

# E-cigarette use, thirdhand smoke awareness, and motivation to participate in physical activity in adolescents

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## Abstract

This study aims to investigate the levels of e-cigarette use, thirdhand smoke awareness, and motivation to participate in physical activity among adolescents, to reveal the relationship between these variables and to contribute to reducing future health risks. This descriptive and cross-sectional study included 657 volunteer students from a vocational and technical Anatolian high school. Data were collected using the "Thirdhand Smoke Awareness Scale" and the "Physical Activity Participation Motivation Scale," and analyzed using SPSS 26 software. Among the participants, 21.5% reported cigarette use, and 19.6% reported e-cigarette use. Non-smoking students demonstrated significantly higher physical activity motivation scores ( $54.67 \pm 9.91$ ) than smokers ( $52.08 \pm 7.74$ ) ( $p < .01$ ). The mean thirdhand smoke awareness score was  $32.44 \pm 9.38$ , with awareness levels correlating with parental education levels ( $p < .05$ ). A weak positive correlation was identified between physical activity motivation and thirdhand smoking awareness ( $r = 0.153$ ,  $p < .01$ ). Students who exercised regularly exhibited significantly higher physical activity motivation scores ( $57.09 \pm 10.64$ ) than those who did not ( $52.02 \pm 8.08$ ) ( $p < .01$ ). This study reveals that cigarette and e-cigarette use is a widespread public health problem among young people and that these behaviors begin at an early age. This study emphasizes the importance of educational programs and regulatory measures to reduce cigarette and e-cigarette use, promote physical activity, and increase awareness of thirdhand smoke.

**Keywords:** awareness, e-cigarette, physical activity, thirdhand smoke

## Main points

- The manuscript addresses the following key points:
- E-cigarette use: The e-cigarette use among adolescents is investigated.
- Awareness of thirdhand smoke: The study investigates the awareness levels of adolescents regarding thirdhand smoke.
- Motivation to participate in physical activity: The relationship between adolescents' motivation to participate in physical activity and their awareness of thirdhand smoke is investigated.

## Introduction

The use of cigarettes and other tobacco products is a serious public health issue with fatal consequences and a global impact. According to recent statistics, 47% of the population reported using at least one tobacco product, such as cigarettes, cigars, pipes, or hookahs, at least once in their lifetime, while 33.3% stated that they had used such products within the past year (Havaçeliği Atlam et al., 2020). This finding highlights the widespread impact of tobacco products on public health. In

recent years, electronic cigarettes, developed as an alternative to traditional smoking, have further exacerbated this issue.

Electronic cigarettes (e-cigarettes) are battery-operated devices that deliver nicotine and other addictive substances to users, mimicking the act of smoking (Yeh et al., 2022). The flavors used in e-cigarettes contribute to their pleasant aroma, leading individuals to perceive these products as "natural," "healthy," or "less harmful." This perception makes e-cigarettes particularly appealing to young people and adolescents. Indeed, research indicates that e-cigarette

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use is three times more prevalent among adolescents than adults (Dayi et al., 2019). However, the increasing prevalence of adverse health effects of e-cigarettes poses a significant public health concern. E-cigarettes have been reported to cause numerous health issues including dyspnea, coughing, lung cancer, paranasal cancers, chest pain, tachypnea, and tachycardia (Seiler-Ramadas et al., 2021). The rising rates of cigarette and e-cigarette use, coupled with the decreasing age of initiation, underscore the growing importance of tobacco control efforts.

Thirdhand smoke is defined as the absorption of particulate matter from tobacco smoke by surfaces such as furniture, clothing, and walls after smoking, followed by chemical reactions that transform these particles into a reinhalable form (Yeh et al., 2022). Additionally, thirdhand smoke components can re-enter the gas phase and disperse into air, leading to exposure through inhalation, skin contact, and ingestion (Yeh et al., 2022). However, common cleaning methods, such as opening windows, ventilating spaces, using fans or air conditioning, or wiping surfaces, are insufficient to prevent or eliminate thirdhand smoke (Önal et al., 2021).

The harmful effects of thirdhand smoke pose significant risks, particularly in children and adolescents. Studies suggest that thirdhand smoke can cause damage at the genetic level and pose serious risks for infants (Haardörfer et al., 2017). Therefore, raising awareness among children and adolescents regarding the effects of thirdhand smoke is of great importance. Furthermore, to promote a healthy lifestyle among adolescents, it is essential not only to encourage them to avoid tobacco products but also to support their participation in physical activities.

Physical activity (PA) is defined as “the entirety of movements that enable energy expenditure through the use of the musculoskeletal system in daily life” (Stricker et al., 2020). This concept is not limited to sports activities but is considered within a much broader framework. Daily life activities, such as walking, running, sports, games, work-related tasks, and exercises, can all be classified as physical activities. Physical activity is a fundamental element that meets biological, social, mental, and emotional needs. It plays a crucial role not only in maintaining physical health but also in preserving mental well-being. Studies have shown that participation in PA among adolescents contributes to weight control, reduces depression and anxiety, and improves the quality of life (Stricker et al., 2020; Tahir & Aslan, 2023). Despite the benefits of PA, the level of participation of children worldwide remains significantly low. It has been reported that participation in PA decreases during adolescence (ages 10–16), with this decline being more pronounced among girls (Watson et al., 2017).

Recent studies suggest a direct interaction between PA and thirdhand smoke exposure. The persistence of thirdhand smoke residues, particularly in enclosed environments where PA takes place, increases the level of exposure. This elevated exposure may adversely affect respiratory functions and consequently reduce an individual’s physical performance (Hrubá & Žaloudíková, 2012). Although Elshazly et al. (2020)

note that the impact of passive smoke exposure on lung function is limited, they emphasize that its effects on PA cannot be entirely disregarded. Additionally, Acuff et al. (2015) suggest that thirdhand smoke may impair respiratory health, thereby indirectly reducing participation in PA.

