Linking craving to addiction severity in alcohol use disorder: The mediating impact of psychological flexibility

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SUMMARY

Objective: Alcohol Use Disorder (AUD) is a long-term mental health condition marked by alcohol use that is hard to regulate and accompanied by persistent cravings, both of which contribute to increased addiction severity and relapse risk. Psychological flexibility, a critical component of Acceptance and Commitment Therapy (ACT), has been shown to help individuals tolerate cravings without resorting to substance use.

Method: This study investigated the hypothesis that psychological flexibility serves as a mediator in the relationship between alcohol craving and addiction severity in individuals with AUD. The sample consisted of 86 individuals diagnosed with AUD who completed the Penn Alcohol Craving Scale, the Acceptance and Action Questionnaire–Substance Abuse, and the Addiction Profile Index. The potential mediating effect of psychological flexibility was analyzed using a mediation model.

Results: Craving was positively correlated with addiction severity and negatively correlated with psychological flexibility. Psychological flexibility significantly predicted lower addiction severity and partially mediated the relationship between craving and addiction severity, accounting for 29% of the total effect.

Discussion: The findings indicate that psychological flexibility plays a mitigating role in the relationship between craving and addiction severity in AUD. The effectiveness of psychosocial interventions, particularly ACT-based treatments, may be enhanced by targeting psychological flexibility. Further longitudinal and multicenter studies are warranted to confirm these mechanisms and inform clinical practice.

Key Words: Alcohol use disorder, Craving, Psychological flexibility, Addiction severity, Acceptance and Commitment Therapy

INTRODUCTION

Alcohol use disorder (AUD) is a chronic and relapsing psychiatric condition characterized by compulsive alcohol use, impaired control, and withdrawal symptoms (the experience of negative emotional and physical symptoms when not drinking). According to DSM-5, meeting at least two of eleven criteria establish the diagnosis, which can range from mild to severe (1–4).

One key concept in understanding the consequences of AUD is the severity of addiction. Factors influencing addiction severity include the number of diagnostic symptoms present, the degree to which alcohol use impairs daily functioning, the intensity of craving, the type and quantity of substance used, the frequency of use, and the individual's motivation to quit (5) Craving, defined as a strong and persistent urge to consume alcohol or other substances—often accompanied by physiological symptoms—has been recognized as a central feature of AUD. It plays a significant role not only in predicting relapses but also in determining addiction severity (6,7).

Alcohol use disorder (AUD) is recognized as the most common subtype of substance use disorders (SUDs) globally and associated with substantial psychiatric, physical, social, and economic burdens, including millions of deaths annually and signifi-

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cant healthcare costs (8–11). These alarming figures underscore the urgent need for effective clinical interventions and increased research efforts aimed at mitigating the impact of AUD. A comprehensive understanding and classification of alcohol-related issues is essential, especially given the diverse and multifaceted nature of these problems (12–14).

In recent years, psychological flexibility has emerged as a promising therapeutic target in the treatment of AUD and other SUDs. Within the framework of Acceptance and Commitment Therapy (ACT), psychological flexibility involves maintaining awareness of the present moment while engaging in purposeful, value-driven behavior, despite the presence of distressing internal states (15). In contrast, psychological rigidity—particularly in the form of experiential avoidance, which involves efforts to escape or suppress unwanted internal experiences—is viewed as a core pathological process in the development and maintenance of substance and alcohol use disorders. From this perspective, substance use often functions as a maladaptive coping mechanism aimed at diminishing emotional discomfort or psychological distress (16). In such cases, individuals may use alcohol or drugs to temporarily alleviate these aversive internal states. However, although this strategy may offer short-term relief, it tends to perpetuate a harmful cycle in which reliance on substances increases over time. This process undermines the development of more adaptive emotional regulation skills and contributes to heightened psychological inflexibility (17).

Enhancing psychological flexibility is thought to contribute to reduced substance use by improving an individual's ability to tolerate distress and by fostering motivation for behavior change (18,19). Support for this hypothesis comes from interventions like ACT, which have shown significant efficacy in treating individuals with SUDs (20–23). Ulusoy et al. reported that psychological flexibility mediated the relationship between depressive symptomatology and addiction severity, implying that enhanced psychological flexibility may enable individuals to cope with depressive experiences without turning to substances (24).

