BELIEFS ABOUT THIRD-HAND TOBACCO SMOKE AMONG UNIVERSITY EMPLOYEES: A CROSS-SECTIONAL STUDY

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SUMMARY

Objectives: This study aimed to evaluate the beliefs about third-hand tobacco smoke (THS) among administrative and academic staff at a university. THS is a residual pollutant from tobacco smoke that lingers on surfaces and poses health risks, particularly to children. The study also aimed to understand these beliefs in relation to socio-demographic factors.

Methods: A cross-sectional survey was conducted with 332 university employees aged 18 and over. Data were collected between September and December 2023 through face-to-face and online questionnaires. The survey included the Beliefs About Third-hand Smoke (BATHS-T) Scale and questions on socio-demographic characteristics, second-hand smoke exposure, and attitudes towards a smoke-free campus. Beliefs About Third-hand Smoke Scale total and sub-dimension scores increase, it is understood that the participant□s belief in the negative effects of third-hand tobacco exposure on persistence and health increases.

Results: The average age of participants was 36.1 years, with 38.3% being administrative personnel and 61.7% academic personnel. About 40.5% of the participants used tobacco products. The mean total BATHS-T score was 35.6, with health and persistence subscale scores averaging 19.9 and 15.7, respectively. Non-smokers had significantly higher BATHS-T scores than smokers. The participants with children scored higher on the health sub-dimension. Additionally, 78.9% supported a smoke-free campus, and those supporting it had higher BATHS-T scores. Awareness of the harms of second-hand smoke correlated with higher BATHS-T scores.

Conclusion: The study highlights that non-smokers and those with children are more aware of THS risks. There is strong support for a smoke-free campus among university staff. The findings suggest a need for increased education on THS, especially targeted at smokers and those without children. Universities can play a crucial role in promoting smoke-free environments and raising awareness about the health risks associated with THS.

Key words: environmental tobacco smoke pollution, passive smoking, health awareness, smoke-free policy, university

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INTRODUCTION

The use of tobacco products is one of the biggest public health problems facing the world. The use of tobacco and tobacco products causes more than 8 million deaths a year, 1.2 million of which are due to passive smoking (1). The nicotine in tobacco causes high levels of addiction. In addition, tobacco use is an important risk factor for cardiovascular and respiratory diseases and more than 20 different types of cancer (2). Low-income and middle-income countries are the targets of intense tobacco industry intervention and are home to more than 80% of tobacco users worldwide. Most tobacco-related deaths occur in these countries (1, 2).

Second-hand tobacco smoke exposure (SHS), i.e., passive smoking, is defined as the inhalation of smoke from the burning end of a cigarette or other tobacco products consumed by other people (1). There is no reliable level of exposure to second-hand smoke; even short-term exposures can result in serious damage to health (3).

Beyond second-hand tobacco smoke exposure, third-hand tobacco smoke (THS) exposure is also an important type of exposure and was first described in the study by Winickoff et al. in 2009 (4). Third-hand tobacco smoke exposure refers to pollutants left behind on surfaces such as clothing, furniture, hair, skin, walls, and dust after smoking. These pollutants can interact with oxidants and other pollutants commonly found in the indoor environment and form secondary pollutants, some of which are carcinogenic. As an indoor pollutant, THS causes long-term effects, and its toxicity increases cumulatively over time. Additionally, exposure can be monitored not only through inhalation but also through skin contact with contaminated surfaces such as hair and clothing (5).

A study conducted in 2014 evaluating the effects of exposure to THS on health outcomes found that long-term exposure to THS, especially in children and infants, may cause an increase in the risk of cancer in the long term (6). Regarding THS exposure to tobacco smoke from e-cigarettes, in an animal experiment study, deteriorations in lung tissue were observed in THS exposure to e-cigarettes containing nicotine (7). In a study where nicotine

residue in the beds of newborns in the neonatal intensive care unit was measured, nicotine contamination was observed in the babies' cribs in more than 90% of cases, regardless of whether the visiting parents used tobacco products or not. Cotinine levels were detected at detectable levels in more than 90% of urine samples taken from the babies (8).

