Assessment of Information and Perception-Sensitivity Levels of High School Students About Air Pollution

Lise Öğrencilerinin Hava Kirliliği Konusundaki Bilgi ve Algı-Duyarlılık Düzeylerinin Değerlendirilmesi

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Abstract

Background: This study aimed to determine the level of knowledge of vocational school health services students about air pollution, examine some of the variables thought to be related, and evaluate the levels of air pollution perception and sensitivity.

Materials and Methods: This is a cross-sectional study conducted on a group of a high school students in Turkey between March 2018 and March 2019. The prepared questionnaire was delivered online. The level of knowledge about air pollution was evaluated by information questions, and those who scored 4.5 and below were accepted as having "insufficient knowledge about air pollution." The students' Air Pollution Perception and Sensitivity levels were evaluated with the "Air Pollution Perception and Sensitivity Scale."

Results: The number of those with insufficient knowledge about air pollution was 867 (34.7%). Being male, 16 years of age and under, living in towns and villages, having a father's education level at secondary school, and not being a member of any environmental organization were determined as risk factors for insufficient knowledge about air pollution.

Conclusions: Those with sufficient knowledge about air pollution have higher Air Pollution Detection and Sensitivity levels. In order to increase the air pollution knowledge level of Vocational School of Health Services students, it is recommended to carry out informational and educational studies on the subject.

Key Words: Adolescent, Air pollution, Knowledge, Perception, Sensitivity

Öz

Amaç: Bu çalışmanın amacı, lise öğrencilerinin hava kirliliği konusundaki bilgi düzeylerini belirlemek, ilişkili olduğu düşünülen bazı değişkenleri incelemek ve hava kirliliği algı ve duyarlılık düzeylerini değerlendirmektir.

Materyal ve Metod: Araştırma, Türkiye'de bir sağlık meslek lisesinde öğrenim görmekte olan bir grup öğrenci üzerinde Mart 2018-Mart 2019 tarihleri arasında gerçekleştirilen kesitsel tipte bir çalışmadır. Çalışmanın amacına uygun olarak oluşturulan anket form öğrencilere çevrimiçi platform aracılığı ile gönderilmiştir. Çalışmamızda araştırmacılar tarafından hazırlanan hava kirliliği ile ilgili bilgi soruları ile bilgi düzeyi değerlendirilmiştir. 4,5 ve altında puan alanlar "hava kirliliği hakkında yetersiz bilgi sahibi" olarak kabul edilmiştir. Öğrencilerin Hava Kirliliği Algılama ve Duyarlılık düzeyleri "Hava Kirliliği Algılama ve Duyarlılık Ölçeği" ile değerlendirilmiştir.

Bulgular: Hava kirliliği konusunda yeterli bilgisi olmayanların sayısı 867 (%34,7) idi. Erkek olmak, 16 yaş ve altında olmak, belde ve köylerde yaşamak, babanın ortaokul eğitim düzeyine sahip olması ve herhangi bir çevre kuruluşuna üye olmamak hava kirliliği konusunda yetersiz bilgi düzeyi için risk faktörleri olarak belirlendi.

Sonuç: Hava kirliliği konusunda yeterli bilgiye sahip olanların Hava Kirliliği Algılama ve Duyarlılık düzeyleri daha yüksektir. Sağlık lisesi öğrencilerinin hava kirliliği bilgi düzeylerinin artırılması için konuyla ilgili bilgilendirici ve eğitici çalışmaların yapılması önerilmektedir.

Anahtar Kelimeler: Algı, Duyarlılık, Hava Kirliliği, Lise, Öğrenci.

Introduction

Air pollution is a health-threatening situation that arises due to natural causes such as volcanic activities, fires, and earthquakes, as well as unnatural causes such as transportation, energy, fossil fuel use, and industrial activities(1). A critical parameter in determining air pollution is Particulate Matter (PM). PM10 denotes coarse respirable particles smaller than 10 μm in diameter, while PM2.5 refers to fine respirable particles smaller than 2.5 μm. PM10 and PM2.5 are known as the most hazardous types of aerosol pollutants due to their inhalation risks. Carbon monoxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO2), and volatile organic compounds (VOC) are the main gas pollutants (2). The air pollution level is determined by the ratio of 2.5 microns and smaller particles per cubic meter. According to the World Health Organization (WHO), 25 micrograms of particulate matter per cubic meter is considered the highest in air pollution. PM2.5 level above 100 indicates harm to health, and a measurement above 250 indicates an alarming level(3). According to the IQair air quality report, which determines PM 2.5 values for 106 countries are determined, Turkey ranks 46th in air pollution with a PM 2.5 value of 18.7μg/m³(4). WHO data states that air pollution causes the death of approximately 7 million people every year, with 9 out of 10 people exposed to pollutant high pollutant levels (5). The perspectives of individuals, particularly young people, on issues that harm the environment are known to influence their decisions and lifestyles, eventually shaping behavior patterns leading to either preservation or degradation. Many ideas and beliefs about this are formed in the early years of life or during school age (6).Therefore, determining the knowledge and perceptions of young people about air pollution can be crucial and can guide them towards improvements in this regard.

