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JOURNAL OF DEPENDENCE

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

Filiz Ersöğütçü[1] , Mine Ekinci[2]

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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.

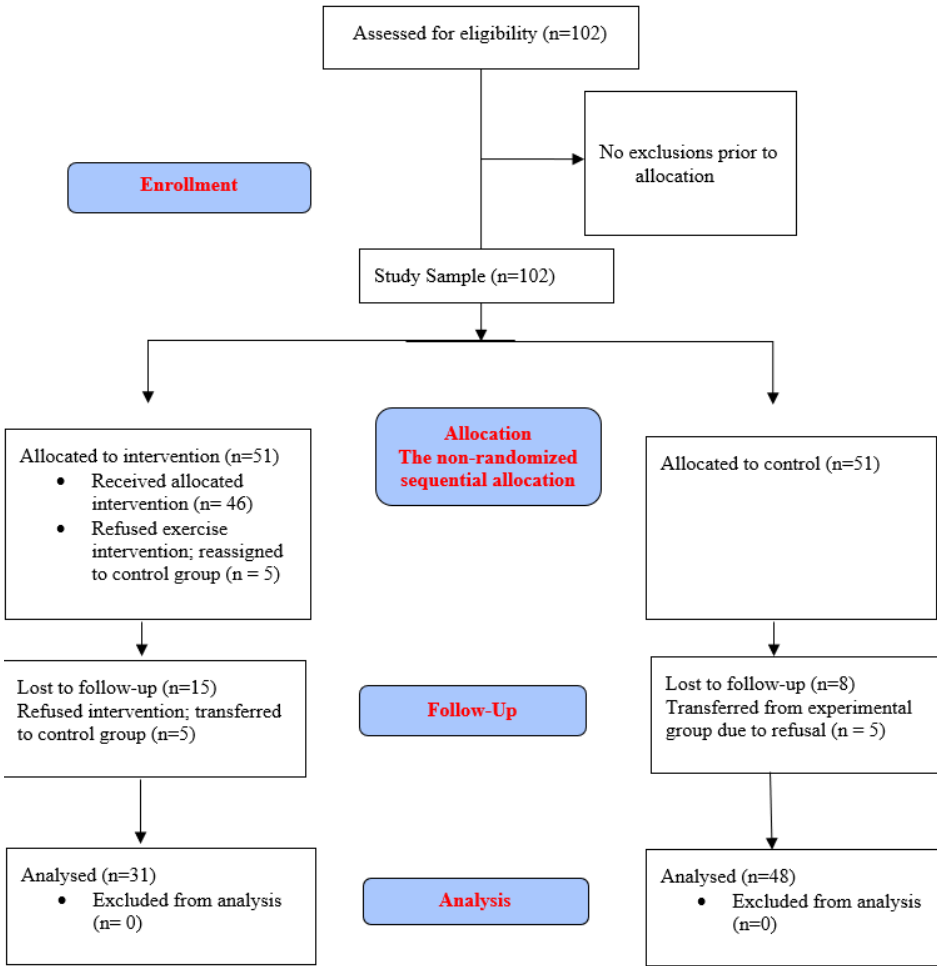

Figure 1. *CONSORT-style flow diagram for quasi-experimental design*

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 $\overline{X}$ ± SD	21st Day $\overline{X}$ ± SD	3rd Month	Test and p value*
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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Is derived from thesis?

This study was prepared by rearrangement of the first author's doctoral thesis, entitled "The Effect of Pilates-Assisted Acceptance and Commitment Therapy (ACT)-Based Mindfulness Training on Self-Esteem and Social Functioning of Individuals Diagnosed with Substance Use Disorder". The thesis was conducted under the supervision of Mine Ekinci.

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).

Authorship Contributions

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Research Article

Knowledge levels of family medicine residents regarding smoking cessation counseling: the effect of an educational program

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Abstract:

Objective: Screening for tobacco use and providing brief smoking cessation interventions are among the most cost-effective preventive services in primary care. Family physicians play a key role in tobacco control; however, in Türkiye, family medicine residents have limited access to Ministry of Health smoking cessation training programs. To address this gap, a brief training was incorporated into the residency curriculum. This study evaluated its effect on residents' knowledge regarding smoking cessation counseling.

Methods: This single-group pretest–posttest study included 66 family medicine residents at the Department of Family Medicine, Çukurova University Faculty of Medicine. Participants received a three-hour theoretical training delivered by a pulmonologist involved in Ministry of Health smoking cessation programs. Knowledge was assessed using a questionnaire administered before and after the training. Analyses were conducted with residents who completed both assessments.

Results: The mean age was 31.68 ± 7.31 years, and 56.1% were female. Current smokers comprised 18.2%, and 4.5% were former smokers. Only 10.6% had prior experience in a smoking cessation clinic. Most residents (69.7%) perceived their knowledge as partially sufficient, and 7.6% considered it adequate; 95.5% expressed willingness to receive training. Post-training knowledge scores increased significantly compared with pre-training scores (10.70 ± 3.19 vs. 13.87 ± 2.71; $t(60) = -6.203$; $p < 0.001$).

Conclusion: A brief three-hour theoretical training significantly improved residents' knowledge of smoking cessation counseling. Integrating clinic rotations and evaluating long-term outcomes may further strengthen effectiveness.

Keywords: Family medicine, smoking cessation, residency training, tobacco control

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Introduction

Smoking remains one of the leading causes of preventable mortality worldwide. Approximately 7.7 million deaths each year are attributed to tobacco use, with reported smoking prevalence rates of 33% among men and 7% among women (GBD 2019 Tobacco Collaborators, 2021; U.S. Department of Health and Human Services, 2020). Although smoking rates have declined in high-income countries, its continued prevalence in low- and middle-income countries poses a major challenge to global tobacco control efforts. Smoking is closely associated with cardiovascular diseases, lung cancer, chronic obstructive pulmonary disease, and numerous other chronic conditions (World Health Organization, 2022). Therefore, smoking cessation is of critical importance for both prolonging life expectancy and improving quality of life (World Health Organization, 2022; Jha et al., 2013).

Family physicians working in primary care play a pivotal role in the early identification of tobacco use and the provision of effective smoking cessation counseling. Their close and continuous contact with the community, ability to assess patients regularly regardless of the reason for visit, and provision of comprehensive, continuity-based care position them uniquely in tobacco control efforts. Smoking cessation counseling, recognized as a highly cost-effective intervention, requires primary care physicians to possess a high level of knowledge and skills in the management of tobacco dependence (Centers for Disease Control and Prevention, 2014).

In Türkiye, however, family medicine residents face various barriers to participating in smoking cessation training programs organized by the Ministry of Health, which aim to enhance the quality of brief cessation interventions. This highlights the need to incorporate smoking cessation counseling knowledge and skills into residency training programs (World Health Organization, 2022; Stead et al., 2013). Accordingly, a brief smoking cessation training module was integrated into the structured educational activities, and the effectiveness of this intervention constituted the focus of the present study. In practice, participation in these programs may be limited by structural and logistical barriers, including restricted training quotas, scheduling conflicts related to the intensive workload of residency programs, geographic constraints for residents working outside major urban centers, and limited access to accredited training opportunities.

The aim of this study was to evaluate the effect of the structured "Basic Smoking Cessation Counseling Training Program" delivered at the Department of Family Medicine, Çukurova University Faculty of Medicine, on residents' knowledge levels regarding smoking cessation counseling.

Theoretical Framework

Tobacco dependence is a complex health problem with biopsychosocial components, requiring a multidimensional treatment approach. International guidelines emphasize that smoking cessation interventions should be structured around three main components—psychological support, behavioral interventions, and pharmacotherapy—which together form the basis of the theoretical framework of the present study.

The psychological foundations of smoking cessation counseling focus on enhancing individuals' awareness of nicotine dependence, assessing readiness to change, and strengthening intrinsic motivation (Miller & Rollnick, 2013; West et al., 2015). The Transtheoretical Model proposed by Prochaska and DiClemente suggests that individuals progress through distinct stages during the cessation process and that interventions should be tailored accordingly (Prochaska & DiClemente, 1983; Prochaska & Velicer, 1997). From this perspective, the family physician's primary role is to accurately assess the patient's readiness for change and to select an appropriate counseling strategy aligned with the individual's stage of change (Fiore et al., 2008). Motivational interviewing techniques facilitate the exploration of ambivalence, the linking of cessation to personal values, and the internalization of behavior change (Miller & Rollnick, 2013).

Thus, the psychological component constitutes a core dynamic of smoking cessation counseling and provides a framework that enhances the effectiveness of other intervention modalitis.

Behavioral interventions target smoking-related routines, triggers, and habit loops. Among the most commonly used approaches are the "5A's" (Ask, Advise, Assess, Assist, Arrange) and the "5R's" (Relevance, Risks, Rewards, Roadblocks, Repetition), particularly for unmotivated smokers (Prochaska & Velicer, 1997; Fiore et al., 2008), they continue to be endorsed in updated international recommendations, including the U.S. Preventive Services Task Force and the World Health Organization guidelines on tobacco cessation (USPSTF, 2021; World Health Organization, 2023). These structured approaches remain central to the delivery of brief interventions in primary care settings.

The neurobiological dimension of nicotine dependence necessitates effective management of withdrawal symptoms. Clinical guidelines indicate that pharmacological agents such as nicotine replacement therapy, bupropion, and varenicline significantly increase smoking cessation success, particularly when combined with behavioral counseling (Fiore et al., 2008; World Health Organization, 2020). While each component may be effective independently, evidence suggests that cessation rates increase substantially when psychological, behavioral, and pharmacological components are applied in a comprehensive and integrated manner (Stead et al., 2013). Therefore, smoking cessation counseling should be approached as a multidimensional, patient-centered process rather than a single-faceted intervention (USPSTF, 2021). In this context, the Basic Smoking Cessation Counseling Training aimed to provide residents with a holistic perspective encompassing psychological, behavioral, and pharmacological aspects of smoking cessation.

Methods

Study Design and Participants

This study employed a single-group pretest–posttest quasi-experimental design to evaluate the knowledge levels of family medicine residents regarding smoking cessation counseling at the Department of Family Medicine, Çukurova University Faculty of Medicine. The intervention consisted of a structured three-hour theoretical training session on smoking cessation counseling.

The study population comprised all residents enrolled in the family medicine specialty training program at the department (n = 126). Of these, 66 residents (52%) agreed to participate and completed the pretest questionnaire. Five participants did not complete the posttest; therefore, analyses were conducted using data from 61 participants with complete pretest and posttest measurements. Accordingly, paired samples t-test analyses were performed with 60 degrees of freedom.

Data Collection Instrument

Data were collected using a self-administered questionnaire developed by the research team. The questionnaire consisted of three sections and a total of 42 items, designed to assess participants' sociodemographic and professional characteristics, tobacco use status, knowledge of smoking cessation counseling, and attitudes toward electronic cigarettes.

The first section included 16 items assessing age, gender, marital status, type and year of residency training, years of medical practice, current and past tobacco use, motivation to quit smoking, previous training on smoking cessation counseling, and self-reported knowledge regarding smoking cessation counseling and electronic cigarettes. These variables were used solely for descriptive and grouping purposes and were not included in the knowledge score.

Development of the Knowledge Questionnaire

The knowledge questionnaire was developed through a structured, multi-step process. First, a comprehensive review of national and international clinical practice guidelines and key resources on tobacco dependence and smoking cessation counseling was conducted to identify core knowledge domains relevant to routine family medicine practice (e.g., Fiore et al., 2008, and national guidelines). Based on this review, an initial pool of 23 multiple-choice items was generated by the research team.

In the second step, the draft items were independently reviewed by three subject-matter experts in family medicine and addiction/pulmonary medicine. The experts evaluated the items in terms of content relevance, clinical applicability, and clarity. Based on their feedback, items that were overlapping, insufficiently clear, or not directly applicable to primary care practice were revised or removed. This process resulted in a final set of 20 knowledge items.

The second section of the questionnaire consisted of 20 multiple-choice items designed to assess basic and clinically applicable knowledge of smoking cessation counseling in the context of family medicine. The items covered key domains including fundamental concepts of nicotine dependence (e.g., definitions of relapse, lapse, and third-hand smoke), assessment tools (e.g., components of the Fagerström Test for Nicotine Dependence), evidence-based pharmacological treatments (e.g., nicotine replacement therapy, bupropion, varenicline, and cytisine), management of withdrawal and relapse, the role of healthcare professionals in tobacco control, and national epidemiological data and guideline recommendations.

All items were formatted as multiple-choice questions with a single correct answer. Scoring was conducted using a dichotomous approach: each correct response was awarded 1 point, while incorrect or "don't know" responses received 0 points. No negative scoring was applied. Accordingly, total knowledge scores ranged from 0 to 20, with higher scores indicating greater basic smoking cessation counseling knowledge. No cutoff score was defined, and the total score was analysed as a continuous variable.

The knowledge questionnaire was intentionally designed to assess essential, practice-oriented knowledge expected of family medicine residents rather than advanced or specialist-level expertise.

The third section comprised six Likert-type items assessing attitudes toward electronic cigarettes (e.g., "Using electronic cigarettes is healthier than using conventional cigarettes" and "Electronic cigarette use is a public health problem"). Participants rated their level of agreement on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). These items were analysed descriptively and were also used to examine changes in attitudes before and after the training.

The pretest questionnaire was administered immediately before the training session, and the posttest questionnaire was administered immediately after completion of the training. The full knowledge questionnaire is provided as Supplementary Material.

Educational Intervention

As part of the structured residency education program, participants received a three-hour face-to-face theoretical training delivered by a faculty member from the Department of Pulmonology at Çukurova University, who also provides services in a smoking cessation clinic. The training was designed to comprehensively cover psychological, behavioral, and pharmacotherapeutic foundations of smoking cessation counseling. Due to the intensive residency schedule, the training was designed to be brief and focused, and no additional self-directed learning assignments were provided.

Details of the intervention are presented in Table 1 in accordance with the TIDieR-Education (Template for Intervention Description and Replication) framework.

Table 1. Description of the smoking cessation counseling educational intervention according to the TIDieR checklist

Section	Description
Rationale	*A short, structured educational program was required due to gaps in family medicine residents' knowledge of smoking cessation counseling and limited access to Ministry-provided training programs.*
Theoretical framework	*Transtheoretical Model, Motivational Interviewing, the 5A–5R brief intervention framework, cognitive–behavioral approach, and the biopsychosocial model of nicotine dependence.*
Learning objectives	*Explaining the fundamentals of addiction; applying the 5A–5R approach; using motivational interviewing principles; identifying pharmacotherapy options; integrating brief interventions into clinical practice.*
Intervention content	*Adaptation of the steps Ask, Acquire, Appraise, Apply, and Assess to smoking cessation counseling.*
Materials	*Slide presentations, guideline summaries, and knowledge tests (pre-test and post-test).*
Educational strategies	*Face-to-face lecture, case-based discussions, and question–answer sessions.*
Incentives	*No financial or material incentives were provided; participation was voluntary.*
Instructor	*A faculty member from the Department of Pulmonary Diseases at ..... University, also providing services at a smoking cessation outpatient clinic.*
Mode of delivery	*Face-to-face group training; instructor-to-participant ratio of 1:66.*
Setting	*Meeting hall of the Department of Family Medicine, Çukurova University Faculty of Medicine.*
Schedule and duration	*Single session lasting 3 hours; sequence: pre-test → training → post-test.*
Face-to-face / self-directed learning	*The intervention was entirely face-to-face; no self-directed learning assignments were included.*
Planned adaptations	*The training was intentionally brief and focused due to the intensive residency schedule.*
Unplanned modifications	*No changes were made during the intervention.*
Attendance	*Attendance was confirmed using a participation list; the attendance rate was 100%.*
Fidelity	*The intervention was delivered as planned with respect to duration, content, and materials.*

Rationale for the intervention: Identified deficiencies in family medicine residents' knowledge regarding smoking cessation counseling and limited access to Ministry of Health training programs necessitated the development of a short, structured educational intervention

Data Analysis

Descriptive statistics, including frequency, percentage, mean, and standard deviation, were calculated. To evaluate the effect of the educational intervention on knowledge levels, differences between pretest and posttest scores were analyzed using a paired samples t-test. When parametric assumptions were not met or when group distributions were notably imbalanced, the Kruskal–Wallis test was applied. Comparisons between categorical variables were conducted using Pearson's chi-square test.

