ORIGINAL ARTICLE

Relationship between Anxiety, Stress, and Psychological Dependence on Smoking in University Students: A Correlational Study

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RESUMEN

Introducción: el consumo de tabaco y la dependencia asociada constituyen problemas de salud pública relevantes en adultos jóvenes. En estudiantes universitarios, la ansiedad y el estrés pueden coexistir con el consumo de tabaco, aunque la literatura acerca de su relación específica con la dependencia psicológica es aún limitada. **Objetivo:** analizar la relación entre ansiedad, estrés y dependencia psicológica al tabaquismo en estudiantes universitarios, así como comparar estas variables según sexo y área académica. **Método:** se realizó un estudio cuantitativo, no experimental, transversal y correlacional, con 200 estudiantes de una ciudad del noroeste de México seleccionados mediante muestreo no probabilístico por cuotas. Se aplicaron el Inventario de Ansiedad de Beck, la Escala de Percepción Global de Estrés y el Test de Glover-Nilsson. Se utilizaron estadísticos descriptivos, pruebas *t* de Student, correlación de Pearson y tamaños del efecto. **Resultados:** las mujeres reportaron mayor ansiedad que los hombres (t = -2.40, p = .017, d = .33), con tamaño del efecto pequeño. Los estudiantes de ingeniería presentaron mayor dependencia psicológica al tabaquismo que los de programas no ingenieriles (t = 2.90, p = .004, d = .41), con efecto pequeño a moderado. La dependencia psicológica al tabaquismo se relacionó positivamente con ansiedad (r = .219, p < .01; IC 95% [.083, .347]) y estrés (r = .145, p < .05; IC 95% [.006, .278]); ambas asociaciones fueron de magnitud baja. No se observó una asociación significativa entre ansiedad y estrés (r = .094, p > .05). **Discusión y conclusiones:** la dependencia psicológica mostró asociaciones pequeñas con ansiedad y estrés, lo que respalda una interpretación multifactorial del fenómeno. Los hallazgos resaltan la necesidad de integrar componentes de regulación emocional y manejo del estrés en estrategias universitarias de prevención y cesación del tabaquismo.

Palabras clave: salud mental, conducta de fumar, jóvenes adultos, regulación emocional, educación superior.

ABSTRACT

Introduction: tobacco use and associated dependence are significant public health issues among young adults. Anxiety and stress can coexist with tobacco use in university students, although literature regarding their specific relationship with psychological dependence remains limited. **Objective:** to analyze the relationship between anxiety, stress, and psychological dependence on tobacco among university students, and to compare these variables based on sex and academic field. **Method:** a quantitative, non-experimental, cross-sectional, and correlational study was conducted with 200 students from a city in northwestern Mexico, selected via non-probability quota sampling. The Beck Anxiety Inventory, the Global Perceived Stress Scale, and the Glover-Nilsson Test were administered. Descriptive statistics, Student's *t*-tests, Pearson correlation, and effect sizes were used. **Results:** women reported higher anxiety than men (t = -2.40, p = .017, d = .33), with a small effect size. Engineering students exhibited higher psychological dependence on tobacco than students in non-engineering programs (t = 2.90, p = .004, d = .41), with a small-to-moderate effect. Psychological dependence on tobacco was positively associated with anxiety (r = .219, p < .01; 95% CI [.083, .347]) and stress (r = .145, p < .05; 95% CI [.006, .278]); both associations were of low magnitude. No significant association was observed between anxiety and stress (r = .094, p > .05). **Discussion and conclusions:** psychological dependence showed small associations with anxiety and stress, supporting a multifactorial interpretation of the phenomenon. The findings highlight the need to integrate emotional regulation and stress management components into university-based tobacco prevention and cessation strategies.

Keywords: mental health, smoking behavior, young adults, emotional regulation, higher education.

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Received on: April 22th, 2026
Accepted on: October 2th, 2026
Web publication on: October 16th, 2026

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INTRODUCTION

Tobacco use remains one of the leading preventable threats to public health. The World Health Organization (WHO) reported that tobacco causes more than seven million deaths each year and that nicotine is a highly addictive substance, particularly relevant for adolescents and young adults (WHO, 2026). Although global trends show a progressive decline in use, the transition to university life remains a period of vulnerability due to the convergence of new academic demands, behavioral autonomy, social exposure, and lifestyle changes.