According to the PA guidelines published by the World Health Organization in 2020, it is recommended that children and adolescents (ages 5–17) engage in at least 1 hour of moderate to vigorous PA daily. It has been noted that individuals who regularly participate in physical activities during childhood and adolescence are more likely to maintain this habit throughout their lives (Önal et al., 2021). Therefore, promoting participation in PA, particularly during young adulthood when habits are established, is of great importance. In this context, this study aimed to determine the levels of e-cigarette use and awareness of thirdhand smoke among adolescents, identify their motivations for participating in physical activities, and examine the relationships between these variables. This study is expected to make a significant contribution to the literature by helping to reduce potential future health risks, such as those associated with e-cigarette use, thirdhand smoke exposure, and lack of PA.

## Material and Methods

The design of this study is a descriptive and cross-sectional study.

### Sample

The universe of this study consists of 871 students who are actively studying in the fields of information technology, electrical-electronics, graphic design and photography, and accounting-finance in the 2024–2025 academic year at Mersin Yahya Gunsur Vocational and Technical Anatolian High School. In this study, the sample calculation method was not used; instead, the aim was to reach the entire universe by including students who were registered at the school and participated in the study voluntarily. First, the students were informed about the study, and data were collected from 657 students who agreed to participate in the study voluntarily.

### Ethics Committee Approval and Informed Consent

The research was approved by the Suleyman Demirel University Social and Human Sciences Ethics Committee with the decision numbered 159/7 dated December 19, 2024. The necessary permissions for the institution where the research would be conducted were obtained with the application numbered MEB.TT.2025.015783 and dated January 10, 2025 to the Republic of Türkiye Ministry of National Education Research Implementation Permits Application and Evaluation Module. Detailed information about the study was given to the participants, and those who wanted to participate were asked to sign a detailed information form, a voluntary participation form, and a parental consent form. Additionally, permission to use the scale was obtained from the author via an email indicating the intent to use it.

## Measures

Data were collected through a face-to-face survey conducted in classrooms between January and March 2025. The survey included the “Thirdhand Smoke Awareness Scale,” the “Motivation for Participation in Physical Activity Scale,” and questions regarding students’ attitudes toward e-cigarette use, as well as their socio-demographic information.

The Thirdhand Smoke Awareness Scale was developed by Haardörfer et al. (2017) and adapted into Turkish, with reliability and validity studies conducted by Önal et al. (2021). The 9-item scale consists of two dimensions: health effects and environmental persistence. It is scored on a 5-point Likert scale (1 = Strongly disagree to 5 = Strongly agree). The scale has a Cronbach’s alpha value of 0.71, with a minimum total score of 9 and a maximum total score of 45 (Haardörfer et al., 2017). Higher total scores indicate greater awareness of thirdhand smoke.

The Motivation for Participation in Physical Activity Scale developed by Tekkurşun-Demir and Cicioğlu (2018) consists of three subdimensions: individual, environmental, and amotivation. It includes 16 items and is scored on a 5-point Likert scale ranging from 1 (Strongly agree) to 5 (Strongly disagree). The scale has a Cronbach’s alpha value of 0.80, with a minimum score of 16 and a maximum score of 80. Higher scores indicate greater motivation to participate in physical activities (Demir, 2018).

## Data Analysis

Data were analyzed using IBM SPSS Statistics version 26 (IBM SPSS Corp.; Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages. For the numerical variables, normality was assessed by calculating skewness and kurtosis values (Table 1). According to the rules of normal distribution, skewness and kurtosis values should fall within a range of  $\pm 2.0$  (George & Mallery, 2010). Within this framework, all the scales and subdimensions presented in Table 1 demonstrate a normal distribution. Based on these results, parametric tests were employed for data with a normal distribution, including independent sample *t*-tests, one-way ANOVA, and Pearson correlation analysis. The correlation coefficient was interpreted as follows: 0.00–0.30 indicates a low-level relationship, 0.30–0.70 indicates a moderate-level relationship, and 0.70–1.00 indicates a high-level

relationship. Throughout the study, significance levels of 0.05 and 0.01 were used as thresholds for statistical significance (Büyükoztürk, 2020).

In this study, a reliability analysis was conducted for all scales and subdimensions, and the Cronbach’s alpha values are presented in Table 2. Reliability analysis reveals the consistency of all items within a scale or subdimension and their homogeneity in measuring the construct being examined. According to the reliability analyses, the  $\alpha$  coefficient is expected to be above 0.60 (Pallant, 2020). Accordingly, the reliability of the scales and subdimensions used in this study was found to be sufficient.

## Results

Of the participants, 79% were male, and 21% were female. The majority of participants were enrolled in the Information and Technology Department (47.9%), while ninth grade students (36.8%) constituted the largest group in terms of grade distribution. A total of 21.5% of the participants reported smoking. Among smokers, 21% were female ( $N = 29$ ) and 79% were male ( $N = 112$ ). Among the smokers, 43.3% consumed 9–16 cigarettes per day. The percentage of participants who attempted to quit smoking was 36.9%, whereas 27.7% expressed a desire to quit smoking. This discrepancy suggests that some individuals may have been compelled to attempt quitting due to health problems or external pressures rather than voluntarily. The rate of alcohol use among the participants was 19.9%, and the rate of e-cigarette use was 19.6%. Additionally, 58.4% of participants believed that e-cigarettes were addictive. The rate of hookah use was 31.8%, whereas the rate of cigar/pipe use was 23.4%. A total of 79.9% of participants lived with both parents. Regarding parental education levels, the highest proportion of mothers had secondary education (40.2%), and the highest proportion of fathers also had secondary education (49.3%). Among the participants, 90.7% did not have any chronic illnesses, and 65.9% reported their economic status as moderate. Furthermore, 60% of participants were exposed to cigarette smoke (Table 3).