Effect size was calculated to assess the magnitude of the intervention's impact, and Cohen's d was used for paired samples t-test results. According to Cohen's classification, $d = 0.20$ represents a small effect, $d = 0.50$ a medium effect, and $d \geq 0.80$ a large effect. Statistical significance was set at $p < 0.05$ for all analyses.

Results

Among the 66 residents (mean age = 31.68 ± 7.31 years), 56.1% were female, 59.1% were married, and 72.7% were full-time family medicine residents. A total of 89.4% reported no prior experience working in a smoking cessation clinic. Regarding smoking status, 77.3% had never smoked, 4.5% were former smokers, and 18.2% were current smokers. The majority (69.7%) described their knowledge level as "somewhat knowledgeable," while only 7.6% reported being "sufficiently knowledgeable." Nevertheless, 95.5% expressed a desire to receive smoking cessation counseling training (Table 2).

Table 2. Demographic characteristics and smoking-related variables of participants (n = 66)	
Variable	**n (%) / Mean ± SD**
Age (years)	*31.68 ± 7.31*
Years of medical practice	*6.97 ± 7.07*
Gender	
Female	*37 (56.1)*
Male	*29 (43.9)*
Marital status	
Married	*39 (59.1)*
Single	*27 (40.9)*
Resident type	
Full-time	*48 (72.7)*
Part-time / other	*18 (27.3)*
Smoking cessation clinic experience	
Yes	*7 (10.6)*
No	*59 (89.4)*
Smoking status	
Never smoker	*51 (77.3)*
Former smoker	*3 (4.5)*
Current smoker	*12 (18.2)*
Perceived knowledge of smoking cessation counseling	
No knowledge	*15 (22.7)*
Limited knowledge	*46 (69.7)*
Adequate knowledge	*5 (7.6)*

SD: standard deviation.

As shown in Table 3, knowledge scores increased significantly following the training, $t(60) = -6.20$, $p < .001$. The effect size was moderate to large (Cohen's $d = 0.79$), indicating a substantial improvement in participants' knowledge.

Table 3. Comparison of pre-test and post-test knowledge scores					
Test	**Mean ± SD**	**t (df)**	***p***	**95% CI**	**Cohen's d**
Pre-test	*10.70 ± 3.19*	*–6.203 (60)*	*< 0.001*	*–4.18 to –2.14*	*0.79*
Post-test	*13.87 ± 2.71*				

CI: confidence interval.

Given that the total possible score range was 0–20, potential floor (0–3) and ceiling (17–20) effects were examined, and no significant clustering at either extreme was observed. This finding suggests that the observed score increase reflects a true effect of the educational intervention rather than a limitation of the measurement tool. Additionally, the reduction in standard deviation from 3.19 in the pretest to 2.71 in the posttest suggests a more homogeneous knowledge level following the training.

No significant differences were found in pretest knowledge scores across the three subjective knowledge groups—participants who reported "I do not know anything," "I know a little," and "I have sufficient knowledge"—based on the Kruskal–Wallis test ($\chi^2(2) = 4.284$, $p = 0.117$). Similarly, no significant association was observed between pretest knowledge level and counseling practice patterns (providing counseling personally, referral, or other approaches) ($\chi^2(6) = 10.113$, $p = 0.120$).

In this study, behavioral outcomes were assessed through residents' self-reported smoking cessation counseling practices (providing counseling personally, referral, or other approaches) and the frequency of recommending smoking cessation to patients. Accordingly, no significant differences were found between smoking status (never smoker, former smoker, current smoker) and counseling practices ($\chi^2(4) = 4.310$, $p = 0.366$). Subjective knowledge levels regarding smoking cessation and pretest scores also did not differ according to the frequency of recommending smoking cessation to patients ($\chi^2(6) = 3.117$, $p = 0.794$; $\chi^2(3) = 0.934$, $p = 0.817$, respectively). Overall, pretest knowledge levels were not significantly associated with these counseling-related behaviors.

Analysis of the relationship between e-cigarette knowledge levels and attitudes revealed no statistically significant differences across knowledge groups regarding statements such as "E-cigarettes are healthier than conventional cigarettes," "E-cigarettes help with smoking cessation," "E-cigarettes serve as a gateway to conventional smoking," and "E-cigarette use is a public health problem." Although a trend toward decreased belief in the relative harmlessness of e-cigarettes was observed with increasing knowledge, this difference did not reach statistical significance ($p > 0.05$)

Discussion

This study demonstrated that a three-hour theoretical training significantly improved family medicine residents' knowledge levels regarding smoking cessation counseling. The moderate-to-large effect size observed (Cohen's $d = 0.79$) suggests that even brief educational interventions can yield substantial learning outcomes. Consistent with previous studies, educational interventions have been shown to enhance physicians' knowledge and self-efficacy, although these gains do not always translate directly into clinical practice (Stead et al., 2013). Recent evidence continues to support that even brief or blended training formats can improve clinicians' competence in brief tobacco interventions in primary care settings. For example, an online training aligned with WHO materials was associated with improved competency among primary care doctors, underscoring the potential impact of scalable educational formats (Moeteke et al., 2024).

Despite the significant increase in knowledge, no meaningful differences were observed between individual characteristics (smoking status, subjective knowledge perception, prior smoking cessation clinic experience) and counseling behaviors. The observed discrepancy between perceived knowledge sufficiency and actual knowledge performance suggests that self-assessment may not be a reliable indicator of competency. Likewise, the absence of an association between physicians' smoking history, perceived knowledge, and counseling practices indicates that knowledge alone is insufficient to explain counseling behavior. Consistent with this finding, preventive health behaviors are influenced by multiple factors, including motivation, time constraints, institutional support mechanisms, and patient demand (Zwar & Richmond, 2006; Hartmann-Boyce et al., 2021). Qualitative research from primary care settings further emphasizes the role of practical constraints (e.g., time pressure, routines, competing demands) and organizational structures in shaping the implementation of smoking cessation counseling, which may help explain why knowledge gains do not automatically translate into consistent practice (Dannapfel et al., 2023).

Findings related to e-cigarettes reflect a similar pattern. Although higher knowledge levels were associated with a trend toward more cautious attitudes, the differences were not statistically significant. The complex and often contradictory information environment surrounding e-cigarettes may play a role in shaping participants' attitudes (Hartmann-Boyce et al., 2021), highlighting the need to strengthen physicians' access to evidence-based information on this topic. The lack of statistically significant change may also be attributable to the relatively limited emphasis placed on electronic cigarettes within the training content, as well as the

possibility that participants held pre-existing and relatively stable attitudes shaped by ongoing public and professional debates. These findings suggest that smoking cessation training programs may benefit from dedicating more structured and evidence-based content to e-cigarettes, particularly addressing areas of uncertainty and conflicting information encountered in clinical practice.

Limitations

This study has several limitations that should be acknowledged. First, the use of a single-group pretest–posttest design makes the study susceptible to internal validity threats such as testing effects and time-related factors, which may complicate the attribution of the observed increase in knowledge solely to the intervention. In addition, the absence of a control group limits causal inferences regarding the effectiveness of the training. Furthermore, since the posttest was administered immediately after the training, only short-term knowledge gain could be evaluated, and it remains unclear whether the improvement in knowledge would be sustained over time. Finally, participation in the training was voluntary, which may have introduced selection bias; it is likely that residents who were more interested and motivated regarding smoking cessation counseling were overrepresented in the sample. Therefore, the findings should be interpreted as reflecting immediate post-training knowledge gains rather than knowledge retention. An ideal study design would include a follow-up assessment conducted 1–3 months after the intervention to evaluate the durability of the observed knowledge improvements. Future studies may also benefit from grouping knowledge items into thematic domains to examine domain-specific learning gains following smoking cessation training.

Conclusions

This study showed that a structured three-hour smoking cessation training program significantly improved family medicine residents' knowledge levels, with a strong effect size indicating that even brief theoretical interventions can enhance foundational knowledge. However, increased knowledge did not translate directly into counseling behaviors, suggesting that knowledge alone may be insufficient to ensure consistent implementation of smoking cessation counseling in clinical practice.

These findings highlight the need to complement theoretical training with practice-based components, such as clinical exposure and follow-up strategies, to support the integration of smoking cessation counseling into routine care. Further research using larger samples and longitudinal designs is warranted to better understand how educational interventions can lead to sustained behavioral change.

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Research Article

Development and validation of the Aktan–Akar risk-taking scale

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Abstract

Objective: The aim of this study was to examine the psychometric properties of the Aktan–Akar Risk-Taking Scale, which was developed to assess university students' risk-taking tendencies across different life domains.

Method: Data were collected from 395 university students (18–25 years; $M = 20.57$, $SD = 1.72$). An item pool was generated and refined based on expert and student evaluations. Construct validity was examined via exploratory and confirmatory factor analyses; reliability via Cronbach's alpha. Convergent and divergent validity were evaluated through inter-subscale correlations and associations with the Rathus Assertiveness Scale. Criterion-related validity was assessed through correlations with dispositional self-control, gender role self-concept, and core gender identity. Domain differences and associations with demographic variables were also analyzed.

Results: The EFA revealed a four-factor structure for the Risk-Taking Scale, explaining 38.40% of the variance, with domains of Physical–Safety, Academic–Ethical, Social Media–Entrepreneurial, and Financial–Debt risks. CFA confirmed this model, and subscale alphas ranged from .67 to .72. Correlations among subscales and with assertiveness supported convergent and divergent validity. Lower dispositional self-control was associated with greater risk taking, and risk taking in different domains reflected gender role expectations.

Conclusion: Risk-Taking Scale is a valid and reliable measurement tool for assessing domain-specific risk-taking tendencies among university students. The scale may be used in research and applied settings to examine the psychosocial determinants of risk-taking behaviors and to support preventive intervention efforts.

Keywords: Risk-taking, validity, reliability, dispositional self-control, gender roles

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Introduction

Emerging adulthood is a critical developmental period during which individuals experience rapid and multidimensional changes across biological, cognitive, emotional, and social domains (Christie & Viner, 2005). Spanning approximately the ages of 18 to 25, emerging adulthood is characterized by increased independence from parental figures, ongoing identity exploration, instability in life roles, and heightened sensitivity to social and emotional experiences. During this period, increasing autonomy, identity exploration, the growing importance of peer relationships, and heightened emotional intensity amplify emerging adults' tendencies to explore their environments and test boundaries (Branje, 2022; Scholte & Van Aken, 2020; Soenens et al., 2017). These developmental characteristics render emerging adulthood, similar to adolescence, a particularly sensitive period for the emergence of risk-taking behaviors (Steinberg, 2017).

Risk-taking behavior is defined as the conscious engagement in an action that may potentially lead to negative outcomes, or the intention to engage in such an action (Gençtanırım, 2014). In emerging adulthood, risk-taking may manifest across a wide range of domains, including substance use, violations of traffic and safety rules, academic and ethical misconduct, risky behaviors in digital environments, and impulsive decision-making in social relationships (Huang et al., 2025; Feijóo et al., 2025; Gençtanırım, 2014). Research indicates that such behaviors may lead to physical and psychological problems in the short term and contribute to academic failure, addiction, and mental health problems in the long term (Feijóo et al., 2025; Hair et al., 2009).

The increase in risk-taking behaviors during emerging adulthood is influenced not only by individual characteristics but also by social and cultural factors. Peer pressure, reduced parental monitoring, gender roles, and the widespread use of media and digital platforms are among the key determinants in this process (Bozzini et al., 2020; Ciydem & Bilgin, 2022; Vannucci et al., 2020; Sasson & Mesch, 2016). In particular, gender norms that expect males to be more courageous, assertive, and open to danger may encourage risk-taking behaviors, whereas risk-taking among women in emerging adulthood may be more limited or manifested in different domains (Ciydem & Bilgin, 2022; Sasson & Mesch, 2016). Nevertheless, there is a clear need for valid and reliable measurement tools to comprehensively assess the domains and extent to which individuals in emerging adulthood engage in risk-taking behaviors (Gençtanırım, 2014).

In the existing literature, a substantial proportion of studies examining risk behaviors in adolescence and emerging adulthood focus on single risk domains (e.g., substance use or traffic behaviors) or measure the frequency of previously exhibited behaviors (Davtalab et al., 2025; Martin-Storey et al., 2025). However, this approach makes it difficult to holistically evaluate emerging adults' general risk-taking tendencies and their risk profiles across different domains. Moreover, the low reported frequency of certain risky behaviors complicates the distinction between whether these behaviors are genuinely avoided or whether opportunities for such behaviors are limited (Jing et al., 2023; de la Torre-Luque et al., 2021). Therefore, the development of scales that assess individuals' intentions to engage in risky behaviors during emerging adulthood and their perceptions of likelihood have emerged as an important need. Previous studies conducted in Türkiye have primarily relied on adaptations of existing risk-taking measures developed in Western contexts, which have largely focused on traditional risk domains such as substance use, traffic behaviors, or general risk propensity (Gençtanırım, 2014; Dinç ve Tez, 2019). These instruments have shown acceptable psychometric properties however their content has been limited in terms of capturing digital risk behaviors and context-specific experiences relevant to emerging adults in Türkiye. Moreover, to our knowledge, no domain-specific risk-taking scale has been developed to systematically assess contemporary digital, academic–ethical, and financial risk domains within this cultural context.

In response to these limitations, although the international literature includes measurement instruments that assess risk-taking behaviors in a domain-specific manner, most of these scales have been developed for adult samples and do not fully align with the developmental characteristics of emerging adulthood, which represents a transitional period between adolescence and adulthood, nor with specific cultural contexts (Cardenas Fujita et al., 2025; Fino et al., 2021; Witte, 1996). In today's rapidly digitalizing world, social media, online interactions, and digital risks have become major risk domains for individuals in emerging adulthood; however, these domains are insufficiently represented in existing scales (Cardenas Fujita et al., 2025; Fino et al., 2021; Gençtanırım, 2014). Furthermore, items developed independently of cultural context may fail to adequately reflect the daily life experiences and risks encountered by emerging adults in Türkiye (Cardenas Fujita et al., 2025). In the present study, the scale was structured based on theoretical approaches that conceptualize risk-taking behaviors from a domain-specific perspective (e.g., ethical, financial, health/safety, recreational, and social risks). From a theoretical perspective, treating risk-taking as a multidimensional construct is supported by evidence showing that individuals may display high risk propensity in certain domains while remaining risk-averse in others. Different risk domains involve distinct motivational processes, perceived costs and benefits, social norms, and anticipated consequences. For example, physical and safety risks are often driven by sensation seeking and perceived invulnerability, whereas academic–ethical risks are more closely related to moral reasoning and normative control. Similarly, financial and debt-related risks reflect economic decision-making under uncertainty, while social media–related risks are embedded in social approval, identity presentation, and rapidly changing digital norms. Accordingly, conceptualizing these domains as separate but related dimensions provides a theoretically coherent framework for assessing risk-taking tendencies during emerging adulthood. While building upon the frameworks provided by existing scales, the study aimed to generate original items that reflect behavior patterns aligned with emerging adults' contemporary life practices and cultural context.

