The Effect of Drinking Water Quality on Some Hematological Parameters In Female Laboratory Mice

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Abstract

The present study was designed to determine the effect of two sources of drinking water on some hematological parameters in female laboratory mice The animals were divided into three groups: First group (control) it given a physiological solution, Second group: the RO water was given and third group: the river water was given.

Results: the results of the study showed a significant increase($p \leq 0.05$) in the erythrocyte, leukocytes count, percentage of lymphocytes and granular cells ,significant decrease in Hb concentration and PCV percentage in the second and third group when compared with the control group. while mean corpuscular volume insignificantly decrease in the second group and significantly increased in third group. Results also showed a significant increase in platelet count and monocytes percentage in the second group while it decreased in the third group.

Conclusion: we conclude from this study that the water source and its quality have a significant effect on the blood parameters of laboratory animals, and then influence on the animal's health.

Keywords : *Mice; Water; Hematological; RO; Pollution; Rivers .*

Introduction

Water is the nerve of life and an important resource for humans, as it constitutes a large percentage of the content of the cell's living matter in all organisms and a medium for biological reactions, as well as for this it contains many salts ions that causes the survive and continuation of organism in life [(1)].

As a result of water pollution, hundreds of millions of people around the world do not have access to an adequate supply of safe drinking water besides poor sanitation and hygiene, and polluted water causes the death of nearly 3.4 million cases annually, most of them are children and more than one billion people are still not they have access to good water sources despite the continuous efforts of governments, civil societies and the international community [(2)]

Consumption of water from poor sources along with the use of untreated water in agriculture is responsible for many disorders such as health damage to humans such as increased cases of diarrhea, for example Dokan river was the potential source of cholera outbreak in Sulaymaniyah (266 cases) and Kirkuk (160 confirmed cases) in October 2012 and is an example of the health risk of river water pollution as sources of drinking [(3)].

Monitoring and protecting water quality is an important issue, and the physical, chemical and biological characteristics of river water are important for assessing the effects that cause river water quality to deteriorate, and studying it is essential to water quality and reducing the effects of degradation [(4)].

Reverse osmosis water (RO) is a water purification process that uses a partially permeable membrane to remove unwanted molecules, ions from drinking water. In RO, an applied pressure is used for overcome osmotic pressuring a colligative property that is driven by chemical potential differences of the solvent, a thermodynamic parameter. RO can remove many types of suspended and dissolved chemical species as well as biological types (mainly bacteria) from water and is used in both industrial processes and the production of potable

water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be selective, this membrane should not allow ions or large molecules through the holes, but should allow smaller components of the solution (such as H_2O) to pass freely[5].

Material and method

Animals preparation

Eighteen healthy 10-12 weeks old female albino mice and weighing 22-25g were obtained from Thi-Qar University/College of Science. Mice were placed in a controlled temperature room (23-25) c° under a 12hour dark-12hour light cycle.

Samples of water

Water samples were collected from the Euphrates river in Nasiriyah / Dhi-Qar Governorate (the area located in front of the College of Education for Pure Science . Physical, chemical and biological characteristic were evaluated which have importance in determining the validity of the water whether it is river water or drinking water [6] as shown in table (1).

Table .1. Shows percentages of water components for all groups

P	K	Ca	Mg	Cl	pH	ES	TDS	E.coli	Resources of water
Nill	5.6	44	24	390	8	0.0	0.0	Nill	RO
0.03	13.37	52.3	35.6	118	5.92	0.43	336	50	River water

Study design: The mice were assigned into three group (each group contain 6 females):

1--First group (control group) : It was given normal saline 0.9% NaCl.

2- Second group : It was given drinking good water (RO) for a two-month experimental period.

3-Third group : It was given river water for a two-month experimental period.

Hematological assay

After the end of experimental period, the mice were anaesthetized and blood was drawn directly from the heart by cardiac puncture. The hematological tests were done by using Genux Auto Hematology Analyzer where the results read and printed automatically.

Statistical Analysis

The data were analyzed by using Duncan test to determine mean and standard deviation, $p \leq 0.05$ was considered as significant in this study [7 ; 8] .

Results and discussion

The effect of drinking water quality on some hematological parameter (RBC, Hb, PCV and MCV)

The results showed a significant increase ($p \leq 0.05$) in the count of red blood cells (RBCs) in the second and third group when compared with the control group and the results also showed a significant increase in the third group when compared with the second group.

The results also showed a significant decrease ($p \leq 0.05$) in the concentration of hemoglobin in the second group while it was significant increase in the third group compared with the control group, as is the case for achieving a significant increase in the third group when compared with the second group.

The results showed a significant decrease ($p \leq 0.05$) in the packed cell volume(PCV) in the second and third group compared with the control group. The results also showed a significant increase in the third group when

compared with the second group .

The results showed anon significant decrease in mean corpuscular volume(MCV) in the second group and significant increase in third group compared with the control group. The results also showed a significant increase in the third group when compared with the second group as shown in table (2).

