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Influence of some Water Quality Parameters on Nutritive Value of Nile Tilapia (*Oreochromis Niloticus*) Reared on Different Culture Systems (Earthen & Concrete) in Gezira State, Sudan

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Abstract

The work was conducted to evaluate the influence of water quality characteristics on nutritive value of Nile tilapia (*Oreochromis niloticus*) in aquaculture environment, specifically in different types of ponds (earthen and concrete Ponds) in fish farms in Gezira State, mainly crude protein, crude fibre, moisture and dry matter as well as ash. And water quality parameters are: Ammonia, TDS, Temperature and pH. The findings of this work showed some fact on the manifesto of the main effects of some water quality parameters on cultured fish emphasizing on nutritive value between earthen and concrete ponds of *O. niloticus* which serves as the principle basis in evaluating the nutritional and economical value of the fish and water environment as well. A total of 36 samples of nile tilapia (*Oreochromis niloticus*) were collected from earthen and concrete ponds fish farms around Gezira State and the samples were subjected to chemical analysis (moisture, dry matter, ash, crude protein, fat, and crude fibre). Also, a total of 36 samples of water were collected from the ponds where fish samples were taken, the samples were taken from pond sites: (Left, Central and Right of ponds). Then, subjected to analysis. The data was subjected to SPSS by using completely randomized design (CRD). The findings of this study revealed that, *Oreochromis niloticus* from concrete ponds has higher level of nutritive value than earthen ponds farms except fibre contents is higher in earthen ponds farms than concrete ponds farms, and there was highly significant difference ($P \leq 0.01$). In nutritive value of Fish between two types of ponds system, except crude fibre is recorded significant difference at ($P \leq 0.05$) between two ponds culture system. Also, water quality according to pond type showed a highly significant different ($p \leq 0.01$) in all parameters. In contract, Water Quality Parameters according to Pond Sites showed no significant different ($p > 0.05$) in ammonia and TDS. On the other hand, temperature and pH value showed a highly significant different ($p \leq 0.01$). However, all checked parameters of water were fallen in the international acceptable limits. The researchers were recommended that, Facilitations, Encouragements and attention should be paid to aquaculture sector in Gezira state, Sudan so as to increase fish production from aquaculture rather than fisheries sectors.

Keywords: Gezira State, Oreochromis niloticus, ammonia

Introduction

Water is a critical factor in the life of all aquatic species. In aquaculture, any characteristic of water that affects the survival, reproduction, growth, or management of fish or other aquatic creatures in any way is a water quality variable (Boyd, 2003) [4]. In all culture systems, fish performs its physiological activities such as breathing, excretion of wastes, feeding, maintaining salt balance and reproduction in the water medium. Accordingly, the overall performance of any aquaculture system is partly determined by its water quality (Alam and Al-Hafedh, 2006) [1]. Poor water quality stresses and adversely affects fish growth with consequently low production, profit and product quality (Iwama *et al*., 2000) [9]. Production is reduced when the water contains contaminants that can impair development, growth, reproduction or even cause mortality to the cultured species. As a result, fish farmers are obliged to manage water quality so as to provide a relatively stress-free environment that meets the physical, chemical and biological standards for the fishes' normal health and growth performance (Isyiagi *et al*., 2009 and Manal Elkareem *et al*., 2014) [8, 15].

Pollution of aquatic environments with heavy metals has seriously increased worldwide attention and under certain environmental conditions fish may concentrate large amounts of some metals from the water in their tissues (Mansour and Sidky, 2002) [16]. Some metals such as zinc, iron are essential in trace amounts for normal growth and development; however, others such as cadmium, lead and mercury are

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potentially harmful to most organisms even in very low concentrations. Heavy metals and more specifically mercury have been reported as hazardous environmental pollutants able to accumulate along the aquatic food chain with severe risk for animal and human health. However, considerable controversy surrounds the interpretation of the relationship between pathological changes in Nile tilapia and grey mullets and prolonged exposure to water pollutants. It was reported that metals are taken up through different organs of the fish and induced morphological, histological and biochemical alterations in the tissues which may critically influence fish quality (Olojo *et al*., 2005; Fadel & Gaber, 2007 and Khattaby *et al*., (2010) [19, 6, 12]. Irrigation of crops with raw, municipal wastewater has been a common practice for many decades in developing countries such as China, Mexico, Peru, Egypt, Lebanon, Morocco, India and Vietnam, mainly due to its nutrient value recognized by farmers (Jiménez *et al*. 2010) [10]. Most developing countries are located in tropical or sub-tropical areas, and fish is a vital component of food security for these countries. Rivers and lakes in these countries are more accessible and kinder sources of fish, and also carry over 40% of the world's known fish species (Zenebe *et al*., 1998a) [25]. Moreover, the production and consumption of freshwater fish has increased during recent years. Therefore effort is needed to improve the output performances and quality of the most important tropical freshwater fish.

