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Original Research

Assessment of Knowledge and Attitude Regarding Lead Poisoning Among Pharmacists in Jordan

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Abstract

Lead is considered an environmental health hazard, as exposure to small amounts of lead can cause serious health issues. Great efforts are being made globally to raise awareness about lead poisoning and its prevention among health care professionals and communities. The level of knowledge of health care professionals about preventing lead poisoning remains unknown in developing countries. Pharmacists play an important role in increasing awareness due to their direct contact with the community. Therefore, the aim of this study was to evaluate the knowledge and attitudes towards lead poisoning among pharmacists in Jordan. A questionnaire regarding the knowledge and attitudes towards lead poisoning was conducted among pharmacy students and pharmacy graduates at Al-Zaytoonah University of Jordan. The mean score of the participants in the factual knowledge test, the Chicago Lead Knowledge Test (CLKT), was 10.9 out of 24, which revealed inadequate knowledge concerning lead poisoning. High percentage of the respondents (72.2%) believed lead poisoning to be a major concern, and 64.6% of the respondents showed interest in the topic of lead poisoning. The findings of this study highlight the need for increasing the knowledge of Jordanian pharmacists regarding the sources of lead poisoning and its prevention. Increasing awareness of pharmacists would enable them to educate the community on ways to recognize and prevent lead poisoning.

Keywords: attitude, knowledge, lead poisoning, pharmacy, Jordan

Introduction

Direct human intervention in the environment as well as the increase in industrial activities has resulted in the accumulation of harmful substances in the ecosystem which increased its exposure to living organisms. Among these pollutants is lead, a trace metal and well-characterized environmental health hazard, even in low concentrations, on both children and adults which accumulates in the human body and cannot be excreted easily [1-3] The major exposure sources of lead are well documented [4]. Products that contain lead, such as lead-based paints, lead-contaminated food, and lead-contaminated children's toys and water, are considered important sources of lead exposure [5-7]. One of the worthwhile approaches to reducing children's exposure to lead is to stop the use of toys that contain lead and avoid the use of paints that contain lead [8-10].

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Bans on products that contain lead has led to a worldwide decrease in the quantities of lead in the environment, thus decreasing the exposure of the population to lead [11].

The use of hazardous chemicals in many industries and products, such as paint and car fuel, was banned in Jordan in accordance with public health law no. 47 [12]. Despite this ban, the walls of some old buildings and schools are still covered with types of paint that may contain lead, which pose a threat to users' health especially children due to their more intensive hand-to-mouth activity [9]. Jordan, until now, has no direct clear law that govern lead in paint but has started to implement new regulations that limit the use of paints containing lead [13,14]. According to the Jordanian Ministry of Health, the use of lead compounds was allowed in paints used for cars, roads, and other industrial paints until the end of 2012 [12]. Therefore, the possibility of lead exposure is still an issue that requires strict regulations to be resolved. The Land and Human to Advocate Progress (LHAP), a Jordan-based NGO and a partner in the International Pollutants Elimination Network (IPEN), investigated 17 paint products chosen randomly from 16 companies in Jordan, and the products analysis revealed that 12.5% of the paints had lead content that exceeded the Jordanian specification of 600 mg/kg [13]. A study of acute poisoning incidents in the Jordanian population reported 86 heavy metal poisoning cases with lead and mercury during the period of 2014-2018, another study during 2014 revealed that lead blood concentrations were significantly higher in taxi drivers, auto mechanics, and wood workers compared to other groups studied [15, 16]. In March 2018, the Ministry of Health in Jordan declared announcement No. 5503, in which the maximum allowable limit of lead in household decorative paints was reduced from 600 ppm to 90 ppm. Until the end of 2022, lead chromate compounds are still allowed to be used in industrial, car, and road marking paints [14].

Some awareness-raising efforts were conducted in Jordan to increase population's awareness of the dangers of lead, such events were held as few workshops accompanied with the 2018 International Lead Poisoning Awareness Week [17, 18]. Several studies in different countries investigated the level of awareness and attitudes about lead poisoning dangers in different sectors of society and reported low knowledge of respondents about the sources of lead exposure and prevention methods [19-22]. Professional pharmacists play an important role in increasing the awareness of the general population due to their direct day-to-day contact with the community through hospital pharmacies, those in ambulatory care units, and poison call centers [23, 24]. Pharmacists can even help in identifying individuals at risk by recognizing symptoms of lead toxicity and by monitoring chelation therapies in inpatient settings [25-27].

