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Original Article

Monitoring of insecticides' toxicity through tap water contamination

Raafat Mandour

Emergency hospital-Mansoura University, Mansoura 35516, Egypt

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Correspondence to: Raafat Mandour; Tel: +201225260108; Email: . raafat_mandour@hotmail.com

https://orcid.org/0000-0001-5052-5954

ABSTRACT

Objective: The problem of pesticides circulating in the aquatic environment is of global concern because pesticides tend to accumulate in aquatic organisms and sediment soils, posing a threat to human health. This study meant to assess the contamination of tap water from pesticides related to well-being risks and is investigating the possibility of impact on human well-being.

Materials and methods: The survey is dividing into two phases of recruitment, namely the recruitment in various regions of Dakahlia in 2020. Sampling areas selected in line with the locations of major agricultural and industrial activities. Fifty blood, and faucet water samples, each assembled persistently from patients' determined to have pesticide poisoning once having assent. Likewise, ten blood, and water samples each from healthy participants served as a control group. Analyzing pesticides in blood and water samples performed with gas chromatography-mass spectrograph (GC-MS) examination.

Results: The outcomes revealed the presence of organophosphate (Malathion) and organochlorine (Lindane) insecticides.

Conclusion: The presence of those insecticides in tap water and blood samples designated for its real consequences for human well-being and aquatic life. Authorities overseeing the use of unpredictable insecticides must implement strict social controls.

Keywords: Blood; human; insecticides; water

1.Introduction

In developing countries, environmental contamination is a major challenge further complicated by limited resources for early diagnosis and management of its health consequences. Environmental health refers to all or any physical, chemical, and biological external factors that affect a person's behavior, integrating the analysis, evaluation, control and prevention of environmental factors, which may affect health [1]. Water pollution with a range of organic and inorganic substances is one among the foremost genuine difficulties for the healthy and property development of the environment [2]. The physical and environmental health of billions of people might threaten by water pollution [3]. Previous studies have shown that agricultural activities emit unsafe and unhealthy ingredients, which have led to water pollution in these areas. The normal classification of pesticides by target species includes insecticides, herbicides, rodenticides, and fungicides [4]. Since insecticides are the most common toxic substances affecting our population, especial attention is paying to them. Prominent insecticide families include organophosphates, organochlorines, and carbamates. Organophosphates and carbamates are of great concern due to worldwide use, and hurtful general well-being impacts [5]. Organophosphate considered as a large group of insecticides, which have replaced organochlorine due to their lower toxicity and accumulation in the environment, and relatively higher decomposition rates. Current use pesticides typically, contacting with people when they'll emigrate everywhere with rainwater or farmland irrigation waters, getting in urbanized rivers [6]. Pesticides have recognized in numerous aquifers, and surface waters worldwide, as a result of agricultural practices [7]. Pesticide in soil will leach to surface and even water and may bio-accumulate among the organic phenomena [8]. Water-soluble pesticides will be taken away by water molecules, especially during precipitation, penetrate down to the soil layer and eventually reach the groundwater. Otherwise, those insoluble chemicals that are tightly bound to the soil particles will accumulate in the topsoil layer, and they are most likely to be eroded by runoff to the surface water, polluting lakes, rivers and rivers with pesticides [9]. Pesticides might be important sources of exposure to the public when they'll enter the water supply and used domestically as household pesticides.

Owing to national drinking water standards and well-being, all detected organophosphate pesticides relating for at least one health outcome criteria [10]. Humans mainly come into contact with pesticides in water through ingestion and skin contact [11]. Immunological diseases, neurodegenerative illnesses, hematological malignancies and solid tumors might result as unsafe impacts of pesticides on human well-being [12, 13]. Acute health effects depend on pesticide toxicity and the most common effects are vision loss, headache, salivation, diarrhea, nausea, vomiting, wheezing, coma and even death. Moderate pesticide poisoning can cause similar endogenous asthma, bronchitis and gastroenteritis [14]. Many studies in Egypt showed the presence of organochlorine in water (APHA) [15]. Studies on

foreseen environmental concentrations in the risk assessment of pesticide use limiting in literature. The aim of the current work was to evaluate and check the pollution of faucet water by these insecticides related to health risks. In addition, assess the potential for outcomes related to human well-being.

2. Materials and Methods

Study area

The Study area is locating between latitudes, 30^0 30^-–31^0 30^- N and longitudes 31^0 15^-–32^0 00^- E (Figure 1). The water resources comprise surface and ground waters.

Study participants

Participants came from ten with different locations in the Dakahlia region (Figure 1), obtain the medical history from the patient and obtain a type through the respondent's relatives. These individuals were requesting into two groups:

Group 1: Patients' group of (50) individuals determined to have insecticides harming supported

Physical and clinical assessment and affirmed by lab examinations.

Group 2: Healthy group (control; 10) they were clinically free from insecticides harming and of similar age and sex as the patients' group.

