ADVERSE HEALTH EFFECTS OF HEAVY METAL EXPOSURE AND AWARENESS PROGRAM TO REDUCE THESE EFFECTS

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ABSTRACT

Scientific and technological progress in recent times, especially since the beginning of the current century, has led to the spread of pollutants in the environment surrounding man. Due to the impact of this pollution on human health, man should study the nature of these pollutants and be aware of them, and realize the importance of controlling environmental waste that leads to dangerous diseases. Therefore, the current study aimed to increase environmental awareness towards environmental pollutants. The study questions fall on how to increase environmental awareness about environmental pollutants?, And the current study belongs to the descriptive studies, using the social survey method by sample for students at the Faculty of Social Work and the Faculty of Science at Fayoum University, using the environmental awareness scale. By applying to the Faculty of Social Work and Science at Fayoum University, "200 students at Fayoum University distributed as follows = (100 students from the theoretical faculty, which is the Faculty of Social Work, Fayoum University + (100 students from the practical faculty, which is the Faculty of Science, Fayoum University)." Attitudes as a whole related to the extent of environmental awareness came with an average weight of (1.84) and an estimated rate of (61.33%), which is an average level.

Keywords for research: environmental pollution, heavy metals, environmental awareness.

INTRODUCTION

Since heavy metal pollution impacts soil, plants, aquatic life, and human health, it has substantially increased in importance as a global issue. With the rise of anthropogenic activities like industrialisation and the rising urbanisation around the world. The usage of natural resources and environmental pollution have both significantly increased. The biological buildup of heavy metals as a result of various exposures in our ecosystem may have harmful effects on living things as a result of this rise in heavy metal toxicity. These metals' ecological cycles may also result in a public health issue that could have harmful effects on the environment (Taylor and zkoç Bike, 2007; Yi *et al.*, 2011; Avigliano and Schenone, 2015; Islam *et al.*, 2015; Asaduzzaman *et al.*, 2017; Singh and Kumar, 2017; Okereafor *et al.*, 2020).

According to physical criteria, metals with an atomic number larger than 20 and a specific weight greater than 5 g/cm3 are referred to as heavy metals (Seven *et al.*, 2018; Yerli *et al.*, 2020). They impact live metabolisms, as well as the air, land, and water resources, in different ways. ((Dündar and Aslan, 2005; Okçu *et al.*, 2009; Yerli *et al.*, 2020)

The toxicity of heavy metals has led to the development of numerous therapeutic methods. The negative effects are well treated using natural products (Singh *et al.*, 2011; Tchounwou *et al.*, 2012). Almost since the dawn of humanity, medicinal plants and natural remedies have been used to treat a variety of diseases (Bhattacharya, 2018).

Due to its potential for eradicating the harmful effects of heavy metals, nanotechnological techniques are also attracting interest. The development and production of nanomaterials for heavy metal detection and removal have yielded numerous advantages (He *et al.*, 2019).

Toxicity of heavy metals:

Neurotoxicity:

Manganese is a necessary element that is involved in a number of bodily physiological processes. Acute exposure to it may have neuroprotective effects by reducing apoptotic cell death, but excessive exposure can have negative effects such as neurological complications like Parkinson's disease and Alzheimer's disease, which cause apoptotic cell death and alter homeostasis (Goldhaber, 2003).

When arsenic is eaten, the central nervous system experiences cognitive impairment. It also contributes to an excess of neurodegenerative disorders and is associated to a number of neurological conditions, including neurodevelopmental abnormalities. According to Garza-Lamb *et al.* (2019), arsenic poisoning also affects the balance of neurotransmitters and synaptic transmission.

Many heavy metals, including manganese, arsenic, and cadmium, have been identified for their neurotoxic effects.

Additionally, when too much copper or zinc reaches the brain, they, too, like iron, obstruct neurodevelopment (Prohaska, 2000).

Nephrotoxicity:

Cadmium nephrotoxicity causes severe clinical symptoms as aminoaciduria, phosphaturia, glycosuria, and Fanconi-like syndrome (Hazen-Martin *et al.*, 1993; Reyes *et al.*, 2013). Excessive exposure can lead to renal tubular acidosis, renal failure, and hypercalciuria (Friberg *et al.*, 2019). All organs are adversely affected by lead, but the kidneys are the most severely affected. Proximal tubular dysfunction brought on by acute lead nephropathy results in Fanconi-like syndrome. Hyperplasia, interstitial fibrosis, tubule atrophy, renal failure, and glomerulonephritis are the hallmarks of chronic lead nephropathy.

Abrupt tubular necrosis, which is brought on by abrupt renal exposure to mercury, includes a wide range of clinical symptoms including acute dyspnea, altered mental status, stomach discomfort, excessive salivation, tremors, vomiting, chills, and hypotension. On the other hand, long-term exposure to mercury damages the epithelium and results in necrosis of the pars recta of the proximal tubule. Mercury-induced chronic kidney injury is characterised by tubular failure, increased excretion of albumin and retinol-binding protein in the urine, and a nephritic condition with a feature of membranous nephropathy (Lentini *et al.*, 2017).

