



Sudan University of Science and Technology
College of science and technology of Animal production



**Fillet Yield and Chemical Composition of Two Nile
Fish Species (*Labeo niloticus* and *Synodontis schall*)**

إنتاج الفليت والتركيب الكيميائي لإثنين من أنواع الأسماك النيليه (الدبس والقرقور)

**Thesis Submitted in parital Fulfillment of The Requirements of The
Degree of The Bachelor (honors) Fisheries and Wildlife Science**

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الايه:

وَقَالُوا اللَّهُ تَعَالَى فِي السَّمَاءِ وَآتِ فِي الْأَرْضِ رَضِيَ اللَّهُ بِمَا كُنتُمْ تَعْمَلُونَ مِمَّا

تَكْسِبُونَ (صدق الله العظيم الانعام الآية 3

Dedication

This thesis is dedicated to our fathers
and our mother's
and to our brothers and Sisters
finally our friend's

Acknowledgment

With due respect, we would like to thank God from the beginning. Second we would like to thank our supervisor Dr. Haram Hassan Abbas, For her continuous assistant during this study.

Abstract

This study was created in Sudan University of Science and Technology during January-February 2017 to compare the body weight composition and chemical composition of two different Nile fish species (*Labeo niloticus* and *Synodontis schall*) the analysis of chemical composition from laboratory of veterinary-soba .

The results show significant difference between two fish species in the body weight composition and processing yield of fillet, *Labeo niloticus* give 49% fillets higher than *Synodontis schall* which is give 40% fillets).

Chemical analysis showed significant difference in the studied fish species in moisture, fat and Ash which is 71.2 ± 0.2 , 4.5 ± 0.6 and 2.1 ± 0.6 respectively for *Labeo niloticus* and 73.5 ± 0.6 , 2.0 ± 0.3 and 2.3 ± 0.5 respectively for *Synodontis schall*. No significant difference in protein content .

The results suggest that the proximate composition and body weight composition of fish species greatly varies within the studied Spp.

Key words: compare, body weight, chemical composition (*Labeo niloticus* ,*Synodontis schall*).

الخلاصة

أجريت هذه الدراسة في جامعه السودان للعلوم و التكنولوجيا كليه علوم و تكنولوجيا الإنتاج الحيواني قسم علوم الأسماك و الحياه البرية خلال شهري يناير وفبراير من عام 2017 بهدف مقارنة التركيب الوزني و الكيميائي لأسماك الدبس و القرقور، تم تحليل العينات في معمل الأبحاث البيطرية - سوبا

أوضحت النتائج وجود فروق معنويه بين الانواع موضوع الدراسة في التركيب الوزني حيث أعطت أسماك الدبس نسبة أعلى من صافي اللحم بلغت 49% من الوزن الكلي بينما أعطت أسماك القرقور نسبة صافي بنسبه 40% من الوزن الكلي.

نتائج التحليل الكيميائي أوضحت وجود فروق معنويه بين الأنواع موضوع الدراسة في نسب(الرطوبة,الدهن و الرماد) فكانت لأسماك الدبس 71.2 ± 0.2 , 4.5 ± 0.6 و 2.1 ± 0.6 علي التوالي. و 73.5 ± 0.6 , 2.0 ± 0.3 و 2.3 ± 0.5 علي التوالي لأسماك القرور.

تلخص نتائج الدراسة لوجود إختلاف كبير في التركيب الوزني و الكيميائي لأنواع الاسماك موضوع الدراسة.

كلمات مفتاحية : مقارنة, التركيب الوزني, التحليل الكيميائي, (دبس, قرقور).

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CHAPTER ONE

INTRODUCTION

Fish is 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)**, Fish meat contains significantly low lipids and higher water than beef or chicken and is favored over other white or red meats **(Nestel, 2000)**. The nutritional value of fish meat comprises the contents of moisture, , pro-tein, lipids, vitamins and minerals plus the caloric value of the fish **(Nestel, 2000)**.

Fish in the Sudan have been is 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 most highly perishable commodities and the public has always required continuous reassurance abut 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 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 **(Abd-Allah 2011)** The per capita consumption of fish in Sudan is about 1.3 kg/year and it is considered very low compared to the international level, which is about 13 kg/year **(FAO, 2006)**.

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 proportion is 17,50% **(Williams et al 1988)** 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 **(salva and shamul, 2000)**.processors have direct interest in the proximate composition of fish in order to know the nature of the raw material before shilling freezing smoking or canning can be correctly applied **(FAO, 2004)**.

Information on the processing yield may be of great help for fish quality control and for the tracing system, with an increase in profits in the processing chain **(Galvão et al., 2010)**,Studies on the effect of weight on yield, especially with regard to the presentation forms of the product to consumers (whole eviscerated fish, carcass, fillet) may greatly improve meat yields and profits.Fillet and carcass yields depend on several factors, such as size, age, sex, anatomic shape of the body, head size and weight of viscera, skin and fins.The efficiency of the fillet

machine and the expertise in handling are aspects that should be taken into account.

