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For Patients with Celiac Disease: Pay Attention to Polluted Seafood

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Abstract Chemical pollution of water is the contamination of water by foreign matter that deteriorates the quality of the water. Pollution of water by heavy metals are dangerous because they tend to cause Bioaccumulation that means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Chemical pollution of Manzala lake was studied in 4 main localities, Kapoty, Bashtier, Mataryia and Gamil areas which receives high load of sewage, agricultural and industrial wastes from different sources. Heavy metals, such as Zn, Pb, Cd and Hg were estimated in water and fish samples, to reveal high pollution of lake Manzala with such toxic elements, where Zn, reached 800µg/L. Pb,195 µg/L. Cd 45 µg/L and. Hg, 5000 µg/L in water samples.

Keywords: *chemical pollution, heavy metals, water, Manzala lake*

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1. Introduction

Lake Manzala is a shallow costal lake that consisting of thirty basins with depths ranging from 0.7 to 3m in depth, the deepest areas resting in the navigation canal [1,2].

Creation of canals and drains such as the Bahr El-Bakar drain, the Sirw drain, the Ramsis drain and the Hadous drain has created a eutrophic condition and low salinity levels in the lake. The areas around the drain outlets in the south and west are characterized by brackish water and the areas in the northeast, near the sea outlets, are saline [1,3].

Although the lake is still considered as the largest of the Egyptian Delta Lakes, its area has been gradually decreased. Extensive land reclamation during the last century has reduced the lake surface area to less than half of its original size. In the 1900's, its area was estimated at 1,709.4 km2. By the end of the previous century, the area of the lake was estimated to be 1000 km2. The area of the open water is only 742.8 km2 due to the presence of a large number of islets in the lake. During the last decade, the reclamation is progressing at an accelerating pace where land had subsequently been created and islands enlarged [1,4].

Sources of heavy metals can be represented as follows [5].

Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy, and multiple sclerosis. Allergies are not uncommon and repeated long-term contact with some metals or their compounds may even cause cancer [5].

Table 1. The Sources of heavy metals

Heavy Metal	Sources
Chromium (Cr)	Mining, industrial coolants, chromium salts manufacturing, leather tanning
Lead (Pb)	lead acid batteries, paints, E-waste, Smelting operations, coal- based thermal power plants, ceramics, bangle industry
Mercury (Hg)	Chlor-alkali plants, thermal power plants, fluorescent lamps, hospital waste (damaged thermometers, barometers, sphygmomanometers), electrical appliances etc.
Arsenic (As)	Geogenic/natural processes, smelting operations, thermal power plants, fuel
Copper (Cu)	Mining, electroplating, smelting operations
Nickel (Ni)	Smelting operations, thermal power plants, battery industry
Cadmium (Cd)	Zinc smelting, waste batteries, e-waste, paint sludge, incinerations & fuel combustion
Zinc (Zn)	Smelting, electroplating

2. Materials and Methods

Water samples were taken from Kapoty, Bashtier , Mataryia and Gamil outlet areas. The selected sites are host to significant populations around the lake and receive various types of pollutants which negatively affect the condition of the lake and human health.

2.1. Sampling Sites

El-Kapoty Area Samples were taken from the end of the junction canal, which connects the Suez Canal with Lake Manzala; the main source of pollution in this area comes from the city of Port-Said. Effluents such as sewage water and industrial wastes from multiple factories are disposed of in this area of the Lake. This site is close to El-Kapoty village, a fishing village in Port-Said, where they dispose of raw sewage directly into the Lake water. El-Bashtier Area is considered a midpoint between the El-Kapoty and the Mataryia areas; it receives water currents from different directions resulting in high water levels. The depth reaches three meters and is part of the navigation canal. The area has many islets which are inhabited by people who work in fishing and raise animals, El-Mataryia area is considered the fresh-water part of the Manzala Lake; however, it receives high amounts of different types of pollutants. Untreated sewage from the El Dakahlyia governorate empties here as well as 6 million m3/ day of industrial and agricultural waste from the El-Siwr, Hadous, Ramsis and Bahr El-Bakar drains. The drains empty into the El Genka reservoir, a part of the lake that is characterized by vast vegetation composed of reeds and other aquatic plants like the water hyacinth, this area is particularly important for fishing, especially the fishing of Tilapia spp. Gamil outlet is considered the adjoining part of the lake with seawater coming from Mediterranean sea (Figure 1).

