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Determining University Students' Smoking Habits and Awareness Levels About Thirdhand Smoke

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Main Points

- Thirdhand smoke like tobacco smoking is one of the serious public health problem.
- The rate of those who are aware of thirdhand smoke was determined to be only 15.5%.
- Thirdhand Smoke Awareness Scale can be used to measure the awareness level of Health Services Vocational School students about thirdhand smoke.
- Thirdhand smoke is a concept about which awareness in the general public should be raised.

Abstract

This study aims to determine students' smoking status and their awareness level about thirdhand smoke. A web-based questionnaire was applied to 367 students who agreed to participate in the descriptive study. Thirdhand Smoke Awareness Scale was used. The scale was adapted into Turkish by Önal et al in 2021. Confirmatory factor analysis determined the compatibility of the data with the scale. Of the participants, 23.2% are male and 76.8% are female. Acceptable fit indices were reached in the analysis. Cronbach's alpha value was found to be .91. The rate of smokers in the last 30 days is 46%. It was determined that 47.4% of smokers smoke every day. The rate of those who do not know what thirdhand smoke is was determined as 84.5%. No significant difference was found between the awareness levels of the participants according to gender, family structure, place of residence, education level of parents, and economic status of the family ($p > .05$). The fact that the concept of thirdhand smoke has not yet been heard by many does not change the fact that it exists and has certain adverse effects. This research is vital in showing the need for awareness studies on the subject.

Keywords: Cigarette, smoking, student, thirdhand smoke, tobacco

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Introduction

Tobacco, which is one of the most common causes of preventable morbidity and mortality in the world, is primarily consumed in the form of cigarettes. Although users perceive smoking as a personal right, research has proven that exposure to secondhand smoke, known as passive smoking, causes adverse health conditions. Moreover, exposure to thirdhand tobacco smoke as a new concept is being debated. In order to contribute to this discussion, the awareness level of thirdhand smoke among university students has been aimed to be determined at universities where smoking is on the rise.

Approximately one-third (31.3%) of Turkey's population consumes tobacco products. This rate is 22.8% between the ages of 15 and 24 (Turkish Statistical Institute [TÜİK], 2020). In the period of 2020 – 2021, the most recent academic year completed, 8,240,000 students are receiving education at the tertiary level (Council of Higher Education [YÖK], 2022). Universities should be considered to be the most critical places in slowing down the smoking prevalence. Universities, where a stressful life is experienced, can lead to developing a smoking habit. Along with many studies, Cairney and Lawrence's study (2002) has proven this fact. On the other hand, people are never exposed to cigarette

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smoke in the other phases of life as much as they are at university. That is why the tobacco industry has chosen university students as its target group (Wolfson et al., 2009). While the high rate of smoking in the university environment due to the effect of industrial manipulation creates a young population directly harmed by smoking, at the same time, the harmful effects of exposure to secondhand and thirdhand cigarette smoke increase as a result of the predominance of social expectations.

Exposure to secondhand smoke can be experienced at home, at work, and in any other social setting. In order to reduce the hazardous effects of exposure, many countries, being aware of the importance of the exposure, make amendments to their regulations (Asomaning et al., 2008). One of the main goals of changing legislation is to prevent exposure to secondhand smoke and to help improve the overall health of their communities.

Thirdhand smoke is closely related to secondhand smoke. Secondhand smoke is a combination of mainstream and sidestream smoke from breathing environmental smoke passively, leaving harmful chemicals that settle on surfaces over time. Accumulated chemical residues create thirdhand smoke. Thirdhand smoke is the accumulation of secondhand smoke toxins on surfaces in smokers' homes, cars, clothes, and hair. Thirdhand smoke can remain on the floors, counters, and walls of indoor environments for months after smoking (Acuff et al., 2016; Dhall et al., 2016).

