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## Comparative studies on nutritive value of wild and farmed African catfish *Clarias gariepinus*

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### Abstract

The fillet percentage yield, chemical composition and mineral elements of wild and farmed African catfish *Clarias gariepinus* are presented. Farmed males yielded 42.73± 4.42% fillets compared to 49.86± 1.95% for wild males, 51.11± 2.59% for wild females and 46.86±2.45% for farmed females. Studies of proximate chemical composition were examined as parameters of fish flesh quality. The fillets of farmed and wild were significantly different ( $p < 0.05$ ) in moisture (72.8± 5.94 and 75.01± 2.09%), dry matter (26.7± 6.08 and 25± 2.09%), and nitrogen free extract (31.90± 6.58 and 34.5± 1.86%), but there were no significantly different in protein (30.86± 0.68 and 30.98± 0.55%), Ether extract (8.4± 0.30 and 8.1± 0.33%) and ash (1.66± 0.51 and 1.31± 0.26%). The proximate chemical composition showed no significantly different with in sex ( $p > 0.05$ ).

Levels of the macro elements (mg/l), phosphorus, potassium, manganese, sodium and calcium, and micro elements (mg/l), iron and zinc were no significantly different in farmed and wild, Ca (4.02± 0.47 and 4.32±0.59); P (2.87± 0.42 and 2.80±0.45); Mg (2.65± 0.36 and 2.56±0.38); Na (4.32± 0.35 and 4.34±0.32); K (3.76± 0.41 and 4.07±0.25); Fe (1.72± 0.03 and 1.09±0.49) and Zn (0.096± 0.01 and 0.097±0.01).

**Keywords:** fillet yield, proximate, nutritive value, basic minerals, *Clarias gariepinus*, wild, farmed

### 1. Introduction

Fish is one of the most important foods and is valued for its nutritional qualities. Fish flesh is a good source of high quality protein containing essential amino acids in the amount and proportion required for good nutrition. It also provides a good source of vitamins and minerals [19]. It will also enhance the proper mental and immunity development against disease among growing children [17]. In low-income countries, staple foods supply majority of energy but not essential amino acids and micronutrients staples, which can be supplied by fish [7]. The measurement of proximate composition is often necessary to ensure that they meet the requirements of food regulations and commercial specifications [24]. Mineral elements are basic requirement of all living organisms. Some essential minerals may be toxic at their high concentration in body of animals [23]. Fish is an indispensable source of micronutrients, such as iron, iodine, zinc, vitamin A and B [12]. To compare the chemical composition of farmed fish with their natural counterparts is complex; study should be emphasized with more specialized geographical influence with diet playing an important role [16]. Farmed fish tend to be deficient in body protein and ash, so that they almost always contain more lipid than do wild fish, such lipid being the more saturated.

Presently the Objectives of this study was designed to body characteristics and filleting yield indices among farmed and wild *Clarias gariepinus*, and elucidate to evaluate and compare of chemical composition and mineral elements of farmed and wild *Clarias gariepinus*.

### 2. Materials and Methods

This study was conducted at department of fisheries and wildlife lab facility, Sudan University of Science and Technology. Experimental wild fish samples were collected from fish commercial market (Mahile), and farmed samples were collected from fish farm (Topheg Hamed fish farm- soba scheme). Twenty samples from each site were utilized.

Fish samples were identified sexually, cleaned, weighed (gm), and measured (cm) for total length and standard lengths before filleted, respectively.

The viscera, fillets (without ribs), fillet with skin, head, skeleton and fins (with some adhesive

meat), were weighed separately. Fillets were minced and chilled prior chemical analysis using standard method of [3], to determine proximate composition. The major elements, comprising macro (Ca, Mg, Na, K and P) and trace elements (Fe and Zn) and the percentage mineral elements concentration were determined using corning 400, flame photometer for Na and K and (AAS) Atomic Absorption Spectrophotometer phoenix – 986, [3] for the rest. The data of this study were analyzed statistically using computer statistical package (SPSS version 21). (ANOVA) as described by [11].

### 3. Result and Discussion

The farmed fish samples showed significant difference female total weight (324.1±30.35) higher than male (240.6±63.71). Farmed total weight (282.4±64.75) is also smaller weights than those collected from market as wild (340.5±64.33), as reflected in Table (2). This result is in agreement with [6]. Average total length of fish from farmed specimens was ranged from (31.69±2.693) for males and (34.71±1.14) females, with significant different ( $p < 0.05$ ), but with no significant difference ( $p > 0.05$ ) for wild samples Table (2). In addition to that there were significant differences in farmed and wild samples which ranged between (33.20 ± 2.53 to

36.70±1.90) cm. The edible portion as percentage of fillet for farmed and wild samples varied from (44.793 to 50.485%), while farmed *Clarias gariepinus* males and females group varied between (42.725±4.418) to (46.862±2.451), in comparison to wild group which ranged between (49.862±1.953) to (51.108±2.590) males and female fishes tables (2, 3). This result is in agreement with [8, 18, 2, 7]. Also agreed with [4] which concluded that the edible portion of the flesh fish ranges between 40 - 60%, table (2, 3).