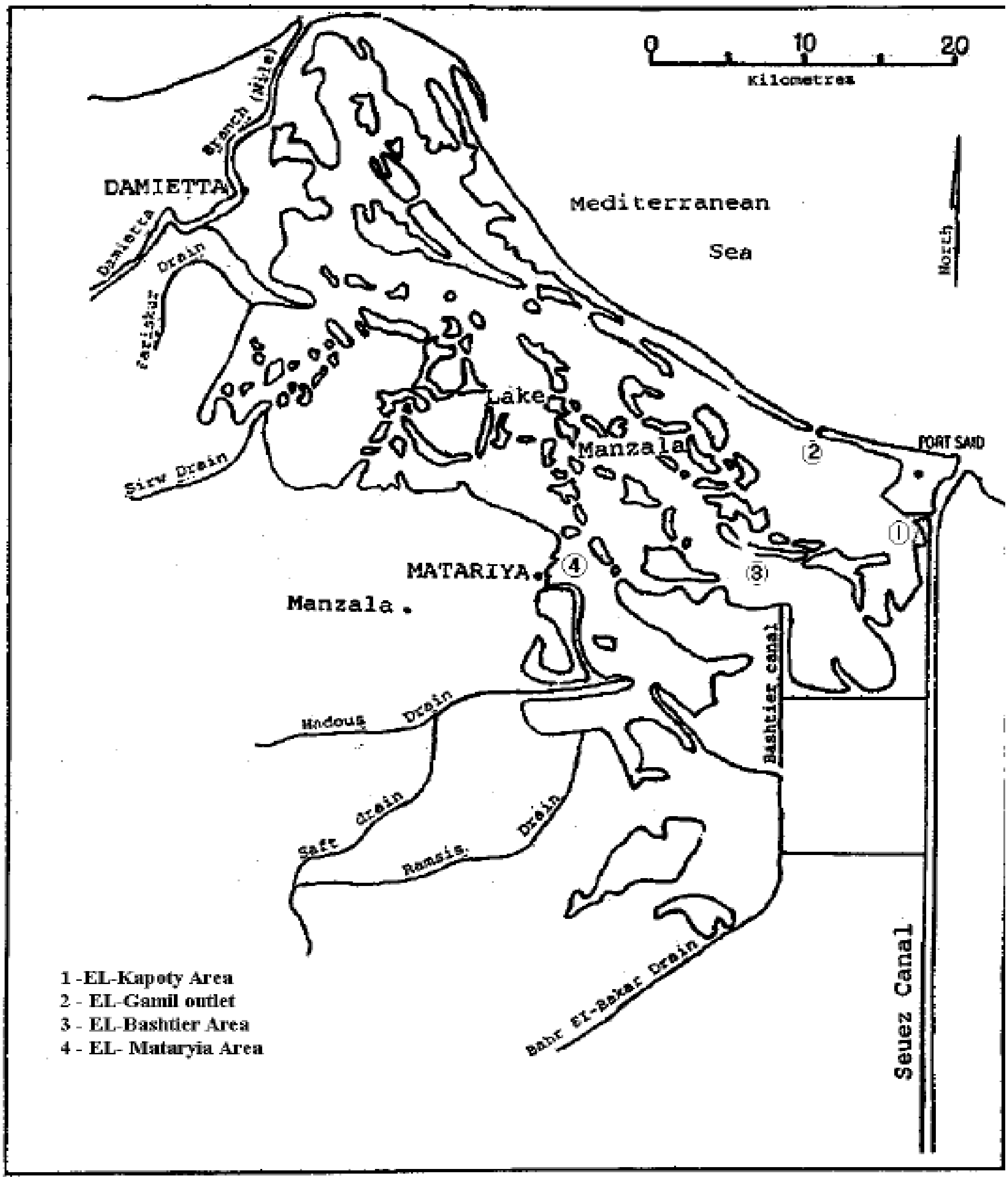

Figure 1. Map of Lake Manzala, showing the three different sampling sites and their respective sources of pollution

2.2. Sampling Methods

Water samples from each site were taken in clean sterile one liter glass bottles and transported from the lake to the laboratory within six hours. The bottles were kept in ice bags and ice jackets for direct examination.