In this regard, developing a culturally sensitive and psychometrically robust measurement instrument that can comprehensively assess risk-taking tendencies during emerging adulthood across multiple domains-such as physical, social, academic, digital, and financial-is of considerable importance. Such a scale would provide a functional tool for researchers, school psychological counselors, and mental health professionals to identify risk-taking behaviors in emerging adulthood, develop preventive intervention programs, and define risk groups. Accordingly, the aim of this study is to develop the Aktan–Akar Risk-Taking Scale as a valid and reliable instrument for measuring individuals in emerging adulthood's tendencies to engage in risk-taking behaviors. Throughout the scale development process, a multidimensional structure was targeted by taking into account the developmental characteristics of emerging adulthood and contemporary risk domains within the Turkish context.

Methods

Design

This study employed a methodological research design.

Participants

A sample of 519 undergraduate students participated in the study. Participants were included in the study if they were between 18 and 25 years of age, were enrolled as undergraduate university students at the time of data collection, provided informed consent, had sufficient proficiency in Turkish to complete the questionnaires, and reported no diagnosis of a mental disorder based on self-report.

Data screening revealed that 48 (9.25%) participants did not respond to any items, 30 (5.78%) participants failed the attention checks,

and 46 (7.32%) participants were older than 25. These participants were excluded from the data set. The remaining 395 participants were predominantly women (n = 351, 88.86%; men n = 42, 10.63%; Table 1). Participants' ages ranged between 18 and 25 (M = 20.57, SD = 1.72). Participants' major was predominantly psychology (n = 385, 87.30%). Most of the participants were unemployed (n = 370, 93.67%), and only 18.38% (n = 68) reported looking for a job. Most participants reported having spent most of their life in a metropolitan city (n = 151, 38.23%) or a city (n = 184, 46.58%). Most participants reported belonging to a middle socioeconomic status group and indicated that their families' purchasing power was high enough to meet some extra expenses. Furthermore, participants' feeling of economic security, assessed with a single item, was 3.66 (SD = 1.35) on a 6-point scale ranging from 1 (Not at all secure) to 6 (Very secure). Most participants' mothers were primary school graduates and fathers were high school graduates, indicating that fathers were more educated than mothers. Finally, most participants' mothers were homemakers.

Table 1. Demographics

	n	%		n	%
Gender			**Department**		
Women	351	88,86	Psychology	348	88,10
Men	42	10,63	Sociology	24	6,08
Unidentified	2	0,51	Other	23	5,82
Work Status			**Place where you have spent most of your life**		
Yes, I work in a full-time job.	4	1,01	Metropolis (e.g., Istanbul, Ankara)	151	38,23
Yes, I work in a part-time job.	17	4,30	City	184	46,58
No, but I would like to work.	68	17,22	Town	31	7,85
No, I am not working.	302	76,46	Village	28	7,09
Other (please specify)	4	1,01			
SES			**Family Purchasing Power**		
Low	19	4,81	Our income does not meet our basic needs	5	1,27
Lower-middle	54	13,67	It only covers our basic needs	56	14,18
Middle	235	59,49	We can cover our basic needs and some additional expenses	262	66,33
Upper-middle	82	20,76	We are financially very comfortable	72	18,23
High	5	1,27			
	Mother		**Father**		
Education	n	%	n	%	
No formal education	30	7,59	5	1,27	
Primary school graduate	141	35,70	74	18,73	
Middle school graduate	72	18,23	73	18,48	
High school graduate	89	22,53	143	36,20	
Vocational school/ University graduate	56	14,18	92	23,29	
Master's or PhD graduate	7	1,77	8	2,03	

Table 1. Demographics (continue)				
	Mother		Father	
Occupation				
Unskilled worker (e.g. construction/ agricultural/temporary worker)	14	3,54	12,15	48
Skilled worker (e.g. master, journeyman)	13	3,29	9,11	36
Public or private sector employee (e.g., teacher, office staff)	48	12,15	14,43	57
Public or private sector manager (e.g., director, supervisor)	7	1,77	6,33	25
Self-employed/tradesperson/professional (e.g., shop owner, pharmacist, lawyer)	12	3,04	24,56	97
Businesswoman	7	1,77	4,56	18
Unemployed – seeking work	1	0,25	2,28	9
Retired	17	4,30	25,82	102
Homemaker	276	69,87		

The final analytic sample of 395 undergraduates was adequate for both the exploratory and confirmatory factor analyses. For the initial EFA, the participant-to-item ratio was approximately 11:1 (395 participants, 35 items), exceeding commonly cited rules of thumb that recommend at least 5–10 participants per indicator and a minimum N of about 200–300 for stable factor solutions (Fabrigar et al., 1999; Kyriazos, 2018; MacCallum et al., 1999). For the CFA, the 17-item four-factor model (57 free parameters) was also estimated with an adequate sample: Monte Carlo studies suggest that for models of this complexity with moderate factor loadings, sample sizes between roughly 200 and 400 generally yield acceptable power, low parameter bias, and proper solutions (Wolf et al., 2013). Because the total sample size was not sufficient to allow for adequately powered and stable EFA and CFA solutions in two independent subsamples, both analyses were conducted on the same sample.

Measurements

Risky behaviors scale: The scale was developed in the present study. At the beginning of item generation, university undergraduate students were asked to describe risky behaviors in which an undergraduate might engage. The items were then reorganized by the author to reduce duplicates, and 43 items were selected for the scale. The items mainly reflected DOSPERT's subdomains of Ethical Risk Taking, Financial Risk Taking, Health/Safety Risk Taking, Recreational Risk Taking, and Social Risk Taking (Dinç ve Tez, 2019). Eight experts in psychology and psychological counseling and 12 psychology undergraduates rated the items in terms of how risky the behavior depicted in each item was on a 7-point scale (1 = not at all; 7 = extremely). The panelists were also asked to provide suggestions for improving the items.

Inter-rater agreement was examined using a two-way mixed-effects model with the average-measures intraclass correlation coefficient (ICC). The average-measures ICC was .84 (95% CI [.72, .93]), indicating good agreement among experts. One-sample t tests revealed that experts and undergraduates were similar in their riskiness ratings (all ts < 1.60, $p > .10$, *Cohen's d*s < 0.727), except for the item about riding without a helmet. Undergraduates ($M = 4.83$, $SD = 1.64$) tended to rate this behavior as less risky than experts ($M = 6.00$, $SD = 0.93$, $t(18) = 1.82$, $p = .09$, *Cohen's d* $= 0.829$). For the final version of the scale, eight items were dropped because they were not rated as risky. Some of the remaining 35 items were revised in wording as suggested by the raters. Four filler items (e.g., "37. Treating a friend

you like to lunch.") were also added to the scale to reduce response bias but were not included in the analyses. Participants were asked to rate how likely they would be to engage in the behaviors described in the items on a 7-point scale (1 = Not at all likely; 7 = Very likely). Psychometric properties of the scales are presented in the Results section.

Dispositional self-control scale (DSC): The DSC was developed by Ein-Gar and Sagiv (2014) to measure individuals' tendency to overcome two kinds of temptations corresponding to Doing Wrong (DW) and Not Doing Right (NDR). DW refers to impulsive actions undertaken to reach short-term gratification that compromise long-term goals. NDR is about delaying or avoiding the actions necessary to accomplish preset goals. The scale comprises four subscales measuring yielding to or overriding the two temptations, i.e., Yielding to Doing Wrong (YDW), Overriding Doing Wrong (ODW), Yielding to Not Doing Right (YNDR), and Overriding Not Doing Right (ONDR). The scale items were rated on a 5-point scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The scale was adapted to Turkish by Akar (2025), who reported good reliabilities for the four subscales (alphas ranging between .70 and .80) and for the two temptation dimensions (alphas were .83 for both). In the present study, the alphas for DW and NDR were .79 and .85, respectively. Higher scores on DW and NDR reflect lower dispositional self-control.

Gender role self-concept scales (GRSC): The GRSC were developed by Altuğ and Aktan (2025). The first scale, GRSC–Traits, focuses on the extent to which an individual endorses positive and negative traits stereotypically attributed to women and men. The scale measures four subdimensions on a 6-point scale (1 = Does not describe me at all; 6 = Describes me completely): feminine positive (FP), including communion-related traits (e.g., compassionate, loving, and kind); feminine negative (FN), covering unmitigated communion-related traits (e.g., touchy, fragile, and fussy); masculine positive (MP), containing agency-related traits (e.g., leader, brave, and assertive); and masculine negative (MN), including unmitigated agency-related traits (e.g., insensitive, rude, and unemotional). Higher scores on each subscale indicate greater endorsement of the corresponding gender-related traits. The second scale measures endorsement of daily behaviors stereotypically attributed to women and men. This scale has two subscales, rated on a 6-point scale (1 = Not at all suitable for me; 6 = Completely suitable for me): behaviors attributed to women (FB) and behaviors attributed to men (MB). Higher scores on each subscale indicate greater endorsement of the corresponding gender-related behaviors. Aktan and Altuğ (2025) reported good reliabilities for all subscales (alphas between .74 and .85). In the present study, the internal consistencies of the subscales were acceptable (between .70 and .84).

Traditional masculinity–femininity scale (TMF): The TMF was developed by Kachel et al. (2016) as a content-free measure of gender role self-concept. On a 7-point scale (1 = Completely masculine; 7 = Completely feminine), individuals are required to rate the extent to which they endorse traditional gender norms. The Turkish item wording used in the present study was based on an unpublished translation provided by N. Sakallı and Ş. Demir in 2023, and the psychometric properties of this Turkish version were examined in detail by Altuğ and Aktan (2025). Their findings revealed that the scale had a single factor and good reliability (alpha = .97), and it was argued that the scale measures core gender identity (Altuğ & Aktan, 2025). In the present study, the internal consistency of the scale was also good (alpha = .95). Higher scores on the scale indicated a more feminine core gender identity.

Rathus assertiveness scale (RAS): The RAS was developed by Rathus (1973) to measure assertiveness and was adapted to Turkish by Voltan (1980). The scale items and response format were revised by Gül (2024) to a 6-point scale ranging from 1 (Not at all suitable for me) to 6 (Very suitable for me). The internal consistency of the revised Turkish version was .83. In the present study, alpha for the scale was .87. Assertiveness refers to individuals'

ability to express their thoughts, needs, and rights in a direct and self-confident manner without violating the rights of others. The Rathus Assertiveness Scale assesses behavioral tendencies such as interpersonal confidence, self-expression, and behavioral initiative in social situations. Although these characteristics reflect taking initiative in social contexts, they do not inherently involve the potential physical, academic, or financial negative consequences that are central to risk-taking behaviors. Therefore, while assertiveness may involve interpersonal initiative, it is conceptually distinct from risk-taking. In the present study, the RAS was used to demonstrate that risk-taking tendencies measured by the Aktan–Akar Risk-Taking Scale are distinguishable from assertive interpersonal behaviors and to examine divergent validity.

Demographics

Participants' gender, age, and family characteristics were measured by a demographic form. In addition, three single-item indicators were used to assess participants' socioeconomic standing. Perceived socioeconomic status was assessed with the question "How would you describe your socioeconomic status?" rated on a 5-point scale (1 = Low; 5 = High). Perceived family purchasing power was assessed on a 4-point scale (1 = Our income does not meet our basic needs; 2 = It only covers our basic needs; 3 = We can cover our basic needs and some additional expenses; 4 = We are financially very comfortable). Finally, perceived economic security was assessed with the item "Currently, how economically secure do you feel?" rated on a 6-point scale (1 = Not at all secure; 6 = Very secure).

Procedure

The study was approved by the Afyon Kocatepe University Social Ethical Board (Date: 05.11.2025, Decision no. 2025/385). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Participants were accessed through social media and were invited to complete the online questionnaire. All participants completed the questionnaires after providing informed consent. Scales were presented in a random order. Scale items were also randomized within each scale. All analyses were run in JASP 0.95.4 (JASP Team, 2025). In this study, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to examine the construct validity of the Risk-Taking Scale. The reliability of the scale was assessed by calculating Cronbach's alpha coefficients. Criterion-related validity was evaluated through correlations with the Rathus Assertiveness Scale (RAS), Traditional Masculinity–Femininity Scale (TMF), Gender Role Self-Concept Scale (GRSC), and Dispositional Self-Control (DSC). In addition, differences across demographic variables were examined using independent samples t-tests, Mann–Whitney U tests, and one-way ANOVA, as appropriate.

Results

Construct validity

Data screening revealed that four items' distributions were not appropriate for factor analysis (i.e., "Secretly looking at a friend's private messages or photos on their phone or computer."). More than 75% of participants rated these items as 1 (Not at all likely). Thus, four items were discarded from the analysis. A principal axis factoring with oblimin rotation was used to examine the factor structure of the scale. The data were appropriate for factor analysis, $KMO = .88$, and Bartlett's test of sphericity was significant, $\chi^2(465) = 3752.20$, $p < .001$.

Eight factors with eigenvalues higher than 1 initially explained 43.70% of the variance. However, the Kaiser criterion is known to over extract factors, and the parallel analysis solution of up to seven factors also produced several weak and unstable factors. In these higher-factor solutions, 11 items had loadings below .40 and four of the factors were defined by only two items each, and their item content did not form coherent or theoretically meaningful domains. Inspection of the scree plot showed a clear elbow after the fourth factor, and the 4-factor solution yielded the clearest simple structure: all retained items

loaded at least .40 on a single factor without salient cross-loadings and each factor grouped conceptually homogeneous behaviors. Thus, a 4-factor solution was retained on the basis of both statistical criteria and theoretical interpretability. In this final solution, 14 items were discarded from the analysis because they had factor loadings lower than .40, were cross-loaded on different factors, or loaded on a factor that was not related to their content.

In the final solution, four factors explained 38.40% of the variance (*KMO* = .86; Bartlett's test of sphericity: $\chi^2(136) = 1562.40$, $p < .001$; **Table 2**). The first factor (*eigenvalue* = 4.81) contained six items related to Physical and Safety Risk-Taking (e.g., "Item 26. Taking part in a dangerous sports activity without having prior experience [e.g., skydiving, bungee jumping, rock climbing]."). The second factor (*eigenvalue* = 1.59) comprised four items related to Academic and Ethical Risk-Taking (e.g., "Item 2. Cheating on an exam."). The third factor (*eigenvalue* = 1.33) contained four items reflecting Social Media and Entrepreneurial Risk-Taking (e.g., "Item 8. Dropping out of your education to become a social media influencer or entrepreneur."). Lastly, the fourth factor (*eigenvalue* = 1.18) included three items related to Financial and Debt Risk-Taking (e.g., "Item 11. Taking out a loan or going into debt for a purchase such as a vacation or clothing without planning how to pay it back.").