Carcinogenicity:

Martinez *et al.*, 2011; Park *et al.*, 2015 showed that arsenic causes DNA damage, changes, histone modifications, and DNA methylation. It also causes epigenetic abnormalities. According to Garcia-Esquinas *et al.* (2013), arsenic exposure increases the risk of cancer through binding to DNA-binding proteins and delaying DNA repair. By producing ROS, the carcinogenic material lead damages the DNA repair system, genes that control cellular tumour growth, and chromosomal shape and sequence. By removing zinc from specific regulatory proteins, it interferes with transcription (Silbergeld *et al.*, 2000).

Reactive oxygen species (ROS) are produced in large amounts by the peroxidative activity of mercury, and these ROS can promote protumor genic

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signaling and the formation of malignant cells. By destroying cellular proteins, lipids, and DNA, ROS can contribute to the development of cancer (Reczek and Chandel, 2017 and Zefferino *et al.*, 2017).

Nickel causes cancer *via* regulating several cancer-causing pathways, such as free radical production, transcription factor control, and gene regulation. It regulates the expression of specific mRNAs, microRNAs, and long non-coding RNAs. In order to increase the modulation of hypoxia-inducible factor-1, it participates in the methylation of the promoter and the downregulation of gene 3 (MEG3) (Zambelli *et al.*, 2016; Zhou *et al.*, 2017). Both of these processes aid in the development of cancer.

Hepatotoxicity:

Lead's toxicity to liver cells has a long history. When exposed to it, oxidative stress is increased, which damages the liver. Because organic solvents and lead have many properties, they can harm the liver when combined (Farmand *et al.*, 2005; Malaguarnera *et al.*, 2012). According to Hegazy and Fouad (2014), prolonged lead exposure may be harmful to liver cells and cause glycogen depletion, cellular infiltration, and chronic cirrhosis. The liver and renal cortex are two cadmium human target tissues (Bernard, 2004). It builds up in the liver after acute exposure and is associated with a number of hepatic dysfunctions. According to Zalups (2000), cadmium alters the cellular redox equilibrium, causing oxidative stress and hepatocellular damage.

Immunological toxicity:

According to Dietert *et al.* (2004) and Hsiao *et al.* (2011), both acute and chronic lead exposure have a number of harmful effects on the immune system and trigger a variety of immunological responses, including an increase in allergies, infectious illnesses, and autoimmunity as well as cancer. Lead exposure has been connected to a high incidence of bladder, stomach, and lung cancer in a number of demographic groups (Rousseau *et al.*, 2007; Steenland and Boffetta, 2000).

Based on the different exposure circumstances, cadmium exposure in the workplace and environment may result in immunosuppressive consequences.

Cardiovascular toxicity:

Kidney disease, bone disease, and cardiovascular disease are all brought on by cadmium. High blood pressure, diabetes, carotid atherosclerosis, peripheral arterial disease, chronic kidney disease, myocardial infarction, stroke, and heart failure have all been linked to low to moderate cadmium exposure (Tellez-Plaza *et al.*, 2008; Schwartz *et al.*, 2003; Messner *et al.*, 2009; Navas-Acien *et al.*, 2004; Hellström *et al.*, 2001).

Cardiovascular toxicity caused by mercury has been demonstrated. According to Yoshizawa *et al.* (2002), levels of oxidised LDL in atherosclerotic lesions, acute cardiac failure, and atherosclerosis are related to mercury levels in hair. Carotid artery stenosis, acute myocardial infarction, and coronary heart disease (Kulka, 2016).

Acute or chronic lead exposure causes a number of problems in the human body. By increasing OS, decreasing NOISE availability, increasing vasoconstrictor prostaglandins, and changing the renin-angiotensin system, chronic lead exposure may lead to arteriosclerosis and hypertension, thrombosis, atherosclerosis, and cardiac disease (Hertz-Picciotto and Croft, 1993; Vaziri, 2008, 2002).

Reversible systolic heart depression brought on by cobalt exposure can be recognised from other cardiomyopathy conditions. Cobalt-induced cardiomyopathy can be slow-moving and deadly. However, survivors typically regain their cardiac function (Packer, 2016).

Skin toxicity:

Numerous skin conditions, such as hyperkeratosis, hyperpigmentation, and several forms of skin cancer, are made more likely by prolonged exposure to arsenic (Huang *et al.*, 2019).

According to Horowitz *et al.* (2002), acrodynia is one of many mercury- and mercury-containing compound-related skin diseases. Mercury toxicity is the most common cause of dermatological issues, according to various research (Boyd *et al.*, 2000).

Numerous skin conditions, such as hyperkeratosis, hyperpigmentation, and several forms of skin cancer, are made more likely by prolonged exposure to arsenic (Huang *et al.*, 2019).

Reproductive and developmental toxicity:

