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Research Article

The effect of Pilates-Assisted acceptance and commitment therapy (ACT)-based mindfulness training on the self-esteem and social functioning of individuals diagnosed with substance use disorder

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Abstract

Objective: This study aimed to examine the association between Pilates-assisted Acceptance and Commitment Therapy (ACT)-based mindfulness training and changes in social functioning and self-esteem among individuals diagnosed with substance use disorder (SUD).

Methods: A quasi-experimental pre-test, post-test, and follow-up design with experimental and control groups was employed. The study was conducted between September 1, 2018, and November 22, 2019, at an inpatient Alcohol and Substance Addiction Treatment Center (AMATEM). Seventy-nine inpatients with SUD participated. The experimental group received 12 Pilates sessions and 9 ACT-based mindfulness sessions in addition to routine treatment. Social functioning was assessed using the Social Functioning Scale (SFS), and self-esteem was measured using the Coopersmith Self-Esteem Inventory (CSEI). Effect sizes were calculated using partial eta-squared (η^2p) and Cohen's d.

Results: Social functioning scores increased over time in both groups. However, the group × time interaction was not statistically significant for total SFS scores ($p = .758$, partial $\eta^2 = .001$) or CSEI scores ($p = .571$, partial $\eta^2 = .004$). A significant main effect of time was observed for social functioning ($p < .001$, partial $\eta^2 = .267$). At the three-month follow-up, the between-group difference in total SFS scores corresponded to a moderate effect size (Cohen's $d = 0.50$), whereas the effect size for self-esteem was negligible (Cohen's $d = 0.05$).

Conclusion: Participation in the Pilates-assisted ACT-based mindfulness program was associated with improvements in social functioning within an inpatient addiction treatment setting. Although longitudinal group differences were not statistically significant, the moderate effect size observed at follow-up suggests potential clinical relevance. Given the quasi-experimental design, causal inferences cannot be drawn, and randomized controlled studies are warranted.

Keywords: Acceptance and Commitment Therapy, Mindfulness, Pilates, Self-Esteem, Social Functioning, Substance Use Disorder

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Introduction

Substance use disorder (SUD), as defined by the World Health Organization, refers to the harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs (WHO, 2022). SUD remains a growing global concern due to its increasing prevalence and its profound impact on individuals, families, and societies. The disorder is associated with numerous physical, psychological, and social consequences, making it one of the most pressing issues in psychiatry (UNODC, 2023).

Substance use disorders have extensive and multifaceted impacts, including personal health deterioration, family disruption, social disintegration, and significant economic burdens. Understanding the factors influencing treatment processes and motivation for recovery is crucial for designing effective interventions. According to the Substance Abuse and Mental Health Services Administration, motivation for change is a key component in addressing substance misuse, as it relates to the probability that a person will enter into, continue, and adhere to a specific change strategy (SAMHSA,2019).

Research highlights that SUD is driven by various underlying factors, including low self-esteem, childhood trauma, socioeconomic disparities, and familial dynamics, all of which contribute to the complexity of addiction (Volkow & Blanco, 2023). Self-esteem, in particular, has been identified as a critical factor in both the initiation and continuation of substance use behaviors (Wright & Jackson, 2023). Additionally, SUD significantly impairs social functioning by disrupting interpersonal relationships and limiting participation in pro-social activities (Moska et al., 2021). This highlights the critical role of addressing self-esteem and social functionality as integral components of addiction treatment, as these factors not only influence the initiation and persistence of substance use behaviors but also significantly impact the effectiveness of therapeutic interventions and long-term recovery outcomes. Enhancing these factors can foster resilience, improve interpersonal relationships, and support individuals in achieving sustainable behavioral changes (Xia et al., 2022).

Traditional medical approaches alone have proven insufficient to combat addiction effectively, leading to a growing emphasis on holistic and psychosocial interventions worldwide. Over the past few decades, mindfulness-based interventions have increasingly gained recognition as evidence-based approaches for treating various forms of addiction (Bowen et al., 2021). Among these approaches, ACT has emerged as a promising method, demonstrating efficacy in improving emotional regulation, reducing relapse rates, and fostering long-term recovery (Aravind et al., 2024). Moreover, somatic practices such as Pilates have shown potential for enhancing body awareness, reducing stress, and promoting psychological well-being, making them valuable adjuncts to traditional treatment (Davis, 2024).

Given the complexity and widespread impact of SUD, there is a pressing need for studies exploring innovative and integrative approaches to addiction treatment. This quasi-experimental study **examines** the effects of Pilates-assisted ACT-based mindfulness training on the self-esteem and social functioning of individuals diagnosed with SUD. The findings aim to contribute to the growing body of literature on the psychosocial dimensions of addiction recovery and offer practical insights for clinical practice.

Accordingly, to empirically assess the effects of this integrative intervention on key psychosocial outcomes, the following hypotheses were formulated and tested.

H0-1: The intervention does not produce a statistically significant difference between the experimental and control groups in self-esteem scores, as measured by the Coopersmith Self-Esteem Inventory, at post-test and/or follow-up assessments.