Third-hand tobacco smoke can be found not only in indoor smoking areas but especially in small indoor spaces such as cars, as a result of people who have smoked entering the environment, even if they do not smoke inside (5). In the environment where the tobacco user enters, exposure to third-hand tobacco smoke continues through particles adhering to objects (8). Therefore, THS exposure poses a risk to the health of everyone in society (5).

The harmful effects of THS on health have been explained. In the literature review, no studies were found evaluating beliefs about THS among university employees in our country. Since university employees are role models for society and students, information about their beliefs about THS is also important. This study aimed to evaluate the beliefs of administrative and academic staff at a university in Izmir about third-hand tobacco smoke according to socio-demographic variables.

MATERIALS AND METHODS

Study Design

This cross-sectional study was conducted by applying a face-to-face and online survey to university staff aged 18 and over.

Sample Size Calculation

The total number of university personnel was 1,732 (academic and administrative) (9). When we stratified the staff into administrative and academic categories, we found that 35% were administrative and 65% were academic. The sample size calculation was performed using the G*Power 3.1.9 program (10). By using previous research finding, we calculated a standardized effect size by assuming that the mean BATHS-T total score would be 34.02 ± 6.67 in the smoker group and 36.02 ± 6.72 in the non-smoker group (11). To show the differences between the two groups, an effect size of 0.30, power of 80%, and an alpha error of 0.05 determined that at least 352 personnel needed to be reached.

Data Collection

The data collection phase was carried out between September and December 2023. Verbal consent was obtained from all the participants, and an online or printed survey was administered. The Beliefs About Third-hand Smoke (BATHS-T) Scale and a data collection form involving questions about socio-demographic characteristics, information about SHS exposure, and perspective on a smoke-free campus were administered to the personnel who agreed to participate in the study.

Beliefs About Third-hand Smoke (BATHS-T) Scale

The Turkish validity and reliability study of the BATHS-T scale used to evaluate beliefs about third-hand tobacco smoke exposure was conducted by Çadırcı et al. (12). The scale is a 5-point Likert type scale consisting of 9 questions. The scale has two sub-dimensions: health and persistence. For the health sub-dimension, the scores of items 1, 2, 3, 7, and 8 are summed; for the persistence sub-dimension, the calculation is made by adding the scores of items 4, 5, 6, and 9. The health sub-dimension questions beliefs about the health effects of third-hand tobacco smoke, and the persistence sub-dimension questions beliefs about the persistence of tobacco products/smoke in the environment (13). Questions in the scale are scored between 1–5 (1 – strongly disagree, 2 – disagree, 3 – not sure, 4 – agree, and 5 – strongly agree). The BATHS-T total score based on nine items can vary between 9 and 45, the health subscale score based on five items can vary between 5 and 25, and the persistence subscale score based on four items can vary between 4 and 20. As the scores increase, it is understood that the participant's belief in the negative effects of third-hand tobacco exposure on persistence and health increases. In the study conducted by Çadırcı et al. (12), the BATHS-T scale has strong reliability in the total and sub-dimensions (Cronbach's alpha = 0.90 for the total score, Cronbach's alpha = 0.81 for the persistence sub-dimension, and 0.86 for the health sub-dimension).

Data Collection Form

A 22-question survey was created and administered by the researchers, following the literature (11, 12, 14–17), in which the participants were asked about their sociodemographic characteristics, knowledge of SHS exposure, and perspectives on a smoke-free campus.

The socio-demographic characteristics included age, gender, education level, place of duty (administrative or academic staff), occupation (medical or non-medical), whether they have children, tobacco product use status, childhood tobacco smoke exposure at home, current tobacco smoke exposure at home, and chronic disease status. They were questioned about exposure to SHS in the work environment and knowledge about the harm of SHS. Awareness of the smoke-free campus concept, their thoughts about the transition to smoke-free campus practice, and their opinions about providing smoking cessation support to those who want it on campus were also questioned.

In the grouping of answers given to the question "Do you smoke?", those who answered "I smoke regularly" or "I smoke intermittently (social smoker)" were included in the "smoker" group, and those who answered "I have never smoked" or "I have not smoked for at least 6 months" were included in the "non-smoker" group. The data collected in the 5-point Likert scale in the data collection form examining their knowledge of SHS exposure, and their perspectives on a smoke-free campus were converted into 3-point Likert scales during the analysis phase. The answers "I definitely support" and "I support" were included in the "I support" group, the answers "I do not support" and "I definitely do not support" were included in the "I do not support" group, and the answers "I am undecided" were left the same.