Among university students, tobacco use is situated within a broader context of mental health and risk behaviors. In Mexico, Hernández-Fuentes et al. (2024) noted that anxiety-related problems and substance use remain relevant among university students. Likewise, Martínez-González et al. (2026) reported that psychosocial risk associated with substance use may differ by sex and academic discipline, and tends to concentrate in health-related areas and areas with high academic demands. These findings reinforce the need to study smoking behavior not only as a consumption behavior, but also in relation to psychological and contextual variables.

Anxiety and stress are particularly relevant in the university population. In a review, Paiva et al. (2025) found a high frequency of anxiety and stress symptoms among university students in different countries. Anxiety involves worry, physiological activation, and restlessness (American Psychiatric Association [APA], 2014), whereas perceived stress is related to the appraisal that demands exceed the available coping resources (Pérez et al., 2014). In addition, contemporary studies have shown sex differences in mental health indicators, with a higher burden of anxiety among women in different university contexts (Hernández-Fuentes et al., 2024; Martínez-González et al., 2026).

The relationship between psychological distress and tobacco use may be complex and may not follow a linear pattern or be necessarily causal. In a university population, Ayran et al. (2022) found a relationship between anxiety and nicotine dependence, whereas El-Sherbiny & Elsary (2022) reported relationships among nicotine dependence, anxiety, and stress. Shah et al. (2026) observed that anxiety was associated with smoking in young university students, although stress showed a different pattern. Considering the above, recent studies indicate that the relationships among these constructs may vary according to sample characteristics, instruments, and the way consumption or dependence is measured.

From the transactional model of stress, behavioral responses are understood to depend on the appraisal of demands and the resources available to cope with them (Lazarus & Folkman, 1984). In turn, the negative reinforcement model of addiction argues that substance use may be maintained when the individual perceives, even temporarily, a reduction in unpleasant emotions or experiences (Baker et al., 2004). In the case of smoking, Kassel et al. (2003) noted that relationships among stress, negative affect, and use depend on the context and stage of the consumption process. From this perspective, anxiety and stress may coexist with smoking behaviors used as a form of regulation or relief, without assuming that these variables by themselves explain dependence.

A relevant distinction exists among frequency of use, physical dependence on nicotine, and psychological dependence on smoking. The latter incorporates behavioral, emotional, and situational components linked to the maintenance of smoking behavior. The Glover-Nilsson Smoking Behavioral Questionnaire was developed to assess these components (Glover et al., 2005), and recent evidence supports the psychometric properties of its Spanish version (Carballo et al., 2023). Its use makes it possible to approach the study of smoking from a broader perspective than one based solely on the number of cigarettes smoked or on physiological symptoms of dependence.

Despite advances in the literature, evidence focused specifically on psychological dependence on smoking among university students remains less extensive than evidence on prevalence of use or nicotine dependence. Similarly, recent findings suggest heterogeneity by sex and academic field, making it relevant to examine these differences as complementary analyses (Martínez-González et al., 2026). In the Mexican context, studying anxiety, stress, and psychological dependence as a whole may contribute to defining the actual magnitude of their associations and avoiding excessively deterministic interpretations.

The objective of the present study, therefore, was to analyze the relationship among anxiety, stress, and psychological dependence on smoking in university students, as well as to compare these variables according to sex and academic field (engineering and non-engineering programs). The main hypothesis was that higher levels of anxiety and stress would be associated with greater psychological dependence on smoking. Comparisons by sex and academic field were considered complementary exploratory analyses.

METHOD

Design

The study followed a quantitative approach, as it was based on numerical measurement of the variables and statistical analysis to test hypotheses (Hernández et al., 2014). A non-experimental design was used because the study variables were not manipulated; it was cross-sectional because data were collected at a single point in time; and it was correlational because the purpose was to analyze the relationship among the variables studied (Cauas, 2015; Rojas, 2011).

Participants

The sample included 200 university students from a city in northwestern Mexico, 111 men and 89 women. The sample included students from non-engineering programs: Psychology (18.5%), Administration (12.5%), Public Accounting (5.5%), Physical Exercise Sciences (5.5%), Associate Professional in Child Development (1%), Early Childhood Education (4.5%), Tourism Business Administration (.5%), Veterinary Medicine and Zootechnics (1%), and Economics and Finance (5%); and from engineering programs: Biosystems (7%), Biotechnology (3%), Industrial Engineering (11.5%), Electromechanics (6%), Civil Engineering (12.5%), Environmental Sciences (3.5%), Software Engineering (1%), and Mechatronics (1.5%). University students who agreed to participate voluntarily and completed the study instruments were included. Incomplete protocols or those with insufficient information to calculate the scores of the analyzed variables were excluded.