Table 4 presents statistical information regarding the Motivation for Participation in Physical Activity Scale and the Thirdhand Smoke Awareness Scale, along with their subdimensions. The total mean score of the Motivation for Participation in Physical Activity Scale was calculated as 54.11

**Table 1.** Skewness and kurtosis values of the data

Scales and Dimensions	Skewness		Kurtosis	
	Statistics	Std. Error	Statistics	Std. Error
Motivation to Participate in Physical Activity Scale	0.038	0.095	0.631	0.190
Individual reasons	-0.658	0.095	0.128	0.190
Environmental reasons	-0.313	0.095	-0.148	0.190
Causelessness	-0.217	0.095	-0.801	0.190
Thirdhand Smoke Awareness Scale	-0.582	0.095	0.075	0.190
Health effects	-0.720	0.095	0.045	0.190
Persistence in the environment	-0.436	0.095	-0.436	0.190

**Table 2.** Reliability analysis results

Scales and Dimensions	Cronbach's Alpha
Motivation to Participate in Physical Activity Scale	0.750
Individual reasons	0.770
Environmental reasons	0.628
Causelessness	0.888
Thirdhand Smoke Awareness Scale	0.924
Health effects	0.874
Persistence in the environment	0.867

$\pm 9.54$ , with a minimum score of 16 and a maximum score of 80. Among the subdimensions of this scale, the mean score for the individual reasons dimension was  $21.54 \pm 5.08$  (min: 6, max: 30), the mean score for the environmental reasons dimension was  $19.93 \pm 4.62$  (min: 6, max: 30), and the mean score for the amotivation dimension was  $12.65 \pm 4.78$  (min: 4, max: 20). The total mean score of the Thirdhand Smoke Awareness Scale was  $32.44 \pm 9.38$ , with a minimum score of 9 and a maximum score of 45. For the subdimensions of this scale, the mean score for the health effects dimension was  $18.37 \pm 5.38$  (min: 5, max: 25), and the mean score for the environmental persistence dimension was  $14.07 \pm 4.48$  (min: 4, max: 20).

The results of the comparison of the Physical Activity Participation Motivation Scale and Thirdhand Smoke Awareness Scale and their subdimensions according to demographic characteristics are shown in Table 5. Based on the mean scores of the Motivation for Participation in Physical Activity Scale in terms of gender, significant differences were found in the subdimensions of environmental reasons ( $p = .03$ ) and amotivation ( $p = .015$ ). Male participants scored significantly higher on the environmental reasons subdimension, while female participants scored higher on the amotivation subdimension. Regarding the grade variable, a significant difference was found in the amotivation subdimension ( $p = .004$ ). Ninth grade students scored significantly higher on the amotivation subdimension than students in the other grades. In terms of the mother's education level, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .018$ ) as well as in the environmental factors ( $p = .048$ ) and amotivation ( $p = .001$ ) subdimensions. The children of mothers with secondary education scored significantly higher on the Motivation for Participation in Physical Activity Scale compared to the children of mothers who were illiterate. Additionally, the children of mothers with primary education scored higher in the environmental reasons subdimension compared to the children of mothers with secondary or university education. A significant difference was also found in the amotivation subdimension based on the mother's education level ( $p = .001$ ). The children of mothers with secondary or university education scored significantly higher in the amotivation subdimension than the children of illiterate mothers. Regarding fathers' education level, significant differences were found in all subdimensions ( $p < .05$ ). The children of fathers with

primary or secondary education scored significantly higher on the Motivation for Participation in Physical Activity Scale, as well as on the individual reasons, environmental reasons, and amotivation subdimensions, compared to the children of fathers who were illiterate.

In terms of health status, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .001$ ), as well as in the individual reasons ( $p = .001$ ) and amotivation ( $p = .001$ ) subdimensions. Participants with good health status scored significantly higher on the Motivation for Participation in Physical Activity Scale and in the individual reasons subdimension than those with moderate or poor health status. Regarding the presence of chronic illness, significant differences were found in the total score on the Motivation for Participation in Physical Activity Scale ( $p = .039$ ) and in the individual reasons subdimension ( $p = .042$ ). Participants without chronic illnesses scored significantly higher on the Motivation for Participation in Physical Activity Scale and in the individual reasons subdimension than those with chronic illnesses.

In terms of regular exercise, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .001$ ), as well as in the individual reasons ( $p = .001$ ) and amotivation ( $p = .001$ ) subdimensions. Participants who exercised regularly scored significantly higher on the Motivation for Participation in Physical Activity Scale, as well as on the individual reasons and amotivation subdimensions, compared to those who did not exercise regularly. Regarding alcohol consumption, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .007$ ), as well as in the individual reasons ( $p = .021$ ) and amotivation ( $p = .001$ ) subdimensions. Participants who did not consume alcohol scored significantly higher on the Motivation for Participation in Physical Activity Scale, as well as on the individual reasons and amotivation subdimensions, compared to those who consumed alcohol.

In terms of smoking, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .004$ ), as well as in individual reasons ( $p = .005$ ) and amotivation ( $p = .003$ ). Nonsmokers scored significantly higher on the Motivation for Participation in Physical Activity Scale, as well as on the individual reasons and amotivation subdimensions, compared to smokers. Regarding hookah use, significant differences were found in the total score of the Motivation for Participation in Physical Activity Scale ( $p = .022$ ) as well as in the environmental factors ( $p = .011$ ) and amotivation ( $p = .001$ ) subdimensions. Participants who did not use hookah scored significantly higher on the Motivation for Participation in Physical Activity Scale, as well as on the environmental reasons and amotivation subdimensions, compared to those who used hookah. No significant differences were found in any subdimension based on the participants' field of study or the number of people they lived with ( $p > .05$ ).