While previous research has explored the associations between craving and addiction severity, as well as between addiction severity and psychological flexibility, the role of psychological flexibility as a potential mediator in the link between craving and addiction severity remains unexamined. Given that psychological flexibility helps individuals reduce experiential avoidance and engage in meaningful behaviors despite internal discomfort, it may serve as a protective factor that moderates the impact of craving on addiction severity. Therefore, this study aims to investigate the potential mediating role of psychological flexibility in the relationship between craving and addiction severity among individuals with AUD.

METHODS

Sample and Procedure

The study was conducted in a specialized outpatient clinic for alcohol use disorder (AUD) at the Research, Treatment, and Training Center for Alcohol and Substance Dependence (AMATEM) within our hospital. The study sample composed of 86 individuals diagnosed with AUD based on DSM-5 criteria who met the inclusion criteria, agreed to participate voluntarily, and presented to the clinic between May and December 2024. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Ethical approval was granted by the Clinical Research Ethics Committee of a local training and research hospital (Decision No: 2024-05-22, dated March 18, 2024).

An a priori power analysis was performed using the G*Power 3.1 software. The alpha error level was set at .05, the desired statistical power at .80, and the effect size ($f^2 = 0.20$) was determined in accordance with Cohen's (1988) conventional benchmarks and a review of the relevant literature, which indicated an effect size between medium and large. The f^2 value was derived from the contribution of craving and psychological inflexibility to the explained variance in multiple regression models predicting addiction severity. As a result of the

analysis, the required sample size was determined to be 59 participants. However, to account for potential attrition and enhance the study's sensitivity, we recruited a total of 86 participants. A post-hoc power analysis confirmed that this final sample size provided a power level of 0.94, ensuring high statistical robustness for the mediation analysis.

Inclusion criteria were: being between 18 and 65 years of age, having a current diagnosis of AUD based on DSM-5 criteria, not receiving treatment for AUD at the time of application, not meeting diagnostic criteria for any disorder likely to impair judgment (e.g., psychotic disorders or delirium), not being intoxicated during the evaluation, not having any mental or physical condition likely to impair comprehension or data reliability, and not meeting the criteria for another substance use disorder.

Participants were thoroughly briefed on the study procedures and provided with information regarding the content of the questionnaires. Informed consent was obtained from individuals who voluntarily agreed to take part in the research. Alongside the sociodemographic questionnaire, the following psychometric instruments were administered to eligible participants: the Penn Alcohol Craving Scale (PACS), the Acceptance and Action Questionnaire–Substance Abuse (AAQ-SA), and the Addiction Profile Index (API).

Measurements

Sociodemographic data form: Participants' demographic characteristics were obtained through a semi-structured sociodemographic questionnaire developed by the researchers, which included items regarding age, gender, educational background, and marital status.

The Penn Alcohol Craving Scale (PACS): PACS is a frequently employed self-assessment tool developed to measure the extent, recurrence, and duration of alcohol craving during the previous seven days. Developed by Flannery et al. (1999), the PACS consists of five items covering key dimensions of craving, providing a brief but psychometrically sound instrument for both clinical and research settings (25). The scale is suitable for monitoring changes in craving during treatment and assessing the relationship between craving and alcohol use outcomes. It has shown high validity in different populations. Evren et al. (2011) conducted a Turkish adaptation of the PACS and reported that the scale had good internal consistency (Cronbach's alpha = 0.91) and strong test-retest reliability (26). Their findings also supported the construct validity of the scale and confirmed its suitability for use in Turkish-speaking clinical and research populations.

Acceptance and Action Questionnaire-Substance Abuse (AAQ-SA): AAQ-SA was employed to evaluate levels of psychological flexibility. The AAQ-SA is a self-report scale that evaluates psychological flexibility in individuals with substance use problems (27). This 17-item instrument was specifically designed for individuals with substance use disorders (SUDs), comprising two subscales. The first subscale, “Willingness” assesses the individual’s openness to and acceptance of substance-related thoughts, feelings, and urges. The second subscale, “Action” measures the degree of engagement in value-driven behaviors and commitment to change despite internal difficulties. Elevated scores on the scale indicate greater psychological flexibility, whereas lower scores reflect increased psychological rigidity. The Turkish adaptation, including validity and reliability analyses, was carried out by Uygur et al. (28).