The production of Tilapia worldwide is being intensified, mainly due to the decline in marine fisheries and to the quality of its meat. Tilapia is suitable for intensive farming and trade. It has characteristics preferred by the market, such as white meat, firm texture, delicate taste, easy filleting, no "Y"-shaped bones, in addition to productive characteristics suitable for breeding: high growth rate and adaptability to different conditions (Jory *et al*., 2000) [11].

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. 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) [17] 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) [20].

Justifications

1. The importance of Nile tilapia (*Oreochromis niloticus*) as a source of Protein and unsaturated fats which is low in cholesterol and triglycerides.
2. The noticeable attention that has been paid at Tilapias culture in Sudan so that there is need for characterization of water quality for Nile and Fish farms, special Earthen and Concrete Ponds.

Objective of this Study

1. To study the influence Culture systems (Earthen and Concrete Pond System) on Nutritive Value of Nile tilapia (*Oreochromis niloticus*) in Gezira State.
2. To estimate some parameters of water quality (Total Dissolved Solids "TDS", and Ammonia as well as Temperature "C°" of Cultured fish Ponds.
3. Standardize the water quality parameters for adequate environment of aquaculture in Gezira State.

Methodology

Area of Study

In the present investigation, two sampling sites (Earthen and Concrete Pond Fish Farms) were selected at Gezira State. The study was carried out. For easy interpretation of results, samples were analyzed depending on general experimental strategy as follows

- The similarities and differences in chemical Nutritive Value of Nile tilapia (*Oreochromis niloticus*) were investigated according to pond sites.
- Water Quality Parameters of were compared sites of ponds.
- The Influence of Water Quality Characteristics on Nutritive Value of Oreochromis niloticus were studied.

Experimental Design

The Study was carried out in Two Areas Identified as Treatments at Gezira State

i). **Treatment 1:** earthen ponds culture tilapia fish was carried out using six ponds for sampling.

ii). **Treatment 2:** concrete ponds culture tilapia fish was carried out using six ponds for sampling.

Fish Sampling

A total of 36 samples of Nile tilapia (*Oreochromis niloticus*) were collected from fish farms at Gezira State, 18 representative samples were randomly collected from each treatment.

Preparation of Fish Samples

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

Preservation of Samples

All collected samples were put 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 36 samples of water were collected from Nile fish farms where fish samples were taken from, 18 representative samples were randomly collected from each treatment. 3 representative samples were taken from water depth (Shallow, Middle and Deep) in sterilized water containers (300 ml) and transferred immediately to the laboratory.

Chemical Composition of Fish

The samples were minced for proximate analysis (Dry matter (DM %), Crude protein (CP %), lipid% and fibre % as well as ash %) using standard AOAC (Horwitz, 2000) [2] methods. The analyses were done in laboratory of Food Technology, Faculty of Engineering and Technology, University of Gezira.

Water Quality Analysis

Water Quality Parameters (Physic-chemical parameters of water) were investigated and analysed include: Ammonia, Temperature, TDS and pH were taken using Digital Electronic Devices.

Statistical Analysis

The data was analysed by using statistical package for Social Studies (SPSS version 14.0). A factorial Completely Randomized Design (CRD) arrangement was used for means separation among Ponds Sites and Water Depth. One way analysis of variance (ANOVA) was used for means separation between Pond Types. A P-value of ≤ 0.05 was considered indicative of a statistically significant difference.

