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Original Article

Investigation of the Relationship Between the Daily Physical Activity Level, Smoking Status, and Nicotine Dependence

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ABSTRACT

OBJECTIVE: This study aims to assess the relationships among physical activity levels, smoking status, and nicotine dependence in university students enrolled in health sciences programs.

MATERIAL AND METHODS: Between March and April 2025, the study included 164 healthy individuals aged 18 and over, comprising 59 smokers and 105 non-smokers. The "Fagerström test for nicotine dependence" and the "international physical activity questionnaire-short form" were used to evaluate nicotine dependence and to determine daily physical activity levels, respectively.

RESULTS: Non-smokers had higher median walking scores ($P = 0.09$) and slightly higher total physical activity levels ($P = 0.20$) than smokers. However, this difference was not statistically significant and should be interpreted with caution. Spearman correlation analysis showed small correlation coefficients between nicotine dependence and physical activity; the highest coefficient was observed for moderate-intensity activity (r = 0.104).

CONCLUSION: Non-smokers exhibited higher physical activity scores, particularly for walking; however, the differences between groups were not statistically significant. This study highlights the potential relationship between physical activity and nicotine dependence among young adults. Further studies are needed to reduce tobacco use and promote physical activity among university populations.

KEYWORDS: Tobacco use, healthy individuals, motor activity

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INTRODUCTION

Nicotine is a highly addictive substance found in tobacco products. The World Health Organization and recent reviews note that regular (habitual) daily smoking is strongly associated with nicotine dependence and is commonly used as an indicator of dependence in population studies.[1] Globally, cigarette smoking represents one of the leading preventable causes of non-communicable diseases and related mortality. It was responsible for approximately 8.71 million deaths and 229.77 million DALYs worldwide in 2019, with cardiovascular disease, neoplasms, and chronic respiratory diseases among the top causes.[2,3] In Türkiye, tobacco use continues to contribute substantially to morbidity and mortality, aligning with trends seen globally. Cigarette smoking is associated with numerous life-threatening health conditions —including cancers, respiratory disorders, cardiovascular diseases, infections, and neurological dysfunctions —thereby contributing to widespread systemic health deterioration.[2,4] Individuals who smoke are generally less likely to engage in regular physical exercise. Recent studies have found that even among smokers without chronic airflow obstruction, skeletal muscle endurance and ventilatory efficiency are significantly impaired during exercise compared to non-smokers[5] and that physical fitness levels are consistently lower among smokers across adult and elderly populations.[6] A 2024 study in Türkiye found that smokers had reduced exercise capacity and shorter breath-holding times than non-smokers.[7]

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Empirical evidence suggests that regular physical activity contributes to reduced smoking behavior and supports efforts to quit. For instance, a large-scale study conducted in China found that individuals aged 16 and older who engaged in exercise were significantly less likely to smoke.[8] Beyond its role in addiction-related behavior, maintaining a routine of daily physical activity is pivotal for disease prevention, rehabilitation, and chronic disease management among healthy individuals.[9] Given the well-documented health risks associated with tobacco use, the proven benefits of physical activity, and the modifiable nature of both behaviors, exploring the interaction between smoking and physical activity remains crucial for the development of effective tobacco control strategies.[10]

This study aims to contribute to a deeper understanding of the interaction between physical activity and smoking behavior by examining how daily physical activity may influence smoking behavior. By shedding light on the potential relationship between these two modifiable behaviors, these findings may help to raise awareness and to support behavioral strategies aimed at reducing tobacco use. Specifically, this research aimed to investigate whether physical activity levels differ by smoking status and whether physical activity is associated with nicotine dependence among smokers. The ultimate goal is to inform the development of more personalized and effective interventions for individuals who smoke.

MATERIAL AND METHODS

Study Design

This research was a non-randomized, controlled, cross-sectional study. Data were collected using standardized questionnaires. The primary objective was to investigate, using data gathered through validated measurement tools, the association between smoking behavior and physical activity levels among individuals. The study was conducted among students of the University of Health Sciences.