When examining the mean scores of the Thirdhand Smoke Awareness Scale in terms of variables, a significant difference

**Table 3.** Demographic findings of participants and their attitudes toward e-cigarettes

Variable	Category	N	%	Variable	Category	N	%
Gender	Female	138	21	Number of cigarettes smoked daily*	1–8	44	31.2
	Male	519	79		9–16	61	43.3
Department	Science and Technology	315	47.9		17 and more	36	25.5
	Electric and Electronics	161	24.5	Quitting smoking trial status*	Yes	52	36.9
	Graphics and Photography	83	12.6		No	89	63.1
	Accounting and Finance	98	14.9	Desire to quit smoking*	No	102	72.3
Class	9th class	242	36.8		Yes	39	27.7
	10th class	118	18	Hookah usage status	Yes	209	31.8
	11th class	127	19.3		No	448	68.2
	12th class	170	25.9	Cigar/pipe usage status	Yes	154	23.4
Parents' relationship status	Married	525	79.9		No	503	76.6
	Single	108	16.4	E-cigarette usage status	Yes	129	19.6
	Others	24	3.7		No	528	80.4
Mother's education status	Not literate	29	4.4	Social environment	No	232	35.3
	Primary education	257	39.1	E-cigarette usage status	Yes	425	64.7
	High school	264	40.2	"E-cigarettes are addictive."	Yes	384	58.4
	University	78	11.9		Partially	197	30
	Postgraduate	29	4.4		No	76	11.6
Father's education status	Not literate	11	1.7	"E-cigarettes are more harmful than cigarettes."	Yes	230	35.2
	Primary education	215	32.7		Partially	206	31.5
	High school	324	49.3		No	217	33.2
	University	86	13.1	"People use e-cigarettes to quit smoking."	Yes	210	32
	Postgraduate	21	3.2		Partially	233	35.5
Chronic disease status	No	596	90.7	No	213	32.5	
	Yes	61	9.3	"E-cigarettes are an alternative to quitting smoking addiction."	Yes	201	30.6
Regular exercise status	Yes	271	41.2		Partially	198	30.1
	No	386	58.8	No	258	39.3	
Economic situation	Good	173	26.3	"The sale of e-cigarettes is legal."	Yes	287	43.7
	Moderate	433	65.9		Partially	194	29.5
	Poor	51	7.8		No	176	26.8
State of health	Good	395	60.1	"The use of e-cigarettes is prohibited in closed areas."	Yes	353	53.7
	Moderate	236	35.9		Partially	170	25.9
	Poor	26	4		No	134	20.4
Place of residence	State dormitory/other	34	5.2	"E-cigarettes cause passive smoking."	Yes	335	51.3
	Family home	623	94.8		Partially	188	28.8
Number of people living	1-3 people	98	20	No	130	19.9	
	4 people	185	37.8	"Using e-cigarettes is more expensive than smoking."	Yes	304	46.3
	5 people	122	24.9		Partially	191	29.1
	6 people and more	85	17.3	No	162	24.6	
Alcoholic beverage drinking status	Yes	131	19.9	"E-cigarettes will replace cigarettes in the coming years."	Yes	268	40.8
	No	526	80.1		Partially	281	42.8
Smoking status	Yes	141	21.5	No	108	16.4	
	No	516	78.5	Respiratory complaint status	No	570	86.8
Age of starting smoking*	10–13	51	36.2		Yes	87	13.2
	14	32	22.7	Presence of smokers in your close circle	No	179	27.2
	15–18	58	41.1		Yes	478	72.8
Years of smoking*	1 year	29	20.6	Exposure to cigarette smoke	Yes	394	60
	2 years	45	31.9		No	263	40
	3 years and more	67	47.5				

Participants provided only one response. There were no questions allowing multiple answers.

The dataset contains no missing values.

\*21.5% of the participants using smoking (N = 141).

**Table 4.** Statistical information on subdimensions and components of scales

Scales and Dimensions	Mean	Standard Deviation	Minimum	Maximum
Motivation to Participate in Physical Activity Scale	54.11	9.54	16	80
Individual reasons	21.54	5.08	6	30
Environmental reasons	19.93	4.62	6	30
Causelessness	12.65	4.78	4	20
Thirdhand Smoke Awareness Scale	32.44	9.38	9	45
Health effects	18.37	5.38	5	25
Persistence in the environment	14.07	4.48	4	20

was found in the environmental persistence subdimension based on the mother's education level ( $p = .041$ ). The children of mothers with primary education scored significantly higher on the scale compared to the children of mothers who were illiterate. Regarding fathers' education level, significant differences were found in all subdimensions ( $p < .05$ ). The children of fathers with primary or secondary education scored significantly higher on the Thirdhand Smoke Awareness Scale, as well as on the health effects and environmental persistence subdimensions, compared to the children of fathers who were illiterate. In terms of regular exercise, a significant difference was found in the environmental persistence subdimension ( $p = .04$ ). However, no significant differences were found in any subdimension of the Thirdhand Smoke Awareness Scale based on participants' gender, health status, chronic illness status, field of study, or number of people they lived with ( $p > .05$ ).

The results of the correlation analysis conducted to determine the relationships between the Motivation for Participation in Physical Activity Scale, Thirdhand Smoke Awareness Scale, and their subdimensions are presented in Table 6. According to the analysis, significant and positive correlations were found between the Motivation for Participation in Physical Activity Scale and its subdimensions. Specifically, a very strong positive correlation was observed between the Motivation for Participation in Physical Activity Scale and the "individual reasons" subdimension ( $r = 0.865, p < .01$ ), while a moderate positive correlation was found with the "environmental reasons" subdimension ( $r = 0.676, p < .01$ ). Additionally, a moderate positive relationship was observed between the "amotivation" subdimension and the Motivation for Participation in Physical Activity Scale ( $r = 0.423, p < .01$ ). When examining the relationships between the Thirdhand Smoke Awareness Scale, its subdimensions, and the Motivation for Participation in Physical Activity Scale, weak but significant positive correlations were found. Specifically, the "health effects" ( $r = 0.154, p < .01$ ) and "environmental persistence" ( $r = 0.136, p < .01$ ) subdimensions of the Thirdhand Smoke Awareness Scale showed weak positive correlations with the Motivation for Participation in Physical Activity Scale. Furthermore, significant relationships were identified between the subdimensions of the Thirdhand Smoke Awareness Scale and the Motivation for Participation in Physical Activity Scale. For example, a moderate positive correlation was found between "individual reasons" and "health effects" ( $r = 0.242, p < .01$ ), as well as between "environmental reasons" and "environmental persistence" ( $r = 0.331, p < .01$ ). On the

other hand, the "amotivation" subdimension was negatively correlated with the Thirdhand Smoke Awareness Scale and its subdimensions. Notably, significant negative correlations were observed between "amotivation" and "health effects" ( $r = -0.211, p < .01$ ) and between "amotivation" and "environmental persistence" ( $r = -0.266, p < .01$ ).