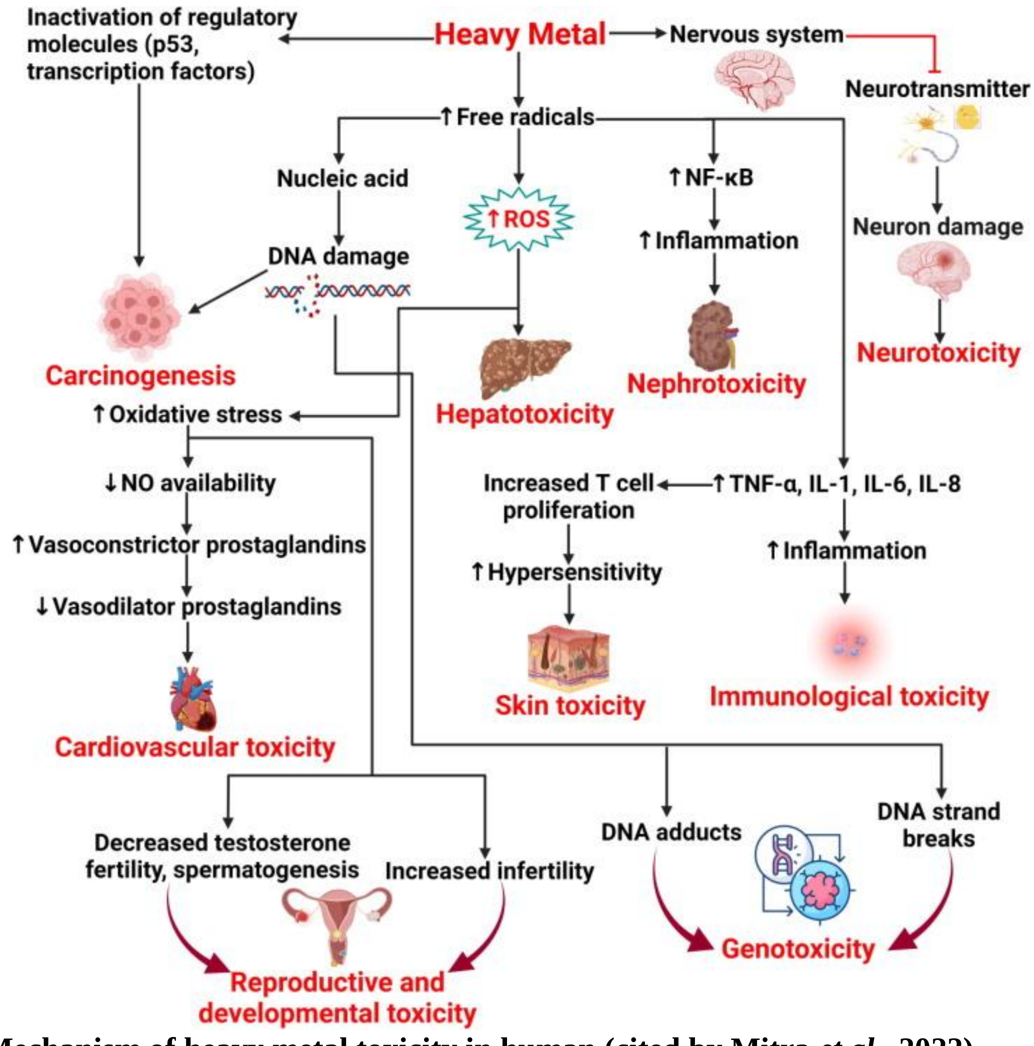
More than 10% of women are at risk of infertility due to their exposure to heavy metals, which are the most frequent environmental contaminants that can result in reproductive disorders (Apostoli and Catalani, 2011). These pollutants include lead, cadmium, mercury, and other pollutants. Subfertility in women is frequently brought on by ovulation problems (Naz and Batool, 2017; Upadhyay *et al.*, 2020).

Currently, the most prevalent cause of female infertility is hormonal imbalance, which is aggravated by endocrine disruption brought on by heavy metal exposure (Rattan *et al.*, 2017). In experimental animals, arsenic results in malformations and is a known human reproductive toxin (Wang *et al.*, 2006). By lowering the weights of the testes, the accessory sex organs, and the quantity of sperm in the epididymis, inorganic arsenic hinders male fertility. Inorganic arsenic exposure alters the levels of the hormones testosterone and gonadotropin, as well as the process of steroidogenesis, in addition to having an impact on sperm production (Kim and Kim, 2015). Consuming arsenic is linked to a higher risk of endometrial cancer in women (Salnikow and Zhitkovich, 2008). When pregnant women are exposed to arsenic, endometrial angiogenesis, which is essential for embryo development, is subsequently hampered. These disorders all contribute to endometriosis symptoms, subfertility, prematurity, sterility, and spontaneous abortions (Milton *et al.*, 2017).

Genotoxicity:

Deoxyribonucleic acid alteration brought on by arsenic's genotoxicity includes chromosomal abnormalities, mutation, the creation of micronuclei, deletion, and sister chromatid exchange (Roy *et al.*, 2018). although its low mutagenicity, arsenic is characterised as a weak mutagen because it influences the mutagenicity of other carcinogens, although having no direct effect on DNA. Arsenic, for instance, has been reported to be more mutagenic in human cells when exposed to UV radiation (Yin *et al.*, 2019).

A summary of mechanism of heavy metal toxicity in human in the following figure



Mechanism of heavy metal toxicity in human (cited by Mitra *et al.*, 2022).

Transition of Heavy Metals to Water and Their Resources

The most important water pollutants are:

Sanitation: through the delivery of sewage lines to the seas or absorption pits in houses that lead to the leakage of their water to groundwater and here the risk is greater.

Industrial waste: water used in industry is diverted to valleys or rivers. One of the most dangerous types of water pollutants and the most dangerous are radioactive substances, as this has become the problem of the times due to the adoption of nuclear energy as an energy source.

Natural pollution: which occurs because of the depletion of a certain resource of water, such as artesian wells, so the percentage of salts and other suspended substances increases.