The chemical composition of African catfish *Clarias gariepinus* farmed and wild groups in respect to sex showed high nutritive value as shown in Table (1). These findings are in accordance with the findings of [9, 20, 15, 14], respectively.

Fish is said to be an excellent source of protein, ether extract, ash and minerals. The wide arrays of results detected in this study have attested the same. However, the contents varied in their concentrations when compared with earlier reports in the identical line [5, 22, 21, 13].

Mineral contents in fish depend on its availability in their environment followed by diet absorptive capability and preferential accumulation of same by the fish [25, 1, 10]. Have studied the proximate and mineral composition of some food fish species and observed that food fishes are good in mineral composition.

**Table 1:** Proximate chemical composition and basic minerals of fillet farmed and wild *Clarias gariepinus*

Proximate parameters	Fish samples		Minerals parameters	Fish samples	
	Farmed	Wild		Farmed	Wild
Moisture	72.833±5.94 <sup>a</sup>	75.016±2.09 <sup>b</sup>	Ca	4.015±0.47 <sup>a</sup>	4.318±0.59 <sup>a</sup>
Dry matter	26.666±6.08 <sup>a</sup>	24.983±2.09 <sup>b</sup>	P	2.873±0.42 <sup>a</sup>	2.796±0.45 <sup>a</sup>
Crude protein	30.865±0.68 <sup>a</sup>	30.983±0.55 <sup>a</sup>	Mg	2.65±0.36 <sup>a</sup>	2.559±0.38 <sup>a</sup>
Ether extract	8.4±0.30 <sup>a</sup>	8.1±0.33 <sup>a</sup>	Na	4.317±0.35 <sup>a</sup>	4.34±0.32 <sup>a</sup>
Ash	1.666±0.51 <sup>a</sup>	1.316±0.26 <sup>a</sup>	K	3.755±0.41 <sup>a</sup>	4.072±0.25 <sup>b</sup>
N.F.E	31.903±6.58 <sup>a</sup>	34.5±1.86 <sup>b</sup>	Zn	0.096±0.01 <sup>a</sup>	0.097±0.01 <sup>a</sup>
			Fe	1.172±0.03 <sup>a</sup>	1.09±0.49 <sup>a</sup>

a and b means in the same column bearing the same superscripts are significantly different ( $P < 0.05$ )

**Table 2:** Body characteristics of farmed and wild (male and female) Africa catfish *Clarias gariepinus*.

Fish	Parameters Sex	T.W (g)	T.L (cm)	S.L (cm)	WAG (g)	V.W (g)	H.W (g)	WAG+D (g)	F.W (g)	F.F (g)	Fillet w (g)
		M±St.D	M±St.D	M±St.D	M±St.D	M±St.D	M±St.D	M±St.D	M±St.D	M±St.D	M±St.D
Farmed	Male	240.6±63.71 <sup>a</sup>	31.6±2.69 <sup>a</sup>	27.8±2.38 <sup>a</sup>	204.1±60.83 <sup>a</sup>	25.9±10.45 <sup>a</sup>	56.2±15.58 <sup>a</sup>	147.7±40.49 <sup>a</sup>	6.9±2.67 <sup>a</sup>	42.1±12.68 <sup>a</sup>	102.4±27.67 <sup>a</sup>
	Female	324.1±30.35 <sup>b</sup>	34.7±1.10 <sup>b</sup>	30.6±0.91 <sup>b</sup>	270.5±28.41 <sup>b</sup>	46.2±6.807 <sup>b</sup>	67.189±5.89 <sup>b</sup>	199.9±24.91 <sup>b</sup>	7.7±2.05 <sup>a</sup>	44.0±5.01 <sup>b</sup>	152.4±21.46 <sup>b</sup>
	Total	282.4±64.75 <sup>a</sup>	33.2±2.53 <sup>a</sup>	29.3±2.29	61.5±3.53 <sup>a</sup>	36.1±13.34 <sup>a</sup>	61.8±12.75 <sup>a</sup>	173.9±42.28 <sup>a</sup>	7.3±2.35 <sup>a</sup>	43.1±9.44 <sup>a</sup>	127.3±35.16 <sup>a</sup>
Wild	Male	345.8±73.23 <sup>c</sup>	36.9±2.16 <sup>c</sup>	32.2±1.72 <sup>c</sup>	294.7±75.63 <sup>c</sup>	15.9±6.65 <sup>c</sup>	90.8±16.27 <sup>c</sup>	223.1±49.67 <sup>c</sup>	8.7±317 <sup>b</sup>	54.2±13.35 <sup>c</sup>	172.4±39.18 <sup>c</sup>
	Female	335.2±57.54 <sup>d</sup>	36.4±1.89 <sup>c</sup>	32.2±1.78 <sup>c</sup>	313.0±53.68 <sup>c</sup>	17.4±7.611 <sup>d</sup>	82.6±21.35 <sup>d</sup>	223.5±38.99 <sup>c</sup>	7.7±2.09 <sup>a</sup>	51.6±13.82 <sup>d</sup>	171.2±29.87 <sup>d</sup>
	Total	340.5±64.33 <sup>b</sup>	36.7±1.9 <sup>b</sup>	32.3±1.78	65.6±3.78 <sup>b</sup>	16.7±6.99 <sup>b</sup>	86.7±18.50 <sup>b</sup>	223.3±43.46 <sup>b</sup>	8.3±2.66 <sup>b</sup>	52.9±13.29 <sup>b</sup>	172.0±33.92 <sup>b</sup>