## Discussion

Tobacco use is recognized as one of the most serious public health issues worldwide. According to the World Health Organization, more than eight million people die each year due to tobacco-related causes. In Türkiye, data from 2020 indicate that the prevalence of tobacco use is 32%, with a higher rate among men (42%) than women (19%). These figures highlight that tobacco use is widespread across society, particularly among men, where the rates are significantly higher. According to the Global Adult Tobacco Survey, 57.5% of tobacco users aged 15–34 reported starting tobacco use at or before the age of 15 (Republic of Türkiye Ministry of Interior Turkish National Police Counter Narcotics Department, 2014). This finding underscores that tobacco use often begins at an early age, placing young individuals at high risk of developing this habit. The findings of this study are consistent with those reported in the literature. In this study, 58.9% of smokers reported starting smoking before the age of 15. This result supports the notion that experimenting with smoking at an early age is a strong predictor of developing smoking habits in adulthood.

The age at which individuals are first introduced to smoking is a critical factor in shaping their smoking habits. The age at first exposure to cigarettes and initial smoking experience among students is of significant importance in this context. According to the literature, a study in Türkiye revealed that 50.9% of individuals were first introduced to smoking at the age of 11 years or younger, whereas 13.6% encountered smoking at the age of 12 (Yılmaz, 2020). The findings of this study align with these results, emphasizing the importance of initiating smoking awareness and educational programs as early as primary school. Furthermore, it is evident that these awareness efforts should continue throughout adolescence through appropriately designed programs. The results of the research show notable differences compared with other studies in the literature. For instance, the 2017 Global Youth Tobacco Survey for Türkiye reported that the prevalence of smoking among youth aged 13–15 was 7.7% overall, with 9.9% among boys and 5.3% among girls. In the same study,

**Table 5.** Comparison of scale and subdimensions according to demographic characteristics

Variable	Category	Motivation to Participate in Physical Activity Scale	Individual Reasons	Environmental Reasons	Causelessness	Thirdhand Smoke Awareness Scale	Health Effects	Persistence in the Environment
Gender	Female	53.51 ± 9.49	20.81 ± 5.13	19.17 ± 4.57	13.53 ± 4.47	31.71 ± 9.37	17.99 ± 5.39	13.72 ± 4.5
	Male	54.27 ± 9.56	21.73 ± 5.06	20.13 ± 4.62	12.42 ± 4.84	32.63 ± 9.38	18.47 ± 5.37	14.16 ± 4.47
Department	p	.404	.059	.03*	.015*	.308	.357	.303
	Science	54.05 ± 9.77	21.45 ± 5.22	19.58 ± 4.82	13.03 ± 4.45	31.71 ± 9.31	18.02 ± 5.37	13.7 ± 4.54
	Electric	54.39 ± 10.21	21.77 ± 5.25	20.18 ± 4.74	12.44 ± 5.2	33.26 ± 9.13	18.8 ± 5.27	14.46 ± 4.29
	Graphics	54.4 ± 8.19	21.58 ± 4.65	20.68 ± 4.01	12.14 ± 5.44	33.17 ± 10.21	18.83 ± 5.74	14.34 ± 4.83
	Finance	53.61 ± 8.82	21.4 ± 4.78	19.99 ± 4.19	12.22 ± 4.45	32.8 ± 9.2	18.39 ± 5.24	14.41 ± 4.23
Class	p	.92	.913	.211	.264	.287	.392	.232
	9th class	54.97 ± 9.97	21.61 ± 5.21	19.86 ± 4.6	13.5 ± 4.44A	31.47 ± 8.76	17.95 ± 5.16	13.52 ± 4.11
	10th class	53.6 ± 10.04	21.69 ± 4.93	20.08 ± 4.59	11.83 ± 4.96B	33.27 ± 9.36	18.9 ± 5.32	14.38 ± 4.37
	11th class	53.35 ± 8.95	21.14 ± 5.1	19.71 ± 4.9	12.5 ± 5.02B	32.74 ± 10.16	18.28 ± 5.69	14.46 ± 4.83
Mother's Education Status	12th class	53.83 ± 8.96	21.63 ± 5.03	20.08 ± 4.48	12.13 ± 4.79B	33.01 ± 9.59	18.66 ± 5.47	14.35 ± 4.74
	p	.355	.806	.888	.004**	.235	.374	.121
	Not literate	49.94 ± 10.66B	19.79 ± 5.67	18.64 ± 5.52B	11.51 ± 5.02B	29.43 ± 10.52	16.97 ± 5.89	12.46 ± 5.1B
	Primary education	53.71 ± 8.92B	21.55 ± 4.85	20.44 ± 4.29A	11.72 ± 4.72B	33.1 ± 9.5	18.53 ± 5.46	14.57 ± 4.37A
Father's education status	High school	55.22 ± 9.87A	21.89 ± 5.17	19.84 ± 4.79B	13.48 ± 4.75A	32.15 ± 9.38	18.2 ± 5.38	13.95 ± 4.53AB
	University	53.5 ± 9.56B	21.11 ± 5.2	19.25 ± 4.59B	13.14 ± 4.52A	32.37 ± 8.65	18.76 ± 5.01	13.61 ± 4.3AB
	p	.018*	.14	.048*	.001**	.212	.391	.041*
	Not literate	46.22 ± 12.3B	17.34 ± 6.81B	16.94 ± 4.93B	11.94 ± 4.59B	23.09 ± 8.75B	14 ± 5.98B	9.09 ± 3.33B
State of health	Primary education	54.18 ± 8.76A	21.83 ± 4.5A	20.71 ± 4.44A	11.64 ± 4.93B	32.8 ± 9.45A	18.5 ± 5.29A	14.31 ± 4.54A
	High school	54.9 ± 9.83A	21.76 ± 5.23A	19.91 ± 4.6A	13.22 ± 4.73A	32.78 ± 9.28A	18.58 ± 5.32A	14.2 ± 4.47A
	University	52.43 ± 9.43A	20.7 ± 5.34A	18.71 ± 4.6A	13.02 ± 4.36A	31.62 ± 9.16A	17.9 ± 5.52A	13.72 ± 4.22A
	p	.004*	.008**	.001*	.002**	.006**	.033*	.002**
Chronic disease status	Good	55.54 ± 10A	22.09 ± 5.1A	20.09 ± 4.6	13.36 ± 4.5A	31.88 ± 9	18.14 ± 5.23	13.74 ± 4.33
	Moderate	52.23 ± 8.1B	20.95 ± 4.8B	19.74 ± 4.4	11.54 ± 5B	33.51 ± 9.7	18.9 ± 5.46	14.61 ± 4.6
	Poor	49.53 ± 9.6B	18.48 ± 5.6C	19.04 ± 5.1	12.01 ± 4.4B	31.17 ± 11.31	16.94 ± 6.46	14.23 ± 5.14
Regular exercise status	p	.001**	.001**	.4	.001**	.082	.086	.06
	No	54.36 ± 9.4	21.67 ± 4.91	20.03 ± 4.58	12.66 ± 4.74	32.55 ± 9.14	18.47 ± 5.21	14.09 ± 4.4
	Yes	51.71 ± 10.62	20.28 ± 6.44	18.91 ± 4.94	12.53 ± 5.2	31.28 ± 11.48	17.39 ± 6.79	13.89 ± 5.19
Regular exercise status	p	.039*	.042*	.071	.834	.312	.135	.745
	Yes	57.09 ± 10.64	22.85 ± 5.21	20.24 ± 4.9	14 ± 4.77	31.79 ± 8.92	18.15 ± 5.16	13.64 ± 4.44
	No	52.02 ± 8.08	20.61 ± 4.79	19.71 ± 4.41	11.7 ± 4.56	32.89 ± 9.67	18.52 ± 5.52	14.37 ± 4.49
Regular exercise status	p	.001**	.001**	.15	.001**	.139	.386	.04*