Addiction Profile Index (API): Addiction severity was measured using the Addiction Profile Index (API), a 37-item instrument developed by Ögel et al. (5). The scale comprises five subdimensions: patterns of substance use, diagnostic criteria for substance use disorders, the impact of substance use on daily functioning, craving, and motivation to cease substance use. The patterns of substance use subscale assesses the type, frequency, and variety of substances used, as well as problems associated with use. The diagnostic criteria subscale corresponds to core DSM-based addiction indicators, such as tolerance, withdrawal, and loss of control. The impact on daily functioning subscale evaluates the negative consequences of substance use on various life domains, including work, education, family, social relationships, financial status, and legal

issues. The craving subscale measures the intensity of the desire to use substances, reflecting the strength and persistence of urges. Finally, the motivation to cease substance use subscale assesses the individual's readiness and willingness to quit, which is considered a key factor in treatment engagement and recovery While each subscale can be evaluated independently, a weighted total score can also be calculated. Scores below 12 suggest low addiction severity, whereas scores above 12 reflect more severe levels of addiction.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS Statistics, Version 26) for descriptive and correlational analyses, and Jamovi software for mediation analysis. Descriptive statistics were applied to summarize the sample characteristics. To test the main hypothesis of the study, a mediation analysis was performed using the medmod module in Jamovi. The analysis aimed to explore the mediating role of psychological flexibility in the association between alcohol craving and addiction severity. All statistical inferences were based on a significance threshold of $p < 0.05$, and 95% confidence intervals were calculated for the parameter estimates.

RESULTS

A total of 86 individuals participated in the study. Of the participants, 10 (11.6%) were women and 76 (88.4%) were men. The mean age was 45.2±11 years. Among the 86 participants, 42 (48.8%) were married and 23 (26.7%) were single. Fifty-two participants (60.5%) reported no previous treatment history. Detailed socio-demographic characteristics are presented in Table 1.

According to skewness and kurtosis values, all scales exhibited a normal distribution.

As shown in Table 2, Pearson correlation analysis indicated a significant negative correlation between addiction severity (API) and Willingness (AAQ-SA) ($r = -0.557$, $p < 0.001$), as well as a significant positive correlation between addiction severity and alcohol craving (PACS) ($r=0.514$, $p<0.001$). Willingness (AAQ-SA) was negatively correlated with alcohol craving ($r=-0.347$, $p< 0.01$). However, the correlations between Action (AAQ-SA) and the other variables were not statistically significant.

Table 1: Sociodemographic characteristics of the participants

Age (Mean–SE)	45.2–11	
	N	%
Sex		
Female	10	11.6%
Male	76	88.4%
Education Level		
Primary School	23	26.7%
Middle School	25	29.1%
High School	29	33.7%
University	8	9.3%
Marital Status		
Married	42	48.8%
Single	23	26.7%
Having Children		
Yes	58	67.4%
No	27	31.4%
Previous Treatment		
Yes	33	38.4%
No	52	60.5%

To further clarify the potential mediating effect of psychological flexibility on the relationship between alcohol craving and addiction severity, a mediation analysis was conducted. Since the "action" subscale did not correlate with addiction severity, it was not included in subsequent analyses, and the mediation analysis was performed using the "willingness" subscale. The model explained 51% of the variance observed in addiction severity. The findings revealed that alcohol craving was significantly associated with lower psychological flexibility ($\beta= -0.347$, 95% CI: -0,97 to -0.27, $p< 0.001$), while psychological flexibility showed a significant association with addiction severity ($\beta=-0.431$, 95% CI: -0.15 to -0.06, $p < 0.001$). Furthermore, alcohol craving demonstrated a significant direct positive effect on addiction severity ($\beta=0.365$, 95% CI: 0.09 to 0.23, $p< 0.001$).

Findings from the mediation analysis indicated that psychological flexibility served as a partial mediator in the relationship between alcohol craving and addiction severity (indirect effect: $\beta=0.150$, 95%

Table 2: Relationships between scale scores (Pearson correlation coefficients)

	API	Action (AAQ-SA)	Willingness (AAQ-SA)	PACS
API	-			
Action (AAQ-SA)	0,021	-		
Willingness (AAQ-SA)	-0,557***	-0,140		
PACS	0,514***	-0,129	-0,347**	-

p<0,01,*p<0,001, API: Addiction Profile Index, AAQ-SA:Acceptance and Action Questionnaire-Substance Abuse, PACS: The Penn AlcoholCraving Scale