a and b means in the same column bearing the same superscripts are significantly different ( $P < 0.05$ )

Whereas: HW = Head weight (g), WAG+D = Fish weight after gutting and de-heading (g), B.W = Body weight (g), FW = Fin weight, T.L = Total length (cm), F.F = Frame (skeleton) and fins (g), S.L = Standard length (cm), Fillet W = Fillet weight (g), WAG = Weight after gutting, St. D = standard deviation, VW = Viscera weight (g), M = Mean

**Table 3:** Slaughter yield of farmed and wild Africa catfish *Clarias gariepinus* male and female (mean values ± St.D)

Fish	Parameters Sex	WAG	V.W	H.W	WAG+D	F.W	F.F	Fillet w	Carcass
		%± St. D	%± St. D	%± St. D	%± St. D	%± St. D	%± St. D	%± St. D	%± St. D
Farmed	Male	84.4±8.92 <sup>a</sup>	10.7±1.98 <sup>a</sup>	23.4±1.59 <sup>a</sup>	61.3±4.20 <sup>a</sup>	2.8±0.61 <sup>a</sup>	17.4±2.03 <sup>a</sup>	42.7±4.42 <sup>a</sup>	51.5±3.54 <sup>a</sup>
	Female	83.4±2.34 <sup>a</sup>	14.3±1.96 <sup>b</sup>	20.7±1.73 <sup>b</sup>	61.6±2.59 <sup>a</sup>	2.4±0.65 <sup>a</sup>	13.6±0.97 <sup>b</sup>	46.9±2.45 <sup>b</sup>	48.7±1.86 <sup>b</sup>
	Total	83.93±36.37 <sup>a</sup>	12.48±2.66 <sup>a</sup>	22.11±2.11 <sup>a</sup>	61.45±3.34 <sup>a</sup>	2.62±0.65 <sup>a</sup>	15.51±2.5 <sup>a</sup>	44.79±4.07 <sup>a</sup>	50.11±3.12 <sup>a</sup>
Wild	Male	91.0±9.54 <sup>b</sup>	4.6±1.24 <sup>c</sup>	26.4±1.67 <sup>c</sup>	64.5±4.73 <sup>b</sup>	2.5±0.48 <sup>a</sup>	15.6±1.49 <sup>c</sup>	49.9±1.95 <sup>c</sup>	46.6±2.16 <sup>c</sup>
	Female	93.4±1.62 <sup>c</sup>	5.1±1.84 <sup>c</sup>	24.7±4.52 <sup>a</sup>	66.7±2.23 <sup>c</sup>	2.3±0.35 <sup>a</sup>	15.3±2.67 <sup>c</sup>	51.2±2.59 <sup>d</sup>	45.2±4.99 <sup>c</sup>
	Total	92.23±6.78 <sup>b</sup>	4.88±1.55 <sup>b</sup>	25.57±3.42 <sup>b</sup>	65.58±3.78 <sup>b</sup>	2.39±0.42 <sup>b</sup>	15.47±2.11 <sup>a</sup>	50.48±2.32 <sup>b</sup>	45.89±3.81 <sup>b</sup>

a,b,c and d means in the same column bearing the same superscripts are significantly different ( $p < 0.05$ ) Whereas: HW = Head weight, WAG+D = Fish weight after gutting and deheading (g), WAG = Weight after gutting (g), FW = Fin weight (g), VW = Viscera weight (g), F.F = Frame (skeleton) and fins (g), M = Mean, WFWS (fillet) = Weight of fillets with skin (g), St.D = standard deviation, Carcass (g)

#### 4. Conclusion

Fish body composition of African catfish *Clarias gariepinus* is a good indicator of the physiological condition for lab observations and appearance of a fish samples but it is relatively time consuming to processing and measure portions in manual filleting.

The percentage of fillet and head were found to be more weight in wild group in comparison to farmed ones.

The percentage variations of Head in male group of wild samples were higher than in farmed male.

The results of comparative analysis of nutritional composition of farmed and wild *Clarias gariepinus* in respectively to sex, the nutrient profile showed both the farmed and wild *Clarias gariepinus* are intensively rich in term of nutritional values and good fillet benefits to human being's health on consumption of fish.

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