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Effect of some Physic-Chemical Parameters of Water on Macro Minerals Composition of Nile Tilapia (*Oreochromis niloticus*) Cultured in Different Environments

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Abstract

The study was conducted to evaluate minerals composition of Nile tilapia (*Oreochromis niloticus*) in wild environment (general Nile) compared with aquaculture environment, specifically in different types of ponds (concrete, polyethylene and earthen Ponds) in fish farms in Khartoum State. Also this work intended to determine and compare some physic-chemical parameters of water in the studied fish environment. Moreover, the study was conducted to compare some parameters according to source of water (Nile or wells). A total of 388 samples of Nile tilapia were collected from River Nile and governmental and private fish farms around Khartoum State and the samples were subjected to mineral analysis (Na, K, Ca, Fe, and P). Water samples were collected for water quality parameters (unionized ammonia NO_3^{-1}, sulphide H_2S, temperature ºC, and pH). The findings of this study revealed that, *Oreochromis niloticus* from Nile environment has higher level of Na, K and P than from ponds and there was highly significant difference ($P \leq 0.01$), but there was no significant difference ($P > 0.05$) for Ca and Fe. Fourty eight water samples were collected from River Nile and governmental and private fish farms around Khartoum State and subjected to physic-chemical analysis. There was a highly significant difference ($P \leq 0.01$) in all water quality parameters according to rearing site. However, when study Nile river water and wells water, H_2S, temperature and pH showed no significant difference ($P > 0.05$), while unionized ammonia showed significant difference ($P \leq 0.05$). Accordingly, the study concluded that Nile river water has a high water quality than other sources of water, also, River Nile aquaculture environment is an immediate environment in relation to ponds environment. The study recommended that more investigation in aquaculture and water quality parameters will provide knowledge and improve fish production.

Keywords: *Oreochromis niloticus, Macro-minerals, freshwater*

Introduction

Fish has an important role in food security and poverty alleviation in both rural and urban areas of Sudan **(Waterman, 2000).** However, a little is known about the nutritional value of the Nile fish that are normally utilized either fresh or preserved dried, salted or smoked **(Waterman, 2000).** The intensive farming of tilapia, *Oreochromis sp*. is rapidly expanding and tilapias (including all species) are the second most widely farmed fish in the world with annual production exceeding two million tons in 2005 (FAO, 2007a,b). Water quality is one of the most critical factors besides good feed/feeding in fish production. For a successful aquaculture venture, the dynamics and management of water quality in culture media must be taken into consideration

Mohamed *et al*., (2009). Tilapia can survive at pH ranging from 5 to 10 but they do best at a pH range from 6 to 9 Mohamed *et al*., (2009). Mohamed *et al*., (2009) pointed-out that, Ammonia and Nitrite are a concern in aquaculture systems and should be monitored regularly. Ammonia production is directly related to feeding and depends on the quality of feed, feeding rate, fish size and temperature (Riche and Garling, 2003). The study of mineral elements present in living organisms is of biological importance; since many of such elements take part in some metabolic processes and are known to be indispensable to all living things (Shul'man, 1974). The most important mineral salts are that of calcium, sodium, potassium, phosphorous, iron, chlorine while many others are also needed in trace amounts **(Shul'man, 1974)**.

The objective of this study was to investigate the effect of water quality parameters (physic-chemical parameters) on Nile tilapia environments (general nile and fish ponds) in Khartoum State.

Materials and Methods

Area of study

In the present investigation, four sampling sites were selected in Nile River and Khartoum State fish farms. For easy interpretation of results, samples were analyzed depending on general experimental strategy as follows: The similarities and differences in macro-minerals characteristics of Nile tilapia (*Oreochromis niloticus*) were investigated among: wild fish, concrete fish ponds, polyethylene fish ponds and earthen fish ponds via laboratory analysis through this study. Physic-chemical characteristics of water were compared among Nile river water and ponds fish farms water in Khartoum State. Source of water for the fish farms where: surface and groundwater (well water, or spring water). The similarities and differences between sources of water also were compared.

