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Nutritive values of two commercial fish *Oreochromis niloticus,* and *Synodontis schall* collected from the White Nile.

Abdel Raheam HA El-Bassir[1*], Dina I M Alim[2], Mariam Yagoub Haroon Abdalla[3], Salma Abaker Yahia Ahmed[3], and Tanzeil Abdrhman Ibrahim Adam[3]

[1]Department of Zoology, Faculty of Science and Technology, Omdurman Islamic University, Khartoum, Sudan

[2]Environment and Natural Resources Research Institute, National Center for Research, Khartoum, Sudan

[3]Department of Zoology, Faculty of Science and Technology, Omdurman Islamic University, Khartoum, Sudan

Email address:

bassiri786@hotmail.com *Corresponding Author: Abdel Raheam HA El-Bassir

Abstract: The proximate, mineral and vitamin composition of two commercially important fish species namely *Oreochromis niloticus (O.niloticus*) and *Synodontis schall (S.schall*) from Al-kalakla area along the White Nile were investigated .The two species represent different grades (*O.niloticus* grade one and *S.schall* grade three) of preference to the Sudanese consumers. Their nutritional values were compared to determine the benefits associated with the consumption of these species. Proximate composition of both *O.niloticus* and *S.schall* showed a non- significant difference in moisture and carbohydrates .Conversely Protein content, crude fat and ash showed a significantly ($p \leq 0.05$) higher content in *O.niloticus* than in *S.schall*. The mineral content of *O.nilticus* was significantly higher in calcium, potassium and phosphorus content and significantly lower in sodium and magnesium than *S.schall*. Results of vitamins A,C and E contents in both fish revealed a non- significant difference .The data showed that both fish are of high nutritional value and good source of proteins ,minerals and vitamins .Results revealed that the grading of both fish are associated with the consumer preference rather than their nutritive values.

Keywords: *Oreochromis niloticus*, *Synodontis schall* ,Heavy metals, Minerals, Pollution,

1.Introduction

Three quarters of the Earth are covered by water, so fish forms a substantial part of the diet of humans in almost all countries in the world since the dawn of time (Mohanty ,2015).Fish are known for their nutritive values, they provide good sources of high quality animal protein, fat, minerals and vitamins and as well as vitamins such as A, D and E. Providing these nutritional values they play important roles in management and prevention of many human diseases (Conquer and Holub, 2002). The consumption of fish is beneficial in heart disease (Mozaffarian and Rimm, 2006), stroke, age related muscular degeneration and mental health (Peet and Stokes, 2005;Tilami and Samples,2018), growth and development, (Young and Conquer, 2005,Tilami and Samples,2018).Despite their importance as health food little is known about the nutritional value of the Nile fish that is normally utilized either fresh or preserved, dried, salted or smoked (Ahmed *et al*.,2017).In comparison to the other sources of dietary animal proteins, consumers have wide choice for fish as far as affordability is concerned as there are many varieties and species of fishes available, especially in the tropical countries (FAO 2013). Inland fish and fisheries play important role in ensuring global food security (Youn *et al* 2014). Knowledge of nutritional value of fish of the different grades would contribute to the understanding of consumers to flesh quality of different species of the Nile fish. This study was carried out on two grades of commercial and preferred species of the White Nile fishes *Oreochromis niloticus* and *Synodontis schall* in order to assess their nutritional values before consumption.

2.Materials and Methods:

Fresh fish specimens of *Oreochromis niloticus*, and *Synodontis schall* were obtained for this study from Al-Kalakla area,along the White Nile of Khartoum State. The samples were washed with tap water and samples of the flesh were taken for different analysis.

2.1. Proximate analysis

2.1.1.Moisture content

The moisture content of the fish species was determined using the air oven drying method using a known weight of the fillet at 105°C until a constant weight was obtained AOAC (2000)..Then the moisture content was calculated using the following formula:

$$\text{Moisture \%} = \frac{\text{Wet weight} - \text{dry weight}}{\text{Wet weight}} \times 100$$

2.1.2. Ash content

Ash content was determined by incineration of the dried sample obtained from moisture determination in a muffle furnace at 500°C for four hours, the ash percentage was given by the following formula:

$$\text{Ash \%} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

2.1.3. Protein content:

Crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method (6.25 X N) AOAC (2000) The protein percentage was given by the following formula:

$$\text{Protein \%} = \frac{(V_2 - V_1) \times N \times 14 \times 100}{1000 \times wt} \times 6.25$$

Where:

V_1= Volume of Hcl used in titration

V2= Volume of Hcl used in blank titration

N= Normality of Hcl used in titration

14/1000= Conversion ratio from ammonium sulphate to nitrogen

Wt.= Weight of sample

6.25= Conversion factor from nitrogen to protein.

2.1.4. Oil content

The fat was determined by extracting the sample with petroleum ether (boiling point 60---80 C^0) for six hours in Soxhelt apparatus. The extract was then dried in an oven at 100—105 C^0 for removal of extra ether traces, following the method by AOAC (2000). The fat content was given by the following formula:

$$\text{Oil \%} = \frac{\text{Weight of ether extracted fat}}{\text{Weight of sample}} \times 100$$

2.1.5. Carbohydrates content

The edible fresh (2.5gm) was stirred with distilled water (10ml) and 52% perchloric acid (13ml) for 20 min. The contents were diluted to 100 ml, filtered into a 250ml

volumetric flask and made up to the mark.The diluted filtrate (1.0ml) was heated with 1% w/v anthrone reagent in sulphuric acid for 20 min. and the absorbance at 630 nm was measured in a Shimadzu UV-160 spectrometer. The concentration of glucose in the sample was calculated using a standard curve.

