish, M., Kavanagh, D. J., Feeney, G. F., Young, R. M., & Connor, J. P. (2016). Craving mediates stress in predicting lapse during alcohol dependence treatment. Alcoholism: Clinical and Experimental Research, 40(5), 1058-1064.  <https://doi.org/10.1111/acer.13034>

Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2010). Distress tolerance and psychopathological symptoms and disorders: a review of the empirical literature among adults. Psychological Bulletin, 136(4), 576-600. [http://dx.doi.org/10.1037/a0019712](https://psycnet.apa.org/doi/10.1037/a0019712)

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour Research and Therapy, 33(3), 335-343. [https://doi.org/10.1016/0005-7967(94)00075-u](https://doi.org/10.1016/0005-7967%2894%2900075-u)

Lyons, R., Haller, M., Rivera, G., & Norman, S. (2020). Negative Affect Mediates the Association between Posttraumatic Cognitions and Craving in Veterans with Posttraumatic Stress Disorder and Alcohol Use Disorder. Journal of Dual Diagnosis, 1-7. <https://doi.org/10.1080/15504263.2020.1741754>

MacCallum, R.C., Browne, M.W., & Sugawara, H.M. (1996). Power analysis and determination of sample size for covariance structure modeling. Psychol. Methods 1 (2), 130–149. <https://doi.org/10.1037//1082-989x.1.2.130>

Magidson, J. F., Listhaus, A. R., Seitz-Brown, C. J., Anderson, K. E., Lindberg, B., Wilson, A., & Daughters, S. B. (2013). Rumination mediates the relationship between distress tolerance and depressive symptoms among substance users. Cognitive Therapy and Research, 37(3), 456-465. <https://doi.org/10.1007/s10608-012-9488-x>

McHugh, R. K., Kertz, S. J., Weiss, R. B., Baskin-Sommers, A. R., Hearon, B. A., & Björgvinsson, T. (2014). Changes in distress intolerance and treatment outcome in a partial hospital setting. Behavior Therapy, 45(2), 232-240. <https://doi.org/10.1016/j.beth.2013.11.002>

Najafi, M., Khosravani, V., Shahhosseini, M., & Afshari, A. (2018). The psychometric properties of the Persian version of the metacognitions about Smoking Questionnaire among smokers. Addictive Behaviors, 84, 62-68. <https://doi.org/10.1016/j.addbeh.2018.03.016>

Nikčević, A. V., Alma, L., Marino, C., Kolubinski, D., Yılmaz-Samancı, A. E., Caselli, G., & Spada, M. M. (2017). Modelling the contribution of negative affect, outcome expectancies and metacognitions to cigarette use and nicotine dependence. Addictive Behaviors, 74, 82-89. <http://dx.doi.org/10.1016/j.addbeh.2017.06.002>

Nikčević, A. V., Caselli, G., Wells, A., & Spada, M. M. (2015). The metacognitions about smoking questionnaire: development and psychometric properties. Addictive Behaviors, 44, 102-107. <https://doi.org/10.1016/j.addbeh.2014.11.004>

Ottonello, M., Fiabane, E., Pistarini, C., Spigno, P., & Torselli, E. (2019). Difficulties in emotion regulation during rehabilitation for alcohol addiction: correlations with metacognitive beliefs about alcohol use and relapse risk. Neuropsychiatric Disease and Treatment, 15, 2917-2925. https://doi.org/[10.2147/NDT.S214268](https://dx.doi.org/10.2147/NDT.S214268)

Paulus, D. J., Bakhshaie, J., Lemaire, C., Garza, M., Ochoa-Perez, M., Valdivieso, J., ... & Neighbors, C. (2016). Negative affectivity and problematic alcohol use among Latinos in primary care: The role of emotion dysregulation. Journal of Dual Diagnosis, 12(2), 137-147. <https://doi.org/10.1080/15504263.2016.1172897>

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: tests of significance and descriptive goodness-of-fit measures. Methods of Psychological Research Online, 8(2), 23-74.