Objectives of this study were :

- To determine the fillet composition of the two fish (*labeo niloticus* and *synodontis schall*).
- To determine the chemical composition of the two fish (*labeo niloticus* and *synodontis schall*).
-

CHAPTER TWO

LITERATURE REVIEW

2.1 Proximate Composition

Knowledge of the proximate composition of fishes can be used to estimate the food value of fishes and to plan the most appropriate industrial and commercial processing. (Priestly, 1790).

As with many animal products fish and fishery products contain water proteins and other nitrogenous compounds, lipids, carbohydrates and, minerals and vitamins. However, chemical composition of fish varies greatly from one species and one individual fish to another depending on age, sex, environment and season (Huss, 1995)

The study of chemical composition of fish is an important aspect of fish flesh quality since it influences both keeping quality and the technological characteristics of the fish (Huss, 1988)

The variations in the chemical composition of fish closely related to the environment of rearing in ponds or nature and completely depend feed intake. During periods of heavy feeding at first the protein content the muscle tissue will decrease very slightly and then the lipid content show a marked and rapid increase. Fish will have starvation period natural and physiological reasons (Bendall, 1962).

The fish chemical composition can be affected by many factors in different species environmental conditions fish size. Level of protein in the diet and feeding rate (Ogata & Shearer, 2000)

Knowledge of chemical composition is essential in order to compare its value as food with other protein foods (Stansby, 1954).

There was a seasonal variation in the protein, fat and moisture contents of *G. niloticus*. The protein, fat and moisture contents were 17.9%, 1.11%, and 74.61% in summer while in winter were 18.0%, 1.68% and 77.07%, respectively (**ELminshawi, 2007**). However, the variation in the percentage of fat is reflected in the percentage of water. The chemical composition quality of the *G. niloticus* and *Heterotis niloticus* (Nauk), were respectively 78.19% and 79.33% moisture, 5.47% and 4.23% ash, 12.52% and 5.76% fat, 61.20% and 67.34% protein, 308.572

2.1.1 Fat content:

Fauconneau *et al* .(1995) reported that the percentage of lipid and protein and the energy content augmented while the water content reduced as the body weight increased.

The lipid contents of fillets from lean fish is low and staple whereas that from fatty species varies considerably. However the variation in the percentage of fat is reflected in the percentage of water, since fat and water normally constitute around- 80 percent the fillet. (**Huss 1995**).

Clucas and ward (1996) reported that the percentage of lipid protein and the energy content augmented while the water content reduced as the body weight increased the lipids present teleost fish species may be divided in two major groups ;the phospholipids and the triglycerides.

2.1.2moisture contents

Moisture contents of fish body does not seem to be constant in view of the inter relationship with many biological and physiological factors, early instability the juvenile stag and subsequent stability was mentioned by (**parker and Vanstone 1966**).

Remijo(1992)reported that the moisture content of fresh *lobeo spp* fish was(70-44-71.2%). **Ahmed (2006)**carried out comparison of nutritive value of fassiekh using *Hydrocynus spp*. And *schilbe SPP*. She mendtioned that the moisture contents of the fresh fish was in the reported(72.9-81.92%).

Clueas and ward [1996] reported that flesh from healty fish contained [70-80]water .

Ali et al[1996]stated that the moisture content in deep frozen fish of *labeo spp*. Was 76.7.

2.1.3The crude protein

crude protein content of fish ranges from less than 8 to more than 25 of fresh weight .however ,most fin fish muscle tissue contains about 18-22 protein [**Sidwell 1981**].

Although the protein fraction is rather constant in most species variation had been observed such as protein reduction occurring in salmon during long spawning migration [**Ando et al 1985**]

Ahmed [2006]reported that the protein cotent was in the range between 18.9-20.5%.

Clucas and ward [1996]reported that flesh from healthy fish contained [15-24%]protein.

Remijo[1992]reported that the protein content in fresh\abeospp fish was 20-21% Johnston[1994] found that fresh fish protein is about 15

2.2The nutritional value of fish

Fish contains significantly low lipids and higher water than beef or chicken and is favored over other white or red meats (**Neil,1996;Nestel,2000**).

The nutritional value of fish meat comprises the contents of moisture, dry matter. Protein. Lipids. Vitamins and minerals plus the caloric value of the fish (**evangelic et al ,1989;chandrashekar and Deosthale, 1993; Steffens 2006**). There are, therefore. number of variables that can affect the overall chemical composition of fish meat. Nonetheless, there is little information on the effects of sex and size (age) on the individual chemical components of Nile Tilapia meat

Fish received increased attention as a potential source of animal protein and essential nutrients for human diets (**Kromhout et al, 1995; zenebeet al 1998; arts et al.,2001;fawoleet et al 2007**).

Minerals are essential nutrients, they are components of many enzymes and metabolism, and contribute also to the growth of the fish (**Glover and Hogstrand 2002**).