Regarding the semester enrolled, participants were distributed as follows: first semester (1.5%), second semester (15.5%), third semester (2.5%), fourth semester (13.5%), fifth semester (1.5%), sixth semester (25%), seventh semester (3.5%), eighth semester (28%), ninth semester (5.5%), and tenth semester (1.5%). The remaining 2% of participants did not specify the semester in which they were enrolled.

Instruments

To assess anxiety, the Beck Anxiety Inventory was used (Sanz et al., 2011), an instrument that measures anxiety symptoms that are less shared with depressive symptomatology, particularly those related to anxiety, panic, and generalized anxiety disorders, according to DSM-5 diagnostic criteria (APA, 2014). It consists of 21 items with a four-option Likert response format: 1 = not at all, 2 = mildly, 3 = moderately, and 4 = severely. In the present study, the scale showed adequate internal consistency, α = .937.

Stress was measured using the Global Perceived Stress Scale (GPSS) by Remor & Carrobles (2001), which assesses general levels of perceived stress. The instrument consists of 13 items with a five-option Likert response format, ranging from 1 = never, to 5 = always. In Mexican samples, the scale has shown adequate internal consistency, with a Cronbach's alpha of .83 (Ramírez & Hernández, 2007). In this study, the scale showed adequate reliability, with α = .826. Items worded in a positive direction were reverse-coded before calculating the total score so that higher scores indicated greater perceived stress.

To assess psychological dependence on smoking, the Glover-Nilsson Test was used (Glover et al., 2005), which identifies behavioral patterns associated with psychological dependence on cigarette use. It consists of 18 items with a five-option Likert response format, from 1 = never, to 5 = always. The Spanish-language version reports adequate reliability, supporting its use in this context (Carballo et al., 2023). In the present study, the scale showed excellent internal consistency, with α = .956.

Procedure

A non-probability quota sampling method was used (Hernández et al., 2014), seeking representation by sex and academic field (engineering and non-engineering programs). Data collection was conducted in person. Before answering the instruments, each participant was informed of the study objective, the voluntary nature of participation, the confidentiality of their responses, and the academic use of the information, and informed consent was obtained. The instruments were self-administered individually, and the data were subsequently entered into SPSS (*Statistical Package for the Social Sciences*) version 23.0.

Data Analysis

Descriptive analyses were performed using means and standard deviations. Before inferential analyses, distribution and homogeneity assumptions were evaluated. Score normality was examined using the Shapiro-Wilk test and complemented with skewness and kurtosis indices; outliers were reviewed using the interquartile range criterion, and the absence of extreme values was verified using 3 times the interquartile range.

Homogeneity of variances for group comparisons was examined using Levene's test. To compare anxiety, stress, and psychological dependence on smoking according to sex and academic field, Student's *t*-test for independent samples was used. The relationship among variables was analyzed

using Pearson's *r* correlation coefficient (Restrepo & González, 2007). To complement statistical significance, effect sizes were estimated: Cohen's *d* for mean comparisons and r as a measure of association size, together with *r2* to express shared variance (Cohen, 1992; Gignac & Szodorai, 2016; Lakens, 2013). Ninety-five percent confidence intervals were calculated for mean differences and for correlations using Fisher's *z* transformation. The interpretation of associations considered both their significance and magnitude, avoiding the equation of small *p*-values with substantively large effects.

Ethical Considerations

The research was reviewed and approved by the Institutional Research Ethics Committee of the Instituto Tecnológico de Sonora, through ruling no. S-007. Similarly, the study was conducted in accordance with the guidelines for research involving human beings of the Declaration of Helsinki (World Medical Association, 2013) and the Regulations of the General Health Law on Health Research (Secretaría de Salud, 2014). Participant confidentiality and anonymity were ensured.

RESULTS

Overall, university students presented low to moderate levels in the variables assessed. For anxiety, they obtained a mean of 1.91 (*SD* = .66) on a scale from 1 to 4, placing them at a mild level. For stress, the mean obtained was 2.97 (*SD* = .65) on a scale from 1 to 5, indicating a mild level; that is, university students perceive themselves as occasionally stressed. For psychological dependence on smoking, a mean of 2.23 (*SD* = 1.04) was observed, suggesting a moderate level of dependence.