Schlauch, R. C., Gwynn-Shapiro, D., Stasiewicz, P. R., Molnar, D. S., & Lang, A. R. (2013). Affect and craving: Positive and negative affect are differentially associated with approach and avoidance inclinations. Addictive Behaviors, 38(4), 1970-1979. <https://doi.org/10.1016/j.addbeh.2012.12.003>

Simons, J. S., & Gaher, R. M. (2005). The Distress Tolerance Scale: Development and validation of a self-report measure. Motivation and Emotion, 29(2), 83-102. <https://doi.org/10.1007/s11031-005-7955-3>

Simons, R.M., Hahn, A.M., Simons, J.S., & Murase, H. (2017). Emotion dysregulation and peer drinking norms uniquely predict alcohol-related problems via motives. Drug and Alcohol Dependence 177, 54–58. <https://doi.org/10.1016/j.drugalcdep.2017.03.019>

Spada, M. M., & Wells, A. (2006). Metacognitions about alcohol use in problem drinkers. Clinical Psychology & Psychotherapy: an International Journal of Theory & Practice, 13(2), 138-143. <https://doi.org/10.1002/cpp.478>

Spada, M. M., & Wells, A. (2008). Metacognitive beliefs about alcohol use: development and validation of two self-report scales. Addictive Behaviors 33(4), 515-527. <https://doi.org/10.1016/j.addbeh.2007.10.011>

Spada, M. M., & Wells, A. (2010). Metacognitions across the continuum of drinking behaviour. Personality and Individual Differences, 49(5), 425-429. <https://doi.org/10.1016/j.paid.2010.04.011>

Spada, M. M., Caselli, G., & Wells, A. (2009). Metacognitions as a predictor of drinking status and level of alcohol use following CBT in problem drinkers: A prospective study. Behaviour Research and Therapy, 47(10), 882-886. <https://doi.org/10.1016/j.brat.2009.06.010>

Spada, M.M., & Wells, A. (2009). A metacognitive model of problem drinking. Clinical Psychology & Psychotherapy, 16(5), 383–393. <https://doi.org/10.1002/cpp.620>

Suzuki, S., Mell, M. M., O’Malley, S. S., Krystal, J. H., Anticevic, A., & Kober, H. (2020). Regulation of Craving and Negative Emotion in Alcohol Use Disorder. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 5(2), 239-250. <https://doi.org/10.1016/j.bpsc.2019.10.005>

Thorberg, F. A., Young, R. M., Hasking, P., Lyvers, M., Connor, J. P., London, E. D., ... & Feeney, G. F. (2019). Alexithymia and Alcohol Dependence: The Roles of Negative Mood and Alcohol Craving. Substance Use & Misuse, 1-7. <https://doi.org/10.1080/10826084.2019.1650773>

Treeby, M., & Bruno, R. (2012). Shame and guilt-proneness: Divergent implications for problematic alcohol use and drinking to cope with anxiety and depression symptomatology. Personality and Individual Differences, 53(5), 613-617. <https://doi.org/10.1016/j.paid.2012.05.011>

Veilleux, J. C., Skinner, K. D., Reese, E. D., & Shaver, J. A. (2014). Negative affect intensity influences drinking to cope through facets of emotion dysregulation. Personality and Individual Differences, 59, 96-101. <https://doi.org/10.1016/j.paid.2013.11.012>

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology, 54, 1063–1070. https://doi.org/10.1037//0022-3514.54.6.1063

Williams, C. L., Vik, P. W., & Wong, M. M. (2015). Distress tolerance in social versus solitary college student drinkers. Addictive Behaviors, 50, 89-95. <https://doi.org/10.1016/j.addbeh.2015.06.025>

Witkiewitz, K., & Villarroel, N. A. (2009). Dynamic association between negative affect and alcohol lapses following alcohol treatment. Journal of Consulting and Clinical Psychology, 77(4), 633-644. <https://doi.org/10.1037/a0015647>

Witkiewitz, K., Bowen, S., & Donovan, D. M. (2011). Moderating effects of a craving intervention on the relation between negative mood and heavy drinking following treatment for alcohol dependence. Journal of Consulting and Clinical Psychology, 79(1), 54-63. <https://doi.org/10.1037/a0022282>

Zavar, A., Jarahi, L., Alimoradi, B., & Khosravi, N. (2015). The alcohol use disorders identification test (AUDIT): reliability and validity of the Persian version. Asia Pacific Journal of Medical Toxicology, 4(1), 37-42.

