

Air Pollution: The Knowledge and Ideas of Students in Tehran-Iran, and A Comparison with Other Countries

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Abstract- Study of students' knowledge about air pollution can help authorities to have better imagination of this critical environmental problem. This research examines guidance school and high school students' ideas about air pollution and the results may be useful for the respective authorities to improve cultural and educational aspects of next generation. In this cross-sectional study, a closed questionnaire was used to examine knowledge and ideas of 2140 randomly selected school students of Tehran-Iran about composition of unpolluted air, air pollution and its causes and consequences. Cognitive scores were also calculated. Outcomes were compared with results of similar researches in Australia, Hong Kong and the United Kingdom. While a student's 'cognitive score' could range from -16 to +16, Iranian students' mean cognitive score was equal to +2.97. There was not significant statistical difference between girls and boys ($P=0.32$). In response to question "most common gas in unpolluted air" nitrogen was mentioned by only 23.7%, While 45.1% of students mentioned oxygen. In general, student's knowledge was not acceptable and there were some misconceptions such as "supposing oxygen as the most prevalent gas in unpolluted air". The findings of this survey indicate that, this important stratum of society of Iran have been received no sufficient and efficient education and sensitization on this matter.

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Introduction

Air pollution is one of the greatest environmental issues of the world which threat health of live creatures. Solid, liquid or gaseous materials that are emitted into the atmosphere because of human activity or natural sources, damage people, animals and plants health (1). Outdoor air pollution is a factor in causing morbidity and mortality that some of its harmful effects appear in

the short-term exposure and others in the long-term contact (2). This major environmental problem affects both developed and developing countries (3).

Air pollution is also an important problem in our setting since different regions of the country and especially Tehran are facing it; the level of air pollution is so severe in comparison with international standards in Tehran (4). Transportation in Tehran is the main cause of air pollution in this big city (5). Damages from

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ambient air pollution in comparison with indoor air pollution in Iran are 83% versus 17% (6). According to the 2009 World Health Organization report estimated number of annual deaths attributed to outdoor air pollution in Iran is 9100 persons and disability-adjusted life year (Daly) is equal to 1 and estimated number of annual deaths attributed to indoor air pollution is 300 persons and Daly is equal to 0.1 (7).

Totally the problem of environmental pollution has become a crisis for many years and it is getting worse day by day. Since the main cause of pollutions is the human self, the more attention has been paid to the social sciences nowadays (8). Awareness of environmental problems has been defined as a complex of knowledge, values and attitudes in interaction with the environmental involvement (9).

People's knowledge about air pollution in cities facing this problem is a very important subject; because their cooperation to combat air pollution is one of the most important bases to improve air quality and this cooperation is directly dependent on the amount of people's awareness.

Views of people especially youths about nature and causes of its destruction affect their next decisions and lifestyle and finally these human's decisions and behavior lead to protection or degradation of the environment. So many of these ideas and beliefs are formed during the early years of life or school era. If respective authorities are aware of education, beliefs and misconceptions that students have received either at or out of school, an excellent opportunity will be created for them to consider these views and attitudes in educational planning (10).

The aim of this study was evaluation of guidance and high school students' knowledge and ideas about air pollution and comparison with three other countries. Furthermore, developing a coherent curriculum about air pollution for Iranian students needs evidence based information and this research tries to respond to this essential requirement. It is needed to mention that a comprehensive study on Iranian students' knowledge about air pollution has not been performed before and there is not any comparative data with other countries in this field.

Materials and Methods

The present cross-sectional study was carried out by National Research Institute of Tuberculosis and Lung Disease (NRITLD) in guidance schools and high schools of 19 educational districts of Tehran from November

2008 to March 2009.

The instrument used in this study was the exact and reliable Persian translation version of the closed form questionnaire which had been used by Boyes *et al.* to evaluate British, Australian and Chinese students' ideas about air pollution (9). The process of translation (English to Persian) and back-translation of the questionnaire was conducted by two separate individuals fluent in English and Farsi who were conversant with the subject. The back translation version was confirmed by designers of the questionnaires. Cronbach's alpha was calculated after the pilot study and was equal to 0.84.

The questions of the questionnaire were two types of cognitive and affective. The first section of the questionnaire (cognitive part) which its results have been discussed in this paper included 35 cognitive items about the composition of clean air, nature of air pollution, the consequences of air pollution, acid rain and the greenhouse effect. The available responses for these Items were "I am sure this is right", "I think this is right", "I don't know about this", "I think this is wrong" and "I am sure this is wrong". There was an open question in this part asking students what is the most common gas in air and there was also another question about students' self assessment of their knowledge about air pollution. Because of large volume of data collected in the study, the results of the second section of the questionnaire (affective part) will be discussed in another article.

