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COMPARATIVE STUDY OF THE BODY WEIGHT CHARACTERISTICS AND EFFECT OF DRYING ON CHEMICAL COMPOSITION OF THREE NILE FISH SPECIES (*Oreochromis Niloticus, Labeo Niloticus* AND *Clarias Spp.*)

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ABSTRACT: This study was carried out to compare the body weights of three different Nile fish species (*Oreochromis niloticus, Labeo niloticus and Clarias spp.*), and the impact of direct sun drying on their chemical composition.36 samples were collected (12 samples/ species). Averages of total length, standard length (cm) and gross body weight (gm) were determined and the findings were as follows: 36.5, 29.75 and 930 for *Oreochromis niloticus*, 49, 39.5 and 1210 for *Labeo niloticus* and 49, 45 and 977.5 for *Clarias spp.* It was noticed that *clarias spp.* has the highest edible meat percentage 46.75% followed by *Labeo niloticus* 38.82% and *Oreochromis niloticus* 33.39%, and there were significant differences (P < 0.05) among the three species. Chemical analysis for the samples was done to determine (protein, fat, ash and moisture contents). The results of protein contents examined were 62%, 61.5% and 61.5% for *Oreochromis niloticus, Labeo niloticus* and *Clarias spp.* respectively. Fat contents were 7.41%, 8.27% and 7.32% for *Oreochromis niloticus*, *Labeo niloticus* and *Clarias spp.* respectively. Moisture contents were 6.7%, 7.5% and 7.5% for *Oreochromis niloticus*, *Labeo niloticus* and *Clarias spp.* respectively. Ash contents were 5.90%, 6.05% and 6.85% for *Oreochromis niloticus, Labeo niloticus* and *Clarias spp.* respectively.

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INTRODUCTION

Fish are the most numerous of vertebrate, with at least 20,000 known species and more than 58% are found in marine environment (Thurman and Webber, 1984). Fish is one of the most important sources of animal protein available in the tropics and has been widely accepted as a good source of protein and other vital nutrients for the maintenance of a healthy body (Andrew, 2001). The less developed countries capture 50% of the world harvest and a large proportion of the catch are consumed internally (FAO, 1985). In many Asian countries over 50% of the animal protein intake comes from fish, while in Africa, the proportion is 17.50% (Williams et al., 1988). In Nigeria, fish constitutes 40% of the animal protein intake (Olatunde, 1998). They have significant role in nutrition, income, employment and foreign exchange earning of the country. Fresh fish is a central point in fish for food utilization. The knowledge of fish composition is essential for its maximum utilization. The nutritional composition of fish varies greatly from one species and individual to another, depending on age, feed intake, sex and sexual changes connected with spawning, the environment and season (Silva and Chamul, 2000).

Processors have direct interest in the proximate composition of fish in order to know the nature of the raw material before chilling, freezing, smoking or canning can be correctly applied (FAO, 2004). In the Sudan fish distributed over an area that amount to 100,000km of fresh water and 760 km of marine, the total sustainable production amount to 114,100 tones/ year and human consumption is estimated at only 1.4kg/ year (Meske, 1985).

Sudan is endowed with diversified surface and underground water resources, and arable lands that are suitable to support a vigorous capture Fishery activities are centered around the River Nile and its tributaries, and the territorial water of Sudan on the Red Sea (FOA, 1999). Fish in the Sudan have is been a major source of protein and energy for many communities especially among the Nilotic tribes of the south and some of Nubian ethnic groups of the far north especially in the lean month of the year. Sudanese people use fish sometimes as the only source of animal protein throughout the year as substitute for meat, particularly in the central Nile valley. Fish is one of the most highly perishable commodities and the public has always required continuous reassurance about its large number of species of widely different sizes and shapes. Because of this variety consumers are often unsure if particular species of product made from them are good to eat. Many countries now have comprehensive system of inspection and control of at least some aspects of fish quality. Thus from several points of view fish quality has become very important in the world. This is because consumers now are more aware of possible food hazards and

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malpractices which will affect the quality as a result of bad handling and processing. Therefore, consumers individually or collectively become more demand in respect of freshness, naturalness, microbial safety, free from pollutants and protection from damage.

The number of simple drying techniques suitable for small-scale, such as at household or village level as described by Brigih et al. (2004). In recent years the annual world production of dried a fishery product has been 350,000 tones, and the biggest production comes from Asia and Africa (Sigurjon, 2003). Salted fish is consumed in many countries, especially the developing countries where they constitute an important source of low cost dietary protein (Bligh et al, 1988).

The aims of this study were to identify the filleting yield characteristics of three Nile fish species and to compare and determine the effect of drying on chemical composition of the studied fish species.

MATERILAS AND METHODS

Locality:

This study was conducted at Sudan University of Science and Technology, College of Science and Technology of Animal Production, department of Fisheries and Wildlife Science.

