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FILLETING YIELD AND PHYSICAL ATTRIBUTES OF SOME FISH FROM LAKE NUBIA

H.M. ADAM SULIEMAN[1]*, M.T. ALI[2] and M.I. TIBIN[3]

[1]College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology, P.O.Box 204, Khartoum North, Sudan
[2]Fisheries Research Centre, El-Shagra
[3] Khartoum University, College of Animal Production

*Email: hassanadamus@yahoo.com

ORIGINAL ARTICLE

ABSTRACT: *Five commercially essential fresh water fish species were collected from Lake Nubia Northern part of the Sudan, consisting of thirty samples each of Bagrus bayad (Bayad), Bagrus docmac (Kabarous), Barbus bynni (Bynni), Labeo coubie (Kadan) and Synodonis sp. (Gargour), these fish species were investigated for physical, filleting yield and body weight characteristics. It was observed that the yield of fish was a reflection of its structural anatomy. Fish with small heads and viscera regardless of the season of spawning as in the case of Bagrus bayad produced a higher filleting yield than those with larger heads and viscera as in the case of Synodonis sp. Using a linear regression analysis, no significant difference was found (P>0.05) and the size of the fish was linearly related to the filleting yield. The physical attributes such as water holding capacity (WHC), cooking losses and sensory evaluation were employed. The results show variation in WHC ranged from 1.53–3.35, cooking losses from 18.17–25.40 %, while sensory evaluation shows that the Bargus docmac scored panel test marks (5.97), which was the most preferred than the rest of the studied species.*

Keywords: *Filleting yield, physical attributes, fish species*

INTRODUCTION

Study of characteristics of fish quality requirement and assessment indices are basic trade relations processes in deciding prosperity of commercial fisheries products. Therefore, study of fish products are deemed to be of paramount importance (El Tay, 1994).

Processors, nutritionists and consumers, all have direct interest in the physical and chemical composition of fish. This can be done through the studying of general condition of fishes via studying their body weight, body length and filleting yield indices. This allows some flexibility in assessing the actual amount of fish tissue consumed and inedible parts discarded.

Lake Nubia together with Lake Nasser formed the second largest human–made Dam in the world after Lake Volta in Ghana (El Shahat, 2000). It was established in 1964 after the construction of High Dam (Ents, 1974) and extends from Cataract at Dal in the Sudan to Aswan in Egypt. The Reservoir is about 480 km long consisting of 300km (Lake Nasser) in Egypt and 180km (Lake Nubia) in Sudan (El Shahat, 2000).

The most predominant fish families in commercial fish landings of Lake Nubia are Cichlidae (*Tilapia sp.*) Cyprinidae, (*Labeo sp.*), Centropomidae (*Lates niloticus*), and Bagridae (*Bagrus bayad* and *Bagrus docmac*), which is not, less than 80% of the total catches (Ali *et al*., 1992). The highest total fish production was 34206 ton in 1981 and the lowest was 751 ton in 1966 (El Shahat, 2000).

Little work has been done in the Sudan concerning fish flesh quality, filleting yield and body weight characteristics particularly in Lake Nubia. However, fragmented work was done by a few Sudanese researchers namely Ali et al. (1992), Hassan (1996), Jok (1996), Ali, (1977) and Ali, (1993) in Lake Nubia and Khalifa et al., (2000) and Pitcher & Preikshot, (2000) in Lake Nasser. The studies of these researchers were concentrated on the body weight characteristics; yield assessment, physical and proximate chemical composition of some commercial fish species of the Lake Nubia and Nasser landings for duration of two decades. The species studied included *Lates niloticus*, *Tilapa sp., S. galilaeous, Labeo niloticus* and *coubie, Synodontis sp., Barbus bynni, Bagrus bayad, Bagrus*

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docmac. The results of body weight composition and yield indices revealed clearly that the percentage decreased in the order of fillet, head, skeleton, viscera and skin for the most of studied fish species.

The objectives of this study are to evaluate and assess the yield of edible and inedible tissues and physical attributes of some important fish species from Lake Nubia represented by three different families and classes of fishes.

MATERIALS AND METHODS

Sampling Site

The sampling site was chosen at Lake Nubia on the River Nile, Northern part of the Sudan on Egyptian border. The Lake extends along latitudes 20° - 27° North, and longitudes 30° - 35° East through the Nubian Desert.