Study Population and Sampling

The study sample consisted of 164 participants, including 59 individuals who reported smoking and 105 individuals who identified as non-smokers. The required sample size was determined using an a priori power analysis performed with G*Power software. Based on the chi-square test parameters —effect size (w = 0.3), significance level (α = 0.05), statistical power (1-β = 0.80), and degrees of freedom (df = 4)—the minimum required sample size was calculated as 133.[11] The analysis assumed equal group sizes; however, in practice, exact group matching was not achieved due to the voluntary nature of participation.

Main Points

- Non-smokers may have higher physical activity levels, particularly in walking.
- Higher nicotine dependence may be related to lower physical activity levels.
- Physical activity could be considered a supportive strategy in smoking-related interventions.

Participants were included in the study based on the following criteria: identifying as male or female, being 18 years of age or older, and having no known medical conditions, i.e., being classified as healthy. Smoking status was categorized as current smokers, former smokers, or never smokers. Exclusion criteria included a history of cardiovascular disease, cancer, or serious pulmonary conditions; pregnancy; or age under 18. After applying these inclusion and exclusion criteria, 164 eligible participants were enrolled in the study (Figure 1).

Data Collection Instruments

In this study, data were collected using the Fagerström test for nicotine dependence (FTND) to assess the level of nicotine addiction and the International Physical Activity Questionnaire Short Form (IPAQ-SF) to evaluate participants' physical activity levels.

International Physical Activity Questionnaire

The IPAQ-SF is designed to assess individuals' levels of physical activity, including walking, moderate-intensity activities, and vigorous-intensity activities, as well as time spent sitting. The total physical activity score is calculated in metabolic equivalent of task (MET)-minutes per week, based on the duration and frequency of reported activities. Standardized MET values are assigned as follows: 3.3 MET-min for walking, 4.0 MET-min for moderate-intensity activity, 8.0 MET-min for vigorous-intensity activity, and 1.5 MET-min for sitting. Based on these scores, physical activity levels are categorized into three groups: Category 1: Inactive – individuals who do not meet the minimum activity criteria; Category 2: Minimally Active – individuals who engage in moderate-to-vigorous activities, achieving at least 600 MET-min/week; Category 3: Highly Active – individuals who meet at least 1500 MET-min/week of vigorous activity or accumulate a total of 3000 MET-min/week through various activities.[12]

Fagerström Test for Nicotine Dependence

The FTND is a widely used six-item questionnaire designed to assess the severity of nicotine addiction. It serves as a practical tool for evaluating the degree of dependence and guiding individualized treatment planning. The test provides a classification based on total scores, offering valuable insights for clinical decision-making. Typically administered as a self-report survey, the FTND collects information on smoking habits and behavioral patterns related to nicotine use. Evidence suggests

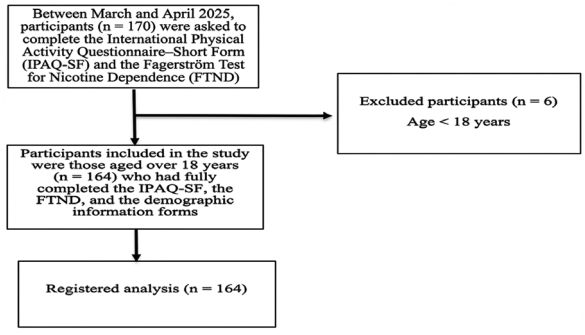

Figure 1. Flow diagram of the study process

that the six-item format enhances the test's ability to accurately determine levels of nicotine dependence. According to the scoring system, total scores of 0–3 indicate low dependence, 4–6 indicate, and 7 or higher indicate high dependence.[13]

In this study, smoking was assessed using participants' smoking status and nicotine dependence level, measured by the FTND.

Ethical Considerations

Ethical approval for this study was obtained from the Hamidiye Non-Interventional Scientific Research Ethics Committee (approval date: 29.05.2025, approval no: 25/488).

Prior to participation, all individuals were informed about the purpose of the study, and it was emphasized that their participation was entirely voluntary. Participants were assured that they could withdraw from the study at any time without any consequences, that their responses would be used solely for scientific purposes, and that all personal data would be kept confidential. Written informed consent was obtained from all participants. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. This study was registered at ClinicalTrials.gov (registration number: NCT07043920).