Fish samples:

Thirty six fish samples of three fish species, Garmut (African cat fish, *Clarias spp.*), Dabs (*Labeo niloticus*) and Bulti (*Oreochromis niloticus*), purchased from Elmourda fish market, Oumderman, Sudan. The length and total weight of individual samples were taken using Measuring board (100cm) and normal balance (10Kg).

Experimental procedure:

The fish samples were washed thoroughly with tap water and weighed individually and degutted using sharpened and clean knives. The treated samples were washed again to remove all the adhesive material and blood, representing and divided into three groups, each group contained 12 samples, all studied species, Garmut (African cat fish, *Clarias spp.*), Dabs (*Labeo niloticus*) and Bulti (*Oreochromis niloticus*).The Total Length, standard Length, Total Weight and Filleting yield indices were determined using different materials (sharpened, knives, balance and measuring board) and recorded in separate tables. The fillets of studied fish species were Packed in plastic bags, and sent to the Central Veterinary Research Laboratory {Soba} to determine chemical composition parameters (moisture, protein, fat, dry matter and ash). As described by (AOAC, 1984).

Drying Method: Fish species samples (36 fillet samples) were hanged up horizontally from the head on hooks and string, at about 70 cm off the ground level to dry in the open air for 12 days from 28 February – 11 March /2011, then packed into plastic bags, sent for chemical analysis (protein, fat, ash, moisture and dry matter) to the Central Veterinary Research Laboratory {Soba}. As described by (AOAC, 1984).

Chemical Composition: The chemical parameters of the studied fish samples were as follows:

Moisture Determination: The samples were weighed at first (Initial weight), then dried in electric oven at 105 C for 24 – 30 hours to obtain a constant weight. The moisture content was calculated as follow:

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

Crude Protein Determination: The kjeldahl method for estimation of nitrogen was applied. Nitrogen content was converted to protein percentage by multiplying 6.25 as follow:

$$\text{Protein \%} = \frac{((Va - Vb) \times N \times 14 \times 100 \times 6.25)}{1000 \times Wt}$$

Where:

Va = volume of HCL used in titration.

Vb = volume of sodium hydroxide of known normality used in back titration.

0.014 = conversion factor of ammonium sulfate to nitrogen.

6.25 = conversion factor of nitrogen to protein.

Wt = weight of tissues sample.

Fat Determination: Fat content (ether extract) of each sample was determined according to Soxhlet method, using 2gm of fish samples. The extraction continued for 5 hours at 100 C. fat percentage was calculated as follows:

$$\text{Fat \%} = \frac{\text{extracted fat weight x } 100}{\text{Initial weight}}$$

Ash Determination: Ash was determined by heating 1g at 550 C in a muffle furnace until a constant weight was obtained. Ash content percentage was calculated by the following formula:

$$\text{Ash \%} = \frac{\text{Ash weight x } 100}{\text{Sample weight}}$$

The Nitrogen – Free Extracts (NFE) Calculated by subtraction as follows:

%NFE = 100 – (Dry matter (DM)), or % Moisture + % Protein + %Fat + % Ash.

Statistical analysis:

The data of the study present was statistical analyzed using one –way ANOVA and FUCTORIAL procedures (SPSS 17.0 for windows). The significance levels were defiantly at P< 0.05, as described by Gomez and Gomez (1984).

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RESULTS

The result in Table 1 Showed the filleting yield indices (head, skeleton, skin and viscera) analysis of three fresh water fish, purchased from El-mourada fish Market.There was a distinctive variation in the mean weight and standard length of investigated fish. The fillet percentage was highest in *Clarias spp.* 46.75% compared to *Oreochromis. Niloticus* which was 30.39%. The highest filleting yield of *Clarias spp.* is due to its small skin (5.5%), skeleton (8.58%) and viscera (6.99%), while the lowest filleting yield of *O. niloticus* is due to large head and skeleton which were 27.16% and 22.84% respectively. The least variable component of carcass was the skeleton which more or less uniform, except for *O. niloticus* and *Labeo niloticus* which recorded a higher percentage skeleton weighed 22.84% and 27.37% respectively.

Table 2 Showed that there were significant differences among filleting yield of three studied fish and Table 3. Showed the effect of direct sun light (open air) on chemical composition of three fish species *O. niloticus*, *Labeo niloticus* and *Clarias spp.* meat, the results show there is significant difference in fat, crude protein, nitrogen free extract and ash among the three different fish species (fresh and dried) at level ($p < 0.01$), al so there is significant different in moisture and dry matter among the three different fish species at level ($P < 0.05$).

Table 1 - Body weight characteristics of three fish species (*O.niloticus*, *L.niloticus* and *Clarias spp.*).