Experimental Species

A total of 150 assorted commercially fish samples, belonging to three families, were selected for this study. These families were Bagridae, Cyprinidae and Mochocidae. The studied fishes were represented by five species, namely, *Bagrus bayad* (Forscal, 1775)*, Bagrus docmac* (Forscal, 1775)*, Labeo niloticus* (Ruppell, 1832), *Barbus bynni and Synodontis sp*. (Block-Schneider, 1801). Each species was composed of 30 samples. The samples were collected fresh from fishermen at landings area, washed with tap water to remove any adhering material, and then placed in insulated boxes with crushed ice for preservation during assessment. The mean body weights of the samples were 1228.5 g, 1848.1 g, 960 g, 1221.4 g and 641.7 g, respectively. The whole fresh samples were taken to laboratory in Nubia Fisheries Plant (LNFP) where their total and standard length were recorded (in cm) using measuring board (100 cm in length) and total body weights were recorded in grams. Then, fishes were filleted, eviscerated, deheaded and skin was removed from scaled fishes (*B. bynni* and *Labeo coubie*) and left for scaleless fishes (*B. bayad, B. docmac and Synodontis sp*.) using sharp knives. The weight of viscera, fillets (with ribs), heads, skins and skeletons (with some adhesive meat and fins) were weighed separately using weighing balances (10 kg capacity for large fishes and 2 Kg capacity digital balance for small samples).

Sensory evaluation

Sensory evaluation of samples was carried out using nine panelists comprised of senior members of staff and some students of College of Animal Production, Department of Meat Science. For each session random samples were cooked and prepared carefully, and then random samples were offered to panelists in panel room. Every treatment was given a random code number, which was changed in each session. The assessors scored for color, texture, flavor and juiciness. An overall acceptability score was given to cooked fish using an eight-point hedonic scale, where eight was extremely desirable while one was extremely undesirable.

Water holding capacity

Three grams were taken from every sample of fish species, placed on filter paper and then 25 kg load was placed on the top of the sample for two minutes. The water released was absorbed by filter paper. The amount of squeezed water was determined by difference between two rings and was expressed as percentage.

Cooking losses

The samples to be used for determination of cooking losses were randomly selected. Every sample was weighed separately and placed in aluminum foil and cooked in oven (100° C). Samples were allowed to cool to room temperature then reweighed. The cooking losses were determined by weight difference between cooked and uncooked samples and expressed as a percentage (Ziprin et al., 1981).

Statistical Analysis

The data of the present study were analyzed using statistical methods according to social science software (SPSS, version 10), one way analysis of variance (ANOVA) and regression line as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The results of this study shed a light on some physical, body weight characteristics and filleting yield of five commercially fresh water fishes. Table 1 shows a significant variation in the mean body weight, standard length and filleting yield indices of fish investigated. The fillet percentage was highest for the *B. bayad* at 46.86 % and lowest for *Synodontis sp*. (40.80%). The highest filleting yield of *B. bayad* was due to small viscera (4.48 %) and skeleton (20 %) while the lowest filleting yield of *Synodontis sp*. was due to its large head, which measured 33.55 %.

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The least variable component of the filleting yield indices was the viscera, which were more or less uniform except for *Labeo coubie* and *Synodontis sp.*, which recorded highest percentage of viscera (11.40% and 11.39%, respectively).

Table 1 - Average filleting yield indices (± standard error) of five fresh water species from Lake Nubia