Results and Discussions
Results
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. Better knowledge of their nutritional value, which is expected to be closely associated with fish species, could contribute to the understanding of variability in meat quality of different species of the Nile fish. Moreover, the measurement of some proximate profiles such as protein contents, lipids and moisture contents is often necessary to ensure that they meet the requirements of food regulations and commercial specifications (Watermann, 2000) [22]. This study was conducted to evaluate the similarities and differences in Water Physic-chemical characteristics of Nile tilapia (*Oreochromis niloticus*) farm cultured in different pond systems: earthen *and* concrete ponds at Gezira State:

Table 1: Nutritive Value of Nile Tilapia according to Pond Types

	Ponds			
Chemical Composition (%)	**Earthen Ponds**	**Concrete Ponds**	**±SE.**	**Sig.**
Moisture	81.88^{a}	80.44^{b}	0.05	**
Dry Matter	18.11^{b}	19.62^{a}	0.030	**
Ash	0.20^{b}	0.27^{a}	0.008	**
Protein	17.04^{b}	17.27^{a}	0.031	**
Oil	0.67^{b}	0.88^{a}	0.007	**
Fibre	0.18^{a}	0.17^{a}	0.014	NS

^{ab} ≡ Means with similar superscripts within the same row are not significant different.
**≡ significant at (P ≤ 0.01).
NS ≡ not significant.
Sig. ≡ Significant Level.
SE. ≡ Standard Error of Means.

Table 2: Profile of water quality parameters according to pond types

	Pond			
Parameter	**Earthen Ponds**	**Concrete Ponds**	**± SE.**	**Sig.**
Ammonia (mg/L)	0.25^{a}	0.84^{b}	0.09	**
TDS (mg/L)	417.00^{b}	354.78^{a}	15	**
Temperature (C°)	29.29^{a}	26.23^{b}	0.63	**
pH	6.68^{a}	6.12^{b}	0.05	**

^{ab} ≡ Means with similar superscripts within the same row are not significant different.
**≡ significant at (P ≤ 0.01).
Sig. ≡ Significant Level.
TDS ≡ Total Dissolved Solids.
SE. ≡ Standard Error of Means

Table 3: Profile of Water Quality Parameters according to Pond Sites

	Pond Site				
Parameter	**Left**	**Central**	**Right**	**± SE.**	**Sig.**
Ammonia (mg/L)	0.65	0.44	0.52	0.13	NS
TDS (mg/L)	393.50	381.33	382.88	23	NS
Temperature (C°)	29.11^{a}	28.27^{a}	25.90^{b}	0.78	**
pH	6.28^{b}	6.47^{a}	6.41^{ab}	0.05	**

^{ab} ≡ Means with similar superscripts within the same row are not significant different.
**≡ significant at (P ≤ 0.01).
Sig. ≡ Significant Level.
TDS ≡ Total Dissolved Solids.
SE. ≡ Standard Error of Means.

Discussion
This study was conducted to evaluate the influence of water quality parameters on nutritive value of Nile tilapia (*Oreochromis niloticus*) in aquaculture environment, specifically in different types of ponds (earthen and concrete Ponds) in fish farms in Gezira State, mainly crude protein, crude fibre, moisture and dry matter as well as ash. And water quality parameters are: Ammonia, TDS, Temperature and pH. The findings of this work showed some fact on the manifesto of the main effects of some water quality parameters on cultured fish emphasizing on nutritive value between earthen and concrete ponds of *O. niloticus* which serves as the principle basis in evaluating the nutritional and economical value of the fish and water environment.

Nutritional Value
Information concerning the nutritive value of freshwater fishes is useful to ecologists and environmentalists who are interested in determining the effects of changing impacts of biological/environmental conditions on the composition, survival, and population changes within fish species. It is also valuable to nutritionists concerned with readily available sources of low-fat, high-protein foods such as most freshwater fishes, and to the food scientists who are interested in developing them into high-protein foods while ensuring the finest quality flavor, color, odor, texture, and safety obtainable with maximum nutritive value (Kinnesella *et al*., 1978) [13]. The fluctuations in nutritive value parameters in the present study are shown in table 1 bellow;

Moisture Content (MC)
Table (1), showed that, the moisture content (MC) of *O. niloticus* from earthen and concrete ponds was 81.88% and 80.44, respectively. There was a highly significant difference (P≤0.01) in moisture content of *O. niloticus* between earthen and concrete ponds. The earthen ponds fish was recorded the higher percentage of moisture than concrete ponds.

Dry Matter (DM)
Table (1), showed that, the dry matter content of *O. niloticus* from earthen and concrete ponds was 18.12 and 19.56%, respectively. There was a highly significant difference (P≤0.01) in Dry content of *O. niloticus* between earthen and concrete ponds. The concrete ponds fish was recorded the higher percentage of dry matter than earthen ponds. These differences probably might be due to the differences in feeding types and ages, although all sampled fish were equal in weight and size but their ages may differ, and the aged fish have more bones than small aged fish, and as bone tissues increase, the dry matter content increase accordingly. However, the findings of this research are greater than (Fawole *et al*., 2007). They were investigated proximate composition of body tissues of Nile Tilapia (*Oreochromis niloticus*) and figured-out that; Dry Matter content 7.50%.