Considering the unique role that pharmacists could play in the prevention of lead poisoning and raising the population's awareness, this study aimed to evaluate the knowledge and attitudes towards lead poisoning among pharmacy college students and professional pharmacists as a sample of pharmacists. Assessing the knowledge and attitudes of pharmacy students and professional pharmacists may indeed help in developing and implementing better strategies as well as targeted campaigns to help limit the risks of lead poisoning and to increase the population awareness towards lead exposure and poisoning.

Material and Methods

Sample Recruitment

A questionnaire was conducted as an online survey using Google Forms distributed using different social media platforms among pharmacy college students and pharmacy graduates from Al- Zaytoonah University of Jordan. During the study duration that lasted for two months, the total number of individuals in the target population of this study was 5404 pharmacy college students and pharmacists who graduated from Al-Zaytoonah University of Jordan (60.1% females and 39.9% males). As this is considered a cross-sectional study, the sample size that was required to achieve representative sample of pharmacy undergraduate students and graduates was calculated to be 359 using the formula described by Daniel and Cross [28]. A total of 435 participants responded to the survey. This study was conducted according to the guidelines of the Declaration of Helsinki as an ethical principle for any research that involving human subjects including: consents and data collection the study also approved by the Ethics Committee of Al-Zaytoonah University of Jordan (IRB approval number 02/23/2020-2021). Informed consent was obtained from all subjects involved in the study.

Questionnaire

Data collection tool used in this study consisted of two validated questionnaires to assess participants knowledge and attitudes towards lead poisoning were the Chicago Lead Knowledge Test (CLKT) which is a questionnaire developed to evaluate the knowledge toward lead poisoning including questions about sources of lead, the effect of lead on health, and the effect of nutrition on the impact of exposure to lead. In addition to the baseline lead poisoning awareness and attitude questionnaire [21, 29]. Some of the questions were developed by the research team and all the questions were translated from English to Arabic through the forward–backward–forward technique [30]. The survey questions were evaluated by several specialists from the field. A pilot study was conducted as well among randomly selected individuals, for the sake of clarity

although responses were excluded from the analyzed data.

The questionnaire consisted of five sections:

1. Demographic characteristics of the participants.

2. Questions about the respondent's sources of information regarding lead poisoning.

3. Perceived knowledge about lead poisoning; 9 items that are related to risks and health concerns of lead poisoning were included in this section [21]. Respondents were expected to estimate their own level of knowledge of risks and health concerns of lead poisoning. The answers were: yes, no, or I don't know (Table 1).

4. The Chicago Lead Knowledge Test, which consists of 24 questions designed to test the respondent's actual knowledge about lead poisoning. The questions were categorized as follows: general information (5 items), exposure (11 items), prevention (4 items), and nutrition (4 items) [21, 29]. The answers were: correct, incorrect, or I don't know (Table 2). The CLKT was scored by granting one point for each correct answer with the highest possible score being 24. The higher score will represent a good knowledge toward lead poisoning Accordingly, for testing that the correct answers were given a score of "1", while incorrect and I don't know responses were given a score of "0".

5. Attitudes towards lead poisoning: 6 statements were used to measure the favorable (4 statements) and reserved (2 statements) attitudes towards lead poisoning. The answers were: agree, disagree, or I don't know (Table 3). Attitudes towards lead poisoning were scored as follows: disagree, I don't know, and agree were scored as 1, 2, and 3, respectively. Therefore, the highest possible scores for favorable and reserved attitudes were 12 and 6, respectively. On the other hand, the lowest possible scores for favorable and reserved attitudes were 4 and 2, respectively. A higher percentage of agreement with statements related to a favorable attitude (higher score) indicates that the respondent is interested and feels a responsibility to take action in regard to the problem of lead poisoning. Conversely, higher percentages of agreement with statements related to a reserved attitude (higher score) indicate the respondent's disinterest regarding the topic of lead poisoning.

Data Analysis

Data analysis was performed using the Statistical Package for Social Sciences software SPSS (version 26). The analysis focused on examining relationships between variables. The data were analyzed and interpreted in terms of objectives using descriptive statistics such as frequency, percentage, mean, and standard deviation.