The aim of this study is to determine the level of knowledge of the vocational school health services students about air pollution, to examine some of the variables, and evaluate their perception and sensitivity levels towards air pollution.

Materials and Methods

This cross-sectional study was conducted on a group of students enrolled in a health vocational school in Turkey between March 2018 and March 2019. According to the records of the Ministry of National Education, there were a total of 379 Vocational Schools of Health Services serving in Turkey in the 2018-2019 academic year. The total number of students studying in these high schools was 159,180. Out of these schools, 56 admitted students with a base score of 360 and above in the 2018-2019 academic year, with a total of 3,524 students. The study aimed to include all students.

To conduct the study, written permission of the Ministry of National Education was obtained with the approval from the Harran University Clinical Research Ethics Committee dated 07.06.2018 and numbered E 28588. Additionally, verbal permissions were obtained from the school administrations to collect data in the high schools included in the study.

For the study, a questionnaire was prepared using the literature. The questionnaire included sociodemographic characteristics of the students (gender, age, class, place of residence, family income, mother's education level, father's education level), and variables thought to be related to air pollution knowledge (information about environmental protection organizations, environmental protection organizations, and environmental awareness).

The pre-prepared survey forms were uploaded to the Google Form online platform, and the questionnaire form link was sent to the students via e-mail, Whatsapp, and Facebook applications through the school directorates included in the study. Students were informed about the subject and purpose of the study through the link sent, and they were given ten days to fill out the questionnaires. A total of 2,498 students (70.9%) who agreed to participate in the study during data collection constituted the study group.

The study evaluated the student's knowledge level about air pollution with 6 knowledge questions prepared using the literature. The information questions were scored, with "one point" given for each correct answer. Scores ranged from 0 to 6. A DUMMY variable was derived with a mean of 0.0001 and a standard deviation of 0.00001, indicating a normal distribution. Using this variable, students were divided into two clusters via K-Means cluster analysis based on their knowledge scores. The scores obtained for these cluster characteristics were then evaluated using ROC analysis. The value with the highest sensitivity and specificity from the ROC analysis was accepted as the cutoff (7). According to the ROC analysis, those who scored 4.5 or less were considered to have "insufficient knowledge about air pollution."

The study assessed students' Air Pollution Perception and Sensitivity levels using the "Air Pollution Perception and Sensitivity Scale," developed by Akkurt in 2011, consisting of 40 questions in a 5-point Likert type (8). Each question was scored as "I strongly disagree one point" to "I agree 5 points." Scale scores ranged from 40 to 200, with higher scores indicating greater perception and sensitivity to air pollution. Students' family income status was categorized as "good, medium, or bad" based on their perceptions.

Data were analyzed using Minitab and SPSS (version 15.0) Statistics Package programs in the computer environment. The normal distribution of data was assessed using the Shapiro-Wilk test. Statistical analysis included Student t-test, Chi-Square test, and Logistic Regression Analysis. A significance level of $P<0.05$ was considered statistically significant.

Results

The study group comprised 1,698 (68.0%) women and 800 (32.0%) men, with ages ranging from 14 to 19 and a mean age of 15.69 ± 1.07 years. A total of 60.2% (n=1503) of students were in the 15-16 age group, and 31.1% (n=777) were in the 10th grade. Furthermore, 70.2% (n=1,758) of the study group resided in the city center..