To evaluate students' knowledge about air pollution and determine a cognitive score for any student, we used students' answers to 16 items of the cognitive part of the questionnaire that were clearly right or wrong compared with current scientific understanding. For each scientifically right statement, a "sure right" response was given a mark of 1, "think right" 0.5, "don't know" 0, "think wrong" -0.5, and sure wrong -1. The scoring was reversed for statements that were scientifically wrong. The cognitive score was the sum of the any person's score for each of the 16 items and ranged from -16 to +16.

The findings of Iranian students were compared with the data of three other mentioned countries where this research had been done with the same questionnaire.

The study population was a random sample of guidance school and high school (both public and private schools) students of Tehran. The type of sampling was multi stage. To sample from all socioeconomic status levels we divided Tehran into five regions (north, south, east, west and center), then we chose two female guidance schools, two female high

schools, two mail guidance schools and two male high schools of any region randomly (totally 40 schools). Volunteer students of any grade level (1-6: first year of guidance school to third year of high school) at each school participated in the study. Students' gender and grade and also region of the school were registered.

Students were assured that it was not a test and any results would be confidential. The questionnaires were completed by students themselves and under supervision of their own teacher and questioner of the project without time restriction. 2140 persons of 2188 eligible students participated in the study (response rate: 97.8%). The data were analyzed using SPSS version 11.

The Ethics committee of the NRITLD approved the study. Additionally, students participated in the study voluntarily and the questionnaires were anonymous.

Results

Demographic data of the 2140 Iranian participants in the study are presented in table 1. While 22.1% of the students were in grade one, 20.7%, 16.3%, 16.5%,

12.9% and 11.3% were studying in grade two, three, four, five and six respectively.

Table 2 shows Iranian students' responses to items about the "composition of clean unpolluted air" and compares the data with three other countries. The "sure right" and "think right" responses were combined to provide the proportions of students who affirmed each statement in all the tables. The best known components of clean air for Iranian students were oxygen (81%) and water vapor (74%). For three other countries the situation was the same, but the percentage of Iranian students who accepted these gases as components of clean air were statistically significant less than students from the U.K and Australia. Iranian students (68%) were more informed than students of other countries about the fact that nitrogen is a component of clean air with statistically significant difference. On the other hand, while 39% of Iranian students were sure or thought that there is Carbon monoxide in clean air; students of three other countries accepted this item less than them ($P < 0.001$).

Table 1. Descriptive data of Iranian students who participated in the study.

Sex	Grade						Total
	1	2	3	4	5	6	
Girls	171 (36.2%)	164 (36.9%)	128 (36.6%)	129 (36.4%)	100 (36.1%)	88 (36.4%)	780 (36.4%)
Boys	302 (63.8%)	280 (63.1%)	222 (63.4%)	225 (63.6%)	177 (63.9%)	154 (63.6%)	1360 (63.6%)
Total	473 (100%)	444 (100%)	350 (100%)	354 (100%)	277 (100%)	242 (100%)	2140 (100%)

Distribution of girls and boys in the six grades has no statistical difference. Grade 1: first year of guidance school/ Grade 2: second year of guidance school/ Grade 3: third year of guidance school/ Grade 4: first year of high school/ Grade 5: second year of high school/ Grade 6: third year of high school

Table 2. Percentage of students who affirmed the presence of any component in the clean air.

Components	Country			
	Iran	England	Australia	Hong Kong
CFCs	37%	25% ***	20% ***	17% ***
Nitrogen	68%	60% ***	53% ***	61% ***
Ozone	49%	42% ***	46%	32% ***
Methane	38%	22% ***	24% ***	14% ***
Water vapor	74%	89% ***	87% ***	76%
Hydrogen	69%	57% ***	66% *	58% ***
Carbon Dioxide	65%	68%	59% **	59% **
Nitrogen Oxides	42%	29% ***	24% ***	29% ***
Sulphur Dioxide	24%	13% ***	11% ***	17% ***
Pollen	59%	60%	54% **	22% ***
Oxygen	81%	95% ***	91% ***	83%
Carbon Monoxide	39%	26% ***	26% ***	23% ***

*: $P < 0.05$ **: $P < 0.01$ ***: $P < 0.001$

Table 3. Percentage of students who affirmed any item about nature of air pollution.