Table .2. The effect of drinking water quality on some hematological parameter (RBC, Hb, PCV and MCV), N =(6) (mean ± standard deviation)

Groups	(RBC× 10^5/mm^3)	(Hb – g/dL)	(PCV%)	MCV (fL)
First group (control)	81.01 ± 1.1 a	12.8 ±1.3 a	44.6± 1.5 a	46.9 ±1.15 a
Second group	88.06 ± 2.82 b	11.9± .89 b	40.7±1.35 b	46.6 ± .74a
Third group	95.04 ± 1.23 c	14.5±1.17 c	44.2±.82	47.3 ±1.15 b

Differences of letters indicate differences of significant at(P≤0.05)

The reason for this increase in the count of red blood cells may be due to the influence of bacteria and parasites where these organisms affect the bone marrow, (especially in the reddening colonies) which is the site of the formation of red blood cells or the reason for this increase is the direct effect of these organisms on the cell divisions that generate red cells as they differentiate into erythrocytes[9]

Erythropoietin which is excreted from the kidneys as a result of a decrease in the percentage of oxygen supply to the body's cells, controls the formation of erythrocytes in the bone marrow by stimulating the production of red blood cells and its role in preserving the red ancestors from programmed cell death and stimulating them to grow and divide until the formation of reticulocytes which develops into mature red blood cells. The secretion of this hormone weakens a lot when the kidneys get sick, as bacteria may secrete toxins that affect kidney [10] Therefore, the increase in the number of red blood cells may be due to the effect of bacteria on erythropoietin through two side, either affecting the site of its secretion or affecting the way it affects, while the first side may be the result of the effect of toxins of organisms on the kidneys where the site of the secretion of this hormone, and the other side of the effect on the mechanism of action of erythropoietin may be a result of the influence of germs on the sensitivity of the target cells to erythropoietin, thus losing its effectiveness and the degree of its effect in those cells.

The effect of drinking water quality on some hematological parameter (WBC, Lymphocytes. Monocytes, granular cells and PLT)

The results showed a significant increase (p≤0.05) in the count of white blood cells in the second and third group when compared with the control group and the results also showed a significant increase in the third group when compared with the second group.

The results showed a significant increase (p≤0.05) in the percentage of lymphocytes in the second and third group when compared with the control group and the results also showed a significant increase in the third group when compared with the second group.

The results showed a significant increase (p≤0.05) in the percentage of monocytes in the second group while it decreased significantly in the third group compared to the control group and the results also showed a significant decrease in the third group when compared with the second group.

The results showed a significant increase (p≤0.05) in the percentage of granular cells in the second and third groups when compared with the control group and the results also showed a significant decrease in the third group when compared with the second group.

The results showed a significant increase (p≤0.05) in the count of platelets in the second group while it decreased significantly in the third group compared with the control group and the results also showed a significant decrease in the third group when compared with the second group as shown in table (3) .

Table .3.the effect of drinking water quality on some hematological parameter (WBC, Lymphocytes. Monocytes, Eosinophil and PLT), N =(6) (mean ± standard deviation)

Group	×103/mm3) WBC	Lymphocyte %	Monocyte %	Eosinophil %	PLT
First group (control)	3.90± .56 a	55.60 ±1.08a	5 ±.12a	6.60±.54 a	241±3.8 a
Second group	5.4±.53 b	77.29±.66b	13.15±.57 b	9.40±.35b	690.2±7.91 b
Third group	6.52±.41 c	89.01± .25 c	2.6±.30c	8.57±.36 c	229.49±1.06c

Differences of letters indicate differences of significant at(P≤0.05)

As for the increase of white blood cells in general and lymphocytes in particular in the blood of the second group, this increase may be a natural reaction to the threat represented by the entry of foreign bodies such as bacteria and parasites found in drinking water which was previously mentioned to prove their presence in such a type of water as it represents white cells are the main pillar of the immune system and the first to respond to combat any threat especially biological threats represented by this type of organism. .

It is noted from the increase in the total count of white cells the difference of immune responses against such a type of threat, as the increase of lymphocytes becomes clear that there is a large activity in the production of antibodies by this type of cell or the increase in the numbers of killer lymphocytes while the increase in other cells, such as mono and neutral is Evidence of increased ingestion by this cell type against the bacterial species present in the water

It has been observed from the results of the study that most of the increase is due to the count of lymphocytes and consequently an increase in their percentage compared to granular and monocytes which is observed to decrease in percentage [(11).]

The count of white blood cells may remain within the normal range or there may be an increase in parasitic infection [(12).]

(13) reported an increase in the count of WBC to more than 10,000 cells / mm 3 in 11 patients out of 15 pinworm infections.

As for the reason for the decrease in the monocytes it may be due to the effect of toxins as some types of bacteria secrete a toxin called beta which analyzes the leukocytes, as well as the secretion of a toxin called kama, which causes the release of lysosome enzymes in the neutrophils. It leads to an increase in exudation by pumping the sodium element and thus an increase in

the flow of potassium ion. There are toxins that work to prevent the process of phagocytosis by phagocytosis, as well as remove the granules and consequently their angular death [10].

The results of the current study showed a decrease in the count of platelets in the blood of the third group when compared with the control group Platelets like other solid blood components result from the divisions, growth, and development of Megakaryocytes in the bone marrow under stimulation of the thrompoietin secreted by the liver which plays a major role in stimulating, multiplying and maturing those cells to form platelets (14) so low levels of thrombocytopenia may be caused by the presence of water-presenting organisms on the secretion of this hormone by decreasing its secretion as a result of the effect on the cells secreting it.

The results of the current study were in agreement with the results of a study[15] that showed an increase in the number of white blood cells while it was not consistent with them in the results of red blood cells which decreased in this study.

Conclusion

We conclude from this study that the water source and its quality have a significant effect on the blood parameters of laboratory animals, and then influence on the animal's health.

Financial Disclosure : There is no financial disclosure

Conflict of Interest : None to declare

Ethical Clearance : all experimental protocol were approved under university of Thi-Qar collage of education for pure sciences , biology department and all experimental carried out accordance with approved guidelines .

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