Sampling and research technique

This research was conducting between two periods in 2020. Sixty blood samples (10 ml each) were collecting from all individuals, once agreed and before participating in this study. In addition, 60 faucet drinking water samples (500 ml each) from similar patients were collecting on two different dates; the pesticide applying to the farmland once in summer, so this season runs through the rainiest season in the autumn. To assess the spatial variety of pollution by the pesticides, surface water (seven areas, Table 1) the samples were collecting from homes of the patient's situation with few meters to agricultural fields. Likewise, In order to assess potential groundwater pollution, from water wells (three areas, Table 1) close to the drainage system.

For water samples, the study followed APHA [15] standard methods for assortment, preservation and inspection. Blood samples were analyzing plasma pseudo-cholinesterase level (Pche) by the spectrophotometer keep with Elman *et al.*, [16] and red blood cells acetyl cholinesterase activity (Ache) keep with Crane *et al.,* [17]. Determination of aspartate transaminase (AST) and alanine transaminase (ALT) were doing keep with Bruits and Ashwood [18]. The analysis of pesticides in blood and water samples was researching and tested within the Wiley library using gas chromatography-mass spectrometry. Calibration standards and control samples are prepared ready freshly every day. The study uses certified standard solutions of analytical grade chemicals for sample preparation and inspection. Privacy and confidentiality of sample's records and data were determined through the coding system

Statistical analysis

Coding, inputting and process the data on the computer developed SPSS program. The quantitative data was conferring as to mean ± standard deviation (SD), and therefore the qualitative data were presenting a number and a percentage. Data analysis is to determine important differences between applied mathematics groups. Results are considering as statistically significant if p-value ≤ 0.05.

3. Results

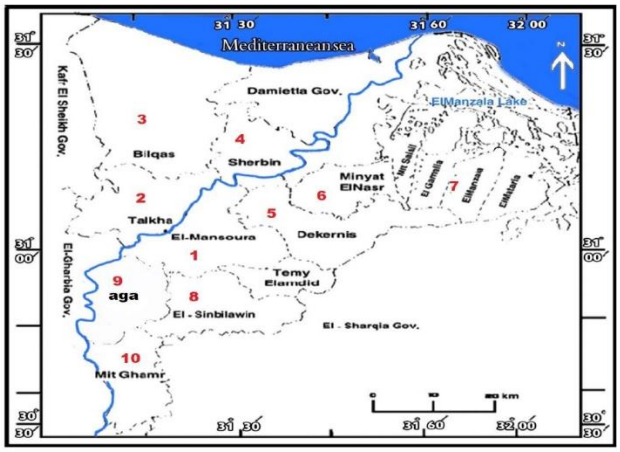


Figure 1: Location map

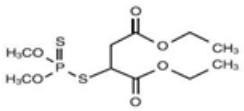
Table 1. Areas, water type and number of samples

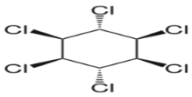
No	Areas	Group	Water type	No of water samples	No of blood samples
1	Mansoura			5	5
2	Talkha			5	5
3	Bilqas			5	5
4	Sherbin			5	5
5	Dekernis	Group I	Surface	5	5
6	Minyat el-nasr			5	5
7	El-Manzala			5	5
8	El-sinbillawin		Ground	5	5
9	Aga			5	5
10	Mit-ghamr			5	5
		Group II	Control	10	10
	Total			60	60

The drinking water and blood samples detected by GC-MS contained organophosphate (Malathion) and organochlorine (Lindane) insecticides.

Several pesticides will have an effect on the body's cholinesterase levels. It's necessary to monitor cholinesterase levels in a timely manner [19]. There was indirect correlation between the severity of poisoning and each of plasma pseudo-cholinesterase (Pche) levels and acetyl cholinesterase (Ache) activity percent. The cholinesterase enzyme showed highly significant decrease (P

< 0.001) in severe (26 %) poisoning compared to moderate (8 %) and mild (66 %) poisoning (Table 2). The activity was calculating from the activity value of the control participants and represented as a percentage. The actual enzyme activity was 9.18% in severe cases, 30.12% in moderate poisoning, and 47.52% in mild poisoning (Table 2). As for the degree of poisoning, the average AST level is exaggerated as the severity of the poisoning will increase. On the other hand, the mean ALT levels were near to the levels of the control group in mild and moderate poisoning cases. It absolutely was significantly higher in severe poisoning.