\*p < .05. Different superscript letters indicate statistically significant differences between groups according to post-hoc comparisons (p < 0.05). Groups sharing the same letter are not significantly different. Bold values indicate statistically significant results).

\*\*p < .01

**Table 5.** Continued

Variable	Category	Motivation to Participate in Physical Activity Scale	Individual Reasons	Environmental Reasons	Causelessness	Thirdhand Smoke Awareness Scale	Health Effects	Persistence in the Environment
Alcoholic beverage drinking status	Yes	52.08 ± 7.74	20.62 ± 5.27	20.12 ± 4.76	11.36 ± 5.31	33.49 ± 10.77	18.89 ± 6.1	14.6 ± 5.18
	No	54.62 ± 9.81	21.77 ± 5.02	19.88 ± 4.59	12.97 ± 4.59	32.17 ± 8.99	18.23 ± 5.18	13.94 ± 4.28
	p	.007**	.021*	.594	.001**	.149	.211	.13
Smoking status	Yes	52.08 ± 7.74	20.47 ± 5.07	20.01 ± 4.52	11.6 ± 4.96	31.89 ± 11.05	17.89 ± 6.27	14 ± 5.23
	No	54.67 ± 9.91	21.83 ± 5.05	19.9 ± 4.65	12.94 ± 4.69	32.59 ± 8.87	18.49 ± 5.11	14.09 ± 4.25
	p	.004**	.005**	.817	.003**	.437	.24	.828
Hookah usage status	Yes	52.86 ± 8.28	21.06 ± 5.06	20.6 ± 4.58	11.21 ± 5.19	33.21 ± 10.52	18.77 ± 5.95	14.44 ± 4.95
	No	54.7 ± 10.04	21.76 ± 5.09	19.61 ± 4.61	13.32 ± 4.42	32.07 ± 8.78	18.18 ± 5.08	13.9 ± 4.24
	p	.022*	.101	.011*	.001**	.147	.184	.15

\*p < .05. Different superscript letters indicate statistically significant differences between groups according to post-hoc comparisons (p < 0.05). Groups sharing the same letter are not significantly different. Bold values indicate statistically significant results).  
 \*\*p < .01

**Table 6.** Correlation levels between the motivation for participation in physical activity scale and the thirdhand smoke awareness scale and their subdimensions

Scale and Subdimensions	Factor	MPPAS	Individuals Reasons	Environmental Reasons	Causelessness	THSAS	Health Effects
Motivation for Participation in Physical Activity Scale	r	1					
	p						
Individuals reasons	r	0.865**	1				
	p	.001					
Environmental reasons	r	0.676**	0.599**	1			
	p	.001	.001				
Causelessness	r	0.423**	0.084*	-0.253**	1		
	p	.001	.031	.001			
Thirdhand Smoke Awareness Scale	r	0.153**	0.237**	0.313**	-0.248**	1	
	p	.001	.001	.001	.001		
Health effects	r	0.154**	0.242**	0.271**	-0.211**	0.960**	1
	p	.001	.001	.001	.001	.001	
Persistence in the environment	r	0.136**	0.205**	0.331**	-0.266**	0.941**	0.809**
	p	.001	.001	.001	.001	.001	.001

Note: MPPAS = Motivation for Participation in Physical Activity Scale; THSAS = Thirdhand Smoke Awareness Scale. \*p < .05, \*\*p < .01

smoking rates in Mersin for the 13–15 age group were 6.7% for boys and 4.9% for girls (Halk Sağlığı Genel Müdürlüğü, 2017). Additionally, data from the Turkish Monitoring Center for Drugs and Drug Addiction (TUBİM) indicate that the smoking rate among high school students nationwide is 8.3% (Republic of Türkiye Ministry of Interior, 2015). These findings highlight that the smoking prevalence varies by region and age group. Previous studies have also suggested that smoking and alcohol use rates change over time. For example, according to the 2008 Parliamentary Research Commission results in Türkiye, the smoking rate among high school students was 15.6% (21.8% for boys and 7.5% for girls), whereas the alcohol use rate was 16.5% (31.5% for boys and 10.6% for girls) (Metel et al., 2020). The higher prevalence of smoking and alcohol use observed in this study suggests an increasing trend in these behaviors among adolescents. However, it is important to note that this trend may be related to the characteristics of this study's target population, which consisted of vocational high school students. Indeed, the literature indicates that vocational high school students may have higher rates of substance use than science high school students (Yılmaz, 2020).

