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Impact of Rearing Environment on Chemical Characteristics of Catfish, Khartoum State, Sudan

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ABSTRACT: This study was conducted in Khartoum State; the aim of this study was to evaluate Chemical composition of Catfish (*Clarias gariepinus*) reared in different environments in Khartoum State. A total of 60 samples of catfish (*Clarias gariepinus*) were collected from Nile river and earthen ponds fish farms around Khartoum State and the samples were subjected to chemical composition analysis (Dry matter (DM%), Crude protein (CP%), Either Extract (EE%) and Crude fiber (CF%) moisture% Nitrogen Free Extract (N.F.E%) Ph as well as ash %). The data was subjected to statistical analysis (SPSS) by using one way analysis of variance (ANOVA). The findings of this study revealed that, Catfish (*C. Gariepinus*) from Nile environment has Higher in nutritive values than catfish from earthen pond environments and there was highly significant difference (P≤0.01) except the pH. Accordingly, the study concluded that the fish from Nile River water has a high in nutritive values than earthen pond fish.

KEYWORDS: catfish, jebel Alaulia, Elmaorada market, Khartoum state.

INTRODUCTION

Fish are produced for human consumption and other purposes through capture fisheries and aquaculture, both of which can make substantial contributions to economic growth and food supply. Capture fisheries harvest resources in both marine and freshwater environments and are equivalent to hunting while aquaculture is the farming of aquatic organisms such as fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production and these include regular stocking, feeding, and protection from predators, amongst other things, as well as the manipulation of the environment, the formulation of feed, genetic improvements, and marketing in a manner that maximizes profitability **(FAO., 2006).** Several countries have now focused their attention on the development of aquaculture with Egypt being the leading example in Africa. In that country the government proposed an aquaculture development plan in the late 1970s to boost the development of the sector and by the mid-1980s, the annual production from aquaculture had increased dramatically from a mere 17,000 tones to 45,000 tones. The target is to produce 1.7 million tones of fish by 2017 with 1.0 million tones coming from aquaculture **(FAO-NASO., 2009)** Aquaculture production alone in Egypt exceeds the total national fish production (captures fisheries and aquaculture combined) of any of the East African countries **(FAO., 2009)** in spite of plentiful water resources in the region. In Africa, fish is a significant source of animal protein accounting for up to 80% of daily animal protein intake **(FAO., 2007).** According to the World Fish Centre the supply of fish in Africa is in crisis. Sudan is one of the large countries in Africa with an area of 1861,500 km the contribution of fisheries to the is currently marginal. The tropical freshwater fish, catfish, is the culture environment for fish and other aquatic organisms. It is the physical support in which they carry out their life functions such as feeding, swimming, breeding, digestion and excretion **(Bronmark and Hansson., 2005)**. Based on this, access to adequate, regular and constant supply of good quality water is vital in any aquaculture project. According to **(Sikoki and Veen., 2004)**. Fishes are reared in different culture media that can retain water and these are earthen ponds, concrete, plastic, wooden, metal, glass and fiber glass tanks. The recent increase in intensive aquaculture production in Nigeria will require effective water quality management for its success **(Ezenwa., 2006)**.

Justification

The Importance of Catfish (*Clarias gariepinus*) rearing environment type as a source of protein and polyunsaturated fatty acids which decrease the risk of cardiovascular diseases for humans.

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The objective

To evaluate Chemical composition of Catfish (*Clarias gariepinus*) that to be taken from their rearing environment (Nile river and Earthen ponds) in Khartoum State.

MATERIALS AND METHODS

Area of study

In the present investigation, two sampling sites were selected which are: River Nile and fish farms in Khartoum State. For easy interpretation of results; samples were analyzed depending on general experimental strategy as follows:

- ✓ The similarities and differences in nutritive value (crude protein CP%, crude fiber%, Ash%, moisture%, Dry matter DM%, Either Extract %, Nitrogen Free Extract NFE%, and Ph of Catfish (*C. Gariepinus*) were analysed and compared between River Nile fish and fish farms.

Experimental design

The study was carried out in to two areas identified as treatments at Khartoum State:
Treatment (1) River Nile fish (wild Catfish) was carried-out using (Elmaorada fish market) for fish sampling;
Treatment (2) Fish farms (cultured Catfish) was carried out using (Jebel Al-aulia farms) for fish sampling.

Fish sampling

A total of 60 samples of Catfish (*C .Gariepinus*) ranged from 1.10kg weight and 46 cm length were collected from Nile River and fish farm (Jebel Aulia) in Khartoum State, 30 representative samples were randomly collected from each treatment.

Preparation of fish samples

Collected fish were divided in to two parts, each one was removed and washed with clean, potable water, after that, 20 grams of dorsal muscle were taken and transferred to sterilized plastic (60 ml size), then, sent to Sowba laboratory for approximate analysis.