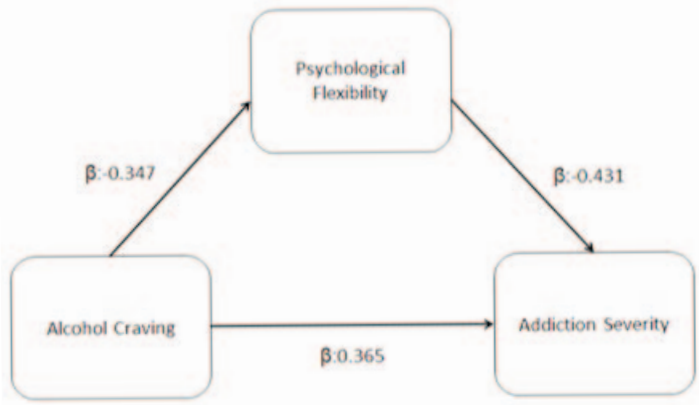

Figure 1. The standardized path coefficients of the tested model.

CI 0.02 to 0.11, p=0.005), explaining 29% of the overall effect. The remaining 71% was attributable to the direct influence of alcohol craving on addiction severity. A comprehensive summary of the mediation model results is presented in Table 3.

Figure 1 illustrates the standardized path coefficients of the tested model. The direct relationship between alcohol craving and addiction severity remained significant. The Sobel test confirmed the significance of the mediation effect (one-tailed $p < 0.001$; two-tailed $p < 0.001$).

DISCUSSION

Current literature shows that craving is a significant challenge for patients with AUD and is directly related to clinical severity as observed in other substance use disorders (6,7,29,30). Within this framework, the current findings are consistent with existing literature, revealing a significant positive relationship between craving and the severity of addiction. Furthermore, the results support the notion that craving functions as a significant predictor of addiction severity, in line with previous empirical evidence (5–7,29,31). While the link between craving and AUD is well-documented, the psychological mechanisms that sustain or intensify this relationship are not yet fully understood. Existing literature suggests that psychological flexibility is negatively associated with the severity of addiction (17,24). To date, empirical investigations have not directly addressed the potential mediating role of psychological flexibility in the association between alcohol craving and addiction severity. The present study, utilizing a clinical sample of individuals diagnosed with AUD, provides evidence that psychological flexibility significantly mediated this relationship, suggesting a potential psychological pathway contributing to addiction severity in the context of craving. In our study, psychological flexibility partially mediated the relationship between alcohol craving and addiction severity, explaining 29% of the total effect. Notably, elevated craving levels were linked to reduced psychological flexibility. Furthermore, an inverse association was observed between psychological flexibility and the severity of addiction.

Psychological rigidity—a core construct within Acceptance and Commitment Therapy (ACT)—refers to attempts to avoid or suppress unpleasant internal experiences(32). This concept overlaps with experiential avoidance and difficulties engaging in valued behavior (33). Both have been linked to alcohol/substance use disorders. From this perspective, craving—defined as an overwhelming urge to use alcohol accompanied by relief-oriented thoughts—may lead individuals to use substances to escape internal experiences. Such avoidance can disrupt value-based action (16,17). Willingness and acceptance represent the functional alternative within the psychological flexibility model (32,33). In our study, the AAQ-SA scores, particularly the willingness subscale, were negatively associated with craving and addiction severity, which supports this theoretical interpretation.

Several studies highlight the role of experiential avoidance in substance use. Forsyth et al. suggested

Table 3: Results of indirect and direct effects from the mediation analysis model

				95% CI				
Model	Model Pathway	Estimate	SD	Lower	Upper	Beta	Z	p
Indirect Effect	A.C.>P.F.>A.S	0.0653	0.0232	0.0200	0.1107	0.150	2.82	0.005
Components	A.C.>P.F.	-0.6153	0.1793	-0.9667	-0.2640	-0.347	-3.43	< .001
	P.F. > A.S.	-0.1062	0.0214	-0.1482	-0.0642	-0.431	-4.95	< .001
Direct Effect	A.C.>A.S	0.1594	0.0380	0.0849	0.2338	0.365	4.19	< .001
Total Effect	A.C.> A.S	0.2247	0.0406	0.1450	0.3043	0.514	5.53	< .001

A.C.: Alcohol Craving, P.F.: Psychological Flexibility, A.S: Addiction Severity

that avoidance of distressing internal states increased substance use among veterans (34). Stewart et al. found that experiential avoidance predicted coping-motivated alcohol use (35). The short-term effectiveness of using substances to avoid distressing internal experiences is well-documented, as it provides immediate relief from aversive thoughts and emotions, thereby reinforcing the behavior (36). In line with this perspective, Ulusoy et al. demonstrated that psychological inflexibility mediated depressive symptoms and addiction severity (24). A meta-analysis (2025) also reported a moderate positive association between experiential avoidance and substance use (37). Although craving was not directly examined in those studies, these findings collectively indicate that avoidance-based processes are relevant in AUD. Our findings further support earlier studies by demonstrating an inverse relationship between psychological flexibility and the severity of addiction.