Experimental design

The study was carried out in four areas identified as treatments at Khartoum State: Treatment (1) wild tilapia fish was carried-out using four areas for sampling in Nile river where fish were captured; Treatment (2) concrete ponds culture tilapia fish was carried out using four farms for sampling, feed types: sunken, manufactured normally by local feed plant and protein levels is ranged from 25 – 27%, water source is Nile; Treatment (3) polyethylene ponds culture tilapia fish was carried out using four farms for sampling; feed types was afloat and manufactured by specialized manufacture and protein levels is up-to 35%, source of water is groundwater (wells). Treatment (4) earthen ponds culture tilapia fish was carried out using four farms for sampling feed types: afloat and manufactured by specialized manufacture; and Protein levels is 27 – 35%, source of water is Nile.

Fish Sampling

A total of 388 samples of Nile tilapia (*Oreochromis niloticus*) ranged from 55–65 grams weight and 10–15 cm. length were collected from Nile River and governmental and private fish farms around Khartoum State, 97 representative samples were randomly collected from each treatment.

Preparation of fish samples

Collected fish were cut into three parts horizontally and in the middle. Each one was gutted, scaled, fins removed and washed with clean, cold potable water, after that 30 grams were taken from this part and transferred to sterilized container (60 ml size).

Preservation of Samples

All collected samples were kept into sterilized containers and preserved immediately in minced ice preservative container by means of layers (first minced ice layer then samples layer and ice layer and so on).

Water Samples

A total of 48 samples of water were collected from Nile River and governmental and private fish farms around Khartoum State, 12 representative samples were randomly collected from each treatment. The samples were collected in sterilized water containers (300 ml) and transferred immediately to the laboratory.

Macro-minerals analysis

Sodium (Na) mg/g, Potassium (K) mg/g., Calcium (Ca) mg/g., Iron (Fe) mg/g. and Phosphorus (P) mg/g. were analysed using–a GallenRamP Flame Analyser and Spectrophotometer according to **(Vogel, 2000).** The analyses were done in laboratory of Food Technology, Faculty of Engineering and Technology, University of Gezira.

Water quality analysis:
The following water Quality Parameters (Physic-chemical parameters of water) were investigated and analysed **as follows**:

Temperature: Temperature was measured using digital thermo-meter which was taken directly in the fish farms or fields where fish samples were taken.

pH determination: The pH value was determined with a glass-electrode of a newly calibrated Digital pH-meter version (elektro-mag M822, at room temperature.

Determinations of NO_3^-N **and** H_2S**:** Ammonia-Nitrogen (NH_3-N mg/l), Nitrate-nitrogen (NO_3^-N mg/l) and hydrogen sulphide (H_2S mg/l), were analysed in Institution of Environmental Studied laboratory, University of Khartoum, by DR Spectrophotometer Apparatus (version DR 3900.

Statistical analysis
The data was analysed using statistical package for Social Studies (SPSS version 17.0). A factorial Completely Randomized Design (CRD) arrangement was used for means separation among types of farms (treatments). One way analysis of variance (ANOVA) was used for means separation between sources of water. A P-value of $\leq$ 0.05 was considered indicative of a statistically significant difference**.**

Results
The findings of the present study showed some fact on the manifesto of the popular cultured fish emphasizing on macro-minerals and chemical composition among wild and farmed *Oreochromis niloticus* and between water sources which serves as the principle basis in evaluating the nutritional and economical value of the fish as well as water quality parameters.

Table 1: Profile of macro-minerals (mg/g) in fish according to the rearing sites (n=97)

Rearing sites	Na (mg/g)	K(mg/g)	Ca (mg/g)	Iron (mg/g)	P (mg/g)
Nile	27.22[a] ± 0.09	38.86[b] ± 0.16	39.20[a] ± 0.21	0.34 ± 0.01	230.73[a] ± 0.17
Concrete Pond Farms	27.34[a] ± 0.09	38.62[a] ± 0.16	38.39[b] ± 0.21	0.31 ± 0.01	230.20[b] ± 0.17
Polyethylene Pond Farms	26.71[b] ± 0.09	34.60[c] ± 0.16	38.40[b] ± 0.21	0.33 ± 0.01	230.01[b] ± 0.17
Earthen Pond Farms	27.38[a] ± 0.08	37.10[b] ± 0.14	36.70[c] ± 0.18	0.33 ± 0.01	231.14[a] ± 0.14
Overall	27.15 ± 0.04	36.89 ± 0.08	38.17 ± 0.10	0.33 ± 0.01	230.54 ±0.08
Sig.	**	**	**	NS	**

* Means with similar superscripts within the same column are not significantly different.