Burton (2011) highlighted a new and alarming consequence of indoor smoking as "thirdhand smoke." The term was first introduced and coined by Szabo (2006). Thirdhand smoke is complex, resulting from residual tobacco smoke contaminants that adhere to smokers' clothes and hair, indoor surfaces, furniture, and dust. These pollutants remain there long after secondhand smoke has been cleared out. Thirdhand smoke exposure results from unintentional (mainly via inhalation, but also through ingestion and skin) contact with tobacco smoke and related chemicals in the absence of concurrent smoking. Exposure may occur long after cessation of smoking due to close contact with smokers and regular exposure to indoor environments where tobacco is smoked (Protano & Vitali, 2011).

People urge the country's decision-makers to impose sanctions on smoking, through which awareness of non-self-induced cigarette smoke increases. Since it is not possible to prevent smoking, the solution to the problem cannot be provided by ventilation systems or specifically dedicated smoking areas (Singh & Lal, 2011). The only way to adequately protect all smokers and non-smokers from cigarette smoke is to develop policies to completely eliminate smoking in all indoor spaces, including residences (Wipfl et al., 2008). It has been observed that countries that have prepared nationwide regulations on smoke-free areas have observed improvements in cardiovascular health cases and a decrease in smoking-related mortality rates (Frazer et al., 2016). Increasing the level of awareness on the subject at every stage of society is essential, requiring special attention.

Methods

Research Model

The model of the research is the descriptive survey model.

Participants

The population of the research consisted of 939 students attending Başkent University Vocational School of Health Services in the 2021 – 2022 academic year. In the sample selection, the sampling method of unknown probability was used, and 367 students were reached.

Data Collection Tools

Personal information form. A web-based questionnaire and the Thirdhand Smoke Awareness Scale were administered to the participants. The questionnaire includes questions about sociodemographic characteristics, smoking, and thirdhand smoke.

The Beliefs about Thirdhand Smoke. The Turkish adaptation of the Thirdhand Smoke Awareness Scale was made by Önal et al. in 2021, and the Cronbach's alpha value of its validity and reliability was .71. The scale is composed of nine questions with a five-point Likert-type scale with two factors. The scale includes the sub-dimensions of "health effects" and "permanence in the environment" (Önal et al., 2021). The "health effects" sub-dimension consists of items 1, 2, 3, 7, and 8, and the "permanence in the environment" sub-dimension consists of items 4, 5, 6, and 9. Confirmatory factor analysis (CFA) was performed to evaluate the compatibility of the collected data with the scale structure. Before the analysis, the conformity of the data to the normal distribution was evaluated with the skewness and kurtosis coefficients. Agreeing with the items of the scale was arranged as "strongly disagree," "disagree," "partially agree," "agree," and "strongly agree." Scoring is scored from 1 to 5, starting with the option "strongly disagree." There is no reverse-scored item. The total score varies between 9 and 45.

Process

Data research forms collected from volunteer students were used to obtain the data for the study. Ethics committee permission for the research and legal permissions for the application have been taken from Başkent University (Date: 11.03.2022, Issue: 17162298.600-53). Written informed consent was obtained from all participants. Permission was obtained from the author for the "Thirdhand Smoke Awareness Scale." The designed questionnaire was directed to the participants online. Statistical Package Program for Social Sciences version 25.0 (IBM Corporation, Armonk, NY, USA) and IBM AMOS version 23.0 (Amos Development Corporation, Meadville, PA, USA) programs were used.

Data Analysis

The suitability of the data to the normal distribution was examined by the Kolmogorov – Smirnov test and the skewness and kurtosis coefficients. The consistency of the data with the scale structure was determined by Confirmatory Factor Analysis (CFA). The model's fit was evaluated using the root-mean-square error of approximation (RMSEA), the chi-squared statistic divided by the degrees of freedom (CMIN/*df*), comparative fit index (CFI), and goodness-of-fit index (GFI) fit indices, and the internal consistency of the scale was evaluated with Cronbach's alpha coefficient. The *t*-test and one-way analysis of variance was used for comparisons between the groups. Statistical significance was evaluated at the $p < .05$ level.