Parameter / Type of fish	*O.niloticus*	*L.niloticus*	*C.spp.*	Sig.
Total length/cm	36.5 ± 0.58^{a}	49 ± 1.16^{b}	49 ± 0.82^{b}	**
Standard length/cm	29.75 ± 0.50^{c}	39.5 ± 1.29^{b}	45 ± 0.82^{a}	**
Total weight/gm	930 ± 21.60^{b}	1210 ± 106.15^{a}	977.5 ± 71.82^{b}	**
Head weight/gm	252.5 ± 6.46^{b}	121.25 ± 11.09^{c}	283.75 ± 11.09^{a}	**
Viscera weight/gm	65 ± 5.77^{b}	132.5 ± 34.03^{a}	101.25 ± 13.15^{a}	**
Skin weight/gm	92.5 ± 2.89^{b}	112.5 ± 6.46^{a}	53.57 ± 4.79^{c}	**
Skeleton weight/gm	212.5 ± 19.37^{b}	330 ± 13.54^{a}	83.75 ± 4.79^{c}	**
Fillet weight/gm	282.5 ± 17.09^{c}	470 ± 47.61^{a}	398.75 ± 38.38^{b}	**
Inedible Part%	56.98 ± 1.5^{a}	48.28 ± 0.53^{b}	45 ± 1.26^{b}	**

Sig: Significant; N = 4; **: Significant P < 0.05); ^{ab}Means with different superscripts at the same raw differ significantly by Least Significant Difference (LSD) test at P < 0.05.

Table 2 - Comparisons of percent fillet yield of three fish specie (*O.niloticus*, *L.niloticus* and *Clarias spp.*).

Parameter / Type of fish	*O.niloticus*	*L.niloticus*	*C.spp.*	Sig.
Average head % ±SD	14.16 ± 0.67^{b}	10.06 ± 0.93^{c}	29.09 ± 1.16^{a}	**
Average viscera %±SD	10.33 ± 0.6^{a}	10.85 ± 1.97^{a}	6.99 ± 0.5^{b}	**
Average skin %±SD	9.95 ± 0.44^{b}	9.32 ± 0.42^{a}	5.52 ± 0.58^{c}	**
Average skeleton %±SD	32.84 ± 1.85^{b}	27.37 ± 1.51^{a}	8.58 ± 0.41^{c}	**
Average fillet %±SD	33.39 ± 2.05^{c}	38.82 ± 1.29^{a}	46.75 ± 1.32^{b}	**

Sig: Significant; N = 4; **: Significant (P < 0.01); ^{abc}Means with different superscripts at the same raw differ significantly by Least Significant Difference (LSD) test at P < 0.0.

DISCUSSION

The results of this study shed a light on body weight characteristics, filleting indices and proximate chemical composition studies (Ether extract, Crude protein, Nitrogen free extract, Ash, Moisture, Dry matter) of three commercial fresh water fishes. *Oreochromis niloticus* possessed large skeleton 32.84% which had an adverse effect on the filleting yield of fish, Also there are some attributes which are responsible for decreasing the filleting yield such as skeleton, skin and viscera. In the case of *Labeo niloticus* which recorded 27.37%, 9.32% and 10.85% respectively.

Clarias spp. had moderate skin and viscera weight which resulted in the high filleting yield (46.75%) among the studied fishes, although the head of the *Clarias spp.* was large in comparison with rest of the its components, this did not affect its filleting yield which was (46.75%) because on the other hand it has a lower skin and skeleton percentage (5.52%) and (8.58%) respectively. The filleting yield results indicated that the body weight composition revealed a significant difference in head; viscera, skin, skeleton and fillets of the three fish (*Oreochromis niloticus, Labeo niloticus,* and *Clarias spp.*). This result is in agreement with Eoy (1991) who studied carcass composition and filleting yield of ten fish species from Kanji Lake. He reported that the weight of whole fish and weights of fillets were significant different to each other (P<0.01).

And also the results of Obanu and Ikeme (1988) studies on processing characteristics and yield of some fishes of the River Niger. They mentioned that the fillets, head, viscera and bones were in the range 33.5- 68%, 11-31%, 3.89- 9.8% and 1.32- 15.3% respectively. The results obtained were agreement with Mac (1992) who studied the meat, yield and nutritional value of O. *niloticus* and S. *galilaeous*, and found that the processing characteristics of this species have decreasing order of fillets, head, skeleton, viscera and skin.

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Table 3 - The effect of direct sunlight (open air) on the chemical composition of the three fish species (*Oreochromis niloticus, Labeo niloticus and Clarias spp.*).