Items	Country			
	Iran	England	Australia	Hong Kong
Some air pollution is natural	52%	44%***	57%**	36%***
Some pollutants work together to make different ones	75%	67%***	61%***	66%***
If the air smells all right, it isn't polluted	35%	12%***	14%***	9%***
Some air pollution is because of too much normally present gas	45%	55%***	60%***	46%
Some air pollution is caused by animals	56%	45%***	63%***	60%*
Some air pollution is caused by plants	31%	26%**	33%	28%
If the air looks clear, it isn't polluted	48%	10%***	13%***	11%***

*: $P < 0.05$ **: $P < 0.01$ ***: $P < 0.001$

Table 3 includes statements about nature of air pollution; (Data of Iranian students have been compared with three other countries in all the tables) some misconceptions such as “if the air smells alright, it isn't polluted” (35%) and “if the air looks clear, it isn't polluted” (48%) were more common in Iranian students ($P < 0.001$).

Items about consequences of air pollution have been shown in table 4. Percentages of Iranian students, who knew that greater risk of getting asthma, heart diseases and lung diseases are consequences of air pollution, were statistically significant higher than other students.

According to table 5 more Iranian students were aware of “more greenhouse effect nowadays” in

compare with students of three other countries with statistically significant difference. On the other hand, the fraction of Iranian students who believed “more acid rain nowadays” was statistically significant more than only Australian students but for students from England and Hong Kong the situation was reverse.

Iranian students' responses to the question “How much do you think you know about air pollution?” were respectively for answers a lot, something, a little and nothing 14%, 51%, 29%, and 6%. There were significant statistically difference in this field between Iranian students and students from Hong Kong ($P < 0.001$) and Australia ($P < 0.001$).

Table 4. Percentage of students who affirmed any item as a consequence of air pollution.

Items	Country			
	Iran	England	Australia	Hong Kong
Plants won't be able to grow so well	83%	84%	78%***	79%*
More people will start to get asthma	78%	74%**	54%***	72%***
More people will get stomach diseases	47%	44%	37%***	23%***
Asthmatic people will have more asthma attacks	78%	80%	69%***	83%**
Plants won't be able to make seeds and reproduce so well	63%	57%**	53%***	51%***
More people will get lung diseases	79%	73%***	68%***	82%*
More people will get brain diseases	40%	17%***	25%***	32%***
More abnormal babies will be born	58%	49%***	46%***	49%***
More people will get heart disease	76%	42%***	33%***	50%***

*: $P < 0.05$ **: $P < 0.01$ ***: $P < 0.001$

Table 5. Percentage of students who affirmed any item about the acid rain and the greenhouse (GH) effect.

Items	Country			
	Iran	England	Australia	Hong Kong
More acid rain nowadays	66%	77%***	63%*	71%**
Some acid rain is essential	33%	29%*	22%***	22%***
Some acid rain is natural	44%	47%	45%	32%***
More of a GH effect nowadays	69%	74%**	82%***	79%***
Some GH effect is essential	54%	45%***	49%**	47%***
Some GH effect is natural	44%	36%***	51%***	36%***

*: $P < 0.05$ **: $P < 0.01$ ***: $P < 0.001$

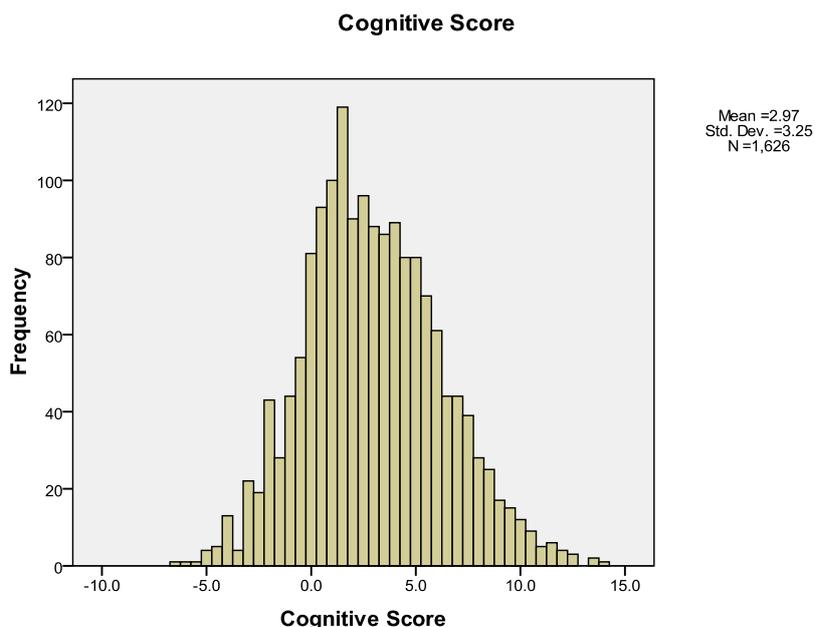


Figure 1. The distribution of Iranian students' cognitive score.