Results

The distribution of the participants in accordance with their sociodemographic characteristics is given in Table 1. Of the participants, 23.2% are male and 76.8% are female. The mean age is 19.80 ± 2.51. Of the students, 80.1% live with their families.

Confirmatory factor analysis coefficients were found to be between −.601 and −2.043, and the data met the normality assumption. The CFA results are presented in Figure 1. In the multi-factor measurement model, a correction (modification) was made between the error terms of items 1 and 2 and the error terms of items 7 and 8. It is seen that the factor loading values of the scale items vary between .61 and .90 (Figure 1). Acceptable fit indices values in CFA; $\chi^2/SD < 3$, RMSEA < .08, CFI > .95, and GFI > .90 (Anderson & Gerbing, 1984). Acceptable fit indices were obtained in the analysis ($\chi^2/df = 2.64$, $p < .001$, RMSEA = .067, CFI = .98, and GFI = .96). In the CFA phase of the study, it is seen that the scale cross-validity was successfully achieved. It was concluded that this scale can be used to measure the awareness of Health Services Vocational School students about thirdhand smoke.

The Cronbach's alpha value of the scale is .91 for the total scale and .88 and .90 for the sub-dimensions of health effects and permanence in the environment, respectively. The Cronbach's alpha value of the total and sub-dimensions of the scale was found to be over .70. Descriptive statistics of the items of the Thirdhand Smoke Awareness Scale are given in Table 2.

In the study, the Health Effects sub-dimension score average was found to be higher than the Persistence in the Environment sub-dimension. Among the items on the scale, item 1 had the highest mean score of 4.38 ± 0.84, and item 5 had the lowest mean score of 3.58 ± 0.94. The rate of smokers in the last 30 days is 46%. It was determined that 47.4% of smokers smoked every day. The rate of those who try tobacco products other than cigarettes is 51%. It has been determined that 65% of those who have tried cigarettes even once have tried other tobacco products, and 28% of those who have tried other tobacco products have used other tobacco products in the last 30 days. When questioned about the last 12 months, 49.4% of smokers stated that they tried to quit smoking, and 64.4% of current smokers answered "yes" to the question "Do you think you can quit smoking now if you want to?" When we look at the frequency of smoking at home, it is seen that almost half of the fathers smoke at home. Currently, 78% of smokers smoke at home, and 55.5% of home smokers only smoke on the balcony. It is seen that 75.5% of smokers inside the house also smoke in the car, and this rate drops to 44.3% among those who smoke only on the balcony. Some smoking characteristics of the participants are given in Table 3.

Table 1.
The Distribution of Participants in Line With Some Sociodemographic Characteristics

Variables	***n***	**%**
Gender		
Male	85	23.2
Female	282	76.8
Father's educational status		
Illiterate	1	.3
Primary school graduate	55	15
Secondary school graduate	72	19.6
High school graduate	154	42
University graduate	79	21.5
No idea	6	1.6
Mother's educational status		
Illiterate	4	1.1
Primary school graduate	85	23.2
Secondary school graduate	72	19.6
High school graduate	156	42.5
University graduate	47	12.8
No idea	3	.8
Economic status of the family		
Income equals expense	256	69.8
Income more than expenses	111	30.2
Total	367	100

Table 2.
Descriptive Statistics of the Items of the Thirdhand Smoke Awareness Scale

Lower Dimension	**Items**	**Mean (SD)**	**December**	**Sub-Dimension Mean (SD)**	**Cronbach's Alpha**
Health effects	1	4.38 (0.84)	1-5	4.04 (0.69)	.88
	2	4.22 (0.83)	1-5		
	3	4.05 (0.88)	1-5		
	7	3.78 (0.83)	1-5		
	8	3.77 (0.82)	1-5		
Environmental persistence	4	3.80 (0.95)	1-5	3.73 (0.85)	.90
	5	3.58 (0.94)	1-5		
	6	3.91 (0.97)	1-5		
	9	3.62 (1.02)	1-5		