Traits	E.E		CP		NFE		Ash		Moisture		DM	
	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated
O .nilotics	7.5±0.2	7.4±0.2	34.4±0.5	62.0±.0.6	29.9±1.3	16.7±0.8	4.6± 0.3	7.2± 0.1	76.3±0.8	6.7±1	23.7±0.8	93.3±1
L .nilotics	8.4±0.3	8.2±0.2	32.2±0.6	61.5±2.7	29.3±1.6	16.9±0.9	4.8±0.2	7.3± 0.2	74.9±0.9	7.1± 0.7	25±0.9	92.9± 0.7
C .lazira	7.3±0.2	7.3 ±0.2	32.3±0.4	61.5±0.7	30.9±0.9	17.8±0.9	5.8± 0.3	7.9± 0.2	76.5± 0.7	7.1± 0.5	23.7± 1	94.5± 0.5
Main effects												
Fish species												
O .nilotics	7.41[b]		48.18[a]		23.34[b]		5.90[c]		41.52[a]		58.48[b]	
L .nilotics	8.27[a]		46.84[b]		23.10[b]		6.05[b]		41.02[b]		58.96[a]	
C .lazira	7.32[b]		46.91[b]		24.38[a]		6.85[a]		40.99[b]		59.11[a]	
Standard error	0.04		0.25		0.23		0.04		0.16		0.17	
Significant	**		**		**		**		*		*	
Treatment												
Untreated	7.71		32.99		30.07		5.06		75.93		24.13	
Treated	7.62		61.63		17.14		7.47		6.43		93.57	
Standard error	0.04		0.2		0.19		0.04		0.13			
Significant	NS		**		**		**		**		**	
Treatment X Fish species												
Significant	NS		*		NS		**		**		**	

[abc] Means with different superscripts at the same raw differ significantly by Least Significant Difference (LSD); N= 4; **: Significant (P < 0.01); *: Significant (P < 0.05); NS: No significant.

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Table 2 shows the average of body weight characteristics for fish under experiment this result is in agreement with the finding of Ali et al. (1992) who studied body characteristics; yield assessment and proximate chemical composition of commercial fish species namely *Lates niloticus*, *O.niloticus*, *Sarotheradeom galilaeous*, *Labeo niloticus* and *Labeo horie*. The results of body characteristics and yield indices revealed clearly percentage decrease in the order of fillets, heads, skeletons, viscera and skin for *tilapia spp.* Compared to order of fillets, skeletons, viscera, head and skin for *Labeo spp.*

Generally the filleting yields of these fish studied were a reflection of their anatomy, species with large head, skin and skeleton, relative to musculature give lower filleting yield, than those with smaller head, skin and skeleton, on the other hand, *O.niloticus* had high inedible parts (head, skeleton and viscera) which recorded (56.98%). And the lowest inedible parts for *Clarias spp.* (48%). These inedible parts are often discarded except for few considerations head and skeleton are used as by product.

The result of chemical composition is in agreement with Clacus and Ward (1996) who reported that flesh from healthy fish contains (70-80% water).The results of this study is in agreement with Babiker and Dirar (1992) studies on the fermented, dried fish in Sudan on three fish species; Dabs (*Labeo spp.*), Bulti (*Tilapia spp.*) and Germut (*Clarias spp.*). They mentioned that the chemical composition results showed that moisture contents were 9%, 7.1% and 7.7% protein content 65%, 58.1% and 55.9%. Fat content 11.3%, 18.2% and 17%, and ash content 18.5%, 22.9% and 12.6% respectively.

CONCLUSION

Recently, the demand of tilapia (*oreochromis niolticus*), Dabs (*Labeo niloticus*) and catfish (*Clarias spp.*) consumption increased continuously because, these fishes are of low price but, high nutrition food. It was noticed that *clarias spp.* has the highest edible meat percentage 46.75% followed by *Labeo niloticus* 38.82% and *Oreochromis niloticus* (33.39%), and there were significant differences ($p< 0.05$) among the three species.

The results of protein contents examined were 62%, 61.5% and 61.5% for *Oreochromis niloticus, Labeo niloticus* and *Clarias spp.* respectively. Fat contents were 7.41%, 8.27% and 7.32% for *Oreochromis niloticus*, *Labeo niloticus* and *Clarias spp.* respectively. Moisture contents were 6.7%, 7.5% and 7.5% for *Oreochromis niloticus*, *Labeo niloticus* and *Clarias spp.* respectively. Ash contents were 5.90%, 6.05% and 6.85% for *Oreochromis niloticus, Labeo niloticus* and *Clarias spp.* respectively.

When comparing protein contents of the three fish species it was found that *Labeo niloticus* and *Clarias spp.* have equal protein contents, but *Oreochromis niloticus* has different percentage. Moreover it was found that *Labeo niloticus* and *Clarias spp.* have equal Moisture contents. Also it was found that the three fish species have different fat contents with the highest level for *Labeo niloticus* followed by *Oreochromis niloticus* and the least level for *Clarias spp.*

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