For anxiety, the items with the highest scores corresponded to symptoms such as inability to relax, nervousness, restlessness, and feeling hot. For stress, the items with the highest means referred to perceived control and management of personal situations, such as trusting one's ability to cope with problems, controlling difficulties, and perceiving that things turn out as expected. For psychological dependence on smoking, the highest scores indicated that students have greater dependence on tobacco use in social situations or in specific situations that encourage use, or as a form of reward or emotional regulation.

Normality analyses showed significant deviations in the three variables ($p < .001$); however, skewness and kurtosis values were moderate, no extreme outliers were identified, and the assumption of homogeneity of variances was met (Levene, $p > .05$). Nonparametric sensitivity analyses reproduced the same pattern of results.

In comparisons by sex, women showed higher anxiety than men: t (198) = -2.40, p = .017, d = .33; the difference was small, and its 95% *CI* for the men-women difference was [-.405, -.035]. No statistically significant differences were observed in stress: t (198) = 1.34, p = .180, d = .18, or in psychological dependence on smoking: t (198) = 1.58, p = .116, d = .22 (Table 1).

According to academic field, engineering students presented higher psychological dependence on smoking than students in non-engineering programs: t (198) = 2.90, p = .004, d = .41, 95% *CI* of the

Table 1
Differences in Anxiety, Stress, and Psychological Dependence on Smoking by Sex.

	Men		Women					
Scale	*M*	*(SD)*	*M*	*(SD)*	*t (df)*	*p*	*d*	*95% CI Δ*
Anxiety	1.81	(.671)	2.03	(.643)	-2.40 (198)	.017	.33	[-.405, -.035]
Stress	3.03	(.628)	2.91	(.674)	1.34 (198)	.180	.18	[-.062, .302]
Psychological dependence	2.33	(1.06)	2.10	(1.00)	1.58 (198)	.116	.22	[-.060, .520]

Note: t = Student's *t* statistic; *df* = degrees of freedom; *p* = probability value; *d* = Cohen's effect size; 95% *CI* Δ = 95% confidence interval for the mean difference.

Table 2
Differences in Anxiety, Stress, and Psychological Dependence on Smoking by Academic Field.

	Engineering		Non-engineering					
Scale	*M*	*(SD)*	*M*	*(SD)*	*t (df)*	*p*	*d*	*95% CI Δ*
Anxiety	2.00	(.687)	1.83	(.642)	1.85 (198)	.066	.25	[-.016, .356]
Stress	3.02	(.663)	2.94	(.640)	.887 (198)	.376	.12	[-.102, .262]
Psychological dependence	2.45	(1.020)	2.03	(1.025)	2.90 (198)	.004	.41	[.134, .706]

difference [.134, .706]. The magnitude was small to moderate. Differences in anxiety: t (198) = 1.85, p = .066, d = .25, and stress: t (198) = .887, p = .376, d = .12, did not reach statistical significance (Table 2). The comparison by field should be interpreted as exploratory because of the heterogeneity of the programs grouped together.

Psychological dependence on smoking was positively associated with anxiety: r = .219, p < .01, 95% *CI* [.083, .347], and with stress: r = .145, p < .05, 95% *CI* [.006, .278]. Both associations were of low magnitude. The relationship between anxiety and stress was not statistically significant: r = .094, p > .05, 95% *CI* [-.045, .230] (Table 3).

Table 3
Correlation Matrix Among Variables.

	Anxiety	*Stress*	*Psychological dependence on smoking*
Anxiety	1		
Stress	.094	1	
Psychological dependence	.219**	.145*	1

Note: ** p < .01; * p < .05.

In terms of shared variance, anxiety shared approximately 4.8% of the variance with psychological dependence on smoking, whereas stress shared approximately 2.1%. These percentages confirm that, although the associations were statistically significant, their magnitude was limited and does not allow anxiety or stress to be considered sufficient explanations of psychological dependence on smoking.

DISCUSSION AND CONCLUSIONS

The results show that psychological dependence on smoking was positively related to anxiety and stress, although the magnitudes were small. This finding is consistent with studies linking mental health indicators to nicotine use or dependence in university students (Ayran et al., 2022; Shah et al., 2026). However, the magnitude of the relationships and the research design prevent causal interpretations. Shared variance was 4.8% for anxiety and 2.1% for stress, which seems to indicate that both variables are part of a broader and multifactorial phenomenon.