Table 3.
Smoking Characteristics of the Participants

Variables	*n*	%
Have you ever tried/smoked a cigarette in your life, even for one or two puffs?		
Yes	254	69.2
No	113	30.8
How old were you when you tried/smoked for the first time?		
I have never tried smoking	114	31.1
7 years and under	5	1.4
I was 8 or 9 years old	4	1.1
I was 10 or 11 years old	4	1.1
I was 12 or 13 years old	28	7.6
I was 14 or 15	63	17.2
16 years or older	149	40.6
How many days have you smoked in the last 30 days?		
0 days	198	54.0
1 or 2 days	18	4.9
3 – 5 days	7	1.9
6 – 9 days	11	3.0
10 – 19 days	28	7.6
20 – 29 days	25	6.8
Every day (all 30 days)	80	21.8
Considering the days you smoked in the last 30 days, how many cigarettes did you usually smoke per day?		
I have never smoked in the last 30 days (one month)	199	54.2
Less than 1 cigarette per day	13	3.5
1 cigarette a day	16	4.4
2 – 5 cigarettes a day	47	12.8
6 – 10 cigarettes a day	51	13.9
11 – 20 cigarettes a day	37	10.1
More than 20 cigarettes a day	4	1.1
Have you ever tried a tobacco product other than cigarettes before in your life? (such as pipe, cigar, fine cigar, hookah)		
Yes	187	51.0
No	180	49.0
Have you ever used a tobacco product other than cigarettes in the last 30 days? (such as pipe, cigar, fine cigar, hookah)		
Yes	53	14.4
No	314	85.6
Do you first smoke or want to smoke in the morning the moment you get up?		
I do not smoke	210	57.2
No, I do not smoke or do not want to smoke first in the morning	89	24.3
Yes, I sometimes smoke or want to smoke right after I wake up	49	13.4
Yes, I always smoke or feel the need to smoke first every morning	19	5.2
Have you tried to quit smoking in the last 12 months?		
I have never smoked	144	39.2
I have not smoked for the last 12 months	61	16.6
Yes	80	21.8
No	82	22.3
Do you think you could quit smoking right now if you want to?		
I have never smoked	140	38.1
I currently do not smoke	78	21.3
Yes	96	26.2
No	53	14.4
Do you smoke inside the house?		
I have never smoked	147	40.1
I currently do not smoke	79	21.5
I smoke inside the house	49	13.4
Smoking is not allowed inside the house, I only smoke on the balcony.	61	16.6
I do not smoke inside the house or on the balcony.	31	8.4
Do you smoke inside the car?		
I have never smoked	143	39.0
I currently do not smoke	79	21.5
I smoke in the car	71	19.3
I do not smoke in the car	74	20.2
Total	367	100

Of the participants, 79.8% think that indoor tobacco use should be prohibited. When the subjects are asked their opinions about the use of tobacco in open areas, it is seen that the rate of those who think that it should be banned decreased to 46%. The rate of those who did not support the tobacco-free campus project was 33.6%, and about a quarter of the participants stated that they were undecided. Of the participants, 97.3% think that the smoke of cigarettes smoked by others is harmful to them. The rate of those who do not know what thirdhand smoke is was determined to be 84.5%. Some information and opinions of the participants about smoking are given in Table 4.