NS ≡ not significant.

Sig. ≡ Significant Level.

*≡ significant at ($P \leq 0.05$).

**≡ significant at ($P \leq 0.01$).

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Table 2: Profile of macro-minerals (mg/g) in fish according to the source of water (n=97)

Water Source	Na (mg/g)	K(mg/g)	Ca (mg/g)	Iron (mg/g)	P (mg/g)
Nile	27.30[a] ± 0.04	37.47[a] ± 0.10	37.96 ± 0.14	0.33 ± 0.01	230.74[a] ± 0.09
Wells	26.71[b] ± 0.09	34.60[b] ± 0.12	38.40 ± 0.07	0.33 ± 0.01	230.06[b] ± 0.15
Overall	27.16 ± 0.04	36.81 ± 0.10	38.06 ± 0.11	0.33 ± 0.01	230.58 ± 0.08
Sig.	**	**	NS	NS	**

*Means with similar superscripts within the same column are not significantly different.

NS ≡ not significant.

Sig. ≡ Significant Level.

*≡ significant at ($P \leq 0.05$).

**≡ significant at ($P \leq 0.01$).

Table 3: some water quality parameters according to rearing sites

Rearing Site/Parameters	Nile	Concrete Pond Farms	Polyethylene pond farms	Earthen pond farms	Overall	Sig.
Unionized ammonia NO_3^{-1} (mg/l)	1.67[b] ± 0.02	1.29[c] ± 0.02	1.82[a] ± 0.02	0.44[d] ± 0.02	1.31 ± 0.01	**
Hydrogen sulphide H_2S (mg/l)	0.03[d] ± 0.00	0.05[c] ± 0.00	0.18[b] ± 0.00	1.03[a] ± 0.00	0.32 ± 0.00	**
Temperature (°C)	27.33[a] ± 0.32	26.67[a] ± 0.32	26.62[a] ± 0.31	25.27[b] ± 0.34	26.47 ± 0.16	**
pH	6.94[c] ± 0.03	8.11[a] ± 0.03	7.56[b] ± 0.03	7.58[b] ± 0.04	7.55 ± 0.02	**

*****Means with similar superscripts within the same row are not significantly different.

NS ≡ not significant.

Sig. ≡ Significant Level.

*≡ significant at ($P \leq 0.05$).

**≡ significant at ($P \leq 0.01$).

Table 4: some water quality parameters according to source of water

Water Source	Nile	Wells	Overall	Sig.
Unionized ammonia NO_3^{-1} (mg/l)	$1.16^b \pm 0.08$	$1.82^a \pm 0.03$	1.34 ± 0.07	**
Hydrogen sulphide H_2S (mg/l)	0.35 ± 0.07	0.18 ± 0.00	0.30 ± 0.05	NS
Temperature . (ºC)	26.46 ± 0.21	26.62 ± 0.40	26.50 ± 0.19	NS
pH	7.54 ± 0.08	7.56 ± 0.06	7.55 ± 0.06	NS

*Means with similar superscripts within the same row are not significantly different.

NS ≡ not significant.

Sig. ≡ Significant Level.

*≡ significant at ($P \leq 0.05$).