Table 2. Factor structure of Risky Behaviors Scale

	PSRT	AERT	SMRT	FDRT
26. Taking part in a dangerous sports activity without having prior experience (e.g., skydiving, bungee jumping, rock climbing)/*Deneyimin olmadığı halde tehlikeli bir spor etkinliğine katılmak (örn. paraşütle atlama, bungee jumping, kaya tırmanışı).*	**.621**	.112	-.073	.024
16. Riding an e-scooter or bicycle on crowded roads/*Kalabalık yollarda e-scooter/bisiklet kullanmak.*	**.549**	-.022	.078	.043
19. Riding a motorcycle or riding as a passenger on a motorcycle without wearing a helmet/*Kask takmadan motosiklet kullanmak ya da motosiklete yolcu olarak binmek.*	**.515**	-.113	.038	.011
25. Going hiking off marked trails without checking the route or weather conditions/*Rota veya hava durumunu kontrol etmeden işaretli patikaların dışına çıkarak doğa yürüyüşü yapmak.*	**.480**	-.041	-.066	-.079
22. Exceeding the speed limit to arrive on time (either as the driver or by asking the driver to speed up)/*Zamanında varmak için hız sınırını aşmak (sürücü olarak ya da sürücüden hızlanmasını **istemek**).*	**.474**	-.088	.039	.158
24. Swimming outside designated/supervised areas at the beach/*Plajda belirlenmiş/gözetimli alanların dışında yüzmek.*	**.407**	-.031	-.199	-.005
1. Having an AI system write your thesis, assignment, or research for you even though this is explicitly forbidden in the course/*Derste açıkça yasaklamasına rağmen tez, ödev veya araştırmanı yapay **zekaya** yaptırmak.*	-.043	**-.668**	-.006	.072
2. Cheating on an exam/*Sınavda kopya çekmek.*	.103	**-.656**	.017	.019
5. Making an audio or video recording in class without permission/*Derste izinsiz ses veya görüntü kaydı almak.*	.069	**-.514**	-.109	-.057
4. Presenting qualifications you do not actually have in your CV or internship application/*Özgeçmişinde ya da staj başvurunda aslında sahip olmadığın nitelikleri varmış gibi göstermek.*	.061	**-.426**	-.027	.233

Table 2. Factor structure of Risky Behaviors Scale (continue)				
12. Dropping out of school and becoming a partner in a friend's business idea without informing your family/ *Arkadaşının geliştirdiği bir iş fikri için ailene haber vermeden okulu bırakıp ona ortak olmak.*	.009	.075	**-.671**	.110
8. Dropping out of my education to become a social media influencer or entrepreneur/*Sosyal medya fenomeni ya da girişimci olmak için eğitimimi yarıda bırakmak.*	-.004	-.122	**-.538**	.072
18. Taking part in online "challenges" (e.g., risky tasks or dangerous dares)/ *Online "challenge"lara katılmak (örneğin riskli görevler, tehlikeli meydan okumalar).*	.285	.069	**-.527**	.001
35. Doing things you would not normally do in order to gain followers or earn money on social media/*Sosyal medyadan takipçi kazanmak veya gelir elde etmek için normalde yapmayacağın şeyleri yapmak.*	-.033	-.235	**-.523**	-.002
11. Taking out a loan or going into debt for a purchase such as a vacation or clothing without planning how to pay it back/ *Nasıl geri ödeyeceğini planlamadan tatil ya da kıyafet gibi bir alışveriş için kredi çekmek/borç almak.*	.042	-.061	.048	**.693**
13. Using the credit card given to you by your family in an uncontrolled way/*Ailenin verdiği kredi kartını kontrolsüzce kullanmak.*	-.044	-.057	-.031	**.625**
14. Spending almost all the money you need for that month on buying a mobile phone or other technological devices/*O ay geçiminizi sağlamak için gerekli olan paranızın neredeyse hepsini cep telefonu veya teknolojik araçlar satın almak için harcamak.*	.083	.071	-.169	**.500**

PSRT: Physical & Safety Risk-Taking; AERT: Academic & Ethical Risk-Taking; SMRT: Social Media & Entrepreneurial Risk-Taking; FDRT: Financial & Debt Risk-Taking

To confirm the observed factor structure, a confirmatory factor analysis was conducted. Model fit was evaluated using multiple indices recommended in the CFA literature (Hu & Bentler, 1999; Kline, 2015; Schermelleh-Engel et al., 2003). The four-factor model yielded $\chi^2(113) = 203.97$, $p < .001$, $\chi^2/df = 1.81$, CFI = .94, TLI = .93, RMSEA = .045 (90% CI [.035, .055]), SRMR = .045, and GFI = .97, indicating an overall good fit of the model to the data. The standardized factor loadings of the four-factor solution were presented in **Figure 1**.

Reliabilities, convergent and divergent validity

The internal consistencies of PSRT, AERT, and SMRT were acceptable (alphas were .71, .72, and .72, respectively; **Table 3**). Although the reliability of the FDRT subscale was marginal ($\alpha = .67$), this value is likely attenuated by the small number of items, as the subscale consisted of only three items.

The correlations among subscales ranged from .35 to .46, supporting the scale's convergent validity. The subscales' correlations with RAS were close to zero, indicating the scale's divergent validity. The only exception was the correlation between PSRT and RAS; however, this correlation was much weaker than the correlations among the subscales.

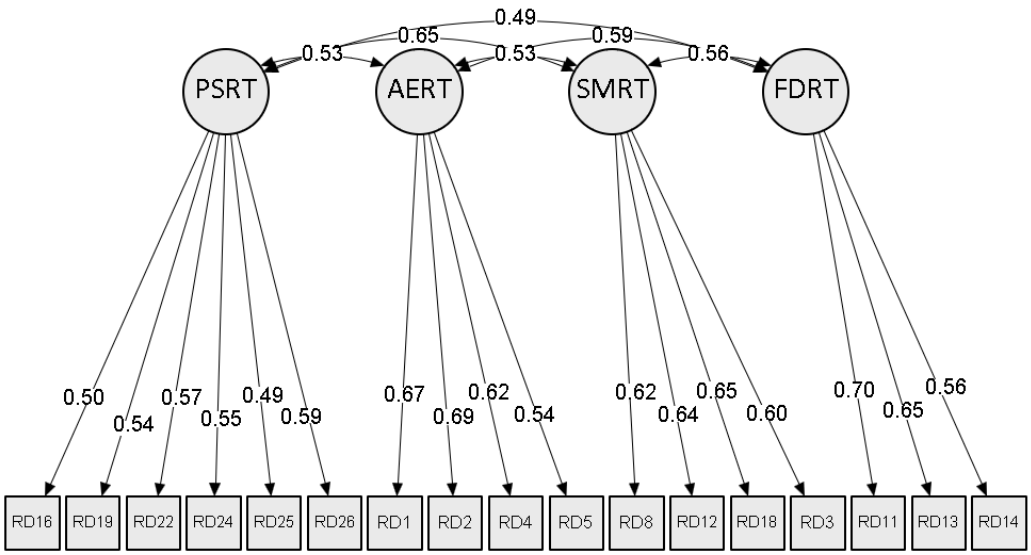

Figure 1. The standardized factor loadings of the four-factor solution in CFA
PSRT: Physical & Safety Risk-Taking; AERT: Academic & Ethical Risk-Taking; SMRT: Social Media & Entrepreneurial Risk-Taking; FDRT: Financial & Debt Risk-Taking

Table 3. Internal consistencies, descriptives and correlations among subscales

	Alpha	Engagement		Riskiness		AERT	SMRT	FDRT	RAS
		M	SD	M	SD				
PSRT	.71	2.89[a]	1.20	5.14[a]	0.90	.39***	.46***	.35***	.19***
AERT	.72	2.51[b]	1.26	5.36[a]	0.85		.39***	.41***	.07
SMRT	.72	1.71[c]	0.95	5.51[a]	0.92			.40***	.07
FDRT	.67	2.43[b]	1.43	5.48[a]	0.73				.00

*$p < .05$, ** $p < .01$, *** $p < .001$. *The mean scores that do not share the same superscript on the same column are significantly different at $p < .001$. Engagement: The extent to which participants (n= 395) perceived it as likely that they would engage in the behavior. Riskiness: The extent to which panelists (n= 20) evaluated the behavior as risky. PSRT: Physical & Safety Risk-Taking; AERT: Academic & Ethical Risk-Taking; SMRT: Social Media & Entrepreneurial Risk-Taking; FDRT: Financial & Debt Risk-Taking*

Correlations with criterion variables

As shown in **Table 4**, all four risk-taking domains were positively associated with lower dispositional self-control, as reflected by positive correlations with DW. These associations ranged from small to moderate in magnitude, with the strongest association observed for FDRT. Correlations with NDR were also positive and significant for AERT, SMRT, and FDRT, whereas the association between PSRT and NDR was non-significant.

Regarding gender role traits, FP were negatively correlated with AERT and SMRT, indicating lower engagement in these domains among individuals endorsing higher levels of communion. FN showed a negative association with PSRT and SMRT, but a positive association with AERT, suggesting a differentiated pattern across risk domains.

Agency-related traits displayed domain-specific associations. MP were positively correlated with PSRT but negatively correlated with AERT, whereas MN was positively associated with all risk-taking domains except SMRT, with the strongest associations observed for PSRT and FDRT.

Table 4. Correlations with criterion variables

	DW	NDR	FP	FN	MP	MN	FB	MB	TMF
PSRT	.16**	.09	-.07	-.14**	.17***	.26***	-.02	.29***	-.32***
AERT	.19***	.24***	-.15**	.11*	-.11*	.18***	.03	-.02	-.07
SMRT	.15**	.13*	-.11**	-.10*	.09	.24***	.00	.15**	-.24***
FDRT	.32***	.25***	-.04	.04	-.03	.18***	.07	-.01	-.01

** p<.05, ** p<.01, *** p<.001; PSRT: Physical & Safety Risk-Taking, AERT: Academic & Ethical Risk-Taking, SMRT: Social Media & Entrepreneurial Risk-Taking, FDRT: Financial & Debt Risk-Taking, DW: Doing Right, NDR: Not Doing Wrong; MP: Musculine Positive (agency); MN: Musculine Negative (unmitigated agency), FP: Feminine Positive (communion), FN: Feminine Negative (unmitigated communion), MB: Musculine Behavior, FB: Feminine Behavior; TMF: Traditional Masculinity-Femininity (core gender identity; 1= Masculine – 7= Feminine)*

With respect to gendered behaviors, MB were positively correlated with PSRT and SMRT, while FB were not significantly associated with any risk-taking domain. Finally, core gender identity, as measured by the TMF, showed negative associations with PSRT and SMRT, indicating that a more masculine gender identity was related to higher levels of risk-taking in these domains.

Domain comparisons

To compare the riskiness ratings of the panelists for the behaviors in the four domains, a repeated measures ANOVA was conducted. Findings revealed that mean riskiness ratings for the four domains were similar, $F(3, 57) = 0.96, p = .42. \eta p^2 =$ 048 (**Table 3**). A similar repeated measures ANOVA with Bonferroni-corrected pairwise comparisons on participants' engagement ratings revealed that the behaviors they would most likely engage in were in the domain of PSRT, followed by AERT and FDRT, and then SMRT, respectively, $F(3, 1182) = 104.53$, $p < .001$, $\eta p^2 =$ 048 (all *t*s > 6.02, $p < .001$, *Cohen's d*s > 0.38).

Relations with demographics

Age was negatively correlated with SMRT ($r =$ -12, $p < .05$), indicating that as participants' age increased, they became less interested in taking risks related to social media and entrepreneurship. PSRT was positively correlated with both mothers' and fathers' education, indicating that participants with more highly educated parents were more likely to engage in risky behaviors related to physical health and safety ($r = 13$, $p < .05$; $r = 11$, $p <$ .05, respectively). Family Purchasing Power was positively correlated with FDRT, indicating that as participants rated their family as having greater purchasing power, they tended to take more risks in the financial and debt domain.

Discussion

In this study, the psychometric properties of the Aktan–Akar Risk-Taking Scale, which was developed to assess individuals' risk-taking tendencies across different life domains, were examined. Risk-taking behaviors are conceptualized as a multidimensional construct associated with self-control and gender role orientations. The present study aims to contribute to the literature by presenting evidence for the construct validity, reliability, and associations of a newly developed, domain-specific measure of risk-taking behaviors with various psychological and demographic variables. The findings were discussed within the framework of construct validity, reliability, convergent and divergent validity, and criterion-related validity.

Construct validity

Both the exploratory and confirmatory factor analyses supported a four-factor structure for the Aktan–Akar Risk-Taking Scale. Overall, the four domains—Physical–Safety, Academic–Ethical, Social Media–Entrepreneurial, and Financial–Debt risk taking—are broadly consistent with the risk domains assessed by the DOSPERT (Blais & Weber, 2006; Dinç & Tez, 2019). However, the present

scale has important advantages over the DOSPERT in that it is more closely aligned with the everyday experiences of emerging adults in the Turkish context. For instance, some DOSPERT items ask about the likelihood of engaging in behaviors that are not particularly relevant or appropriate for emerging adults in Turkey (e.g., Item 6: "Taking some questionable deductions on your income tax return"), and the DOSPERT does not cover risky behaviors in the digital domain. The present scale also differs from the Risk Behavior Scale–University Form (Gençtanırım, 2014), which was likewise developed for Turkish university students but focuses on the frequency of actually performed behaviors (e.g., "I smoke cigarettes"). In contrast, the Aktan–Akar Risk-Taking Scale assesses the perceived likelihood of engaging in risky behaviors. Because actual behaviors are constrained by contextual factors and opportunities, the present scale provides a more direct indicator of risk-taking propensity.

The correlations among the subscales ranged from .35 to .46, supporting the convergent validity of the scale (see Kline, 2015). These findings suggest that, although the subscales reflect a common underlying tendency toward risk taking, the moderate magnitude of the correlations indicates that each subscale represents a distinct and domain-specific aspect of risk-taking behavior.

To evaluate divergent validity, the relationships between the subscales and assertiveness were examined. The results showed that, with the exception of PSRT, none of the subscales were significantly correlated with assertiveness. Given that assertiveness concerns taking initiative in social contexts and expressing one's rights confidently without infringing on others' rights (Rathus, 1973), it could be expected that individuals with a high propensity for risk taking might also be more assertive. However, risk taking typically involves behaviors that may provide short-term benefits but carry the potential for long-term negative consequences (e.g., Blais & Weber, 2006). In this respect, risk taking is a related but conceptually distinct construct from assertiveness. The findings supported this argument for AERT, SMRT, and FDRT. The weak but significant association observed between PSRT and assertiveness suggests that this domain of risk taking may partially overlap with traits such as assertiveness and courage, yet the fact that this association was weaker than the correlations among the subscales indicates that PSRT does not substantially overlap with assertiveness at the construct level.

Reliability of the subscales

In this study, the reliability of the Risk-Taking Scale was assessed at the subscale level using Cronbach's alpha coefficients. The results indicated that the Cronbach's alpha coefficients for the PSRT, AERT, and SMRT subscales ranged between .71 and .72, which fall within the acceptable range for psychological measurement instruments. In the literature, Cronbach's alpha values of .60 and above are considered acceptable, while values of .70 and above indicate good internal consistency (Alpar, 2022; Tavşancıl, 2019). These findings suggest that the three subscales measure risk-taking behaviors in a consistent manner.

The FDRT subscale yielded a marginal level of internal consistency ($\alpha = .67$), which is lower than that of the other subscales and should therefore be interpreted with caution. Although this value may be partially attributable to the small number of items in the subscale, as internal consistency estimates are known to be sensitive to item count (Tavşancıl, 2019), the possibility of increased measurement error cannot be ruled out. Consequently, findings related to financial and debt-related risk-taking should be considered preliminary. While the items demonstrated conceptual coherence and showed meaningful associations with criterion variables, future research should aim to strengthen this dimension by expanding the item pool and re-evaluating its psychometric properties in independent samples.