Statistical Methods

The data were evaluated in the IBM SPSS Statistics Standard Concurrent User V 25 (IBM Corp., Armonk, NY, USA) statistical package program. Descriptive statistics are given as a number

of units, percentage, mean ± standard deviation, median, and interquartile range. Normal distribution of the data of numerical variables was evaluated with the Shapiro-Wilk normality test. Comparisons of numerical variables between groups were made by Kruskal-Wallis analysis and Mann-Whitney U analysis. Dunn-Bonferroni test was used as a multiple comparison test. The independent effects of different descriptive factors on BATHS-T scores were examined with linear regression models. The suitability of the established models for linear regression analysis; Q-Q plot for normality of residuals, Durbin-Watson statistics for autocorrelation, tolerance and variance inflation factor for multicollinearity were checked. For regression analyses, variables with a p-value of < 0.1 were included in the model. Categorical variables were included in the model as dummy variables. Socio-demographic variables were included in the multivariate linear regression model by the backward elimination method. The final model was reached by manually eliminating variables that were not statistically significant using the "enter" method and re-establishing the model. A value of $p < 0.05$ was considered statistically significant.

RESULTS

A total of 332 people working at Izmir Katip Celebi University participated in the study, achieving 94.3% of the targeted sample size. The average age of the participants was 36.1 ± 8.3 (min:18–max: 61) years. When we classified the employees according to their job descriptions, 127 (38.3%) were administrative personnel and 205 (61.7%) were academic personnel. The distribution of all employees of the university is similar to the distribution of administrative and academic personnel. Among all the participants 307 (92.5%) were university/college graduates. The smoking group included 134 (40.5%) participants, 61 (18.4%) of all the participants use tobacco products intermittently, and 73 (22.1%) use tobacco products regularly. Of those using tobacco products, 168 (82.4%) preferred cigarettes and 117 (64.6%) had attempted to quit using tobacco products before. Additionally, 215 (64.8%) of the participants reported being exposed to cigarette smoke at home during their childhood, and 13.6% stated that the people they live with use tobacco products in the house (Table 1).

Among the participants, 270 (82.1%) believed that SHS could cause health problems. Additionally, 305 (92.2%) employees had a positive view of the support provided for quitting smoking on campus; 214 (64.7%) participants heard about the smoke-free campus initiative. Furthermore, 183 (55.6%) thought they were exposed to SHS on campus, and 261 (78.9%) supported the implementation of a smoke-free campus within university borders. The mean total score of all the participants on the BATHS-T scale, the mean persistence sub-dimension score, and the mean health sub-dimension score were 35.6±8.8, 19.9±4.9 and 15.7±4.1, respectively (Table 2).

When the BATHS-T scale total score, health and persistence sub-dimension scores were evaluated in relation to gender, occupation, presence of childhood exposure to cigarette smoke, and the use of tobacco products by the household, no significant difference was observed. The health sub-dimension score was significantly higher among those who had children compared to those who did not ($p = 0.033$). In addition, it was observed that 87.0% of all the participants in the study agreed and strongly agreed that exposure to THS is harmful to children and infants (Fig. 1). When the BATHS-T total scale score, health and persistence sub-dimension scores were compared according to smoking status, the scores of non-smokers were significantly higher than those of smokers ($p < 0.001$) (Table 1).

When BATHS-T total score, health and persistence sub-dimension scores were compared according to the presence of exposure to SHS on campus and having heard of smoke-free campus practice, no significant difference was observed between the groups (Table 3).

The BATHS-T total score, health and persistence sub-dimension scores of those who thought passive smoking was harmful were significantly higher than for their counterparts (Table 3).