A nationwide study in Türkiye found that 67.6% of high school students who smoked were male, while 27.1% were female (Doğan & Ulukol, 2010). In this study, 79% of the students who smoked were male, and 21% were female. These findings indicated that smoking is more prevalent among male students. The study results show that smoking is more common among males. Similarly, in Jordan, the rates of starting to smoke and using are higher compared to females (Alzyoud et al., 2014). In a global study conducted in Bosnia and Herzegovina, 35% of males and only 16% of females smoked daily (Sekulic et al., 2012). In addition, Agaku et al. (2016) reported that the prevalence of smoking was significantly higher in males than in females between middle and high school.

In this study, the prevalence of e-cigarette use was 19.6%, which is a notably high rate compared with other studies in the literature. For instance, a study conducted in the United States with individuals aged  $\geq 15$  years reported an e-cigarette trial rate of 20.3% (Pearson et al., 2012). King et al. demonstrated that the rate of e-cigarette experimentation increased from 3.3% in 2010 to 8.5% in 2013 (King et al., 2013). The higher prevalence of e-cigarette use in this study suggests that it is becoming increasingly common among youth and represents a growing public health concern. When considered alongside the finding that 63.1% of students in this study had never attempted to quit smoking, e-cigarettes appeared to be perceived as an alternative to traditional cigarettes. This perception is becoming more widespread, with some smokers viewing e-cigarettes as a tool to quit smoking. In the literature, 75% of users believe that e-cigarettes can help reduce smoking, while 45%–85% believe they can aid in quitting smoking. Additionally, 53%–80% perceive e-cigarettes as less harmful than traditional cigarettes, and 26% believe they are less addictive (Köseoğlu et al., 2014). In this study, 32% of the students stated that e-cigarettes could help with smoking cessation, 30.6% viewed them as an alternative for combating nicotine addiction, and 35% believed e-cigarettes were less

harmful than traditional cigarettes. These findings indicate that perceptions of e-cigarettes are widespread among young people and may contribute to the increasing prevalence of e-cigarette use.

Despite the widespread perception that e-cigarettes may reduce health risks, these beliefs can be misleading when considering their actual health effects. Studies have identified harmful substances in e-cigarette vapor that can cause lung diseases and cancer. Nevertheless, the belief that e-cigarettes pose fewer health risks remains. In this study, the influence of social environment as a source of e-cigarette awareness was found to be 64.7%. This finding highlights the significant role of peers and social surroundings in increasing the prevalence of e-cigarette use. The presentation of e-cigarettes, their variety of flavor options, and their perception as technological products have been influential factors in their appeal to young people (Özlu, 2025; Pearson et al., 2012). There is growing concern regarding the increasing prevalence of e-cigarette use in Türkiye (Havaçeliği Atlam et al., 2020). Given these trends, it would be beneficial to implement protective educational programs targeting adolescents who are particularly at risk of e-cigarette use.

Cigarettes are known to contain approximately 7000 chemical substances, 69 of which are classified as carcinogenic. Smoking not only harms active smokers but also negatively affects individuals who are passively exposed to cigarette smoke. Individuals aged 15 years and older are frequently exposed to secondhand smoke in public spaces, such as government buildings, restaurants, and cafes (Hacettepe Üniversitesi, Halk Sağlığı Anabilim Dalı, 2016). In this study, exposure to cigarette smoke was 60%. This finding underscores that smoking is not merely an individual issue, but also a significant environmental and societal public health problem. The high prevalence of passive smoke exposure highlights the urgent need for stricter regulations and public health interventions to protect nonsmokers from the harmful effects of secondhand smoke.

Another critical aspect of cigarette smoke is thirdhand smoke exposure. Research has shown that thirdhand smoke can persist in smoking households for up to 6 months, during which exposure to toxic chemicals continues (Arfaeina et al., 2023). This highlights the indirect, yet significant, threats that cigarette smoke poses to human health through environmental contamination. In this study, differences in the subdimensions and total scores of the Thirdhand Smoke Awareness Scale were found to be associated only with the educational level of the parents. This result suggests that, as knowledge levels increase, awareness of thirdhand smoke also improves. Therefore, promoting education and awareness campaigns could play a vital role in mitigating the risks associated with thirdhand smoke.

A review of the literature reveals that, unlike the findings of this study, women tend to have higher average scores on thirdhand smoke awareness scales than men. However, these studies typically focused on adults or parents as their sample population (Köseoğlu et al., 2014; Seiler-Ramadas et al.,

2021). In contrast, the study found no significant difference in scale scores between sexes among adolescents ( $p > .05$ ). Considering that the possible scores on the scale range from 9 to 45, it can be stated that high school students' awareness of thirdhand smoke was above average. Although research on thirdhand smoke is limited, it remains a topic that is not widely understood by the public (Mahabee-Gittens et al., 2021; Wen et al., 2022). The literature suggests that older individuals, men, those with lower income levels, smokers, and individuals living in secondhand homes that have not been renovated tend to have less knowledge of the harmful effects of thirdhand smoke (Xie et al., 2021). This study highlights the importance of parental education levels in thirdhand smoking awareness. This finding suggests that parents' educational backgrounds may indirectly contribute to their children's level of awareness.