**≡ significant at ($P \leq 0.01$).

Discussion

The presence of macro-minerals was detected in studied fish and environment as follows:

Sodium (Na)

Table (1), shows the level of Na (mg/g) of *O. niloticus collected* from Nile river site and farmed *Oreochromis niloticus* from concrete, polyethylene and earthen ponds. The levels were found to be 27.22 mg/g, 27.34 mg/g, 26.71 mg/g and 27.38 mg/g, respectively. Polyethylene ponds fish had a high significant difference (P≤0.01) in sodium content than fish from Nile river, concrete and earthen ponds. And there were no significant differences recorded among fish from Nile river, concrete and earthen ponds. So, the higher Na content was found in *O. niloticus* from earthen ponds and the lower one was found in *O. niloticus* from polyethylene ponds. Also, Table (2) showed that, the Na was 27.30 mg/g and 26.71 mg/g for *O. niloticus* according to source of water (Nile river and wells), respectively. There was a highly significant difference (P≤0.01) in Na content between fish according to water source. Where nile river was recorded a higher Na than wells. The differences probably might be due to the differences in feeding and other factors such as sex and age, and since sampled fish were selected according to size and length but it is hard to sample it according to the age and sex because age will be unknown although the age of farmed fish is known but nile tilapia has fast reproduction manner and this makes the age the selected fish is unknown, also unknown sex is as a result of the small size of sampled fish. However, the findings in agreement with **Murray and Burt (1969)** they were reported that, sodium content is in the range 30-134 mg/g in fish muscle in aquaculture fish.

Potassium (K)

Table (1), shows the average values of potassium (K mg/g) recorded during study period. The mean values of potassium of *O. niloticus* collected from Nile river site, concrete, polyethylene and earthen ponds were 38.86 mg/g, 38.62 mg/g, 34.60 mg/g and 37.10 mg/g, respectively. There was a high significant difference (P≤0.01) in potassium content among *O. niloticus* from Nile river, concrete ponds, polyethylene ponds and earthen ponds. And there were no significant differences recorded in K content among water sources. The maximum of K content was recorded in *O. niloticus* from concrete ponds, whereas the minimum K content was found in *O. niloticus* from polyethylene ponds. Also, table (2) showed that, the K was 37.47 mg/g and 34.60 mg/g for *O. niloticus* according to source of water (Nile river and wells), respectively. There was a highly significant difference (P≤0.01) in K content between fish according to water source. Nile river was recorded a higher K than wells. However, the findings are agreed with **Murray and Burt (1969)** they were reported that, potassium was range from 19 - 50 mg/g in fish muscle in aquaculture fish.

Calcium (Ca)

Table (1), indicates the levels of Calcium (Ca, mg/g) of *O. niloticus* from Nile river site and ponds cultured farms (concrete, polyethylene and earthen ponds), 39.20 mg/g, 38.39 mg/g, 38.40 mg/g and 36.70 mg/g, respectively. There was a high significant difference (P≤0.01) in Ca among *O. niloticus* from Nile River, concrete ponds, polyethylene ponds and earthen ponds. And there were no significant differences recorded in Ca between fish from concrete and polyethylene ponds. So, the higher Ca content was found in *O. niloticus* from Nile River and the lower Ca was found in *O. niloticus* from earthen ponds.

Also, table (2) sources of water (Nile river and wells) showed that, the Ca was 37.96 mg/g and 38.40 mg/g for *O. niloticus* according to source of water (nile river and wells), respectively. There was no significant difference (P>0.05) in Ca content between fish according to water source. Nile river fish was recorded lower Ca than wells. However, the findings in agreement with **Murray and Burt (1969)** who were reported that, Ca was range from 19 - 88 mg/g in fish muscle in aquaculture fish.

Iron (Fe)

Table (1), Fe (mg/g) of *O. niloticus* from Nile river site and ponds cultured farms (concrete, polyethylene and earthen ponds) was 0.34 mg/g, 0.31 mg/g, 0.33 mg/g and 0.33 mg/g, respectively. There was no significant difference (P>0.05) in Fe among *O. niloticus* from Nile river, concrete ponds, polyethylene ponds and earthen ponds. However, the higher Fe content was found in *O. niloticus* from nile river and the lower Fe was found in *O. niloticus* from concrete ponds. Also, table (2) showed that, the iron was 0.33 mg/g for all water bodies (Nile river and wells). There was no significant difference (P>0.05) observed in Fe content between fish according to water source. However, the findings in agreement with **Elagba *et al*. (2010)** they were investigated mineral constituents (mg/g dry weight) of *O. niloticus* in Sudan and figured out that, Iron 0.26 mg/g.