2.3. Physicochemical Characteristics of Water Samples

Physicochemical characteristic of each water sample were evaluated in the field. The temperature of the water samples was determined by using a mercury thermometer. The pH values were determined using a recombination of a pH electrode (Eil Series 1180) and a pH meter (Eill, Model 7030), which was calibrated against pH 4, 7 and 9 buffers. The levels of dissolved oxygen in the water samples were determined using the Oxygen Meter model YSI 58. The chemical analysis to determine the total suspended solids (TSS), ammonia, nitrates, Sulphates, Alkalinity, calcium, magnesium and chloride levels were done using the recommended standard methods of water analysis(mg/L) [6].

2.4. Heavy Metal Analysis

Heavy metals i.e. Lead, Mercury, Cadmium and Zinc were determined by Atomic Absorption Spectrophotometry.

3. Results

Table 2 shows the physicochemical parameters of El-Kapoty area. The temperature ranged between 17 and 30. The pH of the water was found to be slightly alkaline throughout the year with a range of 7.5 to 8.17. Salinity was ranged between 16 to 29. Dissolved oxygen (DO) was ranged between 3.13 to 6.19 mg/l. Total suspended solids (TSS) was ranged between 75 to 180 mg/l. Total dissolved solid (TDS) was ranged between 8240 to 31406 mg/l. Ammonia concentration was ranged between 0.91 to 44.8 mg/l. Nitrate concentration was ranged between 1.05 to 8.96 mg/l.

Table 2. Physico-chemical parameters in El-Kapoty area

Parameters	Autumn	Winter	Spring	Summer	Mean	SD
Temperature(°C)	17	13	28	30	22	8.3
pH	8.17	7.6	7.5	7.53	7.7	0.3
Salinity	16	13	21	29	19.75	7
DO (mg/l)	5.7	2.25	6.19	3.13	4.3175	1.9
TSS (mg/l)	75	110	145	180	127.5	45.2
TDS (mg/l)	8240	14040	22723	31406	19102	10134.2
Ammonia (mg/l)	44.8	0.42	0.91	1.4	11.8825	21.9
Nitrate (mg/l)	8.96	1.05	1.2	1.4	3.1525	3.9

SD standard deviation of the sample.

Table 3. Physico-chemical parameters in El-Gamil outlet.

Parameters	Autumn	Winter	Spring	Summer	Mean	SD
Temperature(°C)	19	20	24	29	23	4.5
pH	8.42	7.52	7.6	7.65	7.8	0.4
Salinity	9	25	25	25	21.0	8.0
DO (mg/l)	6.1	5.35	4.9	4.45	5.2	0.7
TSS (mg/l)	81	350	259	168	214.5	115.9
TDS (mg/l)	6418	33480	28976	24472	23336.5	11863.4
Ammonia (mg/l)	0	2.5	1.53	0.56	1.1	1.1
Nitrate (mg/l)	0	0	0	0	0	0

SD standard deviation of the sample.

Table 4. Physico-chemical parameters in El-Bashtier area

Parameters	Autumn	Winter	Spring	Summer	Mean	SD
Temperature(°C)	16.5	15	23	31	21.375	7.30
pH	7.91	7.8	7.6	7.44	7.6875	0.21
Salinity	8	5	8.5	12	8.375	2.87
DO (mg/l)	5.2	4.85	4.88	4.91	4.96	0.16
TSS (mg/l)	19	80	64	49	53	25.96
TDS (mg/l)	3653	11980	13290	14600	10880.8	4935.79
Ammonia (mg/l)	4.76	4.2	2.9	1.46	3.33	1.47
Nitrate (mg/l)	0	0.17	0.085	0	0.06375	0.08

SD standard deviation of the sample.