Results

Demographic Characteristics

The results revealed that the majority of those who completed the questionnaire were female (71%). More than half of the participants (58.4%) were current students, while 35.6% had a bachelor's degree and only 6% were postgraduates (higher education). More than 55% of the current students who took part in this study are considered senior students. The study also showed that most of the respondents' ages ranged from 18 to 25 years old (74.8%), while the rest of the respondents were above 26 years old (25.2%).

Sources of Lead Poisoning Information

The respondents' sources of information regarding lead poisoning revealed that nearly half of the participants knew about the term lead poisoning through

Table 1. Perceived knowledge about lead poisoning (N = 435).

Question	Responses					
	Yes		No		I don't know	
	N	%	N	%	N	%
I know about the term lead poisoning	262	60.2	173	39.8	-	-
Lead poisoning is a problem in your residential area	79	18.2	220	50.6	136	31.3
Lead poisoning is a problem in my study / work area	67	15.4	230	52.9	138	31.7
I am sufficiently familiar with the sources of lead exposure	120	27.6	234	53.8	81	18.6
I know ways to prevent lead poisoning	126	29.0	309	71	-	-
I know there is drug treatment for lead poisoning	180	41.4	255	58.6	-	-
I know that lead harms the very young and the elderly	391	89.9	44	10.1	-	-
I believe that lead negatively affects the mental capacity of people exposed to lead	316	72.6	33	7.6	86	19.8
I think good nutrition prevents the risk of lead poisoning	228	52.4	90	20.7	117	26.9

Table 2. Chicago Lead Knowledge Test (CLKT): questions and responses (N = 435).

Question	Correct answer	% Correct	% Incorrect	% Don't know
General information				
1. Lead paint chips can be poisonous when eaten	T	75.4	3.2	21.4
2. High lead in the body can affect a child's learning skills	T	78.6	2.5	18.9
3. Most children show signs of being sick right away if they are lead poisoned	F	23.0	31.5	45.5
4. People staying in rented homes sign an agreement that lets them know if there is lead paint in the home	T	15.9	48.7	35.4
5. A child's highest blood lead level generally happens around 5 years of age	F	5.5	23.7	70.8
Exposure				
6. Lead paint is more likely to be found in new homes than in older homes	F	21.8	34.7	43.4
7. Living in a building during renovation/remodeling can increase a child's exposure to lead	T	65.1	5.5	29.4
8. One way for children to get lead poisoned is by having lead dust on their hands and then putting their hands in their mouth	T	74.3	5.7	20.0
9. A child can become lead poisoned from lead dust	T	71.0	4.1	24.8
10. Some pots bought from Mexico or other countries are not safe to use for cooking because they have lead	T	64.4	6.4	29.2
11. Parents who work with lead at their jobs can bring lead home on their clothes	T	70.3	6.4	23.2
12. The lead a pregnant woman has in her body can be given to the unborn baby	T	62.8	4.8	32.4
13. Lead in soil cannot harm children	F	35.6	19.8	44.6
14. Most cases of childhood lead poisoning are caused by drinking water that contains lead	F	13.1	42.1	44.8
15. Most children get lead poisoning by breathing in lead, rather than by eating or swallowing lead	F	17.2	35.6	47.1
16. Some home medicines have lead in them	T	38.9	21.1	40.0
Prevention				
17. Washing a child's hands often helps prevent lead poisoning	T	71.5	6.9	21.6
18. Warm sink water usually contains less lead than cold sink water	F	14.5	21.8	63.7
19. Lead in water can be removed by boiling (the water)	F	21.1	20.0	58.9
20. Cleaning a home with soap and water decreases the lead in the home more than dusting or sweeping	T	49.7	12.4	37.9
Nutrition				
21. The body needs a small amount of lead to be healthy	F	12.6	52.4	34.9
22. Less lead goes in the body if a child eats healthy	T	66.4	6.4	27.1
23. A diet with certain kinds of food like meat or walnuts will help decrease a child's chance of becoming lead poisoned	T	57.0	8.3	34.7
24. A diet with food like milk and broccoli helps prevent lead poisoning	T	64.8	5.5	29.7

their pharmacy education (53.8%). Other sources of knowledge were awareness lectures and scientific articles (34.3%), social media (28.7%), audiovisual media (23.2%), medical staff (14%), the workplace (9.4%), and family (6.2%).