The BATHS-T total score, health and persistence sub-dimension scores of those who supported limiting the use of tobacco products in places where health, education and training, culture and sports services are provided; providing support for smoking

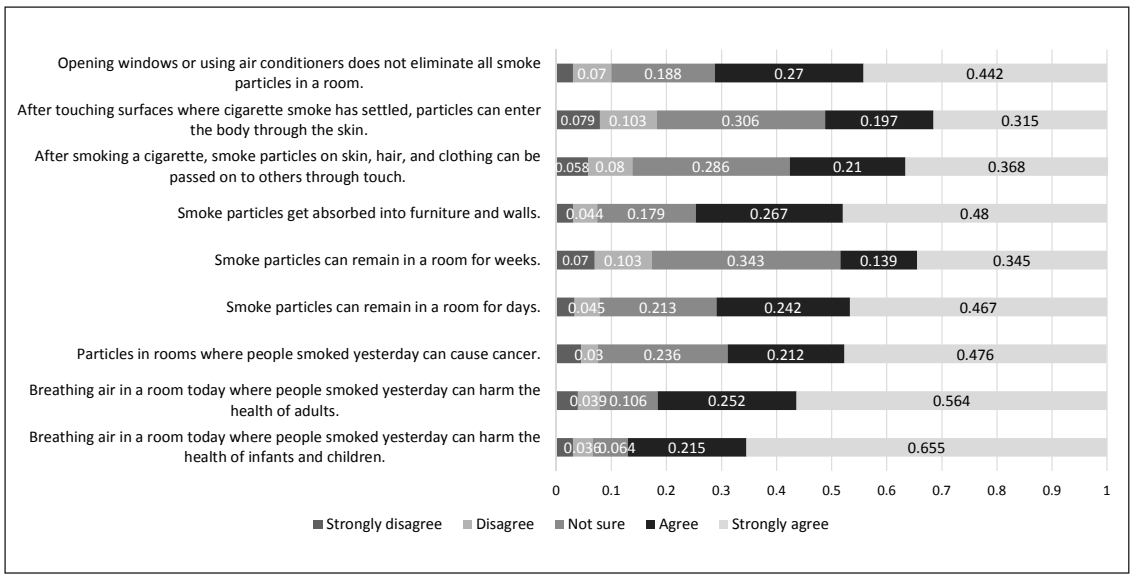

Fig. 1. *Plot of participants' responses to BATHS-T scale questions.*

Table 1. *Comparison of BATHS-T total scale scores and sub-dimension total scores according to socio-demographic characteristics and smoking characteristics of the participants*

Variables	Statistics n (%)	BATHS-T score M (IQR)	Statistics	Health subscale M (IQR)	Statistics	Persistence subscale M (IQR)	Statistics
Gender							
Female	176 (53.0)	37.0 (12.0)	Z = −0.422 p = 0.673	21.0 (8.0)	Z = −0.372 p = 0.710	16.0 (7.0)	Z = −0.516 p = 0.606
Male	156 (47.0)	37.0 (14.0)		21.0 (8.0)		16.0 (7.0)	
Education status							
High school and below	25 (7.5)	39.0 (18.0)	Z = 0.180 p = 0.857	23.0 (8.0)	Z = 0.318 p = 0.750	16.0 (8.0)	Z = −0.022 p = 0.982
University	307 (92.5)	37.0 (12.0)		21.0 (8.0)		16.0 (7.0)	
Occupation							
Medical	135 (44.1)	37.0 (14.0)	Z = −0.553 p = 0.580	21.0 (8.0)	Z = −0.375 p = 0.707	16.0 (7.0)	Z = −0.825 p = 0.409
Non-medical	171 (55.9)	37.0 (13.0)		21.0 (8.0)		16.0 (7.0)	
Child							
Yes	145 (43.8)	37.0 (14.0)	Z = −1.541 p = 0.123	21.0 (8.0)	Z = −2.135 p = 0.033*	16.0 (7.0)	Z = −0.689 p = 0.491
No	186 (56.2)	36.0 (13.0)		20.0 (7.0)		16.0 (7.0)	
Chronic disease							
Yes	56 (16.9)	33.0 (16.0)	Z = 1.096 p = 0.273	19.0 (8.0)	Z = 0.925 p = 0.355	14.0 (8.0)	Z = 1.284 p = 0.199
No	275 (83.1)	37.0 (12.0)		21.0 (8.0)		16.0 (6.0)	
Smoking status							
Smoker	134 (40.5)	34.0 (12.0)	Z = 4.353 p < 0.001*	19.0 (7.0)	Z = 4.303 p < 0.001*	15.0 (7.0)	Z = 4.120 p < 0.001*
Non-smoker	197 (59.5)	39.0 (13.0)		22.0 (7.0)		17.0 (6.0)	
Home smoke exposure in childhood							
Yes	215 (64.8)	36.0 (13.0)	Z = 1.421 p = 0.155	20.0 (7.0)	Z = 1.178 p = 0.239	16.0 (6.0)	Z = 1.528 p = 0.126
No	117 (35.2)	39.0 (14.0)		21.0 (8.0)		16.0 (7.0)	
Have you ever tried to stop using tobacco products?							
Yes	117 (64.6)	36.0 (13.0)	Z = −0.875 p = 0.382	20.5 (8.0)	Z = −0.974 p = 0.330	16.0 (7.0)	Z = −0.886 p = 0.376
No	64 (35.4)	34.0 (12.0)		19.0 (6.0)		15.0 (7.0)	
Do your household use tobacco products in the house?							
Yes	37 (13.6)	33.0 (15.0)	H = 4.525 p = 0.104	18.0 (8.0)	H = 4.827 p = 0.089	16.0 (8.0)	H = 3.286 p = 0.193
No	46 (16.8)	35.5 (12.0)		21.0 (5.0)		16.0 (7.0)	
People I live with do not use tobacco products	190 (69.6)	37.5 (13.0)		21.0 (8.0)		16.0 (6.0)	