The association between anxiety and psychological dependence was the strongest. This result is similar to findings from studies that have documented a relationship between anxiety and nicotine dependence or smoking behavior among young university students (Ayran et al., 2022; Shah et al., 2026). From the negative reinforcement model, one possible interpretation is that smoking may acquire a function of temporary relief from unpleasant internal states (Baker et al., 2004). The cross-sectional design of the present study, however, does not allow the determination of whether anxiety precedes psychological dependence; if consumption contributes to the maintenance of distress, or if both variables are related through unmeasured factors.

The relationship between stress and psychological dependence was statistically significant but weaker. This is consistent with literature showing that the link between stress and smoking depends on context, coping strategies, and the stage of use (Kassel et al., 2003). It also coincides with contemporary evidence that places stress and academic pressure within a set of psychosocial factors related to substance use behaviors among university students (Martínez-González et al., 2026). The low magnitude observed suggests that perceived stress by itself has limited capacity to explain psychological dependence on smoking.

No significant association was found between anxiety and stress. Although both constructs often coexist in university populations, they are not equivalent and may reflect different psychological processes. Anxiety assesses specific cognitive and physiological symptoms, whereas perceived stress refers to the global appraisal of demands and control over them. The absence of association may be related to this conceptual difference, specific characteristics of the sample, or the form of measurement. Consequently, the result should not be interpreted as evidence of general independence between anxiety and stress, but rather as a finding specific to this sample.

In comparisons by sex, women showed higher anxiety than men, although the effect size was small. This pattern is consistent with previous studies that have documented higher anxiety among female university students (Hernández-Fuentes et al., 2024; Paiva et al., 2025). However, the magnitude observed indicates that sex explains only part of the variability and that additional academic, social, and personal factors should also be considered.

Engineering students presented higher psychological dependence on smoking than those enrolled in non-engineering programs, with a small-to-moderate effect. This result should be considered exploratory. Recent research has shown that psychosocial risk and consumption profiles may vary across academic disciplines (Martínez-González et al., 2026); since the academic categories used in this study include heterogeneous programs, however, the

difference cannot be attributed to characteristics specific to engineering programs.

Overall, the findings support a multifactorial interpretation of psychological dependence on smoking. Recent evidence in Mexican university students shows that mental health and substance use are associated with multiple personal and academic conditions (Hernández-Fuentes et al., 2024; Martínez-González et al., 2026). Therefore, the associations found in this study indicate that anxiety and stress should be studied as partial components within a network of risk and maintenance factors.

Future Directions

Future studies should compare specific programs and consider academic workload, social context, frequency of use, and other associated variables. From an applied perspective, university-based tobacco prevention and cessation strategies may benefit from a comprehensive approach that combines information on physical risks with detection of psychological distress, emotional regulation, and stress management. This recommendation should be understood as a preventive implication and not as evidence that treating anxiety or stress is sufficient to modify dependence. Smoking cessation has been associated with subsequent improvements in mental health indicators (Taylor et al., 2014), making it relevant to integrate psychological support services and cessation strategies into university health promotion programs.

Limitations of the Study

The main limitations include the cross-sectional and correlational design, which prevents establishing causality; non-probability quota sampling and the fact that participants came from a single city, which limit generalizability; and the use of self-report measures, which have disadvantages compared with objective measurements. In addition, other variables for characterizing tobacco use were not assessed, such as frequency, age of onset, number of cigarettes per day, use of electronic cigarettes, alcohol or other substance use, depressive symptoms, sleep quality, family history, or coping strategies. The low associations also indicate the need to broaden the theoretical model before proposing more complex predictive models. Longitudinal studies with larger samples could examine temporality, mediators, and moderators of these relationships.

FUNDING

No funding was received for the conduct of this research.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest. They also declare that they did not use artificial intelligence assistants in the writing or generation of this document. All content was verified and edited by the authors, who assume full responsibility for the final version of the manuscript.

AUTHOR CONTRIBUTIONS

Lizzeth Vazquez Carretas: conceptualization, data collection, data analysis, literature review, and writing.
Cinthya Jacquelinne Villalobos Navarrete: methodological conceptualization, literature review, data collection, and data analysis.
Laura Fernanda Barrera-Hernández: supervision, methodology, writing, coordination, data analysis, and editing.
Mirsha Alicia Sotelo Castillo: supervision, validation, review, data analysis, and writing.

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