Perceived Knowledge about Lead Poisoning

The respondents' perceived knowledge about lead poisoning is shown in Table 1. A total of 60.2% of participants reported knowing the term lead poisoning

Table 3. Attitudes towards lead poisoning (frequencies and % of participants that agree) and average score results.

Favorable (% agree)	N = 435	%	Average score *	SD
I am interested in the topic of lead poisoning	281	64.6	1.46	0.679
I think I am at risk of lead poisoning	147	33.8	1.94	0.782
I think I can do something to reduce lead poisoning	126	29.0	1.97	0.743
I think I am responsible for doing something about lead poisoning	235	54.0	1.62	0.747
Reserved (% agree)				
I guess I am not authorized to make a difference to the results of lead poisoning	176	40.5	1.85	0.801
I think lead poisoning isn't a big deal	50	11.5	2.05	0.526

*Average score of the answers with maximum of 3 and minimum of 1 for each statement. (SD: standard deviation).

but only 27.6% were familiar with the sources of lead exposure. About 89.9% of the participants knew that lead harms young and elderly people. Additionally, 29% of the respondents were aware of ways to prevent lead poisoning.

Chicago Lead Knowledge Test (CLKT)

The Chicago Lead Knowledge Test results are represented in Table 2. Participants showed their factual knowledge about lead poisoning as Q1 to Q5 measured the general knowledge of respondents regarding lead poisoning, while Q6 to Q16 measured their knowledge about exposure sources of lead, Q17 to Q20 measured their knowledge about prevention methods against lead poisoning, and Q21 to Q24 measured their knowledge about nutrition-related prevention methods.

The results revealed that the most known information about lead poisoning was that high lead in the body can affect a child's learning skills (78.6%).

The highest score in the CLKT test was 21 out of 24, with a mean score of 10.9 (S.D. = 4.8), which indicates a poor knowledge level among the respondents of this questionnaire. The correct response score means for the four categories of the test were as follows: general questions, 1.9 out of 5, S.D. = 1; exposure, 5.3 out of 11, S.D.= 2.5; prevention 1.5 out of 4, S.D. = 1; and nutrition 2 out of 5, S.D.= 1.3. Accordingly, the highest mean scores were obtained in questions related to exposure sources and nutrition. Respondents showed a relatively good knowledge of food sources (nutrition) that could prevent lead poisoning, meanwhile 52.4% of the respondents believed that the body needs a small amount of lead to be healthy.

A high percentage of respondents knew that washing hands (71.5%) as well as cleaning the house with water and soap (49.7%) are effective as prevention measures against lead poisoning. About 21.8% of the respondents believed that warm sink water usually contains less lead than cold sink water while 63.7% did not know the answer. In addition, only 21.1% knew that lead in water cannot be removed by boiling.

Attitudes Towards Lead Poisoning

In general, results revealed a more favorable (positive) attitude of the participants towards the topic of lead poisoning as shown in Table 3. A total of 64.6% of the respondents showed high interest in the topic of lead poisoning (average score mean = 1.46 out of 3) and 54% felt a responsibility to take action in regard to the problem of lead poisoning (score mean = 1.62 out of 3). In addition, only a few respondents showed disinterest in the topic of lead poisoning, as only 11.5% believed that lead poisoning is not a subject of concern (score mean = 2.05 out of 3), while 72.2% believed it to be of considerable importance. Respondents showed concerns regarding the problem of lead poisoning as 40.5% believed they are not authorized to make a difference to the results of lead poisoning (score mean = 1.85 out of 3). The average score was calculated for all four questions concerning favorable attitudes towards lead poisoning, and the total sample score mean was 6.99 out of 12 (SD = 1.98). The average score for reserved attitudes (two questions) towards lead poisoning was 3.9 out of 6 (SD = 1.06).

Discussion

This study relates to a problem of public health concern and is the first to assess knowledge about lead poisoning among pharmacy students and pharmacists in Jordan. The novelty of this study also lies in assessing the level of knowledge of pharmacists, as pharmacists have a direct daily contact with the community [23, 24], while previous studies conducted in different populations assessed the knowledge level in the general population [21, 29, 31-34]. Participants of this study were all college pharmacy students or pharmacists that graduated from Al-Zaytoonah University of Jordan. Most of the respondents of the survey were females (71%), and this is explainable by the high percentage of female pharmacy students/pharmacists in the targeted population (60.1%). In addition, the higher number of females as respondents to the study might be explained