Ash Content
Table (1), showed that, the dry matter content of *O. niloticus* from earthen and concrete ponds was 0.20 and 0.27%, respectively. There was a highly significant difference

($P \leq 0.01$) in ash content of *O. niloticus* between earthen and concrete ponds. So, the higher ash content was found in *O. niloticus* from concrete ponds. These differences probably might be due to the differences in ages, although all sampled fish were equal in weight and size but their ages may differ, and the aged fish hah more bones than less aged fish, and as bone tissues increase ash content increase accordingly. However, the findings are less than (Fawole *et al*., 2007) [7] findings who were investigated proximate composition of body tissues of Nile Tilapia (*Oreochromis niloticus*) and figured-out that; found that, Ash content is 4.55%.

Crude Protein (CP)

Table (1), showed that, the crude protein content of *O. niloticus* from earthen and concrete ponds was 17.04 and 17.27%, respectively. There was a highly significant difference ($P \leq 0.01$) in crude protein content of *O. niloticus* between earthen and concrete ponds. So, the higher crude protein content was found in *O. niloticus* from concrete ponds. These differences probably might be due to the differences in feeding because, fish from earthen pond was fed on natural food (planktons, blue green algae and water plants) and some supplemented food, so the protein may not be as more as in the case of fish from concrete pond which were fed completely on manufactured fish feed which is well balanced protein equilibrium. However, the findings was disagree with Fawole *et al*. (2007) [7] who was figured out that, the CP% of Nile tilapia tissues *O. niloticus* was 38.40% because this study used part of fish consist bone and muscle and as we known bones contain less protein when compared with muscle.

Oil Content

As shown in table (1), the oil percentage level of *O. niloticus* from earthen and concrete ponds was 0.67 and 0.88%, respectively. There was a highly significant difference ($P \leq 0.01$) in oil content of *O. niloticus* between earthen and concrete ponds. So, the higher oil content was found in *O. niloticus* from concrete ponds. However, the findings are disagreement with Youssouf *et al*. (2013) [24] who was figured out that, the fat% of Nile tilapia *O. niloticus* reared in tanks and in earthen ponds was 8.20%. The differences probably might be due to the differences in feeding grounds because, wild fish is normally eat selectively from the natural feed (planktons and water plants), while concrete ponds cultured fish is depend mainly upon manufactured feed (supplementary diets) and this differ according to ingredients (inputs) used to formulate the feed. As we known one of the fish feed ingredients in Sudan are the cakes which are rich in oil content and this makes the oil in processed feed higher than that of natural feed and fish composition will differ accordingly as it was clearly observed in this study.

Crude Fibre Contents

Table (1), showed that, the crude fibre percentage of *O. niloticus* from earthen and concrete ponds was 0.18 and 0.17%, respectively. There was no significant difference ($P > 0.05$) in fibre content of *O. niloticus* between earthen and concrete ponds. So, the higher fibre content was found in *O. niloticus* from earthen ponds.

Profile of Water Quality Parameters according to Pond Types

Because water is an essential requirement for fish farming, any properly prepared business plan for aquaculture must describes the quality and quantity of water available for the proposed enterprise or feasibility. An experienced aquaculturist can judge whether the water is adequate for the proposed fish farm. The physic-chemical parameters analyzed during study period at different chosen type of Ponds are presented into tables as bellow:

Ammonia

The major source of ammonia in a water of a heavily stocked culture pond or in the effluent of a raceway is from excretion of fish, mostly via their gills. Ammonia is produced by animals as a byproduct of protein metabolism (Boyd, 1990) [3].