Zvolensky, M. J., Feldner, M. T., Eifert, G. H., & Brown, R. A. (2001). Affective style among smokers: Understanding anxiety sensitivity, emotional reactivity, and distress tolerance using biological challenge. Addictive Behaviors, 26(6), 901-915. [https://doi.org/10.1016/S0306-4603(01)00242-8](https://doi.org/10.1016/S0306-4603%2801%2900242-8)

Depression

0.20

0.76

**Obsessive thoughts**

0.86

0.53 \*

0.85

Anxiety

0.75

**Compulsive behaviors**

0.85

Stress

Fit indices:

(χ2 = 14.02, df = 9, CMIN/DF = 1.6, *p* < 0.001, GFI = 0.96, AGFI = 0.93, CFI = 0.96, RMSEA = 0.047)

Fig. 1. Negative affect directly predicting alcohol craving. OCDS=Obsessive Compulsive Drinking Scale.

\* *p*< 0.001.

Depression

0.15

0.85

Alcohol dependence on the AUDIT

0.40 \*

0.85

Anxiety

0.84

Stress

Fit indices:

(χ2 = 14.02, df = 9, CMIN/DF = 1.6, *p* < 0.001, GFI = 0.96, AGFI = 0.94, CFI = 0.97, RMSEA = 0.045)

Fig. 2. Negative affect directly predicting alcohol dependence. AUDIT= Alcohol Use Disorders Identification Test.

\* *p*< 0.001.

**Tolerance**

**Absorption**

**Appraisal**

**Regulation**

**0.69**

**0.91**

**0.93**

**0.77**

**0.13**

-0.03

**0.45**

**- 0.36\*\*\***

**- 0.16\***

**Depression**

**Alcohol dependence on the AUDIT**

0.12

**0.85**

**Anxiety**

**0.33**

**0.40\*\*\***

**0.85**

**0.37\*\*\***

**0.85**

**0.39\*\*\***

**0.14**

**0.18\***

**Stress**

0.05

**Cognitive self-regulation**

**0.20\***

0.01

**0.70**

**0.86**

**Emotional self-regulation**

**0.25\*\***

**0.77**

**0.75**

**0.06**

**Compulsive behaviors**

**Obsessive thoughts**

**0.69**

**0.80**

**Cognitive harm**

**Uncontrollability**

*Fig*. 3. Standardized coefficients for the direct effects of negative affect on alcohol dependence and its indirect effect through distress tolerance, positive and negative metacognitions about alcohol use, and alcohol craving.

OCDS=Obsessive Compulsive Drinking Scale; AUDIT= Alcohol Use Disorders Identification Test.

\* *p*< 0.05.

\*\* *p*< 0.01.

\*\*\* *p*< 0.001.

Table 1

Socio-demographic and clinical characteristics of alcohol-dependent males (*n*=300).

|  |  |
| --- | --- |
|  Characteristics | Mean ±S.D or *n* (*%*) |
| Age, years | 34.00±9.4 |
| Marital status |  |
| Single | 137 (45.7%) |
| Married | 127 (42.3%) |
| Divorced | 36 (12%) |
| Age of onset of alcohol use | 20.5±5.9 |
| Duration of alcohol use | 13.0±7.7 |
| Alcohol craving | 25.8±10.0 |
| Alcohol dependence  | 26.0±7.5 |
| Positive metacognitions about alcohol use | 26.5±8.2 |
| Negative metacognitions about alcohol use | 13.6±4.1 |
| Depression | 9.5±4.0 |
| Anxiety | 9.1±3.9 |
| Stress | 9.7±4.0 |
| Distress tolerance | 42.71±13.0 |