No significant difference was found between the awareness levels of the participants according to gender, family structure, place

Table 4.
Some Information and Opinions of the Participants About Smoking

Variables	*n*	%
Do you think smoking is harmful to health?		
Absolutely not harmful	6	1.6
Probably not harmful	1	0.3
Probably harmful	33	9.0
It is absolutely harmful	327	89.1
Do you think the smoke of other people's cigarettes is harmful to you?		
No way	4	1.1
probably not	6	1.6
Probably yes	104	28.3
Definitely yes	253	68.9
Do you think smoking should be prohibited in closed public areas (e.g. school, shop, restaurant, mall, cinema)?		
Yes	293	79.8
No	74	20.2
Do you think smoking should be prohibited in open public areas (playgrounds, bus stops, building entrances, parks, beaches)?		
Yes	169	46.0
No	198	54.0
What do you think about the tobacco-free campus project (removal of tobacco/smoking areas altogether)?		
I absolutely do not support	67	18.3
I do not support	56	15.3
I'm undecided	88	24.0
I support	85	23.2
I absolutely support	71	19.3
Do you know what thirdhand smoke is?		
I know	57	15.5
I do not know	310	84.5
Total	367	100

of residence, education level of father and mother, and economic status of the family ($p > .05$). The distribution of the Thirdhand Smoke Awareness Scale scores according to some characteristics is given in Table 5.

According to the results of the *t*-test conducted to determine whether the awareness levels of the participants about thirdhand smoke differ according to some variables, it was determined that the difference between those who said "it should be prohibited indoors" and those who said "it should not be prohibited indoors" was not statistically significant at the 95% confidence level. It was determined that the difference between those who said "it should be prohibited in open areas" and those who said "it should not be prohibited in open areas" was statistically significant ($t = 2.557$, $p = .011$). According to the results of the one-way analysis of variance conducted to determine whether there is a difference between the awareness levels in concordance with the support status of the tobacco-free campus project, a statistically significant difference was found between the awareness levels of those who said "I absolutely do not support" and those who said "I support" and "I strongly support" (F=3,419, $p = .009$).

Discussion

When the international literature is examined, it is seen that recent attempts to increase social awareness of the concept of thirdhand smoke have intensified. Convinced in creating public awareness about exposure to thirdhand smoke, Önal et al. (2021) adapted the scale by Haardörfer et al. (2017) into Turkish, via which it was intended to focus on reducing the harms of tobacco smoke exposure at its original scale. In this study, it was determined that beliefs about the health effects of thirdhand smoke were independently associated with smoking bans at home. Record et al. (2022) argue that developing scales to improve knowledge, behavior, and attitude toward thirdhand smoke will offer new opportunities to identify the information gaps, misperceptions, and barriers toward certain behaviors that increase the likelihood of exposure to thirdhand smoke.

One of the most striking points of the research is on the awareness of the concept. While the younger generation with a higher perception is expected to know what a concept such as thirdhand smoke is, the rate of those who know the concept in our sample group was 15.5%. This rate is regarded as low. In a study conducted with 1016 parents at tertiary education and research hospital in Turkey, the rate of those who were aware of the concept was determined to be 8.7% (Akca & Akca, 2022). It has been observed that the awareness of the concept is higher abroad compared to national awareness. According to Record et al. (2021), in their study, carried out with 1087 adults, the rate of those who knew thirdhand smoke was given as 36.5%. In a study completed with parents in Spain, the proportion of those who knew thirdhand smoke was 27% (Díez-Izquierdo et al., 2018). In the study conducted with healthcare professionals in the USA, the rate of those who know what thirdhand smoke means was 35% (Darlow et al., 2017). These rates prove that the general public is facing a danger they are unaware of.

Houses and cars are the most difficult areas to intervene in as smoke-free airspace. In particular, the fact that the ventilation of the area cannot disperse the negative effects and requires an acidic substance to dissolve the nicotine residue on the surfaces increases the danger dimension of exposure to thirdhand smoke (Solheim et al., 2014). Matt et al. (2013), in their research, claimed that a higher level of thirdhand smoke pollution was detected in the oldest rental vehicles. It has been suggested that the best way to get away from thirdhand smoke is not to smoke in the car. Within the scope of the current research, it is seen that the highest awareness scores about thirdhand smoke belong to those who do not currently smoke in their homes and cars. It is thought that the lower awareness among non-smokers is related to the fact that they develop a sort of anxiety about the concept. It is