Relations with self-control

The criterion-related validity of the Risk-Taking Scale was examined through its associations with

the dispositional self-control (Akar, 2025; Ein-Gar & Sagiv, 2014). The results indicated that tendencies toward DW and NDR were positively and significantly correlated with all subscales, with the exception of the relationship between PSRT and NDR. These findings suggest that a higher propensity for risky behavior is generally associated with lower levels of self-control, given that higher DW and NDR scores reflect greater difficulty resisting these temptations. The results are consistent with theoretical approaches emphasizing the close link between risk-taking tendencies and self-regulatory processes (Akar, 2025; Magar et al., 2008). However, the non-significant association between PSRT and NDR suggests that physical and safety-related risks do not always stem from difficulties in initiating or maintaining goal-directed behavior (i.e. NDR). Such risks may, in some cases, be more closely related to sensation seeking, courage, or socially rewarded forms of behavior. Consistent with this interpretation, PSRT showed a small but significant positive correlation with assertiveness, indicating that this domain may partly capture a tendency to engage in bold or self-confident actions rather than solely reflecting deficits in self-control. This pattern further indicates that academic–ethical, social media–entrepreneurial and financial–debt risk-taking tendencies are more strongly associated with deficits in self-control, thereby providing additional support for the criterion-related validity of the Risk-Taking Scale.

Relations with Gender role self-concept and core gender identity

Findings related to gender role self-concept suggest that risk-taking behaviors are embedded in a nuanced pattern of gendered traits and behaviors. Positive traits typically associated with agency and communion appeared to play a protective role, particularly in the AERT domain, which is consistent with the moral and normative nature of this risk area. In contrast, unmitigated agency and unmitigated communion were associated with increased risk taking in this domain, suggesting that extreme and unbalanced personality orientations may facilitate violations of ethical boundaries (Altuğ ve Aktan, 2025; Athenstaedt vd., 2009; Spence vd., 1979).

The PSRT and SMRT domains were more clearly situated along the axis of masculinity. Masculine traits, masculine behaviors, and a more masculine core gender identity (lower TMF scores) were consistently associated with higher levels of risk taking in these two domains. Conversely, unmitigated communion was negatively associated with risk taking in these areas, indicating that dependent and other-oriented personality patterns may be linked to greater risk avoidance. Consistent with this pattern, PSRT also showed a small but significant positive correlation with assertiveness, suggesting that physical–safety risk taking partly overlaps with a tendency to engage in bold, self-confident actions. This is in line with prior work showing that masculine self-descriptions are associated with a greater tendency to engage in risky behaviors, including health-risk and antisocial activities (e.g., Athenstaedt et al., 2009).

In the FDRT domain, unmitigated agency was the only gender role self-concept dimension that showed a significant association with risk taking. This finding suggests that financial and debt-related risk taking may be more strongly linked to self-centered and self-focused tendencies. Within the context of university students living with limited financial resources provided by their parents, this pattern may indicate that engaging in financial risks requires prioritizing one's own needs and desires over those of others.

Domain comparisons

Findings from the domain comparisons indicate that risk-taking behaviors are differentiated more strongly in terms of behavioral tendencies than perceived risk levels. The absence of significant differences in the riskiness ratings provided by the panelists across the four domains suggests that these behaviors are generally perceived as similarly risky. In contrast, participants' tendencies to engage in these behaviors differed markedly across domains.

The highest engagement tendency was observed in the PSRT domain, suggesting that despite their high perceived risk, such behaviors may be evaluated as more socially acceptable or rewarding.

The finding that AERT and FDRT showed lower engagement tendencies compared to PSRT, yet higher tendencies compared to SMRT, indicates that these risk domains may be evaluated in a more controlled and context-dependent manner. The lowest engagement tendency observed in the SMRT domain may be related to the long-term, uncertain, and potentially irreversible consequences associated with these risks. This pronounced differentiation across domains suggests that the Risk-Taking Scale is a sensitive measurement tool capable of distinguishing between perceived risk and behavioral engagement tendencies.

Limitations of the study

This study provides important findings regarding the psychometric properties of the Risk-Taking Scale developed to assess university students' risk-taking tendencies across different life domains. Nevertheless, several limitations should be acknowledged. First, the study sample consisted primarily of university students, with a substantial proportion drawn from psychology programs. The relatively narrow age range of the sample and the predominance of female participants limit the generalizability of the findings to populations with broader age ranges, diverse occupational backgrounds, and more balanced gender distributions. Second, all measures used in the study were based on self-report. Self-report methods are susceptible to biases such as social desirability, recall errors, and individual differences in self-awareness. These limitations may be particularly salient in domains involving normative and moral evaluations, such as risk-taking behaviors, potentially constraining the accuracy of participants' responses. Third, the cross-sectional design of the study does not allow for causal interpretations of the relationships between Risk-Taking Scale scores and self-control, gender role self-concept, or demographic variables. In addition, the present study did not examine the test–retest reliability, predictive validity, or cross-cultural validity of the scale. Finally, the limited number of items in the FDRT subscale may have contributed to its relatively lower internal consistency compared to the other subscales. This limitation may be addressed in future research by adding new items and examining financial risk-taking behaviors in larger and more heterogeneous samples. Taken together, these limitations suggest that further studies are needed to re-evaluate the psychometric properties of the Risk-Taking Scale across different samples, age groups, and cultural contexts, thereby providing more comprehensive evidence for its validity and reliability. In the present study, EFA and CFA were conducted on the same sample. Although the sample size was sufficient for each analyses, this approach may increase the risk of overfitting and limits the cross-validation of the factor structure. Future studies should replicate the factor structure using independent samples or apply split-sample validation strategies to provide stronger evidence for the structural validity of the scale. The use of assertiveness as a discriminant validity criterion, while conceptually related to risk-taking yet theoretically distinct, may nonetheless be considered a limitation when interpreting the discriminant validity findings. A major limitation of the present study is the composition of the sample, which consisted predominantly of women and psychology students. This uneven gender distribution and disciplinary homogeneity may have resulted in restricted variance and potential sampling bias, thereby limiting the generalizability of the findings to more diverse university populations. Future studies should validate the scale using samples with more balanced gender distributions and greater disciplinary diversity to strengthen the external validity of the findings. Some items, particularly those related to academic and ethical misconduct, may be subject to social desirability bias. Participants may have underreported their likelihood of engaging in such behaviors due to normative pressures, which could have led to an underestimation of risk-taking tendencies in these domains. Future studies may

reduce this bias by using indirect or less explicit item wording, incorporating social desirability measures, or employing alternative assessment methods such as implicit or behavioral indicators.

Conclusion

The Risk-Taking Scale developed in the present study offers a practical and multidimensional assessment tool that allows for the domain-specific evaluation of individuals' risk-taking tendencies. Its brief and easy-to-administer format makes it particularly suitable for research and applied settings involving university students and emerging adults, enabling the systematic assessment of risk-taking behaviors. By differentiating among academic–ethical risks, physical and safety-related risks, social media and entrepreneurial risks, and financial and debt-related behaviors, the Risk-Taking Scale may contribute to the development of more targeted intervention and prevention programs. Moreover, the significant associations observed between the Risk-Taking Scale, self-control, and gender role self-concept suggest that the scale can be used not only as a descriptive assessment tool but also as a means of understanding the psychosocial determinants of risk-taking behaviors. Psychological counselors, educators, and mental health professionals may use the Risk-Taking Scale as a supportive tool to identify individuals' risk-taking profiles and to design interventions that are sensitive to individual differences. Finally, applying the Risk-Taking Scale across different age groups, cultural contexts, and clinical or at-risk populations may further expand its scope of use. Such applications may contribute to a more comprehensive understanding of the developmental and contextual dynamics of risk-taking behaviors and enhance the effectiveness of preventive and protective mental health practices.

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Authorship Contributions

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Research Article

Examining the relationship between ultra-processed food consumption and quality of life among middle school students

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Abstract

Objective: With advancing technology and urbanization, traditional dietary habits are increasingly being replaced by ultra-processed foods (UPFs), which are practical, energy-dense, and low in nutritional value. Concerns have arisen that UPF consumption may adversely affect both physical and mental health in young people. This study aimed to examine the relationships between UPF consumption, quality of life, psychological symptoms, and food addiction among middle school students.

Methods: This descriptive cross-sectional study included 207 students 10–15 years aged (predominantly 11–14 years) attending schools in the Yüreğir district of Adana, Türkiye. Data were collected using a Sociodemographic Information Form, the Food Frequency Questionnaire (FFQ), the Yale Food Addiction Scale (YFAS), KIDSCREEN-52, and the Revised Child Anxiety and Depression Scale – Youth Version (RCADS-Y). Statistical analyses were conducted using SPSS 26.

Results: Overall, 46.9% of students met the YFAS diagnostic criteria for food addiction (≥3 symptoms plus clinically significant impairment/distress). UPF consumption frequency was negatively correlated with multiple health-related quality-of-life domains, including Physical Well-being ($r = -0.45$, $p < 0.001$), Moods & Emotions ($r = -0.30$, $p < 0.001$), Friends ($r = -0.18$, $p = 0.012$), and School Environment ($r = -0.30$, $p < 0.001$), while it was positively correlated with Bullying ($r = 0.25$, $p = 0.001$). UPF consumption was positively associated with food addiction ($r = 0.424$, $p = 0.001$). Family income level was significantly associated with UPF intake ($p = 0.037$), with the highest UPF consumption observed among middle-income households. No significant relationship was observed between BMI and food addiction status ($p > 0.05$).

Conclusion: UPF consumption among middle school students was associated with poorer quality of life and higher psychological symptom levels. These findings highlight the importance of addressing dietary habits alongside mental health in children and adolescents. However, as the study was cross-sectional, causal relationships cannot be inferred. Longitudinal and experimental research is recommended to clarify the direction and mechanisms of these associations.

Keywords: Adolescence, Food Addiction, Nutrition, Quality of Life, Ultra-Processed Foods

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Introduction

In the modern world, technological developments, urbanization, and changes in lifestyle have led to a marked transformation in traditional dietary habits. One of the most striking aspects of this transformation is the increasing level of industrial processing applied to foods and the growing presence of ultra-processed foods (UPFs) in daily nutrition. According to the NOVA food classification system (which groups foods based on the nature, extent, and purpose of industrial processing), UPFs are industrially manufactured products that contain numerous ingredients and are typically characterized by the inclusion of various additives, sweeteners, shelf-life–extending chemicals, and high energy density. Examples of UPFs include sugary and carbonated beverages, energy drinks, packaged cakes, cookies, and chips (Çelik, 2023).

The rising consumption of such products during childhood and adolescence has emerged as an important research area not only in terms of physical health, but also with regard to psychosocial well-being and mental health. Frequent consumption of UPFs during these developmental periods is suggested to increase dopamine release in the brain, potentially leading to lasting changes in the reward system. This may reduce satisfaction derived from healthy foods and contribute to the continuation of unhealthy eating behaviors in later life (Bhave et al., 2024).

A growing body of research has shown that UPF consumption is highly prevalent among children and adolescents and is increasingly recognized as an important public health concern (Neri et al., 2022; da Costa Louzada et al., 2021). Evidence from observational studies and umbrella reviews indicates that higher UPF intake is associated with poorer diet quality and unfavorable health outcomes, including cardiometabolic risk and mental health indicators (Pagliai et al., 2021; Askari et al., 2020).

In parallel, the concept of "food addiction" has gained increasing attention as a phenotype characterized by compulsive intake of highly palatable foods despite negative consequences. The Yale Food Addiction Scale (YFAS), originally developed by Gearhardt and colleagues, operationalizes addictive-like eating behaviors by adapting DSM substance dependence criteria to eating-related behaviors (Gearhardt et al., 2009). Meta-analytic evidence suggests that food addiction symptoms and diagnostic-level addictive-like eating are observable in pediatric populations and may be linked to psychosocial impairment (Burrows et al., 2017; Penzenstadler et al., 2019). In addition, systematic reviews report that food addiction prevalence estimates in youth vary across populations, particularly between community samples and clinical/overweight groups (Yekaninejad et al., 2021). Consistent with this, studies in adolescents seeking obesity treatment have reported meaningful associations between food addiction symptoms and disordered eating attitudes (Taş Torun et al., 2022).

Mechanistically, UPFs may be particularly relevant for addictive-like eating because they are industrial formulations designed to deliver highly reinforcing ingredient combinations (e.g., refined carbohydrates and fats), potentially enhancing reward responsivity and cue-triggered craving. Recent reviews emphasize that UPF addiction may represent a clinically meaningful construct that overlaps with—yet may be distinct from—traditional eating disorder phenotypes, and highlight neurobehavioral pathways (reward learning, impulsivity, cue reactivity) as plausible mechanisms (LaFata et al., 2024). Together, these mechanisms provide a plausible framework linking UPF consumption to addictive-like eating behaviors in youth.

In Türkiye, the emerging literature has also begun to examine UPF consumption and its correlates. For example, UPF intake has been associated with food literacy and healthy/sustainable eating behaviors among undergraduate students (Kabasakal-Cetin et al., 2024), and with mental distress and quality of life indicators in university samples (Öztürk & Uzdil, 2025). Moreover, a recent study in children reported an association between UPF consumption and low-

grade inflammation (Mete et al., 2024). However, despite these contributions, evidence remains limited regarding the combined evaluation of UPF consumption, food addiction, and psychosocial outcomes specifically in early adolescence and middle school populations in Türkiye.

Despite the growing body of research on ultra-processed food (UPF) consumption and its health correlates, important gaps remain in the literature. In particular, evidence is limited regarding the combined examination of UPF consumption, addictive-like eating behaviors (food addiction), and psychosocial outcomes such as quality of life, anxiety, and depression during early adolescence. Moreover, studies focusing specifically on middle school populations remain scarce. Addressing these gaps is important because early adolescence represents a critical developmental period during which eating patterns and reward-related behaviors may become established, and psychosocial vulnerabilities may intensify.

Therefore, the present study aimed to examine the relationships between UPF consumption and food addiction risk, quality of life, depression, and anxiety among middle school students. It is expected that this research will contribute to the limited body of literature in Türkiye evaluating these variables together in youth populations and provide guidance for preventive mental health practices, the development of healthy eating behaviors, and the planning of school-based intervention programs.

Based on previous evidence, the following hypotheses were formulated:

1. Higher UPF consumption frequency would be associated with poorer quality of life (lower KIDSCREEN-52 subscale scores).
2. Higher UPF consumption frequency would be associated with greater emotional distress, reflected by higher anxiety and depressive symptom levels (RCADS-Y subscales).
3. UPF consumption frequency would show an associated with addictive-like eating behaviors (food addiction indicators assessed by YFAS).

Method

Sample

The sample of the study consisted of students aged 11–14 years who were enrolled at Süleyman Şah Middle School, located in the Yüreğir district of Adana province. Data collection instruments were administered to a total of 224 students selected using a simple random sampling method. The study site was selected based on feasibility, as the first author was working at this school and official permissions from the relevant educational authorities were obtained only for this school. Therefore, while students within the school were selected using simple random sampling, the school itself was included through convenience sampling. However, 17 students were excluded from the study due to exclusion criteria such as insufficient language proficiency, cognitive impairment, or a history of psychiatric diagnosis; therefore, the analyses were conducted on 207 students.

The target population comprised all students enrolled in the middle school (grades 5–8; N = 773) during the 2023–2024 academic year. We evaluated whether the achieved sample size provided adequate statistical power for the planned correlation analyses (two-tailed). With $\alpha = 0.05$ and 80% power, the final analytic sample ($n = 207$) was sufficient to detect correlations of approximately $r \geq 0.19$, indicating adequate sensitivity for small-to-moderate associations. To account for potential exclusions and missing data, 224 students were initially recruited; after applying exclusion criteria, 207 students were included in the analyses.