Statistical Analysis

All statistical analyses were conducted using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). The normality of the data distribution was evaluated using the Shapiro–Wilk test, which indicated that the data were not normally distributed ($P < 0.001$). Descriptive statistics were presented as frequencies (n) and percentages (%) for categorical variables. For comparisons of continuous variables between two independent groups, the Mann–Whitney U test was applied, whereas comparisons involving more than two independent groups were analyzed using the Kruskal–Wallis H test. In addition, the Spearman rank-order correlation coefficient was used to examine the relationships between measurement scales. A two-tailed P value of less than 0.05 was considered statistically significant in all tests.[14]

RESULTS

The distribution of participants by gender and smoking status is presented in Table 1. According to the study findings, 36.0% of the 164 participants were identified as smokers, while 64.0% were non-smokers. When gender distribution was examined, 31.9% of female participants and 45.8% of male participants reported smoking. The smoking rate was higher among male participants than among female participants. The chi-square test revealed a statistical trend in the association between gender and smoking status (χ^2: 2.863; $P = 0.09$), which did not reach conventional levels of statistical significance.

Participants' daily physical activity levels were evaluated using the IPAQ-SF, and the results are presented as medians with minimum and maximum values (Table 2). When comparing vigorous physical activity levels between smokers and non-smokers, both groups exhibited a median value of 0.00 MET-min/week, with no statistically significant difference observed ($P = 0.79$). The median moderate physical activity level was similar between smokers and non-smokers, recorded as 120.00 (0–1440) MET-min/week, and showed no significant difference ($P = 0.55$). No significant difference was found, and thus these results should not be overinterpreted. Walking activity levels were 594.00 (0–10,395) MET-min/week in smokers and 891.00 (0–19,635) MET-min/week in non-smokers, demonstrating a trend toward statistical significance ($P = 0.09$). A non-significant trend suggested higher walking activity levels among non-smokers. These findings should be interpreted with caution, as they did not reach statistical significance. For total

Table 1. Sociodemographic characteristics of participants stratified by smoking status

	Total participants (n = 164)	Smokers (n = 59)	Non-smokers (n = 105)	Statistic	*P*
Gender					
Female	116 (70.7%)	37 (31.9%)	79 (68.1%)	2.863[a]	0.09
Male	48 (29.3%)	22 (45.8%)	26 (54.2%)		
Age, years (mean ± SD)	21.9±1.4	22.02±1.6	21.98±1.3		0.6

[a]Chi-square test. Data are presented as number (n) and percentage (%). Statistical significance was set at $P < 0.05$
SD: standard deviation

Table 2. Distribution of participants' physical activity levels according to smoking status

Variables	Total participants (n = 164)	Smokers (n = 59)	Non-smokers (n = 105)	*P*
IPAQ-SF				
Vigorous physical activity (MET-min/week)	0.00 (0–2880)	0.00 (0–2880)	0.00 (0–2880)	0.79
Moderate physical activity (MET-min/week)	120.00 (0–1440)	120.00 (0–1440)	120.00 (0–1440)	0.55
Walking activity (MET-min/week)	792.00 (0–19,635)	594.00 (0–10,395)	891.00 (0–19,635)	0.09
Total physical activity (MET-min/week)	1188.00 (0–5508)	1158.00 (0–5508)	1188.00 (0–5508)	0.20

Data are presented as median (min–max). Mann–Whitney U test was used. Statistical significance was set at $P < 0.05$
IPAQ-SF: International Physical Activity Questionnaire Short Form, min: minimum, max: maximum, MET: metabolic equivalent of task

physical activity, median values were 1158.00 (0–5508) MET-min/week for smokers and 1188.00 (0–5508) MET-min/week for non-smokers; there was no statistically significant difference between the groups ($P = 0.20$).

The relationship between the level of nicotine dependence among smokers and their physical activity levels was examined using Spearman's correlation analysis. The correlation coefficients were r = 0.098 for vigorous physical activity, r = 0.000 for walking activity, and r = 0.072 for total physical activity. The correlation coefficient was highest for moderate physical activity (r = 0.104) (Table 3).