Table 2

Zero-order correlations between global negative affect profile, metagognitions about alcohol use, distress tolerance, alcohol craving, and alcohol dependence in alcohol-dependent males (*n*=300).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Negative affect |  |  |  |  |  |  |  |  |
| 1- Depression on the DASS-21 | - |  |  |  |  |  |  |  |
| 2- Anxiety on the DASS-21 | 0.73\* | - |  |  |  |  |  |  |
| 3- Stress on the DASS-21 | 0.72\* | 0.71\* | - |  |  |  |  |  |
| Metacognitions about alcohol use |  |  |  |  |  |  |  |  |
| 4- Positive metacognitions on the PAMS | 0.30\* | 0.28\* | 0.25\* | - |  |  |  |  |
| 5- Negative metacognitions on the NAMS | 0.14\* | 0.15\* | 0.18\* | 0.34\* | - |  |  |  |
| 6- Distress tolerance on the DTS | -0.25\* | -0.22\* | -0.29\* | -0.18\* | -0.16\* | - |  |  |
| Alcohol problems |  |  |  |  |  |  |  |  |
| 7- Alcohol craving on the OCDS | 0.37\* | 0.34\* | 0.41\* | 0.27\* | 0.14\* | -0.24\* | - |  |
| 8- Alcohol dependence on the AUDIT | 0.32\* | 0.35\* | 0.37\* | 0.28\* | 0.26\* | -0.23\* | 0.45\* | - |

Note.

DASS-21=Depression Anxiety Stress Scale-21; PAMS=Positive Alcohol Metacognitions Scale; NAMS=Negative Alcohol Metacognitions Scale; DTS=Distress Tolerance Scale; OCDS=Obsessive Compulsive Drinking Scale; AUDIT=Alcohol Use Disorders Identification Test.

\* *p*< 0.01.

Table 3

Standardized indirect effects using bootstrapping with 5000 resamples.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Paths | Effect  | *SE boot* | *p* | 95% Bias corrected *CI* |  |
|  |  |  |  | Lower bound | Upper bound |
| Direct paths  |  |  |  |  |  |
| NA →Alcohol craving | 0.40 a | 0.08 | 0.001\*\*\* | 0.23 | 0.54 |
| NA →Alcohol dependence | 0.12 | 0.08 | 0.11 | -0.03 | 0.26 |
| Distress tolerance → Alcohol dependence | -0.03 | 0.06 | 0.53 | -0.17 | 0.08 |
| PM → Alcohol dependence | 0.05 | 0.08 | 0.54 | -0.10 | 0.21 |
| NM → Alcohol dependence | 0.20 | 0.09 | 0.03\* | 0.02 | 0.36 |
| Indirect paths  |  |  |  |  |  |
| NA → Distress tolerance → Alcohol craving | 0.06­ a | 0.03 | 0.009\*\* | 0.02 | 0.13 |
| NA → PM → Alcohol craving | 0.07 a | 0.04 | 0.01\*\* | 0.02 | 0.16 |
| NA → NM → Alcohol craving | 0.02 | 0.02 | 0.22 | -0.02 | 0.07 |
| Distress tolerance→Alcohol craving→ Alcohol dependence | -0.16 a | 0.04 | 0.001\*\*\* | -0.25 | -0.08 |
| PM → Alcohol craving → Alcohol dependence | 0.16 a | 0.04 | 0.001\*\*\* | 0.09 | 0.26 |
| NM → Alcohol craving→ Alcohol dependence | 0.03 | 0.03 | 0.08 | - 0.01 | 0.19 |
| NA → Distress tolerance → Alcohol dependence | 0.02 | 0.02 | 0.06 | -0.004 | 0.10 |
| NA → PM → Alcohol dependence | 0.08 a | 0.03 | 0.008\*\* | 0.02 | 0.16 |
| NA → NM → Alcohol dependence | 0.03  | 0.02 | 0.11 | - 0.01 | 0.14 |
| NA → Alcohol craving → Alcohol dependence | 0.22 a | 0.05 | 0.000\*\*\* | 0.14 | 0.33 |

Note.

*CI*= confidence interval; NA=negative affect; PM=positive metacognitions about alcohol use; NM= negative metacognitions about alcohol use

a Confidence intervals not including zero.

\* *p*<0.05.

\*\* *p*<0.01.

\*\*\* *p* <0.001.