Water quality biometrics: measuring water quality depends on the possibility of living organisms such as fish, insects, and other invertebrates in the water. If several different species can live in it, its quality is likely to be good, while if the result is the opposite, the water quality will certainly be poor and unusable.

Toxic heavy metal pollution of the environment is often an issue, especially in polluted resources resulting from industrial operations based on the use of various chemicals. Especially in developing nations, these heavy metals are released into surface waters either directly or indirectly (Sall *et al.*, 2020).

Humans and aquatic life are both toxically affected by heavy metals that cause water pollution. Despite the fact that certain heavy metals, like Co, Cu, Fe, Mn, Mo, and Zn, are required for living things to maintain their important functions at low concentrations (Kr *et al.*, 2007).

Environmental awareness is spreading awareness to others that the physical environment is fragile and indispensable, we can begin fixing the issues that threaten it.

Fostering environmental awareness through reading books and other materials, group learning (in or out of the classroom), educational and motivational seminars, online courses, books, articles, films, and brochures. These are just a handful of the resources you may use to start spreading environmental awareness. Environmental awareness includes three components, environmental knowledge, environmental affection, and environmental responsibility, and each one is measured by a specific scale.

AIM OF STUDY

This study aims to examine people's awareness of the potential for heavy metal pollution. The anticipated results of the study were taken into consideration as a suggestion to stakeholders to provide further actions to enhance environmental quality.

METHODS

Type of study:

Based on the nature of the study problem, and consistent with its objectives. The current study is a descriptive study aimed to characterizing and analyzing the adverse health effects of exposure to heavy metals and an awareness program to reduce these effects.

This study is based on the social survey methodology by the sample Method for second-grade students at the Faculty of social Work, Fayoum University. The type of questionnaire used in this study was a closed questionnaire because the respondents only had to give a sign on one of the answers that were considered correct.

2-study tools:

The data collection tools were represented by an “attitudinal scale for measuring students 'environmental awareness".

The tool is designed according to the following steps:

The researcher designed an attitude scale to measure students' environmental awareness, by referring to the theoretical heritage, the conceptual framework guiding the study, and referring to studies related to the subject of the current study to identify the phrases that are related to each of the variables of the study.

2.1. Instrument validation: The apparent honesty of the arbitrators where:

The tool was presented to (10) faculty members with related specialization, and an agreement percentage of at least (80%) has been approved, some phrases have been deleted and some have been reworded. Accordingly, the form was finalized in its final form.

The form has included:

I. Initial data: name, gender, age, academic position, type of community coming from, participation in university activities.

II. Attitudes to measuring students ' environmental awareness

2.2. stability of the tool: The researcher applied the tools to (10) of the study sample of university students, then she applied the tools again to the same sample after (15) days. Pearson correlation coefficient was used to calculate the constancy and the correlation coefficient was 0.91

This shows that the (strong correlation) between the first application and the reapplication again, which means that the form can be relied on to a high degree, as well as the results that can be reached through it.

Methods of statistical analysis: The data was processed through a computer using the statistical packages program for Social Sciences (SPSS V 24), and the necessary statistical methods were applied:

Judging the level of environmental awareness of students: using the arithmetic mean; where the beginning and end of the categories of the triple scale are three situational responses (a = one degree), (b = two degrees), (C = Three Degrees), and the data was encoded and entered into the V program.24 SPSS, to determine the length of the cells of the triple scale (lower and upper limits), the range was calculated

IF THE AVERAGE VALUE OF THE TERM OR DIMENSION RANGES BETWEEN 1 - 1.67	LOW LEVEL
If the average value of the phrase or dimension ranges from more than 1.67-2.35	Middle level
If the average value of the phrase or dimension ranges from more than 2.35-3	High level

RESULTS

In the beginning, we wanted to judge the credibility and stability of the results of the questionnaires that were conducted in the research by applying the stability coefficient test, and the result that was obtained was a high value of the Reliability Statistics.

Reliability Statistics

Cronbach's Alpha	No of Items
0.993	**19**

First: The initial data.

These questionnaires represent a wide range of students who differ in many characteristics, as they represent males and females, new student and those old, as well as those coming from the urban community or the rural community, different ages, as well as those participating in university activities or not. Thus, the results obtained are inclusive of all points of view from the students.

ITEM	TYPE	FREQUENCY	%
Gender	Male	77	38.5
	Female	123	61.5
Age	Less than 20 years	52	26
	From 20 to less than 22 years	125	62.5
	From 22 to less than 24 year	23	11.5
Academic position	New students	188	94
	Old students	12	6
Community coming from it	Urban community	111	55.5
	Rural community	89	44.5
Participation in university activities	Participant	82	41
	Sometimes involved	21	10.5
	Not participating	97	48.5

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Second: Consequences of attitudes related to the extent of environmental awareness.