Table 1. Distribution of the answers given to the knowledge questions about air pollution knowledge level

The knowledge questions	True n (%)	False n (%)
1. In determining the level of air pollution, the amounts of particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone are measured.	2,275 (91.1)	223 (8.9)
2. Substances smaller than 2.5 microns in diameter are defined as PM 2.5, and substances smaller than 10 microns are defined as PM 10.	1,480 (59.2)	1,018 (40.8)
3. Particulate substances such as PM 2.5 and PM 10 easily reach the lungs and begin showing harmful effects.	1,684 (67.4)	814 (32.6)
4. Events such as volcanoes, forest fires, and dust storms are essential natural causes of airpollution.	2,133 (85.4)	365 (14.6)
5. Heating, transportation, and industrial activities are important artificial air pollution causes.	2,263 (90.6)	235 (9.4)
6. Air pollution paves the way for many diseases, especially lung diseases.	2,291 (91.7)	207 (8.3)

Table 2. Distribution of individuals with sufficient and insufficient knowledge about air pollution according to some sociodemographic characteristics

Somesociodemographiccharacteristics	Airpollutionknowledgelevel			Test value
	Insufficient n (%)*	Sufficient n (%)*	Total n (%)**	$X2$; p
Gender				
Female	553(32.6)	1,145(67.4)	1,698(68.0)	**10.715;0.001**
Male	314(39.3)	486(60.8)	800(32.0)	
Age (years)				
14	157(41.3)	223(58.7)	380(15.2)	
15-16	542(36.1)	961(63.9)	1,503(60.2)	**23.361;0.001**
17 andabove	168(27.3)	447(72.7)	615(24.6)	
Education				
9	272(40.1)	407(59.9)	679(27.2)	
10	274(35.3)	503(64.7)	777(31.1)	**25.453; 0.001**
11	230(34.2)	442(65.8)	672(26.9)	
12	91(24.6)	279(75.4)	370(14.8)	
LivingPlace				
Province	550(31.3)	1,208(68.7)	1,758(70.4)	
District	180(43.7)	232(56.3)	412(16.5)	**30.967;0.001**
Village	137(41.8)	191(58.2)	328(13.1)	
Educationlevel of themother				
Primaryschoolandbelow	351(32.4)	733(67.6)	1,084(43.4)	
Middle School-High School	264(35.7)	475(64.3)	739(29.6	4.982;0.083
University	252(37.3)	423(62.7)	675(27.0)	
Educationlevel of thefather				
Primaryschoolandbelow	328(36.2)	420(63.8)	658(26.3)	
Middle School-High School	338(37.2)	571(62.8)	909(36.4)	**7.973;0.019**
University	291(31.3)	640(68.7)	931(37.3)	
Incomeof Family				
Poor	73 (40.1)	109 (59.9)	182 (7.3)	
Middle	642 (60.6)	1,178 (64.7)	1,820 (72.9)	**6.214; 0.045**
High	152 (30.6)	344 (69.4)	496 (19.9)	
Total	867 (34.7)	1,631 (65.3)	2,498 (100.0)	

*: Total, **: percentage is taken according to the column total.

The number of students whose mother's education level was primary school or below was 1,084 (43.4%), and those whose father's education level was primary school or below was 658 (26.3%). The knowledge question with the highest correct response rate (91.7%) was "Air pollution paves the way for many diseases, especially lung diseases," while the most misunderstood question (40.8%) was "PM 2.5; The presence of substances smaller than 2.5 microns, PM 10 means the presence of substances smaller than 10 microns."The distribution of students' responses to knowledge questions about air pollution is presented in Table 1. In this study, 867 students (34.7%) were identified as having insufficient knowledge about air pollution. It was determined that there was a statistically significant difference between the variables of age, gender, education, place of residence, and father's education level between the groups with insufficient knowledge and those without. The distribution of those with and without insufficient knowledge about air pollution in the study group according to some sociodemographic characteristics is given in Table 2.

Table 3. Distribution of sufficient or insufficient knowledge about air pollution according to some characteristics of environmental organizations

Some features of environmental organizations	Air pollution knowledge level			Test value
	Insufficient n (%)*	Sufficient n (%)*	Total n (%)**	X2; p
The state of hearing the name of any environmental organization				
Heard	476(33.5)	944(66.5)	1,420(56.8)	
Unheard	391(36.3)	687(63.7)	1078(43.2)	2.042;0.153
Membership status of any environmental organization				
Yes	50(22.7)	170(77.3)	220(8.8)	15.280;0.001
No	817(35.9)	1461(64.1)	2,278(91.2)	
Participation in any educational event organized by environmental organizations				
Yes	347(35.1)	642(64.9)	989(39.6)	
No	520(34.5)	989(65.5)	1509(60.4)	0.103; 0.748
Total	867 (34.7)	1,631 (65.3)	2,498 (100.0)	

*: Total, **: percentage is taken according to the column total.*

Among the study group, 1,420 students (66.5%) stated that they had heard the name of any environmental organization, while 220 students (77.3%) were members of any environmental organization. Additionally, 989 students (39.6%) reported participating in educational activities organized by environmental organizations. The distribution of students with and without insufficient knowledge about air pollution based on certain characteristics of environmental organizations is provided in Table 3. Variables related to the level of air pollution knowledge (age, gender, class, place of residence, father's education level, family income status, and membership in any environmental organization) were determined through Logistic Regression Analysis, with results presented in Table 4. Scores on the Air Pollution Detection and Sensitivity Scale ranged from 40 to 200 in the study group, with a mean score of 144.9 ± 16.5. The distribution of scores obtained from the Air Pollution Perception and Sensitivity Scale for students with and without insufficient knowledge about air pollution is given in Table 5.