Parameter / Species	Total Wt. (g)	S.L (cm)	Fillet (%)	Viscera (%)	Head (%)	Skeleton (%)	Skin (%)	Edible Parts (%)	Inedible Parts (%)
Bagrus bayad	1228.5 ±0.12	46.10 ±1.39	46.86^{b} ±0.23	4.48^{a} ±1.38	25.00^{a} ±0.28	20.00^{a} ±0.70	-	46.86 ±0.23	49.54 ±0.95
Bagrus docmac	1848.1 ±1.68	41.46 ±0.62	45.90^{b} ±0.33	6.62^{a} ±0,29	27.83^{a} ±0.64	15.67^{a} ±0.81	-	45.90 ±0.33	50.21 ±0.77
Barbus bynni	1221.4 ±0.10	38.90 ±0.25	44.80^{b} ±0,09	7.37^{a} ±0.32	13.04^{a} ±1.21	21.96^{a} ±1.38	9.65^{a} ±1.04	44.80 ±0,09	52.02 ±0.21
Labeo coubie	957.3 ±0.28	32.20 ±0,80	43.31^{b} ±0.21	11.40^{a} ±1.15	14.17^{a} ±1.07	18.38^{a} ±0.11	9.14^{a} ±1.00	43.31 ±0.21	53.05 ±0.09
Synodontis sp.	641.7 ±1.35	28.20 ±1.39	40.80^{b} ±0.74	11.39^{a} ±1.15	33.55^{a} ±1.36	14.05^{a} ±1.42	-	40.80 ±0.74	58.99 ±1.86
SD	39.74	6.31	4.75	2.73	7.94	2.28	0.25	4.75	3.36

^{a,b} Values are mean percentage of 30 samples of each species. means in the same column bearing the same superscripts are not significantly different at (P>0.05).

The body weight characteristics and filleting yield indices revealed clearly a percentage decrease in the order: fillet, head, skeleton and viscera for *B. bayad, B. docmac and Synodontis sp*. while the percentage decrease order for *Barbus bynni and Labeo coubie* was: fillet, skeleton head, viscera and skin. These results were in agreement with Eyo (1991), Abanu and Ikeme (1988) and Ali et al., (1992).

Synodontis sp. and *B. docmac* possessed large head (33.6% and 27.8%, respectively) which had an adverse effect on the filleting yield of their bodies. Also there were some attributes, which were responsible for decreasing the filleting yield such as skeleton and skin in the case of *Barbus bynni* and *Labeo coubie*, which recorded 21.96 %, 18.34% for skeleton and 9.14 % for skin, respectively.

B. bayad had moderate head and skeleton weights which resulted in the high filleting yield (46.88 %) among the studied fishes, although the head of the B. docmac was large compared to the rest of its components. This did not affect its filleting yield which was (45.90 %) because it had lower skeleton percentage (15.70%).

Generally, the filleting yield of the studied fish species was a reflection of their anatomy i.e. species with large heads and skeleton relative to musculature give lower filleting yield than those with smaller heads and skeletons (Eyo, 1991; Ali et al., 1992).

On the other hand, Synodontis sp. had high inedible parts (head, skeleton and viscera) that recorded 58.99% whereas B. bayad recorded relatively less inedible parts (49. 54 %). These inedible parts are often discarded except for a few considerations where head, skeleton and gonads are used as by-products and sometimes used as diet for low-income people.

The edible parts (fillets) weight of studied fishes was very low when compared with fishes such as Carp (53 %) and Trout (70%) (FAO, 1985). Generally, the percentage of body components of inedible parts (skin, skeleton, viscera and head) of the fresh water fishes was in most cases, higher than the edible parts (fillet) (Table 1). Since these inedible body components (head, skeleton, skin and viscera) are usually discarded except for a few considerations where heads and skeletons are eaten, the purchaser may thus suffer economic loss. Therefore, the use of such inedible parts for manufacture of fish silage or fish meal in different fisheries sectors is suggested.

Little work has been done in Sudan concerning sensory evaluation of fish products. The organoleptic test was carried out for the treated samples to evaluate the mean value of color, texture, flavor and juiciness depending on the personal preference score (Table 2).

Table 2 - Mean organoleptic scores for five fresh water fishes

Treatment / Species	Color	Texture	Flavor	Juiciness	Overall Acceptability
Bagrus bayad	5.8^{a}	5.6^{a}	5.9^{a}	5.8^{b}	5.85
Bagrus docmac	6.2^{a}	6.1^{a}	5.7^{a}	5.9^{b}	5.97
Barbus bynni	5.3^{a}	5.2^{a}	5.6^{a}	5.2^{b}	5.31
Labeo coube	5.9^{a}	5.5^{a}	5.5^{a}	5.4^{b}	5.57
Synodontis sp.	5.7^{a}	5.7^{a}	5.2^{a}	5.4^{b}	5.62
SE	0.47	0.48	0.42	0.49	0.43

^{a,b} Values are mean percentage of 30 samples of each species. Means in the same column bearing the same superscripts are not significantly different at (P>0.05).