M – median; IQR – interquartile range; H – Kruskal-Wallis statistics; Z – standardized Mann-Whitney U test statistics; *p < 0.05

cessation on campus; and adopting a smoke-free campus were significantly higher than for their counterparts (Table 3).

According to the final model obtained in the backward linear regression analysis in which socio-demographic variables were included, the BATHS-T score of non-smokers was significantly higher compared to smokers (Table 4). In the linear regression analysis in which other variables related to SHS exposure were included in addition to the socio-demographical variables, the BATHS-T score of those who knew that passive exposure was harmful to health and those who supported the transition to a smoke-free campus was observed to be significantly higher (Table 5).

Table 2. *Participants' BATHS-T total scale scores and sub-dimension total scores*

Variables	Statistics Mean (SD)
BATHS-T score (9–45)	35.6 (8.8)
Health subscale (5–25)	19.9 (4.9)
Persistence subscale (4–20)	15.7 (4.1)

SD – standard deviation

DISCUSSION

In this study, beliefs about the harms of THS among university employees were investigated. According to the findings, the BATHS-T scores of employees who do not use tobacco and tobacco products are higher than those who use tobacco products.

Table 3. *Comparison of BATHS-T total scale scores and subscale total scores according to passive exposure to tobacco and tobacco products and other characteristics of the participants*