The human body usually contains small amount of these minerals and deficiency in these principal nutritional elements induce a lot of mentioning; as it reduces productivity and causes diseases (**Mills 1980**).

Being used as food, fish is also increasingly demanded for use as feed

However, information concerning the chemical composition of freshwater fishes in general valuable to nutritionists concerned with readily available sources of low-fat, high- protein foods such as most freshwater fishes (**sadiku and oladime 1991**)

The nutritional component of the freshwater fish was found to differ between species, sexes, sizes, seasons, and geographical localities (**zenebeet al 1998b**).

It was also found to influence post-harvest processing and affect the shelf-life of the fish (**clement and lovelli, 1994**). Changes in fatty acid and amino acid concentrations were found to be useful as an index of freshness and decomposition of marinated fish in storage (**khan, 2005**).

From nutritional point of view fish composite of very high nutritional quality, it is rich in most of vitamins, Proteins, minerals, fats and essential amino acid and a nutritious part of human diet an idea which had been justified by some biological experiments that it is nutritionally equivalent to those of meat, milk, eggs (FAO1995).

2.3 Body weight composition:

The edible portion of the fish flesh from some Nile fish ranges between 50 to 60% (Babiker, 1981). The yield of some fish species was estimated to be 29.7 – 48.6% (Gall et al., 1983). While the fillet yields of *Oreochromis niloticus* and *Ictalurus punctus* range between 25.0 to 30.9% (Clement and Lovel, 1994).

The edible portion of the fish flesh from some Nile fish ranges between 50 to 60% (Babiker, 1981). The yield of some fish species was estimated to be 29.7 – 48.6% (Gall et al., 1983). While the fillet yields of *Oreochromis niloticus* and *Ictalurus punctus* range between 25.0 to 30.9% (Clement and Lovel, 1994).

2.4 filleting Yield

Fillet and carcass yields depend on several factors, such as size, age, sex, anatomic shape of the body, head size and weight of viscera, skin and fins. The efficiency of the fillet machine and the expertise in handling are aspects that should be taken into account.

Fish are a source of high quality protein, vitamins and essential minerals. They are practically the sole source of long chain polyunsaturated fatty acids such as those of the Omega-3 series (Jabeen & Chaudhry, 2011). Information on fish chemical composition is highly relevant for the standardization of food products based on

nutritional criteria. It provides elements for decisions on nutritional characteristics and on the follow-up of industrial processes or research by changes in the chemical components

Fish fillet consists of several components, such as moisture, protein, lipids, vitamins and minerals, all of which contribute to the overall meat composition. Fish body composition is affected by both exogenous and endogenous factors **(Huss 1995)**.

Exogenous factors that affect fish body composition include the diet of fish (composition, frequency) and the environment, in which it is found,

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study site

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 during April 2017 the analysis of chemical composition from laboratory of veterinary-soba.

3.2 Material

Cutter ,small knife ,large knife ,gloves, sensitive balance ,

3.3 Sample collection

fresh samples were collected from EL Mawrada fish market.(*labeo niloticus* and *synodontis slugul*). A total of (9) samples of each species stored in ice container and transferred to the Fisheries Laboratory in Sudan University Department of Fisheries and Wildlife Science for preparation and processing

3.4 Samples preparation:

The fish samples were washed thoroughly with tap water and weighed individually and degutted using sharpened and clean knives The Total Length, standard Length, Total Weight and Filleting yield indices were determined using different materials (sharpened, knives, balance and measuring board) , Random samples were taken to conduct the chemical analysis of fresh fish.

3.5 Proximate composition analysis

Moisture content, crude protein, fat and ash were determined for wet sample according to standard methods of Association of Official Analytical Chemists (AOAC, 1985) as follows:

3.5.1 Moisture content determination

The samples were (Initial weight) then dried in an electric oven at 105°C for 24-30 h to obtain a constant weight. The moisture content was calculated as follows:

$$\text{Moisture content (\%)} = \frac{\text{Initial weight} - \text{Dry weight}}{\text{Initial weight}} \times 100$$

Initial weight

3.5.2 Crude protein determination

The Kjeldal method for estimation of nitrogen was applied. Nitrogen content was converted to protein percentage by multiplying by 6.25 as follows:

$$\text{Protein \%} = \frac{(V_a - V_b) \times N \times 14 \times 6.25 \times 100}{W_t}$$

1000 x Wt

Where V_a = volume of HCL used in titration

V_b = volume of sodium hydroxide of known normality used in back titration

14 = conversion factor of ammonium sulfate to nitrogen

6.25 = conversion factor of nitrogen to protein

W_t = weight of sample

N = normality of NaOH

3.5.3 Crude fat determination

Fat content of each sample was determined according to Soxhlet method by ether extract using 2 gm of fish samples.

Extraction continued for 5 hours at 100°C before finding the weight of the extract fat.

Fat percentage was then calculated as follows:

$$\text{Fat \%} = \frac{\text{Extracted fat weight}}{