H0-2: The intervention does not produce a statistically significant difference between the experimental and control groups in social functioning scores, as measured by the Social Functioning Scale, at post-test and/or follow-up assessments.

H1: The Pilates-assisted ACT -based mindfulness intervention leads to an increase in self-esteem scores, as measured by the Coopersmith Self-Esteem Inventory.

H2: The Pilates-assisted ACT-based mindfulness intervention leads to an increase in social functioning scores, as measured by the Social Functioning Scale.

Methods

Research Design

This quasi-experimental study employed a pre-test, post-test, and follow-up design, incorporating both experimental and control groups to evaluate the effects of the intervention.

Study Setting and Duration

The research was conducted at the Treatment Center for Alcohol and Substance Addiction (AMATEM), part of the Elazığ Mental Health and Diseases Hospital, between September 1, 2018, and November 22, 2019.

Population and Sample

The study population consisted of 102 patients who met the inclusion criteria and completed treatment at AMATEM between September 1, 2018, and March 1, 2019. Sample size determination was based on **an a priori power analysis**, which indicated a requirement of 42 participants (21 in each group) at a 0.05 significance level, **a** 0.95 confidence interval, **an** effect size of 0.8, and 0.95 statistical power. Although medium effect sizes are commonly assumed in behavioral research, a large effect size (Cohen's d = 0.80) was selected in the present study due to the multimodal and intensive structure of the intervention and consistent evidence from prior ACT-based **interventions**. A total of 79 individuals completed the study, with 31 in the experimental group and 48 in the control group.

The a priori power analysis determined the minimum required sample size (n = 42); however, all eligible patients admitted during the study period were invited to participate using a consecutive sampling approach, **which resulted in a larger final sample.** Participants were allocated to the control and experimental groups using a sequential, non-random allocation procedure based on admission period, consistent with the quasi-experimental design. Group sizes were unequal due to the non-randomized study design and participant attrition. Some participants who completed baseline assessments did not attend the intervention sessions and were therefore reassigned to the control group. **Additional losses occurred due to the inability to reach participants during follow-up.** These processes are detailed in the **CONSORT-style flow diagram** (Figure 1).

Inclusion Criteria

Participants were included if they:

- Were literate.
- Agreed to participate after being informed about the **purpose of the study.**
- Were open to cooperation and communication.
- Were aged 18–65 years.
- Were diagnosed with substance use disorder based on DSM-5 criteria.
- Had experienced a withdrawal period.
- Were not engaged in a regular exercise program.
- Had no physical disabilities, medical conditions (e.g., coronary heart failure, hypertension, epilepsy), or medication use (e.g., beta-blockers) preventing moderate exercise participation.

Diagnostic Procedures and Clinical Characteristics

All diagnoses of substance use disorder were established by a licensed psychiatrist in accordance with DSM-5 criteria as part of routine inpatient clinical assessments. **No additional structured or semi-structured diagnostic interviews were conducted for research purposes.** In accordance with DSM-5 classification, alcohol use disorder was considered within the broader category of substance-related and addictive disorders and was

therefore included within the study population together with other substance use disorders treated at the AMATEM inpatient unit.

Information regarding comorbid psychiatric conditions and psychotropic medication use was obtained from medical records. According to routine clinical admission policies, individuals with psychotic disorders or active psychotic symptoms, as well as those requiring acute psychiatric intervention, were not admitted to the unit and were therefore not included in the study population. According to routine clinical admission policies, individuals with psychotic disorders or active psychotic symptoms, as well as those requiring acute psychiatric intervention, were not admitted to the unit and therefore were not included in the study population.

Clinical Admission Criteria and Exclusion Considerations

The inpatient treatment unit in which the study was conducted does not admit individuals with psychotic features or severe cognitive impairment as part of its routine clinical admission criteria. Therefore, individuals with active psychotic symptoms or significant cognitive deficits were not present in the study population.

Additional exclusion criteria included the presence of severe medical or neurological conditions that limit physical activity, current participation in another structured psychosocial or exercise-based intervention program, and the inability to complete baseline or follow-up assessments.

Intervention

The intervention was conducted in the AMATEM inpatient unit training facility. All participants in both groups received routine inpatient care provided at the AMATEM unit throughout their hospitalization period. Standard care included the SAMBA (Smoking, Alcohol, and Substance Addiction Treatment Program) psychoeducation sessions, routine medical management, nursing care, and structured daily ward activities. These activities did not include any structured Pilates exercises, ACT–based mindfulness training, or other formal exercise or psychotherapy programs beyond standard care. Thus, the experimental intervention was delivered in addition to routine care, whereas the control group received routine care only.

The experimental group additionally received a Pilates-assisted ACT–based mindfulness intervention. The intervention consisted of 12 Pilates sessions and 9 ACT-based mindfulness sessions delivered over a 3-week period following the completion of the acute withdrawal phase.

Pilates sessions were conducted in a group format, five times per week, with each session lasting approximately 45–50 minutes. Sessions were supervised by a certified exercise instructor employed by the hospital and focused on breathing exercises, core stabilization, stretching, and controlled movements adapted to the participants' physical capacities.