	BATHS-T score M (IQR)	Statistics	Health subscale M (IQR)	Statistics	Persistence subscale M (IQR)	Statistics
Belief that passive smoking can cause health problems						
Yes	39.0 (13.0)[a]	H = 42.111 p < 0.001*	21.5 (7.0)[a]	H = 41.360 p < 0.001*	17.0 (6.0)[a]	H = 37.652 p < 0.001*
No	29.0 (16.0)[b]		15.0 (12.0)[b]		13.0 (8.0)[b]	
Not know	30.0 (11.0)[b]		17.0 (5.0)[b]		13.0 (5.0)[b]	
Exposure to second-hand smoke on campus						
Yes	37.5 (13.0)	Z = −1.558 p = 0.119	21.0 (7.0)	Z = −1.699 p = 0.089	16.0 (6.0)	Z = −1.442 p = 0.149
No	35.0 (14.0)		20.0 (9.0)		16.0 (7.0)	
Having heard about the smoke-free campus application						
Yes	37.0 (13.0)	Z = −0.482 p = 0.630	21.0 (8.0)	Z = −0.713 p = 0.476	16.0 (7.0)	Z = −0.189 p = 0.850
No	37.0 (13.0)		21.0 (7.0)		16.0 (7.0)	
Opinion on restricting the use of tobacco products in places where health, education and training, culture and sports services are provided						
I support	38.0 (12.0)[a]	H = 24.768 p < 0.001*	21.0 (7.0)[a]	H = 22.533 p < 0.001*	16.5 (6.0)[a]	H = 24.593 p < 0.001*
I am undecided	32.0 (12.0)[b]		19.0 (8.0)[b]		14.0 (5.0)[a, b]	
I do not support	30.0 (12.0)[b]		17.0 (9.0)[b]		12.5 (6.0)[b]	
Providing support for smoking cessation on campus						
I support	37.0 (13.0)[a]	H = 12.551 p = 0.002*	21.0 (8.0)[a]	H = 12.059 p = 0.002*	16.0 (7.0)[a]	H = 11.671 p = 0.003*
I am undecided	30.5 (10.0)[b]		17.5 (6.0)[b]		14.0 (4.0)[b]	
I do not support	31.0 (17.0)[b]		18.0 (8.0)[a, b]		13.0 (9.0)[b]	
Implementation of a smoke-free campus						
I support	39.0 (12.0)[a]	H = 37.006 p < 0.001*	22.0 (7.0)[a]	H = 36.973 p < 0.001*	17.0 (6.0)[a]	H = 32.868 p < 0.001*
I am undecided	32.0 (9.0)[b]		19.0 (5.0)[b]		15.0 (5.0)[b]	
I do not support	29.5 (14.0)[b]		16.0 (8.0)[b]		12.0 (7.0)[b]	

M – median; IQR – interquartile range; H – Kruskal-Wallis statistics; Z – standardized Mann-Whitney U test statistics; [a, b, c]indicate the difference between groups; *p < 0.05

Table 4. *Linear regression table – effects of socio-demographic variables on BATHS-T total score*

	Variables	β	Standard error	95% CI		p-value
				Lower bound	Upper bound	
Model 1	Constant	37.839	1.878	34.143	41.535	< 0.001*
	Gender (ref. female)	−0.625	0.932	−2.462	1.211	0.503
	Education status (ref. high school and below)	−0.273	1.717	−3.649	3.104	0.874
	Child presence	0.491	0.944	−1.369	2.351	0.604
	Smoking status (ref. non-smoker)	−4.207	0.939	−6.056	−2.357	< 0.001*
Model 2	Constant	37.559	0.577	36.421	38.697	< 0.001*
	Smoking status (ref. non-smoker)	−4.326	0.907	−6.114	−2.538	< 0.001*
Model 1	Adjusted R^2: 0.055; F: 5.773; p < 0.001					
Model 2	Adjusted R^2: 0.065; F: 22.659; p < 0.001; Durbin-Watson: 1.224					

CI – confidence interval; Model 1 – adjusted for gender, smoking status, educational status, and having children; Model 2 (backward method) – adjusted for smoking status remained significant as a predictor of BATHS-T score; *p < 0.05

In this study, 18.4% of the participants were using tobacco or tobacco products intermittently. According to Turkey Health Survey 2022 data, the rate of individuals over the age of 15 who use tobacco and tobacco products occasionally or daily is 32.1% (18). In this study, the rate of regular users of tobacco and tobacco products was found to be lower than the country average. This may be due to the high education level of our sample; it has been shown in literature that there is a decrease in the prevalence of smoking with higher education levels (19).

As a result of this study, 64.6% of the people who were using tobacco and tobacco products stated that they had tried to quit tobacco products use at least once. According to two different studies conducted in Germany and the United States, the rate of trying to quit smoking in the last year was between 19.0% and

Table 5. *Linear regression table – effects of variables on BATHS-T total score*

Variables	β	Standard error	95% CI		p-value
			Lower bound	Upper bound	
Smoking status					
Non-smoker					
Smoker	–1.613	0.908	–3.400	0.174	0.077
Knowing that passive exposure is harmful to health					
Not know					
Yes	7.223	1.408	4.453	9.993	< 0.001*
No	–0.118	1.965	–3.984	3.747	0.952
Would you support the transition to a smoke-free campus?					
I do not support					
I support	4.624	1.511	1.651	7.597	0.002*
I am undecided	0.769	1.802	–2.777	4.315	0.670
Adjusted R^2: 0.223; F: 19.703; p < 0.001; Durbin-Watson: 1.757					