Table 4. Results of the Logistic Regression Model created with the variables found to be associated with an insufficient level of knowledge about air pollution

Variables	ß	SE	p	OR	%95 CI
Gender (Reference: Female)					
Male	0.309	0.091	**0.001**	1.362	1.141-1.626
Age (referans: 17 years and above)					
14	0.584	0.140	**0.000**	1.793	1.363-2.359
15-16	0.376	0.106	**0.000**	1.457	1.182-1.795
Living Place(Reference :Province)					
District	0.495	0.113	**0.000**	1.641	1.314-2.049
Village	0.354	0.127	**0.005**	1.424	1.111-1.825
Education level of the father (Reference University)					
Primary school and below	0.164	0.111	0.139	1.179	0.948-1.465
Middle School-High School	0.241	0.101	**0.017**	1.272	1.044-1.550
Membership status of any environmental organization (Reference: Yes)					
No	0.583	0.169	**0.001**	1.791	1.286-2.495
Constant	-1.860	0.193	0.000	-	-

SE: Standard Error, OR: Odd's ratio, CI: Confident İnterval

Table 5. Distribution of the average scores obtained from the Air Pollution Perception and Sensitivity Scale of students with sufficient and insufficient knowledge about air pollution

Knowledge level about air pollution	Air Pollution Perception and Sensitivity Scale	
	n (%)	x̄± Sd
Insufficient	867(34.7)	137.7±15.9
Sufficient	1,631(65.3)	148.8±15.5
Total	2,498 (10.0)	144.9± 16.5

t= 16.861; 0.0001

Discussion

The findings of this study revealed that three out of ten students (2,498/867) had insufficient knowledge about air pollution. The most misunderstood knowledge question was with 40.8% 'PM 2.5; The presence of substances smaller than 2.5 microns, PM 10 means the presence of substances smaller than 10 microns" is the question. On the other hand, the most accurately answered question, with 91.7%, was "Air pollution paves the way for many diseases, especially lung diseases." A study in Tehran assessing the knowledge levels of high school students about air pollution reported that students recognized important air pollutants as components of clean air (9). Correcting students' misconceptions is crucial for improving awareness and understanding of air pollution. Environmental consciousness is a mental awareness that reflects one's knowledge of the environment, value judgment, and behavioural intention. It usually represents an individual's subjective perception of the change in the environment over time (10-12).Therefore, correcting students' misconceptions is crucial in improving air pollution.

Women are more sensitive to environmental issues (10,13,14). Women are more dominant than men in the level of environmental anxiety and activities related to the environment (10).Although it is known that environmental sensitivities are higher than men, the use of plastic is higher in women (15). Our study found that men's lack of knowledge about air pollution was higher than women's. In the literature, besides the studies reporting that the environmental risk perception of the female gender is higher than that of the male gender (11,16-18), studies that did not detect any difference in terms of male and female gender have been reported (9,19). This difference between research findings may be due to the studies covering different age ranges. Although a more conscious attitude is expected due to the social roles assigned to the female gender, sustainable life requires both genders to have similar environmental and pollution awareness.

In our study, we observed that individuals aged 16 years and under exhibited a lower knowledge level about air pollution compared to those aged 17 and over. Being 16 years of age or younger was identified as a risk factor for inadequate knowledge about air pollution. Studies conducted in China have similarly reported a correlation between awareness of air pollution and the age variable (20). However, another study has suggested that the age variable is not a significant factor in perceived air pollution (21). The discrepancies in findings across studies regarding the age variable's impact on the perception of air pollution may be attributed to variations in pollution levels in the regions where the studies were conducted.

One of the variables we compared in this study was the students' grade level. Our study found that as the students' grade levels increased, their knowledge about air pollution increased. However, due to the Logistic Regression analysis, this relationship disappeared. In addition, the studies found a difference between the level of education in the literature and the level of knowledge about air pollution (21,22). Some studies have determined that the perception of environmental risk, including air pollution increases as the class level increases (19,23). These different results between studies are likely because they cover different age groups.