The questions in the questionnaire were divided into three groups

The first group relates to water pollution with heavy metals and their use for various purposes, as well as pollution of waterways

The second group relates to heavy metal contamination of food

The third group is related to the pollution of the surrounding environment with heavy metals and the role of awareness in avoiding the harmful effects of all groups

1- Questions related to water and its pollution

Q	RESPONSE	F	%	RANKING	MEAN	TOTAL WEIGHT	E.P. %	S.D	S^2
1	**If you know that drinking water is contaminated with chemical contaminants, you**								
	Drink them plain	75	37.5	2	1.8	360	60	0.716	0.513
	Drink it after filtering	90	45.0	1					
	Refrain from drinking	35	17.5	3					
2	**If your water source is from groundwater, you will**								
	Use it for drinking and preparing meals	76	38.0	2	1.795	359	59.8	0.718	0.516
	Use it for showering and washing dishes	89	44.5	1					
	Not use it at all	35	17.5	3					
3	**If a colleague asks you about the dangers of water contaminated with bacteria, you advise him to**								
	Drink them, it's no affect human health	75	37.5	1	1.98	396	66	0.856	0.733
	Drink from her after her nomination	54	27.0	3					
	not to drink, because they cause diseases	71	35.5	2					
4	**If you see someone spraying the streets with clean water from the tap, you**								
	recommend him for spraying the street to humidify the temperature	81	40.5	2	1.705	341	56.8	0.656	0.430
	Explain to him the danger of wasting clean water	97	48.5	1					
	~~I~~ forbid him to spray the street with clean water	22	11.0	3					

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Cont.

Q	RESPONSE	F	%	RANKING	MEAN	TOTAL WEIGHT	E.P. %	S.D	S^2
5	**When some people dispose waste plastics in the seas and oceans what do you think about it?**								
	A convenient solution for garbage disposal	99	49.5	1	1.745	349	58.17	0.821	0.673
	Harassing holidaymakers on beaches	53	26.5	2					
	Polluting the water of the seas and oceans	48	24.0	3					
6	**If you are responsible in a factory for the discharge of water generated by industry, you**								
	Re-use it again	62	31.0	2	1.945	389	64.8	0.752	0.565
	use it only for agricultural purposes	87	43.5	1					
	processing it before using it for drinking purposes	51	25.5	3					
7	**If you know that a farmer irrigates his crops with water contaminated with heavy metals, you advise him**								
	To use it because it increases the production of agricultural crops	75	37.5	2	2.035	407	67.83	0.888	0.788
	To use it but it will reduce the production of agricultural crops	43	21.5	3					
	Not to use them because they cause diseases to humans until death	82	41.0	1					

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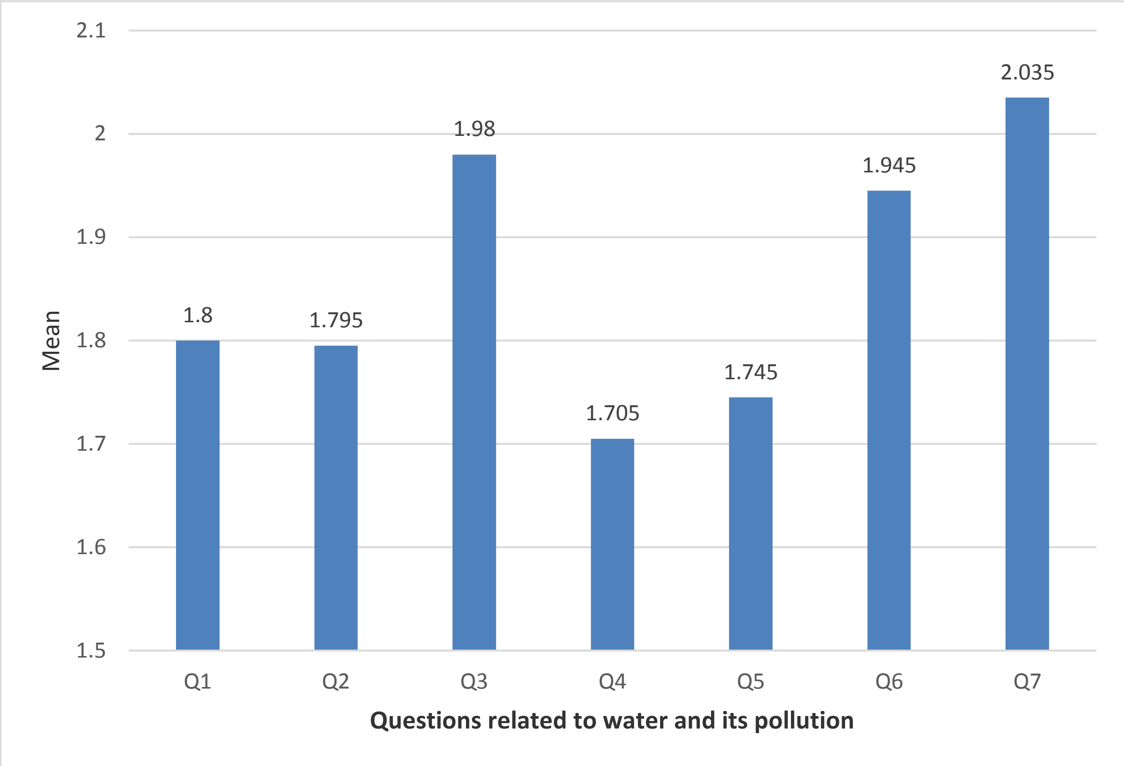
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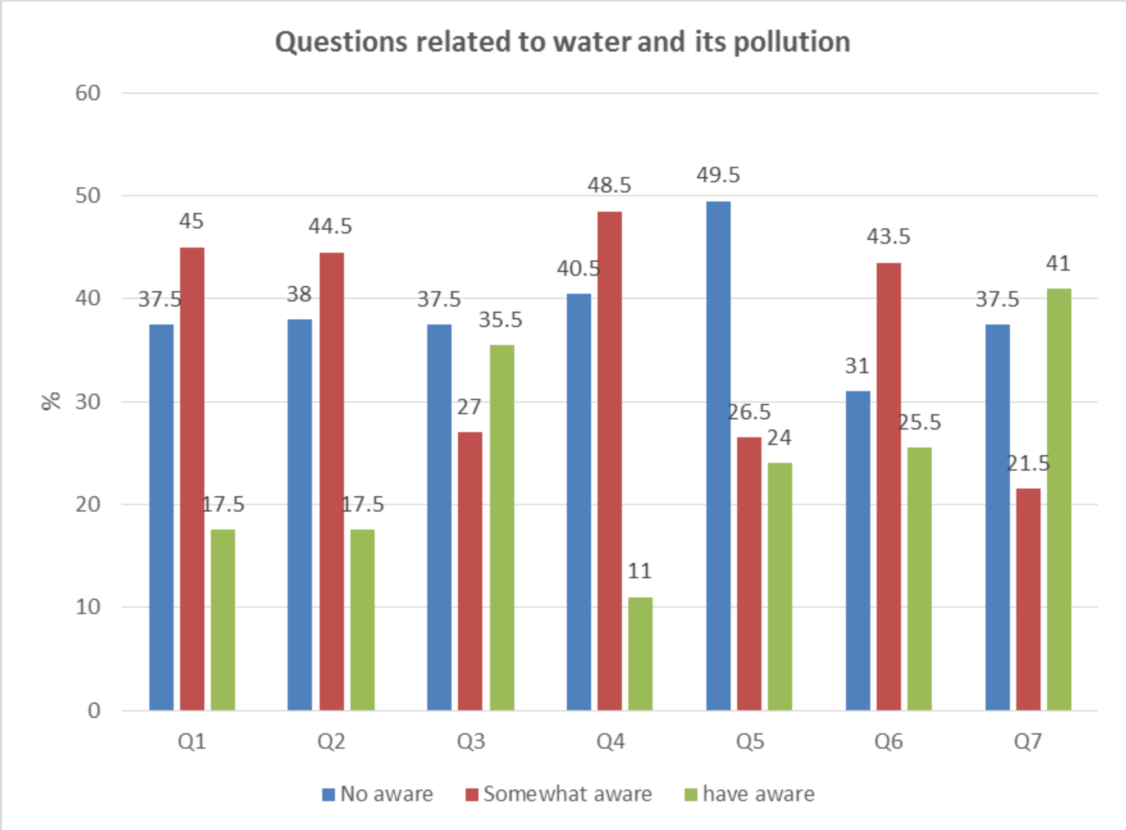
Questions related to water and its pollution