ACT-based mindfulness sessions were conducted in a group format three times per week, with each session lasting approximately 45–50 minutes. These sessions were delivered by the researcher, who holds formal training and certification in ACT and addressed core ACT processes, including mindfulness, acceptance, cognitive defusion, values clarification, and committed action.

The intervention was designed to target shared psychosocial processes associated with substance-related disorders, including impaired social functioning, reduced psychological flexibility, and experiential avoidance, through the integration of structured physical activity and mindfulness-based psychological training. Intervention fidelity was supported through the use of predefined session structures and standardized content delivered by trained providers. Formal fidelity checklists or independent fidelity assessments were not conducted.

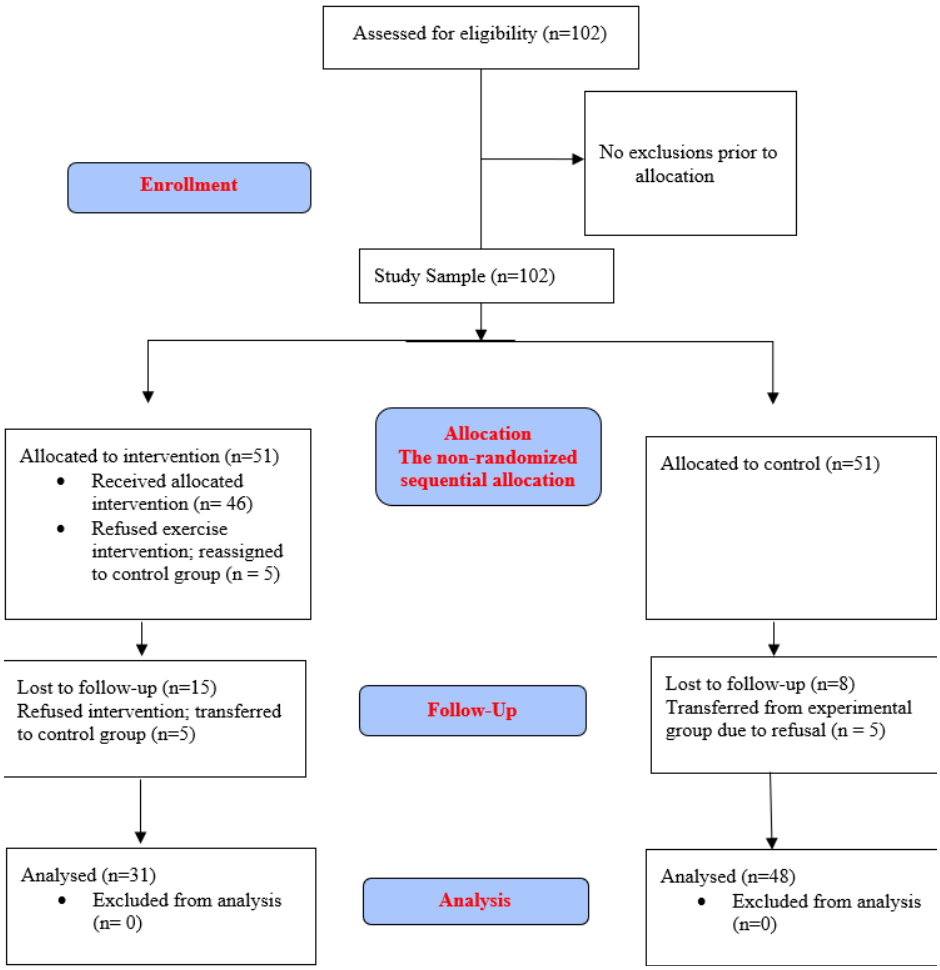

Figure 1. *CONSORT-style flow diagram for quasi-experimental design*

Research Variables

The dependent variables of the study were social functioning and self-esteem scores. The independent variables were Pilates-assisted exercise and ACT-based mindfulness training.

Data Collection Tools

Personal Information Form: The form, developed by the researchers, included 15 items designed to collect sociodemographic data and substance use characteristics, such as age, marital status, and education level.

Coopersmith Self-Esteem Inventory (CSEI): Developed by Coopersmith (1986) and adapted for Turkish populations by Tufan and Turan (1987), the inventory consists of 25 items rated as "like me" or "not like me." Scores range from 0 to 100, with higher scores indicating greater self-esteem. Cronbach's alpha for this study was 0.64 (Coopersmith, 1986; Tufan & Turan, 1987).

Social Functioning Scale (SFS): The SFS, created by Birchwood et al. (1990) and validated for Turkish use by Erakay (2001), assesses social role functioning across seven subscales. Total scores range from 0 to 223, with higher scores indicating better social functioning. Cronbach's alpha for this study was 0.89 (Birchwood et al., 1990; Erakay, 2001).

Data Collection

Data were collected in three stages: pre-intervention, post-intervention (Day 21), and follow-up (Month 3). Pre-intervention and post-intervention data were gathered through face-to-face interviews, while follow-up data were collected via phone calls.

Data collection for the control group was completed before the experimental group.