Table 5.
Distribution of Participants' Scores on the Thirdhand Smoke Awareness Scale According to Some Characteristics

Variable	Group	*n*	$\bar{x}$	ss	
Gender	Male	85	33.765	8.564	$t = -1.782$
	Woman	282	35.511	5.226	$p = .078$
Do you smoke inside the house?	I have never smoked	147	35.408	6.205	F = 2.464
	I currently do not smoke	79	36.266	5.227	$p = .045$
	I smoke inside the house	49	33.959	5.898	
	Smoking is not allowed inside the house, thus I only smoke on the balcony.	61	35.049	5.826	
	I do not smoke inside the house or on the balcony.	31	32.645	8.570	
Do you smoke inside the car?	I have never smoked	143	35.552	5.865	F = 2.778
	I currently do not smoke	79	36.101	5.170	$p = .041$
	I'm smoking in the car	71	33.423	7.350	
	I do not smoke in the car	74	34.797	6.376	
Do you think smoking should be prohibited in closed public places?	Yes	293	35.379	6.156	$t = 1.682$
	No	74	34.027	6.259	$p = .093$
Do you think smoking should be banned in open public places?	Yes	169	35.994	6.317	$t = 2.557$
	No	198	34.349	5.997	$p = .011$
What do you think about the tobacco-free campus project (removal of tobacco/smoking areas altogether)?	I absolutely do not support	67	33.299	7.522	F = 3.419
	I do not support	56	35.036	5.821	$p = .009$
	I'm undecided	88	34.386	5.561	
	I support	85	36.000	4.451	
	I absolutely support	71	36.690	7.143	
Do you know what thirdhand smoke is?	I know	57	35.439	8.053	t = 0.440
	I do not know	310	35.045	5.800	$p = .660$

*$p < .05$.

an expected result that especially those who quit smoking have a high sensitivity to smoking.

Locations with the highest potential for exposure to thirdhand smoke can be counted as follows: smoking houses and apartments, in which people smoke; multi-unit residences where smoking is allowed; cars in which smoking is allowed; and indoor places where smoking is allowed (Drehmer et al., 2017). University campuses, where heterogeneous groups come together, can easily be counted among these places. A study conducted on a university campus found that nicotine levels in public open spaces pose a potential problem of exposure to thirdhand smoke (Silva et al., 2016). Effective smoking bans are needed to prevent pollution from thirdhand smoke. Studies have shown that the pollution created by thirdhand smoke continues long after the bans on cigarette consumption are enacted (Matt et al., 2020).

A limited number of studies in recent years have proven that thirdhand smoke is a significant public health threat. While evidence supports the widespread presence of thirdhand smoke in indoor environments, it is beginning to be a cause for public concern due to its negative effects (Hang, et al., 2020). However, it is thought that these lack general awareness of their potential hazards.

In conclusion, the fact that the concept of thirdhand smoke has not yet been heard by many does not change the fact that it exists and has certain adverse impacts. It is believed that this research will contribute to the social acceptance and awareness of smoke-free policies implemented in both public and private spaces. Increasing the sensitivity of the young population on the subject will help in facilitating the fight against tobacco products. As awareness of thirdhand smoke increases, the level of knowledge about the harms of cigarettes and their derivatives will spread to the general population; thus, the taboo which is related to the fact that tobacco products will pose a danger only to the user and his immediate surroundings might be broken. After achieving the goal of reaching a sufficient level of awareness, studies on the types of thirdhand smoke and the effects they cause will intensify. The findings of all these studies will guide decision-makers in developing certain policies and strategies.

Limitations and Directions/Suggestions for Future Research

The study has some limitations. Study data were collected from a department of a university. In addition, the information obtained

is limited to the answers given to the questions in the questionnaire. It is expected that future studies will change the concept of thirdhand smoke in the perception of society. We suggest that researchers carry out studies so as to increase awareness of the concept.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Başkent University (Approval No: 17162298.600-53).

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