Chemical composition of fish

The samples were minced for proximate analysis (Dry matter (DM%), Crude protein (CP%), Either Extract (EE%) and Crude fiber (CF%) moisture% Nitrogen Free Extract (N.F.E%) Ph as well as ash%) using standard **AOAC (Horwitz, 2000)** methods. The analysis were done in laboratory of Sowba in Khartoum.

Statistical analysis

The data was analysed by using statistical package for Social Studies **(SPSS version 14.0).** one way ANOVA was used for means separation between treatments. A P-value of ≤ 0.05 was considered indicative of a statistically significant difference**.**

RESULTS AND DISCUSSION

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).**

This study was conducted to evaluate nutritive value of Catfish (*C. Gariepinus*) in wild environment (Nile River) compared with aquaculture environment (earthen ponds), in Khartoum State, mainly The similarities and differences in chemical composition: (crude protein CP%, crude fiber%, Ash%, moisture%, Dry matter DM%, Either Extract %, Nitrogen Free Extract NFE%, and Ph).

The findings of the present study showed some fact on the manifesto of the popular cultured fish emphasizing on fat profile, chemical composition among wild and farmed *C. Gariepinus* which serves as the principle basis in evaluating the nutritional and economical value of the fish.

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Table 1. Chemical composition (Mean± SE) of Catfish according to the Rearing Environment type

Chemical composition of Catfish %	Rearing Environment Type				
	Nile	Farm	*S.E*	Overall	*Sig.*
Moisture	73.62	69.62	0.93	71.6 ± 0.66	**
Dry Matter	26.4	30.4	0.94	28.4±0.7	**
Crude Protein	31.7	29.7	0.15	30.7±0.10	**
Crude Fiber	1.09	1.26	0.34	1.17±0.24	**
Ether Extract	7	6.6	0.61	6.8±0.43	**
Ash	1.15	1.23	0.27	1.19±0.09	*
Nitrogen Free Extract	32.66	30.60	1.008	31.63±0.71	**
pH	5.07	4.07	0.12	4.91±0.84	Ns

Chemical composition

Information concerning the chemical composition of freshwater fishes is useful to biologists, ecologists and environmentalists who are interested in determining the effects of changing 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 scientist who is 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)**.

The fluctuations in chemical composition parameters in the present study are shown in tables (1).

Moisture content (MC)

Table (4.1), showed that, the moisture content (MC) of *O. niloticus* from Nile river site and ponds-cultured farms was 73.62%, and 69.62%, respectively. There was a highly significant different (P≤0.01) in the MC%. Moisture % of fish from Nile river site were higher than farmed fish. 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. These results were agreed with ***(Zeinab M. and et al.,* 2024)**, who studied Quality Properties of African Catfish (Clarias gariepinus) Meat as Affected by its Color and figured-out that, the moisture content were ranged from 73.88 to 74.14 in black and gray catfish. Also, the findings in agreement with **(Mmandu and Clement 2020)** who were investigated Fatty Acid Composition of Fillets of African Catfish, Clarias gariepinus Fed with Various Oil-Based Diets, and they were pointed-out that; the moisture % were ranged from 70.74 to 75.88%.

Dry matter (DM)

Table (1), showed that, the DM percentage of Catfish (*C. Gariepinus*) collected from Nile river site and –cultured was 24.60% and 30.40%, respectively. The DM percentage of fish from River Nile was a highly significant different (P≤0.01) from the DM% of fish from fish farm. 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. These results were agreed with ***(Zeinab M. and et al.,* 2024)**, who studied Quality Properties of African Catfish (Clarias gariepinus) Meat as Affected by its Color and figured-out that, the dry matter % were ranged from 25.86 to 26.12 % in black and gray catfish, respectively. Also, the findings in agreement with **(Mmandu and Clement 2020)** who were investigated Fatty Acid Composition of Fillets of African Catfish, Clarias gariepinus Fed with Various Oil-Based Diets, and they were pointed-out that; the dry matter % % were ranged from 24.12 to 29.26 %.

Crude protein (CP)

Table (1), showed that, the Crude protein (CP) percentage of Catfish (*C. Gariepinus*) collected from Nile river site and –cultured was 31.7% and 29.7%, respectively. There was a highly significant difference (P≤0.01) in CP content between *C. Gariepinus* from River nile and fish farms. So, the higher CP content was found in *C. Gariepinus* from River nile and the lower CP content was found in *C. Gariepinus* from farms. these differences probably might be due to the differences in feeding because, wild fish is normally eat selectively from the natural feed (planktons and water plants) which are high in protein because most feed is zoo

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planktons which is animal protein and even plant planktons and water plants which are plant protein nevertheless their protein higher than other diet ingredients like dura and cakes, while cultured fish is always depends mainly/or partially upon manufactured feed (supplementary diets) and this differ according to ingredients (input) used to formulate the feed. However, the findings was disagree with **Fawole *et al*. (2007)** he was figured out that, the CP% of *C. Gariepinus* tissues was 38.40%. also, these findings were less than These results were agreed with ***(Zeinab M. and et al.,* 2024)**, who studied Quality Properties of African Catfish (Clarias gariepinus) Meat as Affected by its Color and figured-out that, the CP % were ranged from 74 to 76 % in black and gray catfish, respectively.