The distribution of participants' nicotine dependence across categorical physical activity groups was evaluated (low, moderate, high). Among individuals with low nicotine dependence, the majority (n = 28) engaged in moderate physical activity (Table 4). Within this group, only 11 participants reported low physical activity levels, and 4 reported high levels. Conversely, among those with high nicotine dependence (n = 2), one exhibited low physical activity and the other high physical activity. Participants with moderate dependence were predominantly classified in the moderate (n = 9) and low (n = 3) physical activity categories. Because the high-dependence group included only two participants (n = 2), no clear pattern could be identified. These findings should therefore be interpreted with caution.

Figure 2 illustrates the relationship between participants' physical activity levels and their scores on the FTND. Examination of this figure reveals that participants with low nicotine dependence predominantly fall within the moderate physical activity category. While the majority of individuals with low dependence engaged in moderate physical activity, increasing dependence corresponded with a shift toward lower physical activity.

Figure 3 presents the distribution of total physical activity scores from the IPAQ-SF according to smoking status. Analysis of the scatter plot indicates that non-smokers tend to have higher physical activity levels than smokers. Notably, walking scores, which represent low-intensity physical activity, were higher among non-smokers and approached statistical significance.

DISCUSSION

This study investigated whether physical activity levels differed by smoking status and whether physical activity was associated with nicotine dependence among smokers. The main findings showed that non-smokers had higher scores than smokers, particularly in walking and total physical activity; however, these differences were not statistically significant. Furthermore, the correlation between nicotine dependence and physical activity levels was found to be weak and not statistically significant. However, participants with low nicotine dependence were mostly in the moderate physical activity category. Therefore, these findings should be considered trends rather than definitive demonstrations of a relationship.

The existing literature consistently emphasizes the impact of physical activity on overall health status. Several recent reviews and meta-analyses have demonstrated that reductions in physical activity are associated with the emergence and progression of chronic diseases.[15] Another study highlighted the significant role of physical activity in individuals' lives, concluding that consistent exercise programs strengthen the immune system and mitigate adverse effects on physical, mental, psychological, and spiritual health.[16] Tobacco use is another major factor contributing to health problems. Previous research has shown that smokers are less physically active than non-smokers.[17,18] Our findings are consistent with this pattern, as non-smokers report higher levels of physical activity, particularly in walking. However, these differences did not reach statistical significance and should be interpreted with caution. Another notable finding of our study was that the total physical activity score assessed by the IPAQ-SF was higher among non-smokers. Nonetheless, the observed tendency aligns with previous studies suggesting that physical activity may help mitigate smoking behavior.[19]

Although the relationship between smoking behavior and physical activity levels has been extensively investigated, further studies are warranted to support new research in this area. In our study, participants' smoking status and dependence levels were similarly categorized into low, moderate, and high. In our sample, no significant association was observed between gender and smoking status, which contrasts with findings that

Table 3. Relationship between level of nicotine dependence and level of physical activity

Variables		Vigorous physical activity	Moderate physical activity	Walking activity	Total physical activity
FTND	**r**	0.098	0.104	0.000	0.072
	n	59			

FTND: Fagerström test for nicotine dependence; r: Spearman's correlation coefficient

Table 4. Relationship between nicotine dependence categories and physical activity levels according to IPAQ-SF

		IPAQ-SF category (n)			Total
		Low	Moderate	High	
FTND-category (n)	Low	11	28	4	43
	Moderate	3	9	2	14
	High	1	0	1	2
Total (n)		15	37	7	59

FTND: Fagerström test for nicotine dependence, IPAQ-SF: international physical activity questionnaire-short form

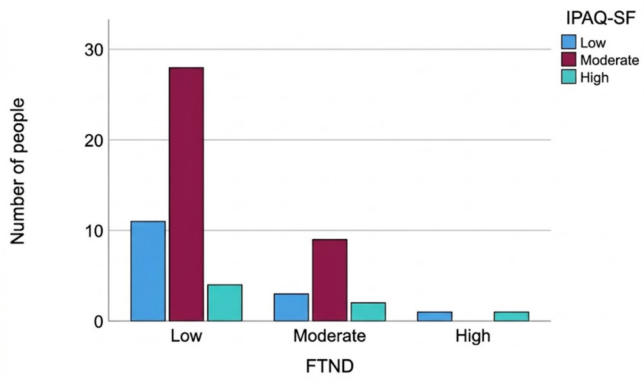

Figure 2. Distribution of physical activity levels based on nicotine dependence categories