Awareness on Problems related to polluted water.

About 42% indicated that they are not aware on water pollution. 58% indicated to be aware on the same problem.

All the results that were obtained from the students' answers to the issues related to water pollution were the answers away from the direct use of polluted water mainly for drinking and in some other purposes except after treatment and a small percentage of the answers in which students need more awareness about the dangers of heavy metal pollution and these were the answers that ranked first are:

Drink it after filtering (45%), use it for showering and washing dishes (44.5%), Explain to him the danger of wasting clean water (48.5%), use it only for agricultural purposes (43.5%) and not to use them because they cause diseases to humans until death (41%).

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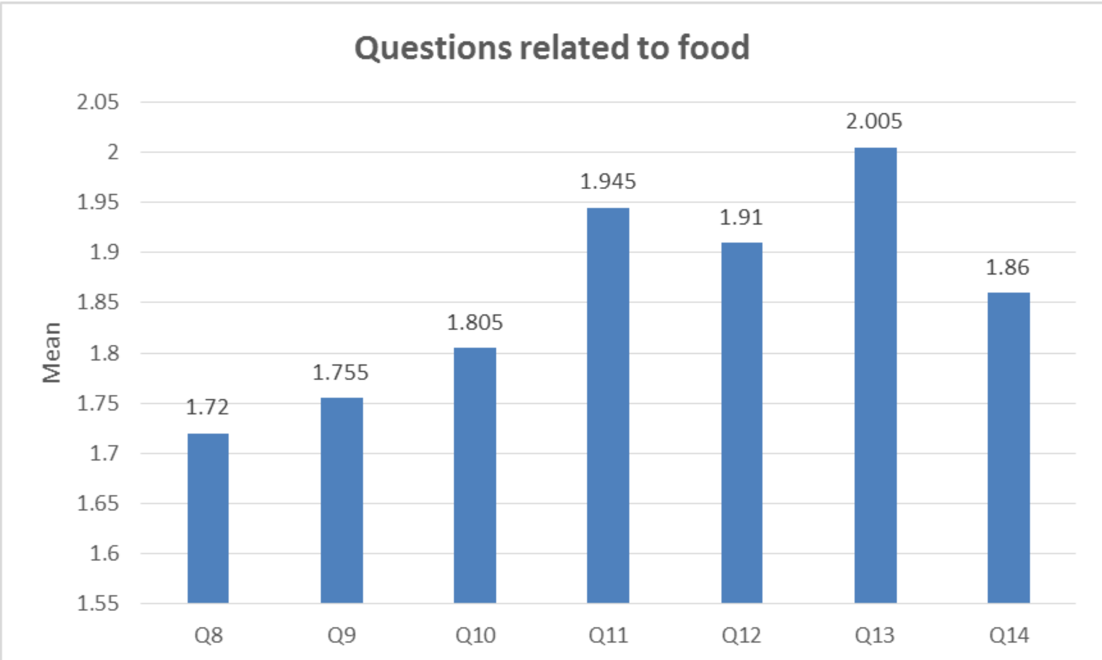
2- Questions related to food