In this study, engaging in regular exercise significantly influenced the "environmental persistence" subdimension of the Thirdhand Smoke Awareness Scale ( $p < .05$ ). This finding suggests that PA may not only contribute to physical health but also play a role in enhancing environmental awareness and understanding the effects of cigarette smoke. Based on this, educational programs aimed at increasing students' awareness and knowledge of thirdhand smoke could be developed.

The literature includes various studies examining the factors affecting students' motivation to participate in PA. In these studies, no significant differences were found in students' motivation for PA participation based on grade level (Bozkurt & Tamer, 2020; Kahiyah, 2020; Türkeli & Namlı, 2019). However, another study reported that tenth grade students were more motivated to participate in PA than twelfth- and ninth-grade students (Demir, 2018).

In this study, ninth grade students scored significantly higher in the "amotivation" subdimension compared to other grades. Although no significant differences were found in the other subdimensions, the overall motivation scores for PA participation decreased as the grade level increased. This decline can be attributed to twelfth grade students focusing more on university entrance exam preparation, spending more sedentary time, and experiencing decreased intrinsic motivation. These variations in the literature suggest that high school students' behaviors are multifactorial and influenced by factors such as the social environment, societal characteristics, socioeconomic status, and individual differences (Türkeli & Namlı, 2019).

This study also found no significant difference in total motivation scores for PA participation between male and female students. However, in the "environmental reasons" subdimension, male students scored higher than female students. This indicates that male students are more motivated by environmental factors such as gaining recognition at school, improving relationships with school administrators and teachers, and demonstrating their peers' abilities. Similar findings in the literature suggest that male students have significantly higher PA levels than female students (Bozkurt & Tamer, 2020; Kudaş et al., 2005). However, contrary to the findings, some studies have reported no significant

differences in PA levels or motivation scores between male and female students (Demir, 2018; Demir et al., 2017). These discrepancies highlight the complex and multifaceted nature of PA behaviors among high school students, which are influenced by a variety of social, cultural, and individual factors.

In this study, it was found that students who engaged in regular exercise exhibited significantly higher motivation for participation in PA in both subdimensions of the scale than those who did not exercise. The positive effects of participation in PA among adolescents have been demonstrated in numerous studies. For instance, one study Chen et al. (2020) reported a positive relationship between life satisfaction and PA, indicating that adolescents who participate in more physical activities have higher levels of life satisfaction. The findings of this study align with these results, showing that students who engage in regular exercise are more motivated to participate in PA and tend to maintain this habit. In the general population, it is well established that regular exercise positively affects physical fitness, including the capacity to lead an active lifestyle, improvements in aerobic endurance, and increased muscle strength, all of which are critical for health (Stricker et al., 2020). This study supports these findings, demonstrating that students who exercise regularly are more motivated to participate in PA and to maintain this behavior over time.

This study found that the mother's education level significantly influenced the motivation for participation in PA. Specifically, as the mother's education level increases, the scores in the "amotivation" subdimension decrease significantly ( $p = .001$ ). Children of mothers with secondary or university education had lower amotivation scores than those of illiterate mothers. This indicates that a mother's education level plays a crucial role in encouraging children to engage in PA. Similarly, fathers' education level was also found to have a significant impact on their motivation for PA. As fathers' education levels increase, they are more likely to encourage their children to participate in physical activities, leading to more active lifestyles. This finding underscores the influence of parental education on children's PA habits. Additionally, the results of the Thirdhand Smoke Awareness Scale further supported the importance of parental education in fostering awareness.

The relationship between motivation to participate in PA and awareness of thirdhand smoke was also explored in this study. These findings indicate that motivation for PA is strongly associated with individual and environmental reasons, while the perception of amotivation negatively affects this motivation. Additionally, a weak but positive relationship was found between thirdhand smoking awareness and PA motivation. This suggests that participation in PA may not only promote individual health behaviors but also enhance environmental awareness.

In conclusion, this study highlights that smoking and e-cigarette use are growing public health concerns among the youth. E-cigarettes are perceived as an appealing alternative for young people, and social environments reinforce this

perception. It was observed that as parents' education levels increased, their awareness of thirdhand smoke also increased. Additionally, students who engaged in regular exercise exhibited higher motivation for PA, and nonsmokers were more willing to participate in physical activities. A weak but positive relationship was found between motivation for participation in PA and awareness of thirdhand smoke. To reduce cigarette and e-cigarette use, promote PA, and raise awareness of thirdhand smoke, the Ministry of Health and relevant policy-making institutions should develop multi-component intervention programs that encourage youth to avoid tobacco products. In this context, it is recommended to implement educational programs in schools, encourage sports activities, conduct awareness campaigns for parents, use effective communication strategies that emphasize the harms of e-cigarettes, and strengthen legal regulations.

### Limitations and Directions/Suggestions for Future Research

This study had several limitations. First, it was conducted exclusively with students enrolled at Mersin Yahya Gursur Vocational and Technical Anatolian High School during the 2024–2025 academic year; therefore, the findings cannot be generalized to all high school students. Additionally, as the study was based on voluntary participation, it was assumed that the participants evaluated the scale items subjectively. Since this study was limited to a specific high school, it is recommended that similar studies be conducted with larger samples from different cities and schools in future studies. In this way, the generalizability of the findings will increase. In addition, the study used only a survey as a quantitative data collection tool. In future studies, the addition of qualitative data collection methods (e.g., interviews or focus group studies) may provide more in-depth information about students' Instagram use and social appearance concerns.

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### Author contributions

Conception and design: B.S., Y.S.; Data acquisition: B.S., Y.S.; Data analysis: B.S., Y.S.; Data interpretation: B.S.; Drafting of the manuscript: B.S.; Critical revision of the manuscript: B.S., Y.S. All authors reviewed the results, approved the final version of the manuscript, and agreed to be accountable for all aspects of this study.

### Ethical approval

This study was approved by the Süleyman Demirel University Social and Human Sciences Ethics Committee (Date: December 19, 2024, Decision/Protocol No: 159/7). Informed consent was obtained from all participants involved in this study.

### Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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### Generative AI statement

The authors declare that no generative AI or AI-assisted technologies were used in the writing or preparation of this study.

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