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The study showed no significant difference (P<0.05) in the parameters of color, texture and flavor for all samples. However, for the parameter of juiciness there was a significant difference observed (P<0.05). This might be due to the effect of water holding capacity and the cooking method. The juiciness was considered to be related to water holding capacity as it was preferred by the panelists. This finding was in agreement with Tibin (1982), Bennion (1980) and Cross et al. (1979).

The overall acceptability scores obtained during this study would closely be related to the overall preference of the consumer for the samples. Remarks made by individual panelists of the organoleptic test showed that *B. docmac* (5.97) was the most preferred one among the studied fishes. This might be attributed to its good color (6.2) and texture (6.1), while *Barbus bynni* scored the lowest marks due to fewer score of color (5.3) and texture (5.2).

Concerning cooking losses, the mean values of samples as given in Table 3, which ranged from 18.9–25%, were in agreement with Culcas (1981) and Tibin (1982) who reported that heat causes the protein in muscle fibres to coagulate and the flesh becomes firmer which resulted in some shrinkage and a lot of weight lost. The cooking losses materials are composed of drip losses, evaporation and material that accumulated in aluminum foil. Factors behind the losses of cooking were the internal temperature of meat, cooking time, method of cooking and pH of flesh. Similar findings were reported by Osman (1995) on flesh of *Labeo niloticus* where the losses were found to be 20 %.

Table 3 - Water holding capacity and cooking losses of five fresh water fishes

Treatment Species	Water holding Capacity (%)	Cooking losses (%)	Significant level
Bagrus bayad	2.62	18.17	*
Bagrus docmac	3.35	22.13	*
Barbus bynni	1.75	25.48	*
Labeo coube	1.77	21.34	*
Synodontis sp.	1.59	19.59	*
SE	0.78	2.46	–

Values are means of 9 samples for each species

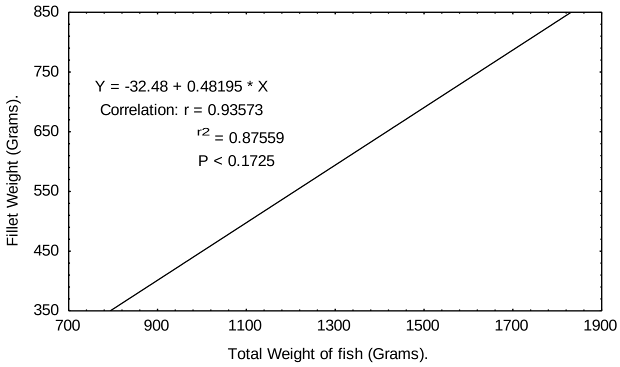

Figure 1 - The regression line of the relationship between fillets and total weight of studied fish from Lake Nubia

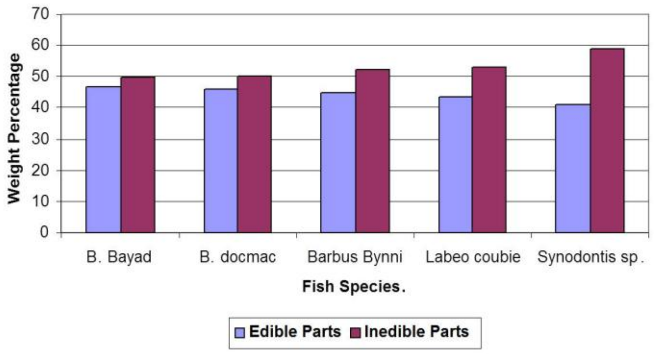

Figure 2 - Shows the relationship between edible and inedible parts studied fish species

The value of water holding capacity (WHC) of the flesh of fish studied, as given in Table 3, were variable from fish to another. *B. docmac* had highest WHC (3.35%), while the *Synodontis* sp. had lower value (1.59%). These results were in agreement with Hamm (1972), who attributed the variation to many factors such as species of fish, physiological condition, seasonal variation, age and stage of sexual maturity. Finally, the results revealed clearly that muscles (flesh) with high WHC were juicy and obtained high organoleptic scores than muscles with low WHC a result that confirmed the findings of Hamm, (1972), Tibin, (1982), Osman, (1995) and Huss, (1988).