Phosphorus (P)

Table (1), shows the levels of P (mg/g) of *O. niloticus* from Nile river site and ponds cultured farms (concrete, polyethylene and earthen ponds) was 230.73 mg/g, 230.20 mg/g, 230.01 mg/g and 231.14 mg/g, respectively. *O. niloticus* from nile river and polyethylene ponds were a high significant difference (P≤0.01) in P from *O. niloticus* from concrete earthen ponds. and there was no significant difference between *O. niloticus* from (nile river and polyethylene ponds) and from concrete and earthen ponds. However, the higher phosphorus was found in *O. niloticus* from earthen ponds and the lower P was found in *O. niloticus* from polyethylene ponds. Also, table (2) sources of water (nile river and wells) showed that, the P was 230.74 mg/g and 230.06 mg/g for *O. niloticus* according to source of water (nile river and wells), respectively. There a highly significant difference (P≤0.01) in phosphorus content between fish according to water source. Nile river was recorded a higher P than wells. However, the findings were in agreement with **Boyd (1990)** who was pointed-out that, phosphorus in ground water is typically much lower than surface water, and he was also mentioned that phosphorus of surface water higher in watershed ponds with row

Physico-chemical parameters of water

The water used for the cultivation of fish will not give maximum production if the Physico-chemical parameters are not optimal for fish and other aquatic organism. Thus planning any type of aquaculture facility requires estimating the water needs**.** The physico-chemical parameters analyzed during study period at different chosen sites of Nile River, and fish rearing sites are presented into table (4.7) **as follows:**

Unionized ammonia (NO_3^-N)

Table (3), shows that, Unionized ammonia (NO_3^-N) mg/L variations in studied water sites. The mean values of water from Nile river, concrete, polyethylene and earthen ponds was 1.67 mg/L, 1.29 mg/L, 1.82 mg/L and 0.44 mg/L, respectively. There was a highly significant difference (P≤0.01) in Unionized ammonia (NO_3^-N) among water sites. The higher NO_3-N was found in polyethylene ponds water and the lower NO_3-N was recorded in earthen ponds water. Also NO_3-N according to the sources of water (nile river and wells) as showed in table (4) Nile river and wells was 1.16 mg/L and 1.82 mg/L, respectively. There was a highly significant difference (P≤0.01) in NO_3-N between Nile river and wells water. Wells water was recorded the higher NO_3-N than nile river water.

Hydrogen sulphide (H_2S)

Hydrogen sulfide (H_2S), rotten-egg gas, is present in some well waters but is so easily oxidizable that exposure to oxygen readily converts it to harmless form. Its toxicity depends on temperature, pH, and dissolved oxygen. Table (3), showed that, hydrogen sulphide (H_2S) mg/L of water from nile river site and farms (concrete, polyethylene and earthen ponds) was 0.03 mg/L, 0.05 mg/L, 0.18 mg/L and 1.03 mg/L, respectively. There was a highly significant difference (P≤0.01) in hydrogen sulphide (H_2S) among water from Nile River, concrete ponds, polyethylene ponds and earthen ponds. The higher H_2S was found in earthen ponds water and the lower H_2S was found in nile river water. Also H_2S according to the sources of water (Nile River and wells) as shown in table (4) nile river and wells was 0.35 mg/L and 0.18 mg/L, respectively. There was no significant difference (P>0.05) in H_2S between Nile River and wells water. However, Nile River water was recorded the higher H_2S than wells water. The recorded differences in H_2S might be due to the anaerobic decomposition of organic matter by bacteria in mud, as figured-out by Rick (2012), any measurable amount after providing reasonable aeration could be considered to have potential to harm fish life. Hydrogen sulfide occurs in ponds as a result of the anaerobic decomposition of organic matter by bacteria in mud and it is toxicity is increased at higher temperatures and a pH less than 8 when the largest percentage of hydrogen sulfide is in the toxic un-ionized form. However, the findings of this study in agreement with **(Lloyd, 1992)** he was pointed out that, the recommended levels of H_2S for tilapia aquaculture is (total ammonia-nitrogen is >0.002 mg/L).