CI – confidence interval; Model 1 – adjusted for smoking, passive exposure, being uncomfortable with passive exposure, knowing that passive exposure is harmful to health, support for the SDS smoking ban, supporting the provision of smoking cessation counselling on campus, supporting the transition to a smoke-free campus; Model 2 – adjusted for smoking, knowing that passive exposure is harmful to health and supporting the transition to a smoke-free campus; *p < 0.05

51.3% (20, 21). In this study, it was questioned whether anyone had ever tried to quit smoking, so the determined rate may have been higher than in the German and US studies.

Among the participants, 64.8% stated that they were exposed to tobacco smoke in the home environment during their childhood. According to a study conducted in Japan, exposure to indoor SHS was detected in 31.1% of the children (22). The reason why exposure to tobacco smoke in the home environment during childhood was higher in this study compared to the study conducted in Japan might be due to the lower awareness of the participants about the harms of tobacco and tobacco products during their childhood compared to today.

In a study conducted among healthcare professionals in Italy, 98.2% of the individuals stated that exposure to SHS was harmful (23). According to studies conducted among university students in our country, the prevalence of those who think that exposure to SHS is harmful ranged between 76.5% and 97.3% (15, 17, 24). In this study, the conviction that exposure to SHS is harmful was reported by 82.1% of the participants, similarly to other studies conducted in Turkey. The reason for the lower rate compared to an Italian sample might be due to differences in the sample characteristics as the Italian study only consisted of participants working in the health field. According to the studies conducted among university students in Turkey, the rate of support for a smoke-free campus varied between 42.5% and 63.8% (14, 15, 17). In this study, the rate of support for the transition to smoke-free campus practice among university employees was 78.9%, a figure higher than in other studies; 64.7% answered "yes" to the question "Have you heard of the smoke-free campus?". In a study conducted among university students, the rate of those who had heard of the smoke-free campus practice was 55.1% (17). The higher rates of smoke-free campus knowledge compared to other studies might be due to the previous involvement of the students in the research on this topic on the same campus. Smoke-free campus policies are practices that will reduce not only SHS exposure but also THS exposure by reducing indoor air pollution.

In a study conducted in our country in 2021, when comparing the BATHS-T scores, the total scores of those who supported the transition to smoke-free campus practice and those who supported limiting tobacco use in public areas were significantly higher than those who did not support it or were hesitant (24). Similarly, in this study BATHS-T total score and sub-dimension scores were higher in those who support a smoke-free campus, those who support limiting tobacco use in public areas, and those who think that SHS exposure is harmful. It shows that people with high knowledge and awareness about SHS exposure will also have higher levels of knowledge about THS.

Based on the findings of two previous studies conducted in Turkey, BATHS-T total and two sub-dimension scores were higher in non-smokers than in smokers, and these findings are in concordance with our study (11, 25). This might be because smokers do not have enough information about the harms of tobacco products. As a result of a multi-centre study conducted in Canada, America, England, and Australia in 2023, it was determined that most smokers did not have sufficient information about the health hazards of smoking (26). In a study conducted among medical faculty students in Turkey, no significant relationship was found between socio-demographic characteristics and smoking status, the total score and sub-dimension scores of BATHS-T scale (27). The reason for this finding may be that the study was conducted only on a sample of medical faculty students who were educated about the harms of tobacco and tobacco products during their training. For this reason, both tobacco users and non-users may have similar levels of knowledge about THS. The inference we can draw from this situation is that we can increase the general awareness and knowledge level by training the public about the harms of tobacco and tobacco products, SHS exposure, and THS exposure.

Additionally, in the study, the BATHS-T health sub-dimension scores of those who had children were higher than those who did not. Children are vulnerable to the harmful effects of THS as they are more likely to touch the environment and express hand-

sucking behaviour, hence the caregivers might be more careful and knowledgeable about the health of their children.