	Malathion	Lindane
Chemical formula	$C_{10}H_{19}O_6PS_2$	$C_6H_6Cl_6$
Molar mass	330.358021	290.83 g/mol

Group	Control group	Patients group (50)			
Parameter	1900 - 3800 U/l n =10	Mild > 1000 U/l n =33 (66 %)	Moderate 1000 - 500 U/l n = 4 (8 %)	Severe < 500 U/l n =13 (26 %)	P Value
Pche Mean ± S.D*	2545.2 ± 477.3	1209.5 ± 245.6	766.8 ± 97.7	233.6 ± 39.5	P < 0.001
Ache Actual enzyme activity %	100 %	47.52 %	30.12 %	9.18 %	P < 0.001
AST (U/L)	25.8 ± 8.7	40.5 ± 1.5	44.4 ± 3.8	67.9 ± 2.2	
ALT (U/L)	23.9 ± 7.3	41.1 ± 2.7	45.7 ± 2.4	59.9 ± 5.9	

S.D*: Standard Deviation ; (Note: the average control value = 2545.2)
AST: normal up to 40 units / ml;ALT: normal up to 45 units / ml; P is significant if ≤ 0.05

highly

4. Discussion

Our research spots the light on the problem of insecticides toxicity among a cohort of inhabitants. Although pesticides are widely used in the agricultural sector, the use of pesticides in cities that are mainly used for indoor gardening to control pests is an important source of pesticide pollution in water [4]. The hospital records of the degree of poisoning supported throughout the study could underestimate the full impact of the poisoning. The drinking water and blood samples detected by GC-MS contained organophosphate (malathion) and organochlorine (lindane) insecticides. The study has shown that agricultural, urban and industrial activities have led to the deterioration of the water quality. This issue explained the clinically variant degree of severity among the poisoned patients that's confirming by cholinesterase enzyme assays. Acetyl-cholinesterase is an enzyme necessary for the conventional functioning of the nervous system of humans, different vertebrates, birds and insects. When cholinesterase levels reduced due to excessive inhibition, the nervous system malfunctions, are leading to death [19]. This may imply that the degree of poisoning fluctuates by country, depending on the standard of life, the circumstances of poisoning, and along these lines the amount of pesticides utilized. The distribution of a series of pesticides in rivers and groundwater depends to a large extent on the characteristics of the land use environment and hydrological system and considers the use of pesticides in the past and present. The most commonly detected pesticides in streams and groundwater are those that the most used and have the compound characteristics of high mobility and persistence in hydrological systems [9]. Ghanem *et al.,* [20] detailed that the concentration of pesticides in groundwater in Jenin was finding to be on the far side those in Tulkarem. The contamination of the tested wells was because of insecticides and not due to effluent disposal, since most of the samples were free from infective indicators. The results showed that using these wells for potable purposes had a potentially high health risk. The potable polluted water wells were because of the uncontrolled industrial and agricultural activity, and because the lack of monitoring of potable water treatment potency. Legislative measures to restrict harmful pesticides may be useful for low- and middle-income countries [21]. This is mainly due to uncontrolled industrial and agricultural activities and lack of monitoring of the effectiveness of drinking water treatment. The strategy of reducing the use of insecticides does not help us protect human health, because there are so many types of pesticides on the market. In this case, people need to turn to ecological agriculture [22]. In environmental correction, chemical removal from potable water is additionally an important concern [23, 24]. Rai *et al*., [25] revealed that acetic acid communicated a powerful perspective towards removal of pesticide residue and that sodium carbonate displayed a great deal of decreases power. The organophosphates were decomposed more quickly and the lowest reduction in organochlorines was recorded.

Malathion

It's one altogether the foremost commonly used organophosphates in many countries in conjunction with Egypt [26]. It acts as a Para fermentation alcohol-based enzyme substance, causing nerve and process damage, which may lead to death [27].

Lindane

Its associate organochlorine chemical variant of hexachlorocyclohexane that has been used each as associate of agricultural pesticide, and as a pharmaceutical treatment for lice and infection [28]. In 2015, the International Agency for Research on Cancer listed Lindane as a well-known human carcinogen [29]. It affects the nervous system, liver, and kidneys, and may otherwise to be a carcinogen [30]. These findings indicated that although degree in Egyptian Ministerial Decree prohibited the import and use of organochlorine in 1996. Several cytotoxic pesticides are still used illicitly, and exposure to those compounds is inevitable [31, 32].

5. Conclusion

Our study assessed the presence of insecticides in water used for drinking and other domestic purposes. Presence of the partner of organophosphate and organochlorine insecticides in water and blood tests designated to their genuine impacts on human wellbeing and aquatic life. The effect magnitude depends on the solubility, adsorption capacity, and biodegradability of the pesticide compounds. Pesticide users are recommended to exchange the utilization of synthetic pesticides with bio-pesticide that exert a lesser environmental impact and also to make sure the right application of pesticides within the agricultural system. As for safety measures, the water bodies during which pesticide compounds are detected should undergo constant monitoring and potable water should undergo advanced water treatment processes if required. Evaluation of pesticide residue management, pesticide fate and application technology will help reduce the adverse health effects of pesticides and their substitutes. Strict social control shall be imposed on the supervision departments for abnormal use of pesticides. There's need of typified medical protection for people who get straightforwardly uncovered or unintentionally on serious of the polluted water.

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No conflict of Interests

Compliance with Ethical Standards

Each participant was clarified before enrolling in this study. Privacy and confidentiality were ensured all through the research work conduction

Author contributions: I have accepted responsibility for the entire content of this manuscript and approved its submission.

Data Availability Statement: All data are within the manuscript

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