Industrial areas, population, vehicles, and emission gases in city centers are among the reasons the air pollution level is higher than in other residential areas (24). Our study determined that living in the city center is an important risk factor compared to those living in villages and districts in terms of lack of information on air pollution. Similar to our findings, it was reported in the study of Gardin and Requia (2023) that the awareness of environmental problems is higher among those living in the city center (25). Considering that those living in the city center are more exposed to air pollution, this is an expected result. However, in their study in Pakistan, Ullah et al. found no difference between the negative physical effects reported by the participants between the settlements with the lowest and highest air pollution levels (26).

The family environment is one of the most critical environments in which the socialization process begins, and it is an important environment where the necessary sensitivity and sense of responsibility can be gained against environmental problems. Families are essential to their children's learning because of their role-model positions. In addition, considering that the education of children first starts in the family, the level and richness of parental education contribute to the child's cognitive development (27). Our study determined that those whose fathers had a university education level had more sufficient knowledge about air pollution than others. According to the Logistic Regression analysis, it has been determined that the father's education level in secondary school/high school is an important risk factor in terms of insufficient knowledge of air pollution. Gardin and Requia found no difference between the father's education level, the mother's education level, and the student's perceptions of environmental pollution (25). Yapici et al. reported in a study they conducted on university students that they did not detect any difference between the educational status of parents and their perception of environmental risk (16). Our study findings differ from other findings because the healthy high school students we included considered their fathers more authoritative than their mothers.

It is expected that the increase in the family's income level will contribute to the increase of the knowledge level of the people as it increases the educational opportunities to be offered and provides more technological opportunities (19). Our study determined that those with good family income had sufficient knowledge about air pollution. However, as a result of the Logistic Regression analysis, it was

seen that this relationship disappeared. Similar to our findings, studies reported that they did not find a difference between income status and knowledge and perception about air pollution (24,28). Studies are reporting that they found a difference between family income status and environmental risk perception (18-20). This diversity among the research findings may be due to the different income level perceptions of the individuals included in the study.

One of the variables that affected our study was the effect of environmental organizations on air pollution information, perception, and sensitivity. According to our findings, there was no difference between those who have heard of an environmental organization and those who have not regarding the adequacy of air pollution knowledge. However, we found that members of an environmental organization have a more sufficient level of knowledge about air pollution than those who do not. Not being a member of any environmental organization poses a 1.7 times risk in terms of insufficient level of air pollution knowledge. According to our study results, while it was determined that being a member of an environmental organization increased the knowledge of air pollution, there was no difference in terms of air pollution knowledge level adequacy between those who participated in any training event organized by environmental organizations and those who did not. While there are studies reporting that participating in or being a member of any environmental event such as a seminar, panel conference on air pollution has an impact on environmental risk perception (24,29), there are also studies reporting that it has no impact (19,23). These different results among the study findings may be due to the difference in the perceptions of the study groups about pollution. With these different research findings, new research is needed to reveal the impact of environmental organizations on students' knowledge of air pollution.

Cognitive factors relate to a person's awareness of the environment, key environmental concepts, and ability to take action (30). Our study found that those with sufficient knowledge about air pollution have higher Air Pollution Perception and Sensitivity levels. Studies on air pollution in the literature also emphasize that the level of knowledge about air pollution affects the perception of air pollution risk (18-20).

This study determined that 34.7% of the students had insufficient knowledge about air pollution. Inadequate knowledge about air pollution was higher in men, those aged 16 and under, those living in towns and villages, those with a father's education level of secondary school or high school, and those who did not have membership in any environmental organization. Those with sufficient knowledge about air pollution had higher Air Pollution Perception and Sensitivity levels. Our findings are significant in terms of showing the knowledge, perception, and sensitivity of healthy high school students about air pollution. In this way, guidance will be provided to the students for the stud-

ies to be carried out on air pollution. To increase the air pollution knowledge level of the students, it may be helpful to carry out informational activities the persons who are related to the subject and to organize educational activities such as posters, brochures, magazines, and social media content that will increase the air pollution knowledge level in schools. In addition, our study measures air pollution knowledge and perception of students studying in 2018-2019. Future studies are needed to determine students' current knowledge, perceptions, and sensitivities. Also, this study can serve as evidence for the development of legislation to implement air pollution reduction policies that are not only based on technical knowledge but also focus on socioeconomic and cultural factors.

The limitations of this study include that it is a cross-sectional type of research, there is no to be a standard measurement tool for evaluating the level of air pollution knowledge, and online tools collect the data.

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