Temperature

Table (3), showed that, temperature (ºC) of water from Nile river site and farms (concrete, polyethylene and earthen ponds) was 27.33 ºC, 26.67 ºC, 26.62 ºC and 25.27 ºC, respectively. The earthen ponds water was found to be a highly significant difference (P≤0.01) in temperature from nile river water, concrete ponds water and polyethylene ponds water. And there was no significant difference (P>0.05) in temperature among Nile River water, concrete ponds water and polyethylene ponds water. The higher temperature was found in nile river water and the lower one was found in earthen ponds water. Also temperature according to the sources of water (Nile River and wells) as showed in table (4) nile river and wells-was 26.47 ºC and 26.62 ºC, respectively. There was no significant difference (P>0.05) in temperature between Nile River and wells water. However, wells water was recorded small amount higher than wells water. When compare temperature concerning farms (nile river, concrete, polyethylene and earthen ponds water) noticed that nile river recorded the higher temperature over all ponds, this is scientifically true because temperature always higher in running water than still water. Moreover, the comparison according to the source of water, temperature found to be higher in wells than nile river water, hence this illustrate the fact that the ground water high in temperature than surface water. Water temperature is an important parameter in this study. The measured water temperature in ponds farms and river nile in this study is considered normal for nile tilapia life in the Khartoum state. The temperature observed in this study corroborates the report of (Lloyd, 1992) he was pointed out that, the recommended level of temperature for tilapia aquaculture 21 – 32 ºC.

pH

Water pH affects metabolism and physiological processes of fish and also exerts considerable influence on toxicity of ammonia. Table (3), showed that, pH of water from Nile river site and farms (concrete, polyethylene and earthen ponds) was 6.94, 8.11, 7.56 and 7.58, respectively. There was a highly significant difference (P≤0.01) in pH from nile river water, concrete ponds water and polyethylene ponds water. And there was no significant difference (P>0.05) in pH between polyethylene ponds water earthen ponds water. The higher pH was found in concrete ponds water and the lower pH was found in nile river water. Also pH according to the sources of water (nile river and wells) as showed in table (4) nile river and wells was 7.54 and 7.56, respectively.–There was no significant difference (P>0.05) in pH between nile river and wells water. However, pH values of wells and nile river water were so close. The measured water pH in ponds farms and river nile in this study is considered normal for nile tilapia life in the Khartoum state. The pH observed in this study agrees the report of (Lloyd, 1992) he was pointed out that, the recommended level of pH for tilapia aquaculture 6.8 – 9.5 ºC.Unfortunately, the majority of information available on water quality in aquaculture deals with salmon species. The values represent quality for the o ptimal growth of the freshwater species rather than absolute limits for specific species (Environmental Policy and Planning, 2013).

Conclusion

Fish has an important role in food security and poverty alleviation in both rural and urban areas of Sudan, but little is known about the nutritional value of the Nile fish that are normally utilized either fresh or preserved dried, salted or smoked. The study was conducted to evaluate minerals composition of Nile tilapia (*Oreochromis niloticus*) in wild environment (general nile) compared with aquaculture environment, specifically in different types of ponds (concrete, polyethylene and earthen Ponds) in fish farms in Khartoum State. Also this work was intended to determine and compare physic-chemical parameters of water in the studied fish environments. Moreover, the study was conducted to compare some parameters according to source of water (Nile or wells). A total of 388 samples of nile tilapia (*Oreochromis niloticus*) were collected from Nile River and governmental and private fish farms around Khartoum State and the samples were subjected to minerals analysis (sodium Na, potassium K, calcium Ca, iron Fe, and phosphorus P). Water samples were collected for water quality parameters (unionized ammonia NO_3^{-1}, hydrogen sulphide H_2S, temperature ºC and pH). The data was subjected to SPSS by using factorial design. It is to be concluded that the findings of this study revealed that, *Oreochromis niloticus* from Nile environment or from ponds with source of Nile water has higher level of sodium, potassium and phosphorus, and there was highly significant difference ($P \leq 0.01$), but there was no significant difference at ($P \leq 0.05$) for calcium and iron. 48 water samples were collected from Nile River and governmental and private fish farms around Khartoum State and subjected to physic-chemical analysis. There was a significant difference ($P \leq 0.05$) in all water quality parameters, between Nile River water and ponds water. However, when compare Nile River water and wells water, hydrogen sulphide, temperature and pH showed no significant difference ($P \leq 0.05$), while unionized ammonia showed a significant difference ($P \leq 0.05$). Accordingly, the study concluded that Nile River water has a high water quality in relation to other sources of water, also, Nile river aquaculture environment is an immediate environment in relation to ponds environment.