Table 2, showed that, ammonia (mg/L) of water from Earthen ponds and Concrete ponds were 0.25 and 0.84 mg/L, respectively. There was a highly significant difference ($P \leq 0.01$) in ammonia between water from earthen ponds and concrete ponds. The higher Ammonia was found in concrete ponds water and the lower was found in earthen ponds water. The earthen ponds were recorded the best value of ammonia than concrete ponds, However, this difference in ammonia whether probably might be due to the nature of pond type, because in the earthen pond we found blue green agley may grow in pond as food and the fish eat this food and clean the pond bottom from residues, so the clean pond bottom the less in Ammonia. Also, perhaps return to the difference in fish density, water change duration and quantity of supplementary feed in fish farms. Hence, the more dense ponds the more waste, also when water spend more time (+20 day for instance) without change this leads to more feces, as it is known that fish feces generate ammonia which is toxic to fish. Moreover, feed residues accumulate in ponds and this also generates ammonia. In addition, there was a strong correlation between temperature and pH with ammonia, the increase in temperature and pH leads to increase in ammonia, as mentioned by Boyd (1990) [3] when temperature fall in 15 ºC and pH 7.0 the ammonia is 0.273, but when temperature increase to 30 ºC and pH 8.0 the ammonia increase to 7.45 accordingly. Ammonia production is directly related to feeding and depends on the quality of feed, feeding rate, fish size and temperature (Riche and Garling, 2003) [20]. However, the findings of this study in less than (Lloyd, 1992) [14] who was figured out that, the recommended levels of ammonia for tilapia aquaculture is >1.00 mg/l.

Total Dissolved Solids TDS

Total Dissolved Solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogen carbonate, chloride, sulfate, and nitrate anions. Total Dissolved Solids (TDS) is a measure of all constituents dissolved in water. The inorganic anions dissolved in water include carbonates, chlorides, sulfates and nitrates. The inorganic cations include sodium, potassium, calcium and magnesium. Thus, sulfate is a constituent of TDS and may form salts with sodium, potassium, magnesium and other cations (WHO, 2003). The fluctuations in the recorded mean TDS levels in the Pond Types are presented in Table (2), showed that, TDS (mg/L) of water from earthen ponds and concrete ponds was 417 and 354.78 mg/L, respectively. There was a highly significant difference ($P \leq 0.01$) in TDS between Earthen and concrete ponds. The higher TDS was found in earthen ponds water and the lower was found in concrete ponds water. The concrete ponds were recorded the best value of TDS than earthen ponds, However, these differences probably might be due to the difference in pond ground, because the nutritional habits for fish reared in earthen ponds are differ from fish reared in concrete ponds, the justification is; in the earthen ponds, fish fed natural food plus supplemented feed, so the residues of food well go to mix with soil, this is why the TDS in concrete ponds is best than earthen ponds. Hence, Earthen ponds water was recorded the higher number of TDS than Concrete ponds. However, the findings of this study fall in the optimal limits. The acceptable range of TDS for aquaculture is 20-450 mg/L **(**Environmental Policy and Planning, 2013**)**. And in the acceptable range which mentioned by WHO, (2003) is 500 mg/L.

Temperature (C°)

Table (2), showed that, temperature (ºC) of water from Earthen and concrete Ponds was 29.29 and 26.23 ºC, respectively. There was a highly significant difference (*P*≤0.01) in temperature from Earthen and concrete ponds. Water temperature is an important parameter in this study. The measured water temperature in Earthen and Concrete ponds this study is considered normal for Nile tilapia life in Gezira state. The temperature observed in this study corroborates the report of (Lloyd, 1992) [14] whom was pointed out that, the recommended level of temperature for tilapia aquaculture 21-32 ºC. Moreover, the recorded temperature is in the ranges of O A. Idam *et al*., (2020) [18] whom were studied

Effect of some Physic-Chemical Parameters of Water on Macro Minerals Composition of Nile Tilapia (Oreochromis niloticus) Cultured in Different Environments in Sudan and figured out that, the temperature is in the range of 25.25-27.33 C°.

pH Values

Water pH affects metabolism and physiological processes of fish and exerts considerable influence on toxicity of ammonia. Table (2), showed that, pH value of water from Earthen and concrete Ponds is 6.68 and 6.12, respectively. There was a highly significant difference (*P*≤0.01) in pH value between earthen and concrete ponds. pH in ponds in this study is normal for nile tilapia rearing. The pH observed in this study less than the report of (Lloyd, 1992) [14] who was figured 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 optimal growth of the freshwater species rather than absolute limits for specific species (Environmental Policy and Planning, 2013).