As has been said before, to evaluate level of students' knowledge; cognitive score was calculated. The range of it was -16 to +16. The distribution of cognitive score for Iranian students is shown in figure 1. The mean cognitive score for them was equal to 2.97 (SD=3.25) which in compare with other countries (Australia=4.86, England=4.79, Hong Kong=4.28) was the lowest one with statistically significant difference.

Mean cognitive scores of Iranian female (2.82) and male (3.03) students didn't have any significant difference ($P=0.32$). There was statistical significant difference between cognitive scores of Iranian students from different grades ($P<0.001$). Additionally students of west region of Tehran had the highest cognitive score in comparison with students of other regions ($P<0.05$).

Assessment of students' responses to the question "what is the most common gas in air?" showed that from 1631 (76.2%) Iranian students who answered this question, only 23.7% knew that nitrogen is the most common gas in the air. 45.1% supposed oxygen the most common gas in the air, 14.5% carbon dioxide, 9% carbon monoxide, 9% nitrogen & oxygen, 6.3% hydrogen, 6% ozone, 6% methane, 4% water vapor and 7.2% other gases.

Discussion

The findings of this survey totally indicated that students of Tehran are not well informed about the air pollution and their knowledge in this field is less than other compared countries. There were also some

misconceptions about important items such as "most common gas in unpolluted air" in their mind.

The knowledge of Iranian students about the composition of clean air seemed unacceptable. For example about half of the students supposed ozone and about forty percents of the students supposed carbon monoxide and nitrogen oxides as components of clean unpolluted air, while these gases are among the main air pollutants in Tehran (11,12). The best known component of clean air for Iranian students and also other countries was oxygen; it could be for the reason that oxygen is a well-known gas for students because of its role in breathing and burning (9). Although pollen is a known air pollutant (13,14), near three fifth of Iranian and English students accepted presence of pollen in unpolluted air.

Some misconceptions about air pollution such as "if the air smells alright or looks clear, it isn't polluted" were more common in Iranian students in comparison with other countries. Since some people plan their outdoor activities based on their own perception of the daily air quality (15,16) these misconceptions are so important; because they can lead to making wrong decisions by people in the field of planning outdoor activities.

Adverse effects of air pollution on human cardiovascular and respiratory systems are known (17-19). Iranian students were more informed in this field. This could be because of the poor air quality in Tehran that had resulted in people's paying more attention to the health effect of air pollution.

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Acid rain includes any acidic precipitation such as rain, snow, hail and fog which are created as a result of presence of specific air pollutants like SO₂ and NO_x (20). Sources of acid rain may be natural such as volcanic eruptions or it may occur because of human activities. While most of the Iranian students believed that acid rain nowadays is more than before; according to researches; trend of production of acidic pollutants at present time in comparison with the past is not clear (10).

There is no doubt about increasing trend of greenhouse effect because of man-made carbon dioxide (21) and the most aware students about this fact were Iranian students.

According to the Iranian students' responses, it seemed that they claim to know more than other students about air pollution; while according to the cognitive score, Iranian students' knowledge about air pollution was lower than that of students from three other countries.

Moreover, it seemed that second year high school students had the most knowledge about air pollution among Iranian students. It could be for the reason that there are some themes about air pollution in the final parts of first year high school students' books in Iran.

Dimitriou and Christidou showed in a study on Greek students that most of them had a total perception about air pollution and they were not able to present a scientific definition of air pollution and they also mixed some important conceptions up such as ozone layer depletion, air pollution, global warming and acid rain (1). It seemed that the students of current study were similar to those from Greece.

Pluhar *et al.* investigated Hungarian students' knowledge about health effect of air pollution; although many of the students didn't mention a specific disease as an environmentally induced one, the most mentioned diseases by students were infections and allergies (22). Iranian students chose respectively lung diseases, asthma and cardiac diseases more than other items in the questionnaire. Since questionnaire of this project was a closed one and it didn't include infectious diseases; this difference is justifiable.

In Varisli's study female students' awareness about environmental issues was more than the male students (23); but there was not this difference among Iranian students.

To compare the data of this project with those from England, Australia and Chinese, using same questionnaire was needed. However it is necessary that future studies will carry out with more developed

questionnaires according to specific situation and culture of Iran. Also, it is needed that such researches will perform in other age groups and people with different levels of education.

This research is the first study in Iran about such an important and effective subject. Considering type of sampling that students were included into the study from any region of Tehran, it is possible to generalize the results of the study to all students of such a big city like Tehran and comparison the data with other countries is also so valuable. In conclusion, considering importance of the air pollution and its hazards to human life, the fact that Tehran is one of the most air polluted cities of the world and findings of this research which showed Iranian students' knowledge in this field is not sufficient and lower than those from other countries, it seems necessary that respective authorities plan specific educational programs in this field for the students.

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