It can be concluded that *B. bayad* had highest filleting yield (47%) followed by *B. domac* (46%), *Barbus bynni* (45%), *Labeo coubie* (43%) and the lowest one was *Synodontis sp.* (40%). The percentage composition of inedible parts of studied fish was higher than the edible parts. Also, flesh with high WHC was juicy and obtained high organoleptic scores.

REFERENCES

Ali MT (1977). Studies on gillnets selectivity in Lake Nubia Fisheries. M.Sc. Thesis. Department of Zoology, U of K.

Ali MT (1993). Lake Nubia commercial landings for two decades (1970-1990). FRC Wadi Halfa.

Ali MT, Babiker RB and Tibin MI (1992). Body weight characteristics, yield indices and proximate chemical composition of commercial fish species of Lake Nubia. (Unpublished report, FRC).

Bennion M (1980). Introductory in Foods. 7th ed. Mac. Millan Publishing Co. Inc. New York, N. Y.
Block-Schneider, (1801). Descriptions of animalian kingdom (Citedfrom Boulenger, 1907).
Cross HR, Berry BW and Muse D (1980). Sensory and cooking properties of ground beef prepared from hot and chilled beef carcasses. J. Food Science.
El Shahat MM (2000). Lake Nasser overview, p.3-6. In: J. F. Craig (ed). Sustainable fish production in Lake Nasser; Ecological basis and management policy. ICLARM Conf. Proc., 61: 184p.
El Tay NO (1994). Chemical composition and quality grading of three fish species as related to environmental conditions in the Blue Nile and White Nile. M.Sc. Thesis U. of K.
Ents BAG (1974). The morphometry of lake Nasser and Nubia. Work. Pap. No. 5. Aswan Regional Planning. High Dam Lake Development Authority. Egypt.
Eyo AA (1991). Carcass composition and filleting yield of ten fish species from Kainji Lake. FAO Fisheries Report FIIU/R467 Suppl. Accra, Ghana. 22-25 Oct.
FAO (1985). Aquaculture statistical data. ADCP, Rome: Food and Agriculture Organization.
Froskal, (1775). Descriptions of animalian kingdom (Cited from Boulenger, 1907).
Gomez KA and Gomez AA (1984). Statistical procedures for Agricultural Research. 2nd ed. Wiley and Sons, Inc.
Hamm D (1972). The Nile River symp. On River ecology and the impact of man, Hydro. Res. Unit. Khartoum, Sudan,. Pp. 127.
Hassan AM (1996). Body Weight Characteristics and Physical Composition of Some Fish Species from Lake Nubia. M.Sc. Thesis Khartoum University, Faculty of Animal Production, Sudan.
Huss HH (1988). Fresh fish quality and quality changes. FAO Fisheries, series No. 29.
Jok GM (1996). Studies of chemical composition of fish flesh. M. Sc. Thesis, Faculty of Animal Production, U of K. Sudan.
Khalifa USA, Agaypi MZ and Adam HA (2000). Population dynamics of *Orechromis niloticus* and *Sarotherodon galilaeus*, p. 87-90. In J.F. Craig (ed.). Sustainable fish production in Lake Nasser; ecological basis and management policy. ICLARM Conf. Proc. 61, 184p.
Obanu ZA and Ikeme AI (1988). Processing characteristics and yield of some fishes of the River Niger in Nigeria. FAO Consultation of fish technology in Africa FIIU/R400 Suppl. Pp. (218-221).
Osman MA (1995). Body structure, yield indices and physical Analysis of *Labeo niloticus* from commercial fish landing to Khartoum (unpublished).
Pitcher TJ and Preilkshot D (2000). RAP FISH. A rapid appraisal technique to evaluate the sustainability status of fisheries, p. 109-116. In J. F. Craig (ed). Sustainable fish production in Lake Nasser; Ecological basis and management policy. ICLARM Conf. Proc. 61, 184p.
Ruppell (1832). Descriptions of animalian kingdom (Cited from Boulenger, 1907).
Tibin MI (1980). Effects of hydrogenated Soya bean oil on sensory, physical, chemical and microbiological properties of ground beef and semi-dry sausage. Ph. D. Thesis, USA.
Ziprin YA, Rhee ZL, Carpenter Hostetler RL, Tereel RN and Rhee KC (1981): Glandless cotton seed, peanut and Soya protein in ground beef patties, effect on rancidity and other quality factors. J food science, 46: 58-61.

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