Q	RESPONSE	F	%	RANKING	MEAN	TOTAL WEIGHT	E. P. %	S.D	S^2
8	**You went to one of the fruit gardens and learned that there is a water source that irrigates the garden with some heavy filters, so you liked the fruit thus**								
	Taking from them what I want to eat	80	40.0	2	1.72	344	57.33	0.666	0.444
	Ask the farmer to wash it	96	48.0	1					
	I don't eat them for the sake of my health	24	12.0	3					
9	**When you use oil to fry some foods more than once, you**								
	Re-purify and use it again	78	39.0	2	1.75	351	58.50	0.691	0.474
	Sell it to street vendors	93	46.5	1					
	Execute it and never use it by me or anyone else again	29	14.5	3					
10	**If you know that some products in the markets contain heavy metals, you**								
	Consume it in a normal way	91	45.5	1	1.80	361	60.17	0.825	0.680
	Refrain from consuming it	57	28.5	2					
	Report it to Consumer Protection officials	52	26.0	3					
11	**If you eat food contaminated with heavy metals, you**								
	Do nothing because the body is able to overcome its harmful effects	60	30.0	2	1.965	393	65.50	0.753	0.567
	Take some folk remedies and recipes	87	43.5	1					
	immediately go to the nearest hospital	53	26.5	3					
12	**If you know that the fish sold in the markets are from contaminated water sources, you**								
	buy these fish and eat them	63	31.5	2	1.91	382	63.67	0.731	0.535
	Refrain from buying them in the first place	92	46.0	1					
	Prevent people from buying it	45	22.5	3					

Cont.

Q	RESPONSE	F	%	RANKING	MEAN	TOTAL WEIGHT	E. P. %	S.D	S^2
13	**If you know that you have eaten food contaminated with heavy metals, so**								
	I eat it because food is not affected by contaminated water	68	34.0	2	2.005	401	66.83	0.830	0.688
	I Identify the source of pollution	63	31.5	3					
	I Resort to medical treatment	69	34.5	1					
14	**If you know that the vegetables you have eaten are contaminated with heavy metals, you can identify them by**								
	Its pungent smell	83	41.5	1	1.86	372	62.0	0.821	0.674
	Increasing weight	62	31.0	2					
	Laboratory analysis	55	27.5	3					



All the results obtained from students' answers to questions related to food contamination were the answers away from the direct consumption of food and a small percentage of the answers in which the students need more awareness about the dangers of heavy metal pollution, and these answers, which took the first place, are: I ask the farmer to wash it (48%). Taking some folk remedies and recipes (43.50%) They refrain from buying them in the first place (46%) Resort to medical treatment (34.50%) Its strong smell (41.50%)

3- Questions related to public awareness.

Q	RESPONSE	F	%	RANKING	MEAN	TOTAL WEIGHT	E. P. %	S.D	S^2
15	**If a friend asks you to explain the dangers of eating food contaminated with heavy metals, you advise him to**								
	Eat it because there is no harm to humans	80	40.0	1	1.985	397	66.17	0.888	0.789
	Eat them even though they infect a person with colic	43	21.5	3					
	not to eat them because they can cause damage to all body systems	77	38.5	2					
16	**you was visiting a friend of yours and you knew that there is a lead Foundry beside his house, so you advise him to**								
	Continued to live in this home	81	40.5	2	1.72	343	57.17	0.668	0.446
	Invite others to visit the neighborhood	95	47.5	1					
	To leaves this house for another faraway area	24	12.0	3					
17	**If a friend of yours is used to smoking constantly in your presence, then you**								
	see that every human being is free in what he does	97	48.5	1	1.815	363	60.50	0.869	0.755
	Advise him to refrain from smoking	43	21.5	3					
	Avoid sitting with him when he smokes	60	30.0	2					
18	**If a thermometer or blood pressure monitor containing mercury breaks, you**								
	Keep it at home	79	39.5	2	1.745	349	58.17	0.687	0.472
	Throw it in the trash	93	46.5	1					
	Bury it in the desert ground	28	14.0	3					
19	**If you see some people collecting garbage and burning it in the open air, you**								
	Love what they do to get rid of the garbage landscape	97	48.5	1	1.7	340	56.67	0.763	0.583
	Advise them not to burn garbage because it pollutes the air	66	33.0	2					
	Prevent them from burning garbage, informs the authorities	37	18.5	3					