2.2. Mineral Analysis

The mineral content (Calcium, Sodium, Potassium, magnesium and phosphorus) were determined using Flame photometric method. Phosphorus was estimated using Vanadomolybdate colorimetric method. The content of the mineral were done in triplicate and reported as mean mineral content in mg/L. of dry matter.

2.3. Vitamin content

The vitamins A, C and E were determined by a liquid chromatographic method. The vitamins were extracted from the tissues with chloroform and methanol, saponified and separated on a Lichrosorb normal phase column followed by UV detection.

2.4. Data analysis

The descriptive statistics (mean, standard deviation) were conducted while statistical significance of differences ($P \leq 0.05$) was determined by T-test using SPSS vesion 20.

3.Results and Discussion

3.1. Proximate composition

This study showed that both fish species have good nutritive values .Proximate composition of both *O.niloticus* and *S.schall* showed a non- significant difference in moisture and carbohydrates (Table 1) .Conversely Protein content, crude fat and ash showed a significantly ($p \leq 0.05$) higher content in *O.niloticus* than in *S.schall* as depicted in Table (1).

Table (1): Mean Proximate composition of *O .niloticus* and S. s*chall* from Al Kalakla area along the White Nile .

Parameter	*O.niloticus*	*S.schall*	p-value
Moisture	75.00±2.3	75.5±0.2	1.0
Ash	6.15±0.5	5.65±0.1	0.05
Protein	31.15±0.04	30.54±0.4	0.05
Fat	6.93±0.1	6.35±0.1	0.03
Carbohydrates	26.15±2.0	27.76±0.1	0.2

These results disagreed with Ahmed *et al*.(2017) who worked with five fish species from Jebel Aulia Dam area along the White Nile ,their results revealed no significant differences in proximate composition of the five species .Results showed higher protein content,ash content and higher fat but lower carbohydrates in *O.niloticus* a grade one fish ,than *S.schall* a grade three fish .Studies carried out on consumers towards fish consumption showed that there were marked regional and tribal effects on consumers preference (Karrar, 1996; El-fazary ,2005)

In general the differences in proximate composition of both species could be attributed to species consumption or absorption capability and conversion potentials of essential nutrients from their local environment. Likewise the difference in the value of crude fat level in the fish species could be due to water, food type, and species (Fabiola and Martha, 2012) and diet of the fish (Zenebe, 2010).

3.2. Mineral content

The mineral content of *O.nilticus* was significantly higher in calcium,sodium, potassium and phosphorus content and significantly lower in magnesium than *S.schall* as shown in Table (2).

Table (2) : Mean mineral content of *O.niloticus* and *S.schall* collected from Al-Kalakla area in the White Nile

Mineral(mg/l)	*O.niloticus*	*S.schall*	p-value
Calcium	4.93±0.03	4.85±0.01	0.02
Sodium	4.36±0.3	3.84±0.1	0.001
Magnesium	2.29± 0.03	2.39±0.02	0.007
Potassium	4.59±0.02	3.87±0.03	0.001
Phosphorus	3.06± 0.02	2.88±0.02	0.001

The variations recorded in the concentration of the different mineral components in the fish examined could have been as a result of the rate in which these components are available in the water body (Yeannes and Almandos, 2003), and the ability of the fish to absorb and convert the essential nutrients from the diet or the water bodies where they live. This is supported by the findings of Ahmed *et al*. (2017).

The difference in mineral content could be attributed to type of feeding of the herbivorous *O.niloticus* fish that showed higher mineral content than the piscivorous *S.schall*, This agrees with the report of Farkas *et al* (2000) and Ahmed *et al* (2017)

that the concentrations of elements in fish body could be related primanly to their feeding habits.

3.3. Vitamin contents

Results of vitamin A,C and E contents in both fish revealed slight variations.Although non- significantly different. Results showed a slightly higher vitamin E in *O.niloticus* than *S.schall* as depicted in Table (3).

Table (3) : Mean Vitamin A,C and E contents in *O.niloticus* and *S.schall* collected from Al-Kalakla area in the White Nile

Vitamin	*O.niloticus*	*S.schall*	P-value
Vitamin A	14.0 ±1.0	14.0±2.0	1.0
Vitamin C	2.5±0.4	2.51±0.4	1.0
Vitamin E	392±8.0	380±4.0	0.27

4.Conclusions

The results of the present study showed that the two examined fish species are good sources of protein, fat, moisture and vitamins. It also revealed the superiority of *O. niloticus* in crude protein,Ca,K,Na and P content while *S.schall* was superior in Mg. It can be concluded that the proximate composition values obtained could be useful to help the consumers in choosing fish based on their nutritional values. The results provide update information in fish fillets composition and vitamins contents to food composition database and consumers can have sufficient knowledge of the nutritive contents of the two popular fish species.

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