by the higher interest of women in health care issues especially health care issues that affect children. The findings showed that pharmacy students and pharmacists generally had poor knowledge about lead poisoning. Participants estimated their own level of knowledge regarding lead poisoning, so the perceived knowledge of the respondents was evaluated. In addition, a factual knowledge test (CLKT) was conducted to estimate the actual knowledge level of the participants. The results of the perceived knowledge estimation of respondents along with the factual knowledge test (CLKT) indicated that the term "lead poisoning" itself is familiar to the respondents, but when it comes to knowing the exact sources of exposure, risks and prevention methods, respondents showed low knowledge. The mean score percentage of the CLKT in Jordanian pharmacy students and pharmacists (10.9; S.D. 4.8) was higher than that of a study conducted in a domestic environment in Nigeria (6.2; S.D. 4.2) [31] and lower than the CLKT scores in a study conducted in the USA on young participants aged 10-18 (12; S.D. = 4.1) [21] as well as a study conducted on adults in the USA (12.2; S.D. = 3.7) [29]. The findings indicate that detailed knowledge regarding lead poisoning sources of exposure and prevention methods is limited, with a considerable amount of misinformation among pharmacy students and pharmacists in Jordan. Similar to previous studies reported in the USA [21, 29], the sources of lead exposure were known to this study sample, but levels of knowledge about the more specific routes of lead poisoning such as breathing and oral exposure was insufficient. Levels of knowledge regarding general prevention measures and food sources that could prevent lead poisoning among Jordanian pharmacists and pharmacy students was relatively good, but it was unexpected that 52.4% of the respondents believed that the body needs a small amount of lead to be healthy and that only 21.1% of the participants knew that lead in water cannot be removed by boiling. Other studies similarly reported that although participants can identify the different sources of lead exposure, detailed knowledge regarding prevention strategies is lacking [21, 29, 31]. In several studies regarding environmental health literacy, it was shown that individuals may easily identify different contaminants of the environment but are less capable of recognizing details related to knowledge and prevention methods [35, 36]. This study's results further showed that almost half of the Jordanian pharmacy students and pharmacists who took part (53.8%) knew about the term lead poisoning through their pharmacy education, which emphasizes that the problem of lead toxicity is discussed in the toxicology course taught at the faculty of pharmacy. Considering the low level of knowledge regarding details related to lead toxicity revealed by the CLKT in this study, it can be suggested that the sources of trace metal toxicity and its prevention methods should be focused on in the experiential training of pharmacy students at Al-Zaytoonah University of Jordan. In addition, it is suggested that the topic of lead poisoning should be given special attention in two courses which were integrated recently in the curriculum of the Bachelor of Pharmacy program: namely the "Global and Public Health in Pharmacy" course as well as the "Drug Information and Health Informatics" course.

It was unexpected that even with the low level of knowledge of college students and pharmacists in this study, the results revealed a more favorable (positive) attitude of the participants towards the topic of lead poisoning; with a high percentage of respondents believing that lead poisoning is an important issue. On the other hand, when asking about taking responsibility towards the problem of lead poisoning, only 54% of the pharmacy college students and pharmacists felt a responsibility to take action with regard to the problem of lead poisoning, and 40.5% believed that they are not authorized to make a difference to the results of lead poisoning. These results might indicate that college students and pharmacists show a readiness to address the problem of lead toxicity but are not aware of their exact role or contribution to help in the topic of lead poisoning. Thus, it is recommended to implement seminars and workshops for current students and pharmacists to discuss the role of pharmacists in preventing lead toxicity in more detail which will increase the awareness of population to lead poisoning. In addition, the college of pharmacy could engage pharmacists in health care campaigns and community education concerning lead poisoning.

Conclusions

This study is the first to our knowledge to assess the level of knowledge and the attitude of pharmacists and pharmacy students towards the problem of lead poisoning. The relatively positive attitude of the respondents towards the topic indicates their willingness to seek more information and to improve knowledge levels of lead poisoning. Regarding our findings, pharmacy education should emphasize on preparing professional pharmacists, which are able to provide health information and assisting the community in gaining more information about lead poisoning and the prevention methods against exposure. Consequently, to better assess and be able to generalize the awareness level on Jordanian health care professionals, future studies could include participants of other health care professions, such as physicians, nurses and paramedics as health care professionals play a critical role in improving the awareness of the community.

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Conflict of Interest

The authors declare no conflict of interest.

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