Crude fibre Contents

Table (1), showed that, the crude fibre percentage of Catfish (*C. Gariepinus*) collected from Nile river site and cultured fish was 1.09% and 1.26%, respectively.. There was a highly significant difference (P≤0.01) in crude fibre content between *C. Gariepinus* from River Nile and fish farms. Fish farm samples were recorded a higher crude fibre content and River Nile were recorded the lower crude fibre content. However, these differences might be interpreted as difference in feeding sites, because fish farms which were recorded higher percentages their feed was manufactured by specialized feed plant and the feed ingredients may had high fibre. Although wild fish was fed on natural feed, nevertheless recorded lower fibre contents.

Ether Extract

Table (1), showed that, the Ether Extract percentage of Catfish (*C. Gariepinus*) collected from Nile river site and cultured fish was 7% and 6.6%, respectively. There was a highly significant difference (P≤0.01) in ether extract content between *C. Gariepinus* from River Nile and fish farms. River Nile samples were recorded higher ether extract content and fish farm fish were recorded the lower ether extract content. These results were disagreed with ***(Zeinab M. and et al.,* 2024)**, who studied Quality Properties of African Catfish (Clarias gariepinus) Meat as Affected by its Color and figured-out that, the fat % were ranged from 21,17 to 19,81 % in black and gray catfish, respectively. Also, the findings in agreement with **(Mmandu and Clement 2020)** who were investigated Fatty Acid Composition of Fillets of African Catfish, Clarias gariepinus Fed with Various Oil-Based Diets, and they were pointed-out that; the fat% were ranged from 3 to 6 %.

Ash Content

Table (1), showed that, the ash percentage of Catfish (*C. Gariepinus*) collected from Nile river site and cultured fish was 1.15% and 1.23%, respectively.. There was a highly significant difference (P≤0.01) in ash content between *C. Gariepinus* from River Nile and fish farms. Fish farm samples were recorded a higher ash content and River Nile fish were recorded the lower ash content. These results were less than ***(Zeinab M. and et al.,* 2024)**, who studied Quality Properties of African Catfish (Clarias gariepinus) Meat as Affected by its Color and figured-out that, the ash % were ranged from 2.99 to 3.00 % in black and gray catfish, respectively. Also, the findings in disagreement with **(Mmandu and Clement 2020)** who were investigated Fatty Acid Composition of Fillets of African Catfish, Clarias gariepinus Fed with Various Oil-Based Diets, and they were pointed-out that; the ash% were ranged from 3.13 to 4,24 %.

Nitrogen Free Extract (NFE)

Table (1), showed that, the NFE percentage of Catfish (*C. Gariepinus*) collected from Nile river site and cultured fish was 32.66% and 30.60%, respectively. There was a highly significant difference (P≤0.01) in NFE content between *C. Gariepinus* from River Nile and fish farms. River Nile samples were recorded a higher NFE content and fish from farms were recorded the lower NFE content.

pH values

table (1) showed that, pH value of Catfish (*C. Gariepinus*) collected from Nile river site and cultured fish was 5.07 and 4.07%, respectively. There was no significant difference (P>0.05) in pH value between *C. Gariepinus* collected from Nile river site and cultured fish.

CONCLUSION

The findings of the present study showed some fact on the manifesto of the popular cultured fish emphasizing on fat profile (General Measurements and chemical composition among wild and farmed *C. Gariepinus* which serves as the principle basis in

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evaluating the nutritional and economical value of the fish as well as water quality parameters. The findings of this study revealed that, Catfish (*C. Gariepinus*) from Nile environment has Higher in nutritive values that catfish from earthen pond environments and there was highly significant difference (P≤0.01) except the pH. In the opposite; Fish from earthen pond environment recorded the higher figures in general measurements except the head length was higher in Nile river fish and there was highly significant difference (P≤0.01). However, when compare Nile River water and earthen pond water, we found that; the pH and electrical conductivity showed a highly significant difference (P≤0.01), and total dissolved solids and salinity showed no significant difference (P>0.05). Accordingly, the study concluded that the fish from Nile River water has a high in nutritive values than earthen pond fish.

RECOMMENDATION

Aquaculture is so recent in Sudan and only few farmers are realize about water quality parameters, hence the facilities and equipment for physico-chemical parameters measurements should be facilitated to aquaculturists and rearing fish.

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