All participants were recruited from the AMATEM inpatient unit and were hospitalized during the study period. A consecutive sampling approach was employed, whereby all eligible inpatients admitted to the unit during the data collection period and meeting the inclusion criteria were invited to participate. Randomization was not feasible due to logistical and ethical constraints inherent in the inpatient clinical setting. Therefore, data from the control group were collected prior to those of the experimental group. To minimize potential temporal bias, all data collection procedures were conducted within the same clinical unit under standardized ward conditions, treatment routines, and staffing, and within a predefined and limited time frame.

Follow-up assessments at the third month were conducted via telephone interviews due to participants' discharge from the inpatient unit and feasibility considerations. During telephone administration, all scale items were read verbatim by the researcher, and responses were obtained directly from the participants. No proxy respondents (e.g., relatives or caregivers) were involved. The same standardized instructions used in face-to-face assessments were applied to ensure consistency across data collection methods.

Statistical Analysis

The collected data were entered into a computerized database and analyzed using statistical software. A p-value of < 0.05 was considered statistically significant. Normality assumptions were assessed prior to parametric analyses. Descriptive statistics were calculated as frequencies and percentages for categorical variables and means, standard deviations, and minimum–maximum values for continuous variables.

Comparisons of categorical variables between groups were performed using the chi-square test. Differences in mean scale scores between the experimental and control groups were examined using the independent samples t-test, and Least Significant Difference (LSD) post hoc analyses were applied when additional comparisons were required. Changes in scale scores within groups over time were analyzed using repeated measures analysis of variance (Repeated Measures ANOVA).

Given the number of comparisons conducted across multiple subscales and time points, no formal correction for multiple comparisons (e.g., Bonferroni adjustment) was applied, as this approach may be overly conservative in exploratory psychosocial research. Therefore, findings with p-values close to the significance threshold should be interpreted with caution, and emphasis was placed on consistency and clinical relevance rather than isolated statistically significant results.

In addition to p-values, effect sizes were calculated to quantify the magnitude of the observed effects. Partial eta-squared (η^2p) values were reported for mixed repeated-measures analyses. For between-group comparisons at the 3-month follow-up, Cohen's d was calculated to facilitate the clinical interpretation of primary outcomes.

Ethical Considerations

The study received ethical approval from the Faculty of Nursing Ethics Committee (Approval No. 2018-6/9, dated July 12, 2018). Written permission was obtained from the hospital administration prior to the study. Participants were informed about the study objectives, and informed voluntary consent was obtained in accordance with the principle of respect for autonomy. Confidentiality was maintained throughout the study in accordance with the ethical principles of human dignity and privacy protection.

Declaration of AI Use

In the preparation of this manuscript, generative artificial intelligence (AI) tools were utilized to enhance the clarity and coherence of the text. Specifically, ChatGPT (version 5.2, OpenAI) was employed for language refinement, academic structuring, and ensuring compliance with journal formatting guidelines. The AI tool was not used

for data analysis, results interpretation, or content generation beyond language assistance. All intellectual and conceptual contributions remain solely the responsibility of the authors.

Results

Table 1 presents a comparison of the descriptive characteristics of the study participants. Of the patients in the experimental group, 51.6% were aged 19–24, 58.1% were primary school graduates, 71.0% were single, 67.8% were self-employed, 58.1% had a moderate income, 71.0% had parents who lived together, and 61.3% lived in Southeastern Anatolia. Of the patients in the control group, 41.7% were aged 19–24, 50.0% were primary school graduates, 77.1% were single, 62.4% were self-employed, 54.2% had a moderate income, 79.2% had parents who lived together, and 61.3% lived in Southeastern Anatolia. Comparison of the groups' descriptive characteristics showed no statistically significant differences ($p > .05$).

Table 1. Comparison of Descriptive Characteristics of Groups

Characteristics	Experimental (n=31)		Control (n=48)		Test and p value
	n	%	n	%	
Age					
19-24	*16*	*51.6*	*20*	*41.7*	$X^2=0.90$
25-30	*9*	*29.0*	*15*	*31.3*	*p=0.63*
31 and above	*6*	*19.4*	*13*	*27.1*	
Educational Level					
Literate	*7*	*22.5*	*7*	*14.6*	$X^2=2.57$
Primary school graduate	*18*	*58.1*	*24*	*50.0*	*p=0.27*
High school graduate and above	*6*	*19.4*	*17*	*35.4*	
Marital Status					
Married	*9*	*29.0*	*11*	*22.9*	$X^2=0.37$
Single	*22*	*71.0*	*37*	*77.1*	*p=0.54*
Occupation					
Self-employment	*21*	*67.8*	*30*	*62.4*	$X^2=0.22$
Government official	*5*	*16.1*	*9*	*18.8*	*p=0.89*
Unemployed	*5*	*16.1*	*9*	*18.8*	
Perception of Income Status					
Low	*13*	*41.9*	*22*	*45.8*	$X^2=011$
Moderate	*18*	*58.1*	*26*	*54.2*	*p=0.73*
Birthplace					
Eastern Anatolia	*9*	*29.0*	*17*	*35.4*	$X^2=0.35$
Southeastern Anatolia	*19*	*61.3*	*27*	*56.3*	*p=0.83*
Other	*3*	*9.7*	*4*	*8.3*	
Relationship Status of Parents					
Together	*22*	*71.0*	*38*	*79.2*	$X^2=4.16$
Divorced/Decedent	*1*	*3.2*	*5*	*10.4*	*p=0.12*
	8	*25.8*	*5*	*10.4*	