Table 5. Physico-chemical parameters in El-Mataryia area

Parameters	Autumn	Winter	Spring	Summer	Mean	SD
Temperature(°C)	17	15	22	30	21	6.68
pH	7.72	7.59	7.7	7.85	7.715	0.11
Salinity	5	3.5	4	5	4.375	0.75
DO (mg/l)	3.9	8.45	6.74	5.04	6.0325	1.99
TSS (mg/l)	40	60	45	30	43.75	12.50
TDS (mg/l)	1578	3800	3747	3694	3204.75	1085.36
Ammonia (mg/l)	4.2	4.48	2.24	0	2.73	2.07
Nitrate (mg/l)	4.2	2.1	1.05	0	1.8375	1.79

SD standard deviation of the sample.

Table 6. Seasonal variation of different heavy metals in water samples of different sites of Manzala Lake

		Kapoty	El-Gamil	Bashtier	Mataryia
	Spring	1700	500	300	350
	Summer	600	700	750	850
Zn (µg/L)	Autumn	250	300	350	550
	Winter	400	800	450	300
	Spring	195	145	90	90
	Summer	195	195	145	110
Pb (µg/L)	Autumn	145	145	145	110
	Winter	50	110	125	80
	Spring	18	26	5	9
	Summer	44	18	22	9
Cd (µg/L)	Autumn	26	26	18	14
	Winter	9	5	18	14
	Spring	2000	2000	700	700
	Summer	5000	2000	1400	1400
Hg (µg/L)	Autumn	2800	2000	1400	1400
	Winter	700	700	1400	700

Table 3 shows the physicochemical parameters of El-Gamil outlet. The temperature ranged between 19 and 29. The pH of the water was found to be slightly alkaline throughout the year with the range of 7.52 to 8.42. Salinity was ranged between 9 to 25. Dissolved oxygen (DO) was ranged from 4.45 to 6.1 mg/l. Total suspended solids (TSS) was ranged between 81 to 350 mg/l. Total dissolved solid (TDS) was ranged between 6418 to 33480 mg/l. Ammonia concentration was ranged between 0 to 2.5 mg/l. Nitrate concentration was 0 mg/l throughout the year.

Table 4 shows the physicochemical parameters of El-Bashtier area. The temperature ranged between 15 and 31. The pH of the water was found to be slightly alkaline throughout the year with a range of 7.4 to 8.91. Salinity was ranged between 5 to 12. Dissolved oxygen (DO) was ranged between 4.85 to 5.2 mg/l. Total suspended solids (TSS) was ranged from 19 to 80 mg/l. Total dissolved solid (TDS) was ranged between 3653 to 14600 mg/l. Ammonia concentration was ranged between 1.46 to 4.76 mg/l. Nitrate concentration was ranged between 0 to 0.17 mg/l

Table 5 shows the physicochemical parameters of El-Mataryia area. The temperature ranged between 15 and 30. The pH of water was found to be slightly alkaline throughout the year with a range of 7.59 to 7.85. Salinity was ranged between 4 to 5. Dissolved oxygen (DO) was ranged between 3.9 to 8.45 mg/l. Total suspended solids (TSS) was ranged between 30 to 60 mg/l. Total dissolved solid (TDS) was ranged between 1578 to 3800 mg/l. Ammonia concentration was ranged between 0 to 4.48 mg/l. Nitrate concentration was ranged between 0 to 4.2 mg/l.

Table 6 shows the Heavy metal concentration by µg/L; in Kapoty area, zinc (Zn) was ranged between 400 to 1700, lead (Pb) was ranged between 50 to 195, Cadmium (Cd) was ranged between 9 to 44, Mercury(Hg) was ranged between 700 to 5000. In El-Gamil outlet, zinc (Zn) was ranged between 300 to 800, lead (Pb) was ranged between 110 to 195, Cadmium (Cd) was ranged between 5 to 26, Mercury (Hg) was ranged between 700 to 2000. In Bashtier area, zinc (Zn) was ranged between 300 to 750, lead (Pb) was ranged between 90 to 145, Cadmium (Cd) was ranged between 5 to 22, Mercury (Hg) was ranged between 700 to 1400. Finally in Mataryia area, zinc (Zn) was ranged between 300 to 850, lead (Pb) was ranged between 80 to 110, Cadmium (Cd) was ranged between 9 to 14, Mercury (Hg) was ranged between 700 to 1400.