Recommendations

According to the findings, we recommended that:

- Further researches should be done to determine water quality parameters (physic-chemical parameters) so as to standardize specific limits for Nile tilapia Oreochromis niloticus culture in order to maximize the productivity.
- Encouragements and attention should be paid to aquaculture sector in order to shift fish production gradually from fisheries sector to aquaculture systems.
- Measurements of water quality parameters should be taken regularly in order to decide whether to change ponds water or not. Monitoring should be focused on unionized ammonia in fish farms because it is toxic to fish even in small amount.
- Aquaculture is so recent in Sudan and only few farmers are aware about water quality parameters, hence the facilities and equipment for physic-chemical parameters measurements should be facilitated to aquaculturists.

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أثر بعض القاياسيات الفيزيوكيميائية للميالا على العناصر المعدنية الكبرى لأسماك البلطي النيلي المستزرعة في بيئات مختلفة

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المستخلص

أُجريت هذه الدِّراسة لتقييم العناصر المعدنية الكبرى لأسماك البلطي النيلي جنس *Oreochromis niloticus* الموجودة في بيئة مياه النيل مقارنةً بالمستزرعة في الأحواض بمختلف أنواعها (الأحواض الأسمنتية، المشمعات البلاستيكية والترابية) في مزارع الأسماك بولاية الخرطوم. أيضاً قصدت هذه الدراسة تحديد ومقارنة بعض القياسات الفيزيوكيميائية للمياه (قياسات جودة المياه) في بيئات الأسماك المدروسة. بالإضافة ذلك أُجريت قياسات جودة المياه في المزارع السمكية (النيل أو الآبار الارتوازية) حسب المصدر . شملت الدراسة تحليل 388 عينة من أسماك البلطي النيلي من كلٍ من النيل والمزارع السمكية الحكومية والخاصة في ولاية الخرطوم، ومن ثم تم التحليل للعناصر المعدنية الكبرى (الصوديوم، البوتاسيوم، الكالسيوم، الحديد، والفسفور) وأيضاً تمَّ جمع عينات من المياه لتحليل قياسات جودة المياه (الأمونيا غير المتأينة، كبريتيد الهيدروجين ودرجة الحرارة، والرقم الهيدروجيني). تمَّ تحليل البيانات ببرنامج الحليل الإحصائي للدراسات الإجتماعية بإستخدام تصميم التجارب العاملية. توصلت النتائج إلى أن كمية الصوديوم، البوتاسيوم والفسفور مرتفعة في مياه النيل بالمقارنة مع مياه المزارع و أن هنالك فرق معنوي كبير ($P \leq 0.01$)، بالنسبة لللكالسيوم والحديد فلا يوجد فرق معنوي ($P>0.05$). كما جمعت عدد 48 عينة من مياه النيل ومياه أحواض الإستزراع وأجريت عليها بعض قياسات جودة المياه. سجلت كل قياسات جودة المياه فروقاً معنوية بين مياه النيل ومياه المزارع السمكية. ولكن عند مقارنة المياه في الأحواض حسب المصدر، وجد أن هنالك فرق معنوي كبير ($P \leq 0.01$) بالنسبة للأمونيا غير المتأينة. ولا يوجد فرق معنوي ($P>0.05$) في كلٍ من كبريتيد الهيدروجينو درجة الحرارة والرقم الهيدروجيني. و خلصت الدراسة إلى أن بيئة مياه النيل هي الأصلح للإستزاع السمكي من مياه الآبار الإرتوازية كما أن مياه النيل هي الأفضل في أحوض الإستزراع. وتوصي الرسالة إلى مزيد من الدراسات في هذا المجال للإضافة العلمية و تحسين الإنتاج السمكي.