AUD is defined as a psychiatric disorder that involves intense craving for alcohol, difficulty coping with these cravings, physical symptoms, and impairment in functioning in areas of one's life while attempting to avoid these challenges or the effects of alcohol (4). Within this definition, craving is explicitly included, along with indications of experiential avoidance and psychological rigidity. The severity of addiction increases as the number and intensity of these DSM-5 diagnostic criteria increase (4). Furthermore, the AUD literature consistently shows that the severity of craving predicts the severity of addiction (5). In this regard, the primary outcome of our research suggests that psychological flexibility plays a significant mediating role in linking craving to increased addiction severity, thereby helping explain how craving may relate to clinical impairment.

In current study, psychological flexibility partially mediated the relationship between alcohol craving and addiction severity, explaining 29% of the total effect. This effect was particularly evident in the willingness subscale. The remaining 71% can be attributed to the direct effect between alcohol craving and addiction severity and other possible mediating factors. These include factors found in the literature such as impulsive behavior, compulsive drinking, and deficiencies in emotion regulation skills (38–40). However, other sub-dimensions of psychological attachment that have not yet been sufficiently researched, such as cognitive fusion, rigid attachment to the conceptual self, and weak contact with the present moment, may also mediate this relationship. It is clear that more research is needed in this area.

These findings may contribute to a deeper understanding of psychosocial intervention mechanisms and highlight flexibility-targeted approaches as clinically relevant. In particular, ACT-based interventions may complement craving-reduction strategies by helping individuals tolerate internal experiences rather than suppress them. Through these interventions, individuals may move toward value-directed living and benefit from abstinence or harm reduction efforts more effectively.

This research is not without limitations. First, the use of a cross-sectional design restricts the ability to draw conclusions about causal relationships within the tested mediation model. Employing a longitudinal approach in future studies would provide a clearer understanding of the directional links among variables. Another methodological limitation concerns the exclusive use of self-report measures to assess addiction severity and related psychological constructs. While these tools are practical and widely used, relying solely on self-reports introduces potential biases—including social desirability, underreporting of substance use, and individual differences in insight—which may affect the accuracy of the findings. Also, the exclusive use of self-report measures may contribute to conceptual overlap between experiential constructs, which should be considered when interpreting the mediation effect. Additionally, the study was conducted in a single clinical center, which may limit the generalizability of the results due to potential sample homogeneity, treatment culture effects, or regional clinical practices that might differ from other settings. A further constraint is the limited representation of female participants, which restricted the ability to examine gender-specific effects. Although the overall findings were statistically significant, the small number of women in the sample prevented a meaningful analysis of gender differences. The limited number of female participants—and the lower-than-expected female-to-male ratio—constitutes a

limitation both in terms of representing all women diagnosed with AUD and in terms of accurately reflecting the overall sample. Moreover, the study did not explore the distinct dimensions of psychological flexibility as potential mediators in the relationship between craving and addiction severity, which represents an additional limitation. Including these components in future research with larger samples may provide more precise insights to guide the development of new treatment and relapse-prevention strategies. Future studies should also incorporate larger, multicenter, and cross-cultural samples to strengthen the generalizability and applicability of the findings to broader populations.

In conclusion, this study highlights psychological flexibility as a key mediating factor linking craving to the severity of addiction in individuals with AUD. Our findings suggest that individuals with intense cravings are more predisposed to psychological rigidity, which increases addiction severity. Our study adds to the growing body of literature emphasizing the importance of acceptance-based approaches such as ACT in AUD treatment by identifying psychological flexibility as one of the key mechanisms underlying this relationship. Our results highlight the potential benefits of targeting psychological flexibility in therapeutic interventions aimed at reducing craving-related functional impairment and enhancing treatment outcomes in AUD. Future longitudinal and multicenter research is warranted to elucidate the underlying mechanisms more thoroughly, thereby informing the development of effective interventions and relapse prevention strategies.

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