The inclusion criteria were: being 10–15 years of age, being enrolled at Süleyman Şah Middle School, having no known physical or psychiatric diagnosis, possessing sufficient cognitive capacity and language proficiency to complete the questionnaires, and providing voluntary participation. Although the target age range of the study was 11–14 years, a small number of participants aged 10 (n = 5) and 15 (n = 1) were also included due to grade-level enrollment in the participating school.

The exclusion criteria were: insufficient language or cognitive ability to complete the questionnaires and/or identification of a psychiatric diagnosis during brief individual mental health assessment interviews conducted by the first author (psychologist) prior to questionnaire administration. These assessments were based on a clinical interview guided by DSM-5 diagnostic criteria; no semi-structured diagnostic interview (e.g., K-SADS) was used. The interview findings were used solely for eligibility screening.

Data Collection Procedure

The data collection process was carried out between April and June 2024. Ethical approval for the study was obtained from the Çukurova University Research Ethics Committee (dated 08.03.2024, decision number 2024/142), as well as from the Adana Provincial Directorate of National Education and the Yüreğir District Directorate of National Education. Written informed consent was obtained from both the participants and their parents after providing detailed information regarding the purpose of the study.

Data Collection Instruments

Sociodemographic Information Form

A sociodemographic information form was used to collect participants' demographic characteristics, including sex, age, socioeconomic and demographic variables, height, weight, and general health status. Height and weight were measured by the first author during the study visit (not self-reported). Briefly, weight was measured using a calibrated digital scale and height was measured using a stadiometer, with participants wearing light clothing and without shoes. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Age- and sex-specific BMI-for-age percentiles were determined using the Centers for Disease Control and Prevention (CDC) 2000 growth charts. Based on CDC percentiles, participants were classified as underweight (<5th percentile), healthy weight (5th to <85th percentile), overweight (85th to <95th percentile), and obesity (≥95th percentile). (Kuczmarski et al., 2000)

Yale Food Addiction Scale

The original Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009) was used (DSM-IV-TR based version). Addiction-like eating behaviors were assessed using the **YFAS,** developed by Gearhardt, Corbin, and Brownell, which operationalizes "food addiction" by adapting **DSM-IV-TR substance dependence criteria** to the consumption of highly palatable foods (e.g., high-fat/high-sugar foods). The YFAS evaluates seven dependence-related criteria and includes additional items assessing clinically significant **impairment** and **distress**, referring to eating behaviors during the **past 12 months**. The scale yields a **symptom count score** (range: **0–7**) and a **diagnostic classification**. Higher symptom count scores indicate greater severity of addictive-like eating behaviors. "Food addiction" defined as endorsement of **≥3 criteria** together with clinically significant impairment and/or distress. The original development study reported good internal consistency (**KR = 0.86** at the item level; **KR = 0.75** at the criterion level) (Gearhardt et al., 2009). The Turkish validity and reliability of the original YFAS has been supported in Turkish samples (Buyuktuncer et al., 2019; Bayraktar et al., 2012). In the present study, internal consistency was acceptable, with a Kuder–Richardson coefficient of 0.71.

KIDSCREEN-52: Health-Related Quality of Life Questionnaire for Children and Adolescents

KIDSCREEN-52 is a multidimensional instrument designed to assess health-related quality of life among children and adolescents aged 8–18 years across 12 countries. It comprises 10 subscales (Ravens-Sieberer et al., 2005): Physical Well-being, Psychological Well-being, Moods and Emotions, Self-Perception, Autonomy, Parent Relations and Home Life, Social Support and Peers, School Environment, Social Acceptance (Bullying), and Financial Resources. Higher scores indicate better perceived quality of life in the corresponding domain. The Turkish adaptation and reliability–validity

studies were conducted by Baydur et al. (2016). Internal consistency for the KIDSCREEN-52 was satisfactory in the current sample, with Cronbach's alpha coefficients ranging from 0.68 to 0.99 across subscales. In the original European validation study, Cronbach's alpha values were reported to range between 0.77 and 0.89 (Ravens-Sieberer et al., 2005), while the Turkish validation conducted by Baydur et al. reported alpha coefficients ranging from 0.69 to 0.90 for the child/adolescent version.

Revised Child Anxiety and Depression Scale – Youth Version (RCADS-Y)

The RCADS-Y is a 47-item self-report scale developed to assess levels of anxiety and depression among children and adolescents (Chorpita et al., 2000). The RCADS-Y includes subscales assessing Separation Anxiety Disorder, Social Phobia, Generalized Anxiety Disorder, Panic Disorder, Obsessive–Compulsive symptoms, and Major Depressive Disorder. Higher scores indicate greater anxiety and depressive symptom severity. The internal consistency of the Turkish version has been reported to be strong to excellent, with a Cronbach's alpha coefficient of .95 (Gormez et al., 2017). In the current sample, the RCADS-Y demonstrated excellent internal consistency (Cronbach's α = 0.99).

Food Frequency Questionnaire (FFQ)

Originally developed in the 1980s, the FFQ is a dietary assessment tool designed to determine how often, in what quantities, and over what period of time individuals consume specific food groups. The number of food and beverage items included typically ranges from 80 to 120 (Willett et al., 1998). Participants' retrospective dietary intake was recorded using the FFQ. Food consumption frequencies were scored on a 0–6 scale, consistent with commonly used FFQ frequency scoring approaches. Higher scores indicating more frequent consumption. For the purposes of this study, FFQ items corresponding to ultra-processed foods (UPFs) were identified based on the NOVA classification system. A total UPF consumption frequency score was then calculated by summing the 0–6 frequency scores across these UPF items, with higher scores reflecting more frequent UPF consumption.

Data Analysis

Data analysis was conducted using SPSS version 26. A sensitivity analysis indicated that the final sample size (n = 207) provided 80% power to detect correlations of approximately $r \geq 0.19$ at $\alpha = 0.05$ (two-tailed). First, the distributional characteristics of the variables were examined. To evaluate the assumption of normality, the Kolmogorov–Smirnov test, histograms, Q–Q plots, and skewness–kurtosis values were collectively considered. As most of the scale scores were found to fall within acceptable normal distribution limits, parametric tests were deemed appropriate for group comparisons. Independent samples t-tests were used for comparisons between two groups, while one-way analysis of variance (ANOVA) was used for comparisons involving three or more groups. Where homogeneity of variance was not met, suitable post-hoc tests were applied. Pearson correlation analysis was used to examine linear relationships between variables. A significance level of $p < 0.05$ was adopted.

Results

Findings Related to Demographic Characteristics

The demographic characteristics of the students who participated in the study were analyzed and are presented in Table 1 as frequencies and percentages. No participant met the CDC criteria for obesity (≥95th percentile).

Table 1. Demographic Characteristics of the Students			
Variable	**Category**	**n**	**%**
Age (years)	*10–11*	*55*	*26.57*
	12	*63*	*30.43*
	13	*46*	*22.22*
	14–15	*43*	*20.77*
Mean ± SD	*12.35 ± 1.15*		
Grade level	*5th grade*	*61*	*29.47*
	6th grade	*60*	*28.99*
	7th grade	*42*	*20.29*
	8th grade	*44*	*21.26*
Gender	*Female*	*142*	*68.60*
	Male	*65*	*31.40*
Regular physical activity	*Yes*	*173*	*83.57*
	No	*34*	*16.43*
BMI (weight status*)	*Underweight*	*102*	*49.28*
	Normal weight	*93*	*44.93*
	Overweight	*12*	*5.80*
BMI (kg/m²)	*Mean ± SD*		*18.96 ± 3.33*
	Range		*12.65–29.49*
Food addiction status(YFAS diagnosis)	*Non-addicted*	*110*	*53.14*
	Addicted	*97*	*46.86*

**BMI categories were classified using CDC 2000 BMI-for-age percentiles (underweight: <5th percentile; normal weight: 5th to <85th percentile; overweight 85–<95, obesity ≥95).*

A total of 207 middle school students participated in the study. The ages of the participants ranged from 10 to 15 years, with a mean age of 12.35 ± 1.15 years. Of the students, 68.6% were female and 31.4% were male. In addition, 83.6% of the participants reported engaging in regular physical activity. According to the BMI classification, 49.3% of the students were underweight, 44.9% were of normal weight, and 5.8% were overweight. Food addiction status (YFAS diagnosis) was operationalized as a categorical variable based on the YFAS diagnostic classification (0 = absent, 1 = present). According to the YFAS diagnostic algorithm, 46.9% of the students met the criteria for food addiction (≥3 symptoms plus clinically significant impairment/distress) (Table 1). Students' height values ranged between 128 and 180 cm (M = 151.85, SD = 9.57), while their weight values ranged between 25 and 87 kg (M = 43.99, SD = 10.11). BMI values ranged between 12.65 and 29.49 (M = 18.96, SD = 3.33).

Frequency of UPF (NOVA Group 4) Consumption

Examination of the UPF consumption frequency in Table 2 reveals that a considerable proportion of items such as flavoured or chocolate milk, ice cream, chips, chocolate, and packaged snack foods are consumed more than once per week. Notably, products such as ice cream, chips, and chocolate–wafer snacks are regularly incorporated into students' weekly and even daily dietary patterns. These results suggest that a substantial proportion of students frequently consume foods classified as UPFs.

Table 2. Frequency of UPF (NOVA Group 4) Consumption							
Food Items	**Never**	**< 1 time/ month**	**1–3 times/ month**	**1 time/week**	**2–3 times/week**	**4–5 times/ week**	**6–7 times/ week**
Flavored or chocolate milk							
n(%)	*27(13,04)*	*18(8,70)*	*11(5,31)*	*20(9,66)*	*46(22,22)*	*21(10,14)*	*64(30,92)*
Ice cream							
n(%)	*0(0,00)*	*0(0,00)*	*2(0,97)*	*19(9,18)*	*52(25,12)*	*72(34,78)*	*62(29,95)*
Pastry products (bakery items)							
n(%)	*3(1,45)*	*0(0,00)*	*6(2,90)*	*27(13,04)*	*87(42,03)*	*53(25,60)*	*31(14,98)*
Biscuits / crackers							
n(%)	*3(1,45)*	*0(0,00)*	*13(6,28)*	*23(11,11)*	*61(29,47)*	*60(28,99)*	*47(22,71)*
Packaged fruit juices							
n(%)	*8(3,86)*	*5(2,42)*	*8(3,86)*	*14(6,76)*	*49(23,67)*	*59(28,50)*	*64(30,92)*
Processed meats (salami, sausage, etc.)							
n(%)	*25(12,08)*	*3(1,45)*	*23(11,11)*	*31(14,98)*	*46(22,22)*	*51(24,64)*	*28(13,53)*
Candy / Turkish delight / chewing gum							
n(%)	*5(2,42)*	*7(3,38)*	*10(4,83)*	*29(14,01)*	*50(24,15)*	*44(21,26)*	*62(29,95)*
Ketchup, mayonnaise and similar sauces							
n(%)	*14(6,80)*	*6(2,91)*	*18(8,74)*	*25(12,14)*	*39(18,93)*	*47(22,82)*	*57(27,67)*
Carbonated soft drinks							
n(%)	*5(2,42)*	*12(5,80)*	*2(0,97)*	*17(8,21)*	*62(29,95)*	*60(28,99)*	*49(23,67)*
Iced teas							
n(%)	*54(26,09)*	*17(8,21)*	*22(10,63)*	*34(16,43)*	*15(7,25)*	*34(16,43)*	*31(14,98)*
Chocolate / wafers							
n(%)	*0(0,00)*	*0(0,00)*	*8(3,86)*	*13(6,28)*	*57(27,54)*	*44(21,26)*	*85(41,06)*
Cream-filled bakery / pastry products							
n(%)	*19(9,18)*	*22(10,63)*	*26(12,56)*	*43(20,77)*	*39(18,84)*	*25(12,08)*	*33(15,94)*
Packaged cakes							
n(%)	*2(0,97)*	*8(3,86)*	*27(13,04)*	*20(9,66)*	*58(28,02)*	*37(17,87)*	*55(26,57)*
Hamburger / onion rings							
n(%)	*23(11,11)*	*21(10,14)*	*56(27,05)*	*21(10,14)*	*38(18,36)*	*23(11,11)*	*25(12,08)*
Chips / corn snacks							
n(%)	*0(0,00)*	*1(0,48)*	*6(2,90)*	*13(6,28)*	*45(21,74)*	*72(34,78)*	*70(33,82)*

Group Differences in Scale Scores and Student Characteristics by Food Addiction Status

Based on Table 3, when the relationship between food addiction status and psychological symptoms was examined, it was found that the total scores of the Revised Child Anxiety and Depression Scale were significantly higher among students with food addiction compared to those without food addiction ($t = -4.199$, $p = 0.001$). Similarly, the subscale scores for separation anxiety disorder, generalized anxiety disorder, panic disorder, social phobia, obsessive–compulsive symptoms, and major depressive disorder were also higher among students with food addiction ($p < 0.05$). These findings indicate that symptoms of food addiction tend to coexist with higher levels of anxiety and depression in students.

Among the students who participated in the study, 50.0% of those without food addiction were underweight according to their BMI values, 45.45% were of normal weight, and 4.55% were overweight.

Among the students with food addiction, 48.45% were underweight, 44.33% were of normal weight, and 7.22% were overweight. No statistically significant association was found between BMI levels and food addiction status ($p > 0.05$) (Table 4).

Table 3. Comparison of RCADS-Y Total and Subscale Scores According to Students' Food Addiction Status

Scale / Subscales	Food Addiction Status	n	Mean ± SD	t	df	p
RCADS-Y Total Score	*Non-addicted*	*110*	*48,46 ± 26,15*	*−4,199*	*205*	*0,001**
	Addicted	*97*	*65,02 ± 30,58*			
Separation Anxiety Disorder (SAD)	*Non-addicted*	*110*	*5,20 ± 4,06*	*−5,019*	*205*	*0,001**
	Addicted	*97*	*8,57 ± 5,56*			
Generalized Anxiety Disorder (GAD)	*Non-addicted*	*110*	*7,02 ± 4,18*	*−3,088*	*205*	*0,002**
	Addicted	*97*	*8,79 ± 4,03*			
Panic Disorder (PD)	*Non-addicted*	*110*	*7,35 ± 5,57*	*−2,739*	*205*	*0,007**
	Addicted	*97*	*9,57 ± 6,11*			
Social Phobia (SP)	*Non-addicted*	*110*	*10,45 ± 5,42*	*−4,615*	*205*	*0,001**
	Addicted	*97*	*14,46 ± 7,06*			
Obsessive–Compulsive Disorder (OCD)	*Non-addicted*	*110*	*7,40 ± 4,58*	*−2,466*	*205*	*0,014**
	Addicted	*97*	*8,89 ± 4,09*			
Major Depressive Disorder (MDD)	*Non-addicted*	*110*	*9,45 ± 5,66*	*−3,880*	*205*	*0,001**
	Addicted	*97*	*12,91 ± 7,18*			

Independent samples t-test was used. $p < 0,05$ is considered statistically significant.

Table 4. Comparison of Student Characteristics According to Food Addiction Status

BMI Levels	Food Addiction Absent (n = 110)	Food Addiction Present (n = 97)	χ^2	p
	n %	*n %*	**0,674**	**0,714**
Underweight	*55 50*	*47 48,4*		
Normal weight	*50 45,4*	*43 44,3*		
Overweight	*5 4,55*	*7 7,22*		

χ^2 = Chi-square test. $p > 0,05$ indicates no statistically significant difference.