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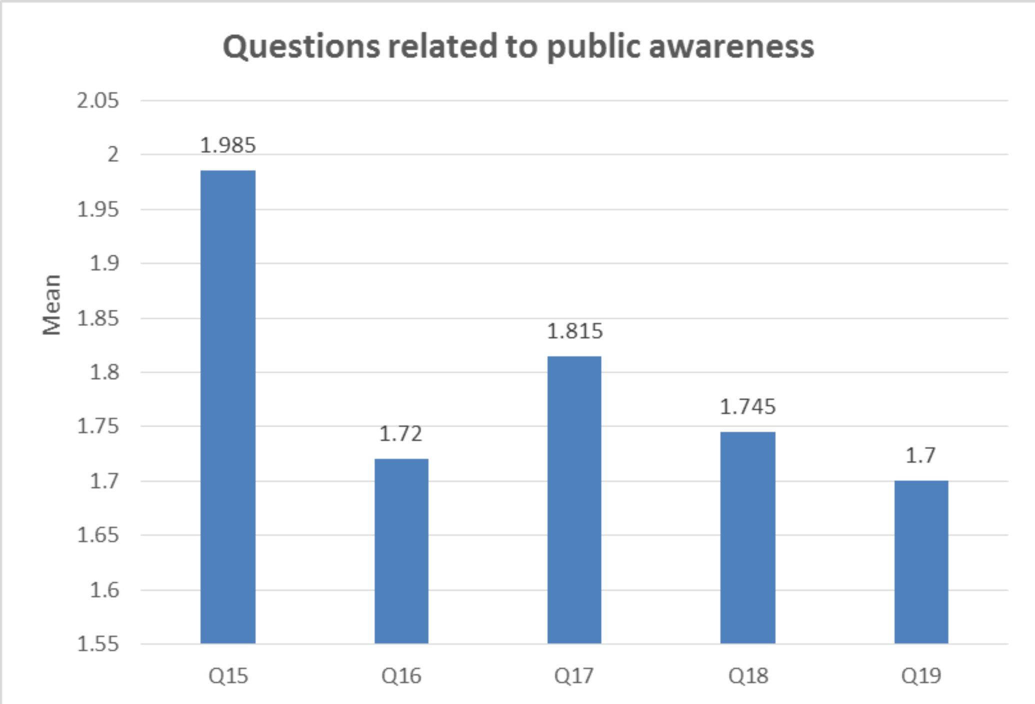

As for the students' answers to general questions that are related to the environment around them, the answers indicate that they are not fully aware of these matters, and the community needs more awareness in these matters, especially those related to the habit of smoking, burning garbage, living near factories that emit smoke, and treating these matters. The state intervenes, and with its assistance, in providing alternative solutions, such as establishing a good system for garbage disposal, activating the punishment for smoking in government institutions, and providing housing away from industrial areas.

The study recommends the importance of raising students' environmental awareness regarding the following aspects: The nature of the water with which fruits and vegetables are irrigated is to be pure. Housing at a sufficient distance from lead foundries. - The danger of drinking water contaminated with chemical pollutants. Preserving the groundwater source. The danger of water contaminated with bacteria. Not wasting water by spraying clean water on the streets. Do not use oil to fry some foods more than once Safe disposal of plastic waste. Safe disposal of industrial water. Do not irrigate with water contaminated with heavy metals. Bear

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in mind that some products in the market contain heavy metals - Awareness that there is food contaminated with heavy metals Mercury contents should be careful. Vegetables contaminated with heavy metals must be identified and avoided. Sanitary disposal of garbage.

The results of current study revealed the need to increase public awareness and awareness of risks regarding the harmful effects of toxic metals, and thus increase public awareness of these effects, which lead to behavioral changes and promote preventive behaviors against them. And the proposed program to promote environmental awareness through reading books and other materials, group learning (inside or outside the classroom), educational seminars in youth centers in villages and hamlets, online courses and articles, films and compulsory or elective courses that are found in the college regulations as requirements for the university

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الآثار الصحية الضارة للتعرض للمعادن الثقيلة وبرنامج التوعية للحد من هذه الآثار

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المستخلص

التقدم العلمي والتكنولوجي في الآونة الأخيرة ، وخاصة منذ بداية القرن الحالي أدت إلى انتشار الملوثات في البيئة المحيطة بالإنسان. ونظراً لتأثير هذا التلوث على صحة الإنسان ، يجب على الإنسان دراسة طبيعة هذه الملوثات والاطلاع عليها ، وإدراك أهمية السيطرة على المخلفات البيئية التي تؤدي إلى أمراض خطيرة. لذلك هدفت الدراسة الحالية إلى زيادة الوعي البيئي تجاه الملوثات البيئية. تقع أسئلة الدراسة حول كيفية زيادة الوعي البيئي حول الملوثات البيئية ؟، وتنتمي الدراسة الحالية إلى الدراسات الوصفية باستخدام طريقة المسح الاجتماعي بالعينات لطلبة كلية الخدمة الاجتماعية وكلية العلوم بجامعة الفيوم باستخدام مقياس الوعي البيئي.

بالتقدم للالتحاق بكلية الخدمة الاجتماعية والعلوم بجامعة الفيوم "٢٠٠ طالب بجامعة الفيوم موزعين كالتالي: (١٠٠ طالب من الكلية النظرية وهي كلية الخدمة الاجتماعية جامعة الفيوم + (١٠٠ طالب من الكلية العملية). وهي كلية العلوم جامعة الفيوم). "الاتجاهات ككل مرتبطة بمدى الوعي البيئي: جاءت بمتوسط وزن (١.٨٤) وبنسبة تقدر بـ (٦١.٣٣٪) وهو مستوى متوسط.

الكلمات المفتاحية للبحث: التلوث البيئي ، المعادن الثقيلة ، الوعي البيئي.

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