In our study, 40.5% of the participants were using tobacco or tobacco products intermittently or regularly. It is important to conduct campaigns to reduce the use of tobacco and tobacco products and to inform about SHS and THS in these campaigns. Because THS exposure can occur when tobacco and tobacco products are previously used in closed environment or when a person who has used these products enters a closed environment (5). A systematic review published in 2022 about toxic components in smoke from tobacco and tobacco products found that nicotine concentrations in air samples in smoking environments ranged from 0.5 to 5 μg/m³, with a mean level of 2.20 μg/m³. In addition, nicotine concentrations in air samples collected from non-smoking rental cars and smoking rental cars were 0.021 μg/m³ and 0.047 μg/m³, respectively. Although these concentrations are significantly lower than mainstream cigarette smoke, THS contributes to prolonged exposure times, resulting in cumulative effect among non-smokers, especially children (28). In a study comparing house dust from smoking and non-smoking homes, detected nicotine concentrations were positively correlated with the number of cigarettes smoked daily by the residents. In addition, nicotine levels were found significantly and positively correlated with the number of cigarettes smoked outside the home. The same study showed that THS was associated with an increased risk of cancer after exposure, especially in children aged 1–6 years (6). This knowledge may provide a reason for individuals to consider quitting tobacco and tobacco products use by realizing the harm they cause to their family and friends. Therefore, it is thought that increasing awareness about the health threats of THS might be effective in reducing tobacco and tobacco product use.

An intervention study from California that performed information activities on THS exposure using social media reported a positive change in the knowledge, awareness levels and subsequent behavioural outcomes of the participants, indicating that mass media campaigns can be useful for increasing the awareness levels in the community (29). According to the national legislation in Turkey, private television organizations and radio broadcasting nationally, regionally, and locally are obliged to make educational broadcasts about the harms of tobacco products to health (30).

In our country, universities tobacco-free campus practices are in line with their own policies. Although the places where tobacco and tobacco product use are prohibited in front of doors in our university are marked with yellow signs on the ground, inspections need to be made more efficiently in order to increase the compliance rates. In fact, tobacco-free campus practices must be implemented as a standard practice for the whole country without leaving it to the decision of university administrations.

Study Limitations

The study was conducted in a province of Turkey with a relatively high socioeconomic level, which may result in higher awareness of a concept such as third-hand tobacco smoke compared to other regions of the country. Additionally, as this was a cross-sectional study, there may have been recall bias due to the reliance on participants' memories for information about past events. Furthermore, since information about those who did not agree to participate in the study was not available, there may have been selection bias in the results.

CONCLUSION

In this study, university employees who did not use tobacco and tobacco products were found to have higher BATHS-T scale total score, health sub-dimension and persistence sub-dimension scores regarding exposure to THS. It is noteworthy that participants with children have higher knowledge about the health hazards of THS exposure. Since THS is a concept that has just started being recognized in society, priority should be given to scaling-up health promotion activities such as informing society through the contribution of health professionals, especially public health and family medicine practitioners working in primary care settings. Social media campaigns have positive effects in terms of increasing the level of knowledge and awareness. For this reason, informative social media campaigns about smoking cessation programmes and harms of THS exposure should be considered by the Ministry of Health and specialized associations. Third-hand tobacco smoke exposure is an issue that should not be ignored in terms of its harms, and work should be focused on increasing the knowledge level of the society on this issue not only by the Ministry of Health but other Ministries such as the Ministry of Education and Council of Higher Education.

One of the duties of universities is to take part in social services, and university personnel should become role models for the students and society. For this reason, it is important to increase knowledge about the harms of tobacco and tobacco product use, SHS, THS, and smoking cessation implementations, starting from university employees, and to disseminate this information to the society through universities to reduce the burden of smoking.

Authors' Contribution

IT – research questions development, literature searches, statistical analyses, interpretation of data, writing the manuscript, data collection; ABB – research questions development, interpretation of data, writing the manuscript, reviewing the manuscript; MT – interpretation of data, writing the manuscript, reviewing the manuscript; KS – statistical analyses, interpretation of data, writing the manuscript, reviewing the manuscript. All authors read and approved the final version of the manuscript.

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Conflicts of Interest

None declared

Adherence to Ethical Standards

Approval of the University Non-Interventional Clinical Research Ethics Committee (Decision No. 0223 of 18 May 2023) was received for this cross-sectional study. Permission to use the scale was obtained from Çadırcı et al.

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