4. Discussion

Lake of Manzala is considered one of the most polluted lakes in the northern coast of Egypt, due to a high load of pollutants from different sources. This in line with the data obtained in this study where physic-chemical analysis of water samples exceeds the limits of national and international legislations.

The physic-chemical analysis of water in Manzala Lake in this study such as temperature, total dissolved solid (TDS), pH, salinity, dissolved oxygen (DO) was agreed with study of Physicochemical Properties of Manzala Lake that done by [7] in Manazala lake

Increasing the levels of heavy metals in Manzala Lake in this study is in line with the data obtained by [8] who study heavy metal residues in some fishes from Manzala Lake and approved that there is high levels of heavy metals in fish.

Some metals in some areas have maximum values during summer and the lowest level in winter as mercury in kapoty, El-Gamil, Mataryia but not all metals agree with this rule as zinc in kapoty and this in contrast with [9] who study the assessment of heavy metals concentrations in water, plankton and fish of Lake Manzala and approved that all metals attained their maximum values during summer, while the lowest level in winter.

The high levels of toxic metals in Lake of Manzala especially in the east northern cost could be because of the increasing volume of industrial complexes in port-said Governorate. This metal pollution negatively affects the marine life directly and human being indirectly through the assimilation of polluted seafood.

References

[1] MacLaren Engineers, Planners and Scientists Incorporated, Thorne, Stevenson and Kellogg, Atkins Land and Water Management and Egyptian Technical Consulting Office. 1982. Volume 1: Summary and Policy Recommendations. Lake Manzala Study. Prepared for the Arab Republic of Egypt and UNDP. Report EGY/76/001-07.

[2] Zaky, M. M. (2004). Study on the microbial pollution and molecular biology of some pathogenic Yersinia species in Lake Manzala. Ph.D. Thesis, Faculty of Science, Mansoura University, Mansoura, Egypt.

[3] Zaky, M.M., (2006). Environmental factors influencing multi-drug resistant and harboring plasmid DNA Aeromonas hydrophila isolated from polluted water of Lake Manzala, Egypt. Proceedings of the 19th Iaps International Conference on Environment, Health and Sustainable Development, Sept. 11-16, Alexandria, Egypt, pp: 159-160.

[4] Zaky, M. M. M. 1994. Microbiological and toxicological study of the environmental pollution of Lake Manzala. M.Sc. Thesis. Faculty of Science, Suez Canal University, Ismailia, Egypt. 108 pp.

[5] Verma R and Dwivedi P (2013): Heavy metal water pollution- A case study. Recent Research in Science and Technology 2013, 5(5): 98-99.

[6] APHA, (1995). Standard Methods for Examination of Water and Waste-Water, 19th Edn., American Public Health Association, Washington, ISBN: 0-8755-131-8.

[7] Elmorsi R Randa, Hamed A. Mohamed and Abou-El-Sherbini S. Khaled. (2017): Physicochemical Properties of Manzala Lake, Egypt. Egypt. J. Chem. Vol. 60, No. 4, pp. 519-535.

[8] Sallam K.I, Abd-Elghany S.M, Mohammed M.A. (2019). Heavy Metal Residues in Some Fishes from Manzala Lake, Egypt, and Their Health Risk Assessment. Toxicology & Chemical Food Safety. Vol. 84, Iss. 7, pp . 1957-1965.

[9] Bahnasawy M.H, Khidr A.A, Dheina N.A. (2009): Assessment of heavy metals concentrations in water, plankton and fish of Lake Manzala, Egypt. Egypt J. Aquat. Biol. & Fish., Vol. 13, No. 2: 117-133