In order to further examine the association between food addiction and body weight indicators, BMI values were also compared between students with and without food addiction. Mean BMI was 18.83 ± 3.09 in the non-addicted group and 19.11 ± 3.59 in the addicted group, and this difference was not statistically significant ($p = 0.550$). Similarly, BMI category distributions did not differ significantly according to food addiction status ($\chi^2 = 0.674$, $p = 0.714$) (Table 4). These findings suggest that, in the present sample, food addiction status was not associated with BMI or BMI-based weight status. In addition, in regression analysis adjusting for age and sex, food addiction status was not a significant predictor of BMI ($\beta = 0.144$, $p = 0.747$).

Correlations Between UPF Consumption Frequency and KIDSCREEN-52 Subscale Scores

When the relationships between students' food group consumption frequencies and KIDSCREEN-52 health-related quality-of-life subscales were examined, ultra-processed food (UPF; NOVA Group 4) consumption frequency showed statistically significant negative correlations with most quality-of-life domains (Table X). Specifically, higher UPF consumption was associated with lower scores in Physical Well-being ($r = -0.45$, $p < 0.001$), Moods & Emotions ($r = -0.30$, $p < 0.001$), General Mood ($r = -0.35$, $p < 0.001$), Self-Perception ($r = -0.28$, $p < 0.001$), Leisure ($r = -0.20$, $p = 0.002$), Financial Resources ($r = -0.25$, $p = 0.001$), Friends ($r = -0.18$, $p = 0.012$), and School Environment ($r = -0.30$, $p < 0.001$). In contrast, UPF consumption was not significantly correlated with the Family and Home Life subscale ($r = -0.10$, $p = 0.110$). UPF consumption was also positively correlated with Bullying (victimization) ($r = 0.25$, $p = 0.001$), indicating higher exposure to bullying as UPF consumption increased.

Pearson correlation analyses indicated that UPF consumption was positively correlated with depressive symptoms ($r = 0.152$, $p = 0.029$), generalized anxiety symptoms ($r = 0.201$, $p = 0.004$), and social phobia symptoms ($r = 0.183$, $p = 0.008$). In contrast, no significant correlation was observed between UPF consumption and obsessive–compulsive symptoms ($r = -0.043$, $p = 0.540$).

Correlations Between KIDSCREEN-52 and RCADS-Y Subscale Scores

When the correlations between KIDSCREEN-52 health-related quality-of-life domains and RCADS-Y symptom scores were examined, several statistically significant negative associations were observed (Table 5). Depressive symptoms (MDD) showed the strongest associations, particularly with the Moods & Emotions domain ($r = -0.55$, $p < 0.001$) and Psychological Well-being ($r = -0.49$, $p < 0.001$). Similarly, generalized anxiety (GAD) and social phobia (SP) were negatively correlated with Moods & Emotions (both $r = -0.45$, $p < 0.001$). Notably, multiple RCADS-Y subscales were also associated with lower quality-of-life ratings in School Environment (e.g., GAD: $r = -0.16$, $p = 0.021$; Separation Anxiety: $r = -0.17$, $p = 0.014$) and Social Support & Peers (e.g., GAD: $r = -0.21$, $p = 0.002$). Overall, higher anxiety and depressive symptom levels tended to be accompanied by less favorable evaluations across several psychosocial domains.

Table 5. Correlations Between KIDSCREEN-52 and RCADS-Y Subscale Scores

RCADS-Y subscale	Physical Well-being	Psychological Well-being	Moods & Emotions	Self-Perception	Autonomy & Leisure	Parent Relations & Home Life	Financial Resources	Social Support & Peers	School Environment	Bullying
Separation Anxiety Disorder	**−0.24 (0.001)**	**−0.32 (<0.001)**	**−0.36 (<0.001)**	**−0.23 (0.002)**	**−0.20 (0.006)**	**−0.27 (<0.001)**	*−0.09 (0.180)*	*−0.12 (0.089)*	**−0.17 (0.014)**	**0.21 (0.004)**
Social Phobia	**−0.23 (0.001)**	**−0.38 (0.001)**	**−0.45 (<0.001)**	**−0.31 (<0.001)**	**−0.25 (<0.001)**	**−0.30 (<0.001)**	*−0.12 (0.083)*	**−0.20 (0.004)**	**−0.21 (0.002)**	**0.25 (<0.001)**
Generalized Anxiety Disorder	**−0.26 (<0.001)**	**−0.37 (< 0.001)**	**−0.45 (<0.001)**	**−0.33 (<0.001)**	**−0.28 (<0.001)**	**−0.32 (<0.001)**	**−0.15 (0.033)**	**−0.21 (0.002)**	**−0.16 (0.021)**	**0.24 (0.001)**
Panic Disorder	**−0.21 (0.003)**	**−0.29 (< 0.001)**	**−0.33 (<0.001)**	**−0.24 (0.001)**	**−0.21 (0.004)**	**−0.26 (<0.001)**	*−0.10 (0.149)*	*−0.09 (0.176)*	**−0.15 (0.028)**	**0.20 (0.006)**
Obsessive–Compulsive Disorder	**−0.23 (0.002)**	**−0.34 (< 0.001)**	**−0.45 (<0.001)**	**−0.30 (< 0.001)**	**−0.24 (0.001)**	**−0.29 (<0.001)**	*−0.13 (0.057)*	**−0.14 (0.045)**	**−0.15 (0.037)**	**0.22 (0.002)**
Major Depressive Disorder	**−0.40 (<0.001)**	**−0.49 (<0.001)**	**−0.55 (<0.001)**	**−0.42 (<0.001)**	**−0.37 (<0.001)**	**−0.36 (<0.001)**	**−0.17 (0.015)**	*−0.06 (0.357)*	*−0.06 (0.420)*	**0.31 (<0.001)**

Pearson correlation coefficients are presented as r (p). Statistically significant correlations ($p < 0.05$) are shown in **bold**.

Table 6. Correlations Between Food Addiction and Food Group Consumption		
Food Group	**Correlation Coefficient (r)**	**Significance Level (p)**
Group 1: Unprocessed Foods	*0.128*	*0.061*
Group 2: Processed Culinary Ingredients	*0.314*	*0.017**
Group 3: Processed Foods	*0.371*	*0.006**
Group 4: Ultra-Processed Foods (UPFs)	*0.424*	*0.001**

Pearson correlation analysis was used. $p < 0.05$ indicates statistical significance.

Correlation Between Food Addiction and Food Groups

In Table 6, a positive, significant, and relatively strong correlation is shown between UPF consumption and food addiction ($r = 0.424$, $p = 0.001$). In contrast, the association between food addiction and unprocessed or minimally processed foods is weak and not statistically significant ($r = 0.128$, $p = 0.061$). In correlation analyses, food addiction was operationalized as a binary variable (0 = absent, 1 = present) based on the YFAS diagnostic criteria.

The Relationship Between Income Level and Consumption of Food Groups

A statistically significant association was observed between family income level and ultra-processed food (UPF; NOVA Group 4) consumption ($\chi^2 = 6.609$, $p = 0.037$), indicating that UPF consumption frequency differed across income categories. Descriptively, UPF consumption was highest among students from middle-income families.

Discussion

In summary, this study examined the associations between ultra-processed food (UPF) consumption, food addiction, psychological symptoms, and health-related quality of life among middle school students. The findings indicated that higher UPF consumption was significantly associated with poorer quality of life and higher levels of anxiety and depressive symptoms. Nearly half of the participants met the YFAS diagnostic criteria for food addiction. UPF intake differed significantly by family income level, whereas no significant association was observed between food addiction and BMI/weight status in the present sample.

The key outcome of this research is the identification of a positive association between the frequency of UPF consumption and food addiction risk in middle school students. Higher intake of UPF-category snacks and sugar-sweetened beverages appears to parallel an increase in food addiction symptoms. This finding aligns with the growing body of literature indicating that the high palatability, energy density, refined sugar, and additive content of UPFs may stimulate reward pathways and reinforce eating behaviour (Gearhardt et al., 2011).

Our results demonstrated that UPF consumption frequency was positively correlated with depressive symptoms, generalized anxiety symptoms, and social phobia symptoms; however, no significant association was observed with obsessive–compulsive symptoms. These results parallel recent epidemiological findings that have identified meaningful associations between UPF consumption and common psychiatric symptoms across both adolescent and adult cohorts (Amelia, 2025; Lane, 2022). Consistent reports of heightened mental health symptomatology among adolescents with high UPF intake reinforce the relevance of dietary quality as a factor associated with psychosocial functioning and well-being.

With regard to quality-of-life indicators, our findings showed that students with higher UPF consumption and an elevated risk of food addiction reported lower scores in perceived physical health and school-related quality of life. This result appears to be consistent with studies conducted in larger populations, which have similarly reported that UPF consumption is associated with poorer overall quality of life and reduced mental well-being (Öztürk, 2025). Such associations suggest that dietary quality is linked not only to metabolic outcomes

but also to psychosocial processes, underscoring the importance of supporting healthy dietary patterns and the preference for nutrient-dense foods during childhood and adolescence (Öztürk, 2025).

In addition, a positive association was identified in our study between the frequency of UPF consumption and BMI. Importantly, this association reflects the relationship between BMI and UPF consumption frequency, and should not be confused with the separate analysis examining BMI in relation to YFAS-based food addiction status. This finding is consistent with previous research reporting that UPFs, despite their low nutritional value, are associated with obesity-related indicators due to their high energy density. In particular, diets characterized by high UPF intake have been shown to be related to increases in body weight and fat mass (Hall et al., 2019; Asgari et al., 2022). However, it should be taken into account that obesity is a multifactorial condition influenced not only by dietary patterns but also by physical activity levels, genetic predisposition, and various environmental factors.

Notably, while UPF consumption frequency was positively associated with BMI, food addiction status itself was not significantly related to BMI or BMI-based weight status in the current sample. This finding contrasts with several previous reports indicating that food addiction symptoms tend to be more prevalent among adolescents with obesity and in clinical samples of youth seeking treatment for obesity (Taş Torun et al., 2022). However, the association between food addiction and BMI may vary depending on the characteristics of the study population. In school-based, non-clinical adolescent samples, food addiction symptoms may be driven more strongly by psychosocial and behavioral factors (e.g., maladaptive eating attitudes, emotional eating, or impulsivity) rather than by body weight alone (Davis et al., 2011; Meule & Gearhardt, 2014). In addition, the limited number of participants in the overweight category in the present study may have reduced statistical power to detect meaningful group differences. Future studies using larger samples with wider representation across weight status categories, and analyses based on BMI-for-age percentiles and/or z-scores, may provide a more sensitive examination of this relationship.

Among the sociodemographic findings, the increase in UPF consumption frequency with age — and particularly its higher prevalence among students in adolescence — is consistent with previous observations suggesting that peer influence, the school environment, and media exposure may increasingly shape dietary choices as children grow older (Monteiro et al., 2019). In addition, the higher prevalence of UPF consumption among children from low–middle income families suggests that sociocultural factors such as economic accessibility, food environments, and awareness of healthy nutrition may play a role in shaping eating behaviors (Hutchinson & Tarasuk, 2022; Asgari et al., 2022). Taken together, these findings highlight the complex structure of the modern food environment and the multidimensional factors influencing children's everyday food preferences.

Since the design of this study is cross-sectional, direct causal inferences regarding the direction of the observed relationships and the underlying mechanisms cannot be made. However, the findings reflect consistent patterns of association between UPF consumption and food addiction, psychological symptoms, and quality of life. Therefore, the evaluation of dietary habits in children and adolescents should be considered together with mental health, quality of life, and behavioural patterns. Future longitudinal and experimental studies are needed to clarify the temporal course of these relationships and to better identify potential mediating variables.

This study was limited to 207 middle school students enrolled in schools located in the Yüreğir district of Adana during the 2023–2024 academic year. Data collection was limited to a single school due to administrative permission procedures, which may limit the generalizability of the findings. Therefore, the extent to which this sample represents the wider population may be limited. In

addition, the gender distribution was unbalanced, with girls representing 68.6% of the sample. This may have introduced gender-related sampling bias and may limit the generalizability of the findings, as the associations between UPF consumption, food addiction indicators, and psychological symptoms may differ by sex. The use of self-report instruments to collect data also carries a risk of response bias. This limitation may be particularly relevant for the sociodemographic questionnaire and the food frequency assessment, in which recall bias may occur. In addition, the cross-sectional design of the study allowed for the examination of relationships between variables at a single time point; however, it precludes causal inference. Therefore, the findings should be interpreted as associations rather than causal relationships. Finally, although the scales used in this study are valid and reliable measurement tools, they are not diagnostic instruments. Therefore, the findings should be interpreted as reflecting symptom levels rather than clinical diagnoses and should not be considered equivalent to formal psychiatric assessment.

Conclusions

In this study, the relationships between UPF consumption and food addiction risk, psychological symptoms, and quality of life were examined among middle school students. Higher UPF intake was associated with greater food addiction symptoms, anxiety, and depression, lower quality-of-life scores, and higher BMI. UPF consumption also tended to increase with age and appeared to be influenced by family and household characteristics. These findings highlight important public health implications, suggesting that taxation, stricter regulation, clearer labelling, and preventive strategies involving children, parents, and schools may help reduce UPF consumption and its potential physical and psychological consequences. Future longitudinal and experimental studies are needed to clarify the causal links between UPF intake and mental health outcomes in young people.

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Review Article

Epigenetic embedding of childhood adversity: Linking adverse childhood experiences to addiction

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Abstract: Adverse childhood experiences shape the developing brain in ways that increase vulnerability to substance use across the lifespan. This review brings together evidence from epigenetics, neuroscience and forensic psychology to explain how early stress becomes biologically embedded. Childhood adversity alters patterns of DNA methylation in genes that regulate stress response, neuroplasticity and reward processing, including NR3C1, FKBP5, BDNF, DRD2 and OPRM1. These molecular changes heighten sensitivity to stress, weaken the capacity to experience pleasure and increase impulsive behavior. As a result, substance use often emerges as an attempt to cope with an internal environment marked by emotional and physiological dysregulation. Repeated substance use then reinforces the same biological pathways, creating a cycle that is difficult to break. Research from different countries shows a clear association between adversity, epigenetic variation and accelerated biological aging. While direct causal evidence in humans is still emerging, statistical models and animal studies suggest a potential basis for the intergenerational transmission of trauma-related susceptibility. Studies from Türkiye report strong links between childhood trauma, dissociation and substance use, although molecular research remains limited. Interpreting these findings through a forensic lens highlights the need to move beyond purely punitive views of addiction. Trauma and biologically informed approach can support more effective prevention, treatment and rehabilitation strategies.

Keywords: Child Abuse, Early Life Stress, Addiction, Epigenetics, Forensic Psychology.

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Introduction

The integration of a forensic psychology perspective into the study of Adverse Childhood Experiences (ACEs) and Substance Use Disorder (SUD) is critical for translating molecular findings into actionable justice and rehabilitation frameworks. While epigenetics illuminates the "biological embedding" of trauma, explaining how early adversity alters gene expression related to impulse control, aggression, and stress regulation also it is the forensic psychological/psychiatric lens that contextualizes these biological adaptations within the realms of criminal responsibility, culpability, and recidivism risk. Merging epigenetic evidence with psychological assessment is essential not to advocate for biological determinism, but to construct a robust bio-psycho-social model that challenges traditional punitive approaches by presenting addiction as a physiological adaptation rather than a mere moral failing.