When the substance use characteristics of the groups were examined, 71.0% of those in the experimental group were found to use heroin, 51.6% started using substances when they were younger than 18 years old, more than half (58.1%) had used substances for less than 5 years, and the vast majority (87.1%) started using substances in a close-friend environment. 77.4% of individuals in the experimental group had previously applied to a health center to quit substance use; similarly, 71.0% had applied to AMATEM before, 74.2% had no individuals using the substance in their family, and

64.5% had been sober for less than 10 months. In the control group, 47.9% of individuals stated that they used heroin, 64.6% started using substances when they were younger than 18 years old, 56.3% had used substances for more than 5 years, and the vast majority (89.6%) stated that they started using substances in a close-friend environment. 58.3% of the individuals in the control group had previously applied to a health center to quit using; similarly, 54.2% had applied to AMATEM before, 81.3% had no individuals using the substance in their family, and 75.0% had been sober for less than 10 months (Table 2). A comparison of the substance use characteristics between the groups showed no statistically significant differences ($p > .05$).

Table 2. Comparison of Substance Use Characteristics of Groups

Characteristics	Experimental (n=31)		Control (n=48)		Test and p value
	n	%	n	%	
Type of Substance					
Heroin	*22*	*71.0*	*23*	*47.9*	$X^2=4.78$
Alcohol	*2*	*6.5*	*3*	*6.3*	*p=0.31*
Marijuana	*1*	*3.2*	*2*	*4.2*	
Opiate drug	*1*	*3.2*	*5*	*10.4*	
Multiple substances	*5*	*16.1*	*15*	*31.3*	
Starting Age for Substance Use					
<18	*16*	*51.6*	*31*	*64.6*	$X^2=1.31$
≤18 and above	*15*	*48.4*	*17*	*35.4*	*p=0.25*
Substance Use Duration					
≤60 months	*18*	*58.1*	*21*	*43.8*	$X^2=1.54$
61 months and above	*13*	*41.9*	*27*	*56.3*	*p=0.21*
First Acquaintance with Substance					
Close Friend Environment	*27*	*87.1*	*43*	*89.6*	$X^2=0.11$
Social environment	*4*	*12.9*	*5*	*10.4*	*p=0.73*
Application to a Health Center to Quit Substance Use					
Yes	*24*	*77.4*	*28*	*58.3*	$X^2=3.05$
No	*7*	*22.6*	*20*	*41.7*	*p=0.08*
Application to Elazığ AMATEM Unit to Quit Substance Use					
Yes	*22*	*71.0*	*26*	*54.2*	$X^2=2.23$
No	*9*	*29.0*	*22*	*45.8*	*p=0.13*
Substance Use in the Family					
Yes	*8*	*25.8*	*9*	*18.8*	$X^2=0.55$
No	*23*	*74.2*	*39*	*81.3*	*p=0.45*
Duration of Staying Sober					
≤10 months	*20*	*64.5*	*36*	*75.0*	$X^2=1.01$
11 months and above	*11*	*35.5*	*12*	*25.0*	*p=0.31*

Table 3 presents the mean SFS and CSEI scores of both groups at pre-test, post-test (Day 21), and 3-month follow-up. Within-group analyses (Tables 4 and 5) indicated statistically significant changes over time in several SFS subscales. In the experimental group, significant differences were observed for interpersonal behavior ($p = 0.04$), pro-social activities ($p = 0.01$), recreation ($p = 0.03$), and total SFS scores ($p = 0.01$). Post hoc analyses (LSD) indicated that these differences were primarily attributable to baseline measurements.

In the control group, significant differences were observed in the independence–competence ($p = 0.01$) and employment/occupation ($p = 0.02$) subscales. Post hoc analyses revealed that the independence–competence difference was associated with baseline measurements, whereas the employment/occupation difference was associated with the third-month assessment. These within-group findings should be interpreted cautiously in light of the overall interaction results.

Table 3. Comparison of the Mean Scores of the Groups Obtained from SFS and CSEI Pre-Test, 21st Day and 3rd Month Measurements

Measurement Time	Groups	Social Functioning Scale								Self-Esteem Inventory
		Social Engagement/ Withdrawal	Interpersonal Behavior	Pro-Social Activities	Recreation	Independence/ competence	Independence/ performance	Employment /Occupation	Total Scale	
Pre-test	*Experimental*	*9.06±2.08*	*6.67±3.71*	*16.35±9.06*	*15.83±7.81*	*24.16±8.08*	*22.90±6.67*	*5.77±2.09*	*107.90±31.01*	*54.32±17.55*
	Control	*8.47±2.57*	*5.89±3.25*	*14.68±9.92*	*14.64±6.40*	*26.12±9.15*	*20.97±6.59*	*6.02±1.32*	*98.75±24.65*	*52.83±12.53*
	Test and p value	*t=1.06, p=0.29*	*t=0.98, p=0.32*	*t=0.75, p=0.45*	*t=0.74, p=0.46*	*t=0.97, p=0.33*	*t=1.26, p=0.21*	*t=0.64, p=0.52*	*t=1.45, p=0.15*	*t=0.44, p=0.66*
21st day	*Experimental*	*9.64±1.72*	*11.06±10.94*	*23.64±12.21*	*17.22±8.55*	*24.41±9.08*	*22.58±7.57*	*6.00±1.77*	*114.58±35.21*	*52.77±14.54*
	Control	*8.27±2.20*	*5.45±2.07*	*16.14±12.56*	*14.04±6.32*	*29.89±5.27*	*22.52±5.01*	*6.35±1.04*	*102.68±21.91*	*49.58±10.65*
	Test and p value	*t=2.94,* **p=0.004**	*t=3.46,* **p=0.001**	*t=2.61,* **p=0.01**	*t=1.90, p=0.06*	*t=3.39,* **p=0.001**	*t=0.04, p=0.96*	*t=1.13, p=0.26*	*t=1.85, p=0.68*	*t=1.12, p=0.26*
3rd Month	*Experimental*	*9.64±1.72*	*11.25±10.85*	*23.70±12.28*	*17.51±8.52*	*24.38±9.08*	*22.64±7.56*	*6.00±1.77*	*115.16±35.11*	*52.78±14.56*
	Control	*9.14±2.62*	*6.41±2.96*	*15.38±9.91*	*14.62±6.72*	*28.12±6.62*	*21.58±6.16*	*5.79±1.42*	*101.10±22.89*	*53.41±12.66*
	Test and p value	*t=0.93, p=0.35*	*t=2.93,* **p=0.004**	*t=3.29,* **p=0.001**	*t=1.67, p=0.09*	*t=2.10,* **p=0.03**	*t=0.68, p=0.49*	*t=0.57, p=0.56*	*t=2.18,* **p=0.03**	*t=0.20, p=0.83*

Data are presented as mean ± standard deviation (SD). Between-group comparisons at each measurement time were conducted using independent samples t-tests. A p value < .05 was considered statistically significant.

In addition to p-values, effect sizes were calculated to aid clinical interpretation. Partial eta-squared (η^2p) was reported for mixed repeated-measures analyses to quantify the magnitude of time and time × group effects. The group × time interaction for total social functioning was not statistically significant ($F(1,75) = 0.096$, $p = .758$), with a negligible effect size (partial $\eta^2 = .001$), indicating no differential change between the groups over time. However, a significant main effect of time was observed ($F(1,75) = 27.317$, $p < .001$, partial $\eta^2 = .267$), reflecting a substantial overall improvement across both groups. Similarly, the group × time interaction for self-esteem was not statistically significant ($F(1,77) = 0.323$, $p = .571$), with a very small effect size (partial $\eta^2 = .004$). At the 3-month follow-up, the between-group effect size for total social functioning was moderate (Cohen's $d = 0.50$), whereas the effect size for self-esteem was negligible (Cohen's $d = 0.05$).

Discussion

The present study examined changes in social functioning and self-esteem among inpatients with substance use disorder who participated in a Pilates-assisted ACT-based mindfulness program in addition to routine treatment. The findings indicate that social functioning scores increased over time in both groups, with a significant main effect of time observed. However, the group × time interaction was not statistically significant, suggesting that longitudinal changes did not differ significantly between the experimental and control groups. No statistically significant group differences were observed in self-esteem scores. These findings contribute to the literature by providing preliminary evidence regarding the feasibility and potential psychosocial effects of integrative body–mind interventions within inpatient addiction treatment settings.

The demographic and substance use characteristics of participants in both the experimental and control groups were statistically similar, ensuring that the observed differences in outcomes could be more confidently attributed to the intervention rather than pre-existing group disparities. Such baseline homogeneity strengthens the study's internal validity, as prior research suggests that demographic variability may influence treatment adherence and psychosocial outcomes in SUD populations (Fink, 2013; Volkow & Blanco, 2023).

Table 4. Comparison of Repeated Measures of the Experimental Group's In-Group SFS and CSEI

SCALES $\overline{X}$ ± SD		Pre-test $\overline{X}$ ± SD	21st Day $\overline{X}$ ± SD	3rd Month	Test and p value
Social Functioning Scale	*Social Engagement/Withdrawal*	*9.06±2.08*	*9.64±1.72*	*9.64±1.72*	*F=2.81, p=0.10*
	Interpersonal Behavior	*6.67±3.71*	*11.06±10.94*	*11.25±10.85*	*F=3.99,* **p=0.04**
	Pro-Social Activities	*16.35±9.06*	*23.64±12.21*	*23.70±12.28*	*F=5.13,* **p=0. 01**
	Recreation	*15.83±7.81*	*17.22±8.55*	*17.51±8.52*	*F=3.78,* **p=0.03**
	Independence-Competence	*24.16±8.08*	*24.41±9.08*	*24.38±9.08*	*F=0.55, p=0.57*
	Independence–Performance	*22.90±6.67*	*22.58±7.57*	*22.64±7.56*	*F=0.49, p=0.61*
	Employment/Occupation	*5.77±2.09*	*6.00±1.77*	*6.00±1.77*	*F=0.74, p=0.39*
	Total Scale	*107.90±31.01*	*114.58±35.21*	*115.16±35.11*	*F=5.26,* **p=0.01**
Self-Esteem Inventory		*54.32±17.55*	*52.77±14.54*	*52.78±14.56*	*F=0.25, p=0.61*

Within-group changes across measurement times were analyzed using repeated measures analysis of variance (ANOVA). When significant main effects were observed, Least Significant Difference (LSD) post hoc tests were conducted. A p value < .05 was considered statistically significant.

Within-group analyses indicated significant improvements over time in several social functioning subscales the experimental group, particularly in interpersonal behavior, pro-social activities, and recreation. However, given that the overall group × time interaction was not statistically significant, these findings should be interpreted with caution. The observed patterns are broadly consistent with prior research suggesting that structured physical activity combined with mindfulness-based approaches may be associated with enhanced social engagement and improved emotional regulation among individuals in addiction recovery (Bricker et al., 2021; Priddy et al., 2018). As a body-awareness practice, Pilates may contribute to self-regulation, stress management, and improved interpersonal awareness, which are theoretically linked to social adaptation processes (Caldwell et al., 2022).

Post hoc analyses suggested that some of the observed changes were primarily attributable to baseline differences, indicating that early-stage shifts in social functioning may have influenced subsequent measurement patterns. Improvements observed in the recreation subscale align with prior research emphasizing the potential role of structured leisure-based activities in supporting adaptive behavioral engagement during recovery (Farhadian et al., 2024; Kitzinger Jr et al., 2023). Given that social isolation is frequently identified as a risk factor for relapse, interventions that incorporate opportunities for social participation and structured activity may be relevant within comprehensive treatment frameworks (Moe, 2023). However, given the absence of a significant group × time interaction in the present study, these interpretations should be considered exploratory in nature.

No statistically significant differences were observed between the experimental and control groups in self-esteem scores across measurement points. This finding differs from some previous studies reporting associations between mindfulness-based interventions, physical activity, and improvements in self-esteem among individuals with substance use disorder (Alpay et al., 2018; Kulu et al., 2018; Cheung et al., 2020). One possible explanation is that changes in self-esteem may require a longer

intervention duration or more directly targeted cognitive and affective components than those incorporated into the present program. Additionally, the relatively low internal consistency of the self-esteem measure in this sample may have reduced its sensitivity to detect subtle changes over time.

Moreover, self-esteem is often deeply intertwined with past experiences of stigma, trauma, and negative self-perception—factors that may require cognitive restructuring techniques such as Cognitive Behavioral Therapy (CBT) or self-compassion training to effectively address (Uyanık & Çevik, 2020; Langford et al., 2022). Future interventions may benefit from integrating ACT-based mindfulness training with structured psychotherapeutic components to foster self-compassion and self-worth more effectively.

Table 5. Comparison of Repeated Measures of the Control Group's In-Group SFS and CSEI

SCALES $\overline{X}$ ± SD		Pre-test	21st Day	3rd Month	Test and p value*
		$\overline{X}$ ± SD	$\overline{X}$ ± SD		
Social Functioning Scale	*Social Engagement/ Withdrawal*	*8.47±2.57*	*8.27±2.20*	*9.14±2.62*	*F=1.73, p=0.18*
	Interpersonal Behavior	*5.89±3.25*	*5.45±2.07*	*6.41±2.96*	*F=2.21, p=0.12*
	Pro-Social Activities	*14.68±9.92*	*16.14±12.56*	*15.38±9.91*	*F=0.60, p=0.55*
	Recreation	*14.64±6.40*	*14.04±6.32*	*14.62±6.72*	*F=0.16, p=0.84*
	Independence–Competence	*26.12±9.15*	*29.89±5.27*	*28.12±6.62*	*F=4.94,* **p=0. 01**
	Independence–Performance	*20.97±6.59*	*22.52±5.01*	*21.58±6.16*	*F=1.15, p=0.32*
	Employment/Occupation	*6.02±1.32*	*6.35±1.04*	*5.79±1.42*	*F=3.86,* **p=0.02**
	Total Scale	*98.75±24.65*	*102.68±21.91*	*101.10±22.89*	*F=1.04, p=0.36*
Self-Esteem Inventory		*52.83±12.53*	*49.58±10.65*	*53.41±12.66*	*F=1.93, p=0.15*

Within-group changes across measurement times were analyzed using repeated measures analysis of variance (ANOVA). When significant main effects were observed, Least Significant Difference (LSD) post hoc tests were conducted. A p value < .05 was considered statistically significant.

Significant within-group improvements were also observed in the control group for the independence–competence and employment/occupation subscales of the Social Functioning Scale. These findings may reflect the potential influence of the structured inpatient treatment environment, including routine clinical care and daily ward activities, on adaptive functioning and vocational engagement (SAMHSA, 2021a). Improvements in the control group highlight the possibility that general treatment effects and natural recovery processes may have contributed to changes over time, thereby attenuating the observed between-group differences.

Notably, the independence–competence improvements emerged from the pre-test phase, indicating that patients may initially exhibit motivation for behavioral change upon entering treatment. However, the observed gains in employment/occupation at the third-month measurement highlight the importance of longer-term vocational and occupational support in reinforcing treatment gains. These findings align with evidence suggesting that sustained recovery is strongly linked to employment stability and social role fulfillment (SAMHSA, 2021b).

The present findings suggest that the integration of mindfulness-based psychological approaches with structured physical activity may be associated with improvements in certain domains of social

functioning within an inpatient addiction treatment setting. Although between-group longitudinal differences were not statistically significant, the observed within-group changes and the moderate follow-up effect size indicate that such integrative approaches warrant further investigation. From a clinical perspective, multidisciplinary teams in addiction treatment settings may consider exploring structured mind–body interventions as complementary components of routine care, pending confirmation through randomized controlled trials.

However, the lack of significant effects on self-esteem suggests that additional interventions, such as CBT, motivational enhancement therapy, and self-compassion training, may be needed to address self-perception issues more effectively (Neff & Germer, 2020). Future studies should explore multi-component interventions tailored to address both self-esteem and social adaptation concurrently.

Limitations of the Study

This study has several limitations that should be considered. First, the relatively small sample size and single-center focus may limit the generalizability of the findings. Secondly, the short intervention and follow-up period may not have been sufficient to observe long-term effects on self-esteem.

Additionally, the study sample was predominantly young, male, and primarily composed of individuals using heroin, all of whom were recruited from a single inpatient treatment center in Southeastern Türkiye. These demographic and clinical characteristics may limit the generalizability of the findings to older populations, female patients, individuals with different substance use profiles, outpatient settings, or other cultural contexts.

In addition, the inclusion of individuals with alcohol use disorder alongside other substance use disorders may have introduced clinical heterogeneity within the sample. Given the limited number of participants diagnosed with alcohol use disorder, meaningful subgroup analyses were not feasible, thereby restricts diagnosis-specific interpretation of the findings. Accordingly, the results should be interpreted as reflecting the effects of the intervention on shared psychosocial processes, such as social functioning and self-esteem, rather than on substance-specific mechanisms. This heterogeneity may have reduced internal consistency and interpretability and should be taken into account when evaluating the study outcomes.

Another important limitation relates to the multicomponent structure of the intervention. As the experimental program combined Pilates exercises with Acceptance and Commitment Therapy (ACT)-based mindfulness training, it was not possible to disentangle the specific contribution of each component to the observed effects. Therefore, the findings should be interpreted as reflecting the effects of the combined intervention rather than the independent effects of Pilates or ACT-based mindfulness alone. Additionally, the absence of formal adjustment for multiple comparisons may have increased the risk of Type I error, particularly for subscale-level findings.

An additional limitation concerns the internal consistency of the Coopersmith Self-Esteem Inventory (CSEI) in the present sample. Cronbach's alpha for the CSEI was 0.64, which is below the commonly accepted threshold for adequate reliability. This relatively low reliability may have reduced the measure's sensitivity to detect changes over time. Therefore, the absence of a statistically significant intervention effect on self-esteem should be interpreted with caution, as this null finding may be partially attributable to measurement limitations rather than a true lack of effect.

An additional limitation relates to the use of different data collection modalities across assessment points. While baseline and post-intervention assessments were conducted through face-to-face interviews, follow-up data were collected via telephone interviews. Although standardized administration procedures were applied, this methodological inconsistency may have introduced measurement bias and should therefore be considered when interpreting longitudinal findings.

Future research should employ larger, multi-site samples with extended follow-up periods to evaluate the sustainability of social functioning improvements and potential delayed self-esteem changes. In addition, future studies using dismantling or factorial designs are warranted to examine the unique and interactive effects of physical exercise and mindfulness-based psychological interventions. Moreover, qualitative research exploring participants' subjective experiences could provide richer insights into how they perceive and respond to mindfulness-based interventions. Longitudinal studies assessing relapse rates, emotional well-being, and quality of life post-intervention would further clarify the long-term efficacy of such approaches.

Conclusion

The findings indicate that participation in a Pilates-assisted ACT-based mindfulness program was associated with improvements in social functioning within an inpatient addiction treatment setting. Although longitudinal between-group differences were not statistically significant, the moderate effect size observed at follow-up suggests potential clinical relevance. No significant between-group differences were observed for self-esteem outcomes.

Given the quasi-experimental design and absence of randomization, causal inferences cannot be drawn. Future randomized controlled trials with larger samples and extended follow-up periods are warranted to clarify the effectiveness of integrated mind–body interventions and to determine their potential role in supporting psychosocial recovery among individuals with substance use disorders.

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Ethical Declaration

Before starting the study, approval was obtained from Atatürk University Faculty of Nursing Ethics Committee (no: 2018-619) and Elazığ Mental Health and Diseases Hospital Alcohol and Substance Addiction Research and Treatment Center (no: 888179374-300-E.1800226749).

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