Profile of Water Quality Parameters According to Pond Sites

Table 3, showed that, ammonia (mg/L) of water from Earthen and Concrete ponds according to pond site: (Left, Central and Right) were 0.65, 0.44 and 0.52 mg/L, respectively. There was no significant difference (*P*>0.05) in ammonia among water from Left, Central and Right sites of earthen and concrete ponds. The higher Ammonia was found in Left sites of ponds and the lower was found in the central ponds sites. The centre of ponds were recorded the best value of ammonia than both right and left sites, However, this difference in ammonia whether probably might be due to the feed residues, because in the feed perhaps to be given in both left and right sites. Also, perhaps return to the difference in fish density, because fish take rest in the sites of ponds, so the residues of fish will increase ammonia in these places (left and right sites of the ponds). Ammonia production is directly related to feeding and depends on the quality of feed, feeding rate, fish size and temperature **(**Riche and Garling, 2003) [20]. However, the findings of this study in less than (Lloyd, 1992) [14] who was figured out that, the recommended levels of ammonia for tilapia aquaculture is >1.00 mg/l.

Total Dissolved Solids TDS

The fluctuations in the recorded mean TDS levels in the Pond site are presented in Table (3), showed that, TDS (mg/L) Table 3, showed that, TDS (mg/L) of water according to pond site: (Left, Central and Right) were 393.50, 381.33 and 382.88 mg/L, respectively.. There was no significant difference (*P*>0.05) in TDS among sites of ponds. The higher TDS was found in left site and the lower was found in central site of ponds water. However, the findings of this study fall in the optimal limits. The acceptable range of TDS for aquaculture is 20-450 mg/L **(**Environmental Policy and Planning, 2013). And in the acceptable range which mentioned by WHO, (2003) is 500 mg/L.

Temperature (C°)

Table (3), showed that, temperature (ºC) of water according to pond site: (left, central and right) was 29.11, 28.27 and 25.90 ºC, respectively. There was a highly significant difference (*P*≤0.01) in temperature in pond site ponds. The left site was recorded the higher temperature whereas the right site recorded the lower temperature. The temperature observed in this study corroborates the report of (Lloyd, 1992) [14] whom was pointed out that, the recommended level of temperature for tilapia aquaculture 21-32 ºC. Moreover, the recorded temperature is in the ranges of FEPA, (1991) and WHO, (1986) whom were figured out that, the desirable ranges of temperature for Aquaculture are 20-30 C°

pH Values

Table (3), showed that, pH of water according to pond site: (left, central and right) was 6.28, 6.47 and 6.41, respectively. There was a highly significant difference (*P*≤0.01) in pH in pond site ponds. The central site was recorded the higher pH value whereas the left site recorded the lower pH value.

Conclusion

The work was conducted to evaluate the influence of water quality characteristics on nutritive value of Nile tilapia (*Oreochromis niloticus*) in aquaculture environment, specifically in different types of ponds (earthen and concrete Ponds) in fish farms in Gezira State, mainly crude protein, crude fibre, moisture and dry matter as well as ash. And water quality parameters are: Ammonia, TDS, Temperature and pH. The findings of this work showed some fact on the manifesto of the main effects of some water quality parameters on cultured fish emphasizing on nutritive value between earthen and concrete ponds of *O. niloticus* which serves as the principle basis in evaluating the nutritional and economical value of the fish and water environment as well. A total of 36 samples of nile tilapia (*Oreochromis niloticus*) were collected from earthen and concrete ponds fish farms around Gezira State and the samples were subjected to chemical analysis (moisture, dry matter, ash, crude protein, fat, and crude fibre). Also, a total of 36 samples of water were collected from the ponds where fish samples were taken, the samples were taken from pond sites: (Left, Central and Right of ponds). Then, subjected to analysis. The data was subjected to SPSS by using completely randomized design (CRD). The findings of this study revealed that, *Oreochromis niloticus* from concrete ponds has higher level of nutritive value than earthen ponds farms except fibre contents is higher in earthen ponds farms than concrete ponds farms, and there was highly significant difference ($P \leq 0.01$). In nutritive value of Fish between two types of ponds system, except crude fibre is recorded significant difference at ($P \leq 0.05$) between two ponds culture system. Also, water quality according to pond type showed a highly significant different ($p \leq 0.01$) in all parameters. In contract, Water Quality Parameters according to Pond Sites showed no significant different ($p > 0.05$) in ammonia and TDS. On the other hand, temperature and pH value showed a highly significant different ($p \leq 0.01$). However, all checked parameters of water were fallen in the international acceptable limits.

Recommendations

According to the Results, We Recommended That

- Facilitations, Encouragements and attention should be paid to aquaculture sector in Gezira state, Sudan so as to increase fish production from aquaculture rather than fisheries sectors.
- Measurements of water quality parameters should be taken regularly in order to decide whether to change ponds water or not.

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