This review allows practitioners to better understand the etiology of harmful behaviors and supports the development of trauma-informed sentencing and rehabilitation strategies that leverage the potential for epigenetic reversibility.

Adverse Childhood Experiences to Substance Use

The causal relationship between the psychosocial stress caused by ACEs and SUD is explained by a complex process of "biological embedding" governed by epigenetic mechanisms (Boyce et al., 2012; Ngo et al., 2025). Although chronic early-life stress does not alter the DNA sequence itself, it reprograms the methylation patterns regulating gene expression, creating a neurobiological "priming" ground (Zang et al., 2023). Specifically, hypermethylation of the *NR3C1* gene, which modulates the stress response, renders the HPA axis hypersensitive, while epigenetic alterations in the *DRD2* and *OPRM1* genes within the reward system blunt the individual's capacity for pleasure (anhedonia) (Misiak et al., 2021; Peña et al., 2019). This molecular landscape leaves the individual vulnerable to external stressors and internally suffering from "reward deficiency." Consequently, substance use in these individuals emerges not as an arbitrary choice, but as an attempt to artificially balance an epigenetically dysregulated neurobiology or as a maladaptive coping strategy (Jordan & Andersen, 2017).

In a cycle, the substances themselves (alcohol, opioids, etc.) imprint their own epigenetic signatures, perpetuating the impairment in the brain's reward and stress pathways and locking in the cycle of addiction (Casiano, 2025).

International Empiric Findings

Quantitative research from international literature highlights significant correlations between early adversity and epigenetic markers (such as DNA methylation and Epigenetic Age Acceleration) that predispose individuals to substance use. A systematic review and meta-analysis of candidate gene studies estimated the overall correlation coefficient between childhood adversity and DNA methylation variation at $r = 0.291$ ($p < 0.001$). This statistically confirms that early life stress significantly predicts variations in the epigenome, particularly in systems regulating stress and immunity (Neves et al., 2021). Longitudinal data indicates a dose-response relationship between ACEs and biological aging. Individuals with 4 or more ACEs demonstrated significant epigenetic age acceleration (EAA) compared to those with fewer adversities. Specifically, at age 20, the Extrinsic Epigenetic Age Acceleration (EEAA) was increased by $\beta = 1.05$ years (95% CI [0.66, 1.44]), and GrimAge acceleration was increased by $\beta = 0.57$ years (95% CI [0.28, 0.87]) (Raffington et al., 2021). Even lower exposure levels (1–2 ACEs) were associated with an acceleration of 0.86 years (Horvath units) (95% CI [0.29, 1.43], $p = 0.003$) compared to individuals with zero ACEs (Bayer et al., 2023).

Substance use itself accelerates epigenetic aging, compounding the effects of trauma. A longitudinal study found that weekly cannabis use from adolescence to adulthood was strongly associated with accelerated DNA methylation aging ($\beta = 1.665$, SE = 0.591, $p = .005$). The cumulative exposure to

mental health symptoms, substance use, and early adversities was associated with an accelerated aging effect of approximately 3.17 to 3.76 years (Lawn et al., 2023). Statistical modeling has shown that the effect of maternal ACEs on neonatal *COMT* gene methylation (a gene involved in dopamine degradation) is 64% mediated by the mother's own *COMT* methylation patterns (Indirect effect: $p = 0.044$, 95% CI [0.0025, 0.32]). This suggests a statistical basis for the biological transmission of trauma susceptibility across generations (Mohazzab-Hosseinian et al., 2023).

Empiric Findings from Türkiye

While epigenetic research in Türkiye is still developing compared to Western literature, recent studies provide strong clinical and preliminary statistics regarding the link between childhood trauma and substance use.

In a study of 133 individuals with substance use disorders in Türkiye, participants scored highest on the Emotional Neglect subscale of the Childhood Trauma Questionnaire (CTQ), with a mean score of 12.83 ± 3.46. This study statistically linked these traumatic experiences to dysfunctional coping mechanisms such as "behavioral disengagement" and "denial" (Orak et al., 2023). Again, a descriptive study involving 173 substance-dependent individuals in Eastern Türkiye reported a total mean CTQ score of 34.8 9± 14.19. The study found a significant, albeit weak, positive correlation ($p < .05$) between dissociative experiences (a psychological detachment often linked to biological stress dysregulation) and types of abuse, particularly emotional and physical abuse (Aktas et al., 2024).

To best of our knowledge there is one molecular study conducted in Türkiye regarding this topic. A molecular study conducted by Yilmaz et al. (2021) on Turkish adolescents with suicide attempts (a group with high ACE prevalence) examined Brain-Derived Neurotrophic Factor (BDNF) gene expression from whole blood samples. Although the study found significantly higher CTQ scores in the case group compared to controls, it reported no statistically significant difference in BDNF gene expression levels between the groups ($p > 0.05$). This "negative" finding is crucial as it suggests that biological embedding in the Turkish population might manifest through more complex, tissue-specific epigenetic mechanisms rather than simple gene expression levels in blood, or that resilience factors specific to the culture might be buffering certain biological effects.

Although Yılmaz et al. (2021) reported no statistically significant difference in *BDNF* gene expression between the trauma-exposed group and controls, this "negative" finding warrants a nuanced interpretation regarding tissue specificity and resilience. It is well-documented that peripheral blood *BDNF* levels do not always linearly reflect brain tissue concentrations, particularly under complex stress conditions (Klein et al., 2011). While blood *BDNF* is often used as a proxy, it is influenced by platelet activation and peripheral inflammation, which may mask central nervous system downregulation in some clinical populations.

The integration of epigenetic evidence into forensic psychology compels a re-evaluation of traditional concepts regarding criminal responsibility and rehabilitation. Unlike fixed genetic mutations, epigenetic modifications—such as the methylation of *NR3C1* or *BDNF*—are dynamic and potentially reversible, representing a "biological scar" of environmental trauma rather than an immutable character flaw. This distinction is critical for forensic risk assessment; it suggests that the impulsivity and emotional dysregulation seen in offenders with a history of ACEs may be driven by a treatable physiological adaptation (Gerra et al., 2024; Mustafin et al., 2019). Consequently, the legal system's focus could shift from purely punitive measures to "epigenetic rehabilitation," where trauma-informed interventions aim to reverse these maladaptive markers. Thus, acknowledging epigenetic reversibility supports a restorative justice model, framing addiction and recidivism not merely as moral failures but as biological cycles that can be

broken with appropriate environmental and clinical remediation.

Allostatic Load

When examined through the lens of social science, early life stress is not merely a psychological trauma but a process wherein social disadvantages are inscribed onto the body. The concept of allostatic load, named by Bruce McEwen, defines the cumulative cost exerted by chronic stress; when an organism is compelled to persistently activate stress response systems (such as the HPA axis) to adapt to environmental challenges, this physiological "wear and tear" precipitates systemic dysregulation and accelerated aging. Epidemiological data underscore the tangibility of this burden; for instance, a study conducted by Slopen et al. (2014) determined that a one-standard-deviation increase in childhood adversity scores was associated with a 9% increase in cumulative biological risk (allostatic load) in adulthood (Incident Rate Ratio = 1.09). Similarly, a large-scale analysis utilizing UK Biobank data statistically demonstrated that each additional adverse childhood experience reported by female participants resulted in a 4% increase in allostatic load (Jakubowski et al., 2023). As elucidated by Arline Geronimus's "weathering hypothesis," this phenomenon serves as evidence that exposure to structural inequalities and systemic stressors accelerate biological aging processes, confirming that health disparities are not merely genetic outcomes but rather the biological residue of lived social experiences.

Exposure to ACEs, including forms like childhood sexual abuse (CSA), is strongly associated with an increased susceptibility to psychiatric diagnoses such as substance use disorders (SUDs) and food addiction (FA) later in life (Wiss et al., 2021). The stress resulting from early life adversity (ELA) generates neurobiological changes, disrupting the circuits responsible for regulating stress response, neuroplasticity, and reward, thereby conferring heightened vulnerability to addictive behaviors (Wiss et al., 2021; Zarse et al., 2019). The overlap between neurobiological changes seen in SUDs and FA further supports the notion that addiction-like eating may serve as a mechanism of self-medication following trauma (Brewerton, 2011; Wiss et al., 2021).

HPA Axis and Stress Response

A major mechanism linking ACEs to addiction susceptibility involves epigenetic modifications of genes related to the Hypothalamic-Pituitary-Adrenal (HPA) axis (Wiss et al., 2021). The HPA axis, which regulates the body's stress response, utilizes the Glucocorticoid Receptor (GR), encoded by the NR3C1 gene, as a critical component of its negative feedback loop (Forum et al., 2025; Khan et al., 2025). Early adversity exposure is linked to altered NR3C1 DNA methylation levels in peripheral cells, which, in turn, has been associated with the development of depressive, anxiety, and SUD in adulthood (Tyrka et al., 2016). Specifically, individuals with a past substance-use disorder diagnosis demonstrated lower levels of DNA methylation in the NR3C1 gene promoter compared to unexposed, healthy controls (Tyrka et al., 2016). Similarly, the FKBP5 gene, which regulates GR activity, exhibits epigenetic changes following stress that are critical to trauma-related disorders like post-traumatic stress disorder (PTSD), a condition highly comorbid with SUDs (Khan et al., 2025; Zannas et al., 2016).

Furthermore, addiction vulnerability influenced by ACEs involves disruption in neurotrophic and reward systems. Brain-Derived Neurotrophic Factor (BDNF) and its receptor, Tropomyosin receptor kinase B (TrkB), which are vital for synaptic plasticity, are impacted by the epigenetic embedding of early stress (Wiss et al., 2021; Vyas et al., 2023). For example, adolescent exposure to alcohol in animal models results in altered epigenetic marks at the *Bdnf4* promoter, leading to decreased transcription and contributing to increased adult susceptibility to SUD (Bohnsack et al., 2022; Kyzar et al., 2019). The dopamine system, central to reward, is also vulnerable: alterations following Early Life Adversity increase impulsive behaviors, which fuel addiction

(Wiss et al., 2021). In functional magnetic resonance imaging (fMRI) studies, Food Addiction (FA) is acknowledged to share neurobiological similarities with SUDs (Schulte et al., 2016; Wiss et al., 2021), often demonstrating reduced cortico-basal ganglia reward sensitivity resulting from inflammation precipitated by ELA (Wiss et al., 2021).

Other receptor systems crucial to stress and behavioral regulation are epigenetically modulated by ACEs, cementing the connection to addiction. Changes in methylation status have been identified in the gene for the serotonin transporter, SLC6A4, following childhood trauma, which is associated with depressive, anxiety, and substance-use disorders (Koenen et al., 2011; Tyrka et al., 2016). Additionally, the opioid pathway is influenced, as evidenced by epigenetic changes in the Kappa opioid receptor (OPRK1) gene observed in suicide victims with a history of child abuse (Lutz et al., 2018; Neves et al., 2021). These disruptions establish biological pathways through which early trauma directly predisposes individuals to addiction, whether through substance abuse or addictive-like eating behaviors, suggesting that addressing the biological consequences of ACEs is necessary for effective recovery (Wiss et al., 2021).

ACEs on Dopaminergic and Opioid Receptor Systems

The influence of ACEs on the dopaminergic (DRD) and opioid (OPRM) receptor systems provides crucial insight into the neurobiological mechanisms underlying increased vulnerability to addiction, including both substance use disorders (SUDs) and food addiction (FA) (Wiss et al., 2021). Disruptions caused by early life adversity (ELA) lead to permanent changes in the brain's reward circuitry, a process known as biological embedding (Wiss et al., 2021). Alterations in the dopamine system specifically are linked to increased impulsive behaviors, which are a major risk factor for developing addictions (Wiss et al., 2021). This vulnerability stems from epigenetic modifications that affect the transcription and expression of dopamine receptors. For example, research examining women exposed to childhood sexual abuse compounded with bulimia spectrum disorder identified hyper-methylation of the Dopamine D2 receptor (DRD2) gene (Groleau et al., 2014; Neves et al., 2021). Furthermore, preclinical models highlight how early-life environment and substance exposure can epigenetically program these receptors; gestational exposure to substances like THC was linked to a decreased density of DRD2 receptors in the nucleus accumbens (NAc) of adult offspring due to an increase in repressive epigenetic marks at the *Drd2* gene (Dinieri et al., 2011; Liu et al., 2024; Sadeghzadeh et al., 2017). The functional implications of these receptor changes are complex and cell-type specific, as overexpression of microRNA-1 (miRNA-1) in D1-containing neurons increased cocaine self-administration (SA) seeking, while overexpression in D2-containing neurons resulted in a reduction of cocaine SA in animal models (Forget et al., 2021; Liu et al., 2024).

The opioid system, mediated through opioid receptors such as the Mu Opioid Receptor (MOR) and Kappa Opioid Receptor (OPRK1), is also critically affected by early life stress and contributes to addiction pathways. Chronic stress has been shown to increase susceptibility to Food Addiction (FA) by increasing the levels of MOR (Liu et al., 2019; Wiss et al., 2021). Moreover, the consumption of highly palatable foods, which is associated with FA and often follows ACE exposure, has been shown to cause endogenous opioid dependence and activate reward areas of the brain in a manner similar to opiates (Colantuoni et al., 2002; Spangler et al., 2004). It is important to note that data on Food Addiction (FA) are presented in this review specifically as a neurobiological model. Given the shared reward circuitry dysfunctions and cross-sensitization observed between FA and Substance Use Disorders (SUDs), these findings offer critical insights into how early adversity disrupts dopaminergic and opioid signaling, regardless of the specific addictive agent.

The gene encoding the Kappa opioid receptor, *OPRK1*, has been specifically linked to trauma-

related pathology. Studies analyzing brain tissue (anterior insula) of suicide victims with a history of child sexual and physical abuse found hypo-methylation of intron 2 in the Kappa variant 1 region (Lutz et al., 2018; Neves et al., 2021). This epigenetic modification was associated with decreased kappa expression (Lutz et al., 2018; Neves et al., 2021). Additionally, chronic stress exposure in adulthood can sensitize an individual's response to opioids, enhancing drug preference behaviors like morphine-conditioned place preference (CPP) via alterations in glucocorticoid receptor (GR)-mediated epigenetic regulation (Chen et al., 2019; Liu et al., 2024). This interplay between the stress response (GR signaling) and opioid pathways highlights how ACEs create a long-lasting biological vulnerability that predisposes individuals to both opioid substance use and addictive eating behaviors.

Conclusion

To sum up, the convergence of molecular genetics and social epidemiology compels a fundamental paradigm shift in how we understand the trajectory from ACEs to addiction. The evidence reviewed herein demonstrates that the "social" and the "biological" are not distinct spheres; rather, through epigenetic mechanisms and allostatic load, social adversity is transmuted into physiological vulnerability. The dysregulation of the HPA axis and reward circuitry manifested in the methylation of genes such as NR3C1, BDNF, and DRD2, confirms that addiction is often less a failure of will than a biological embedding of survival in a toxic environment. Consequently, the forensic and justice systems must move beyond a purely punitive framework. Acknowledging that the "scars" of inequality are written into the genome necessitates a restorative approach. Crucially, unlike genetic mutations, epigenetic marks are dynamic and potentially reversible. Therefore, legal and clinical interventions should be designed not merely to correct behavior, but to leverage this reversibility through trauma-informed rehabilitation strategies.

Ultimately, we recommend the standardization of trauma-informed assessment processes within the judicial system to better identify these biological vulnerabilities. Preventing the intergenerational cycle of addiction requires treating the social conditions that trigger these epigenetic modifications, recognizing that the most effective neurobiological intervention is often a safe and nurturing environment.

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