IPAQ-SF: International Physical Activity Questionnaire Short Form, FTND: Fagerström test for nicotine dependence

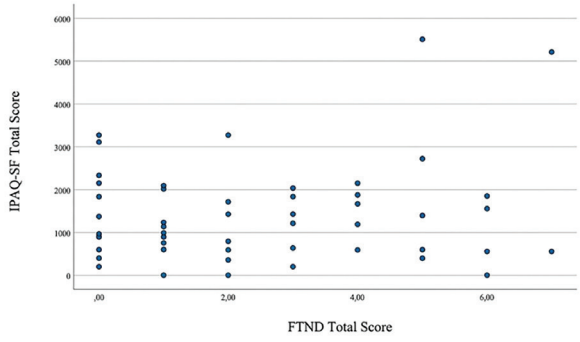

Figure 3. Total IPAQ-SF score according to smoking status

IPAQ-SF: International Physical Activity Questionnaire Short Form, FTND: Fagerström test for nicotine dependence

smoking prevalence may vary by gender depending on cultural and social contexts.[20]

The detrimental effects of nicotine dependence on health are well documented, and its impact on physical activity levels has been examined in various studies. Our study offers a different perspective: it did not demonstrate a strong relationship between nicotine dependence and physical activity levels. Furthermore, analysis of IPAQ-SF and FTND scores in our study revealed that individuals with low nicotine dependence predominantly engaged in moderate physical activity; however, this association did not reach statistical significance and should be interpreted with caution. In contrast, participants with high dependence levels were more frequently clustered within the low physical activity category across subdomains. Similarly, more recent studies report that higher levels of nicotine dependence are associated with lower levels of physical activity and reduced exercise capacity, suggesting a behavioral and physiological link between the severity of nicotine dependence and participation in physical activity.[5,14,21] Our study further indicates that physical activity levels may vary with the degree of nicotine dependence, highlighting the potential role of such activity in behavioral interventions aimed at preventing nicotine addiction. This implies that physical activity could be considered a lifestyle habit that contributes to reduced dependence. Among participants with high nicotine dependence, physical activity levels did not show a clear pattern. Similar findings in the literature have identified physical activity as a protective behavioral factor against smoking.[14] Supporting this, another study reported that low-intensity activities, such as walking, are negatively associated with smoking behavior, and participation in such activities reduces the likelihood of smoking.[9]

Study Limitations

While this study offers a degree of innovation and relevance, it is subject to several limitations. First, as data were collected at a single point in time, causality between smoking behavior and physical activity levels cannot be established. The findings reflect only a cross-sectional snapshot, making it impossible to observe changes over time. Another limitation is that only two participants were classified as having high nicotine dependence. This limits the reliability of comparisons between subgroups and reduces the generalizability of findings related to this category. Future studies could benefit from objective tools such as accelerometers or biochemical markers to verify physical activity and smoking status. Additionally, the influence of psychological or environmental factors, such as stress, peer pressure, or personal motivation, was not evaluated. Investigating these elements could offer a more complete understanding of the behavioral patterns linking smoking and physical activity. However, due to the cross-sectional design, causal inferences cannot be drawn, and the findings should be interpreted with caution.

CONCLUSION

Promoting physical activity may serve as an effective supportive component in smoking cessation efforts and addiction management. Accordingly, physical activity should be incorporated into public health intervention programs aimed at improving overall community well-being. However, the cross-sectional design of this study does not allow causal inferences, which should be acknowledged when interpreting the results.

Ethics

Ethics Committee Approval: Ethical approval for this study was obtained from the Hamidiye Non-Interventional Scientific Research Ethics Committee (approval date: 29.05.2025, approval no: 25/488).

Informed Consent: Written informed consent was obtained from all participants.

Footnotes

Authorship Contributions

Concept: Y.Ö., E.P., Design: Y.Ö., E.P., Data Collection or Processing: Y.Ö., Z.N.Y., E.E.K., N.N.K., N.N.B., Analysis or Interpretation: Y.Ö., C.K., E.P., Literature Search: Y.Ö., Writing: Y.Ö., C.K., E.P.

Conflict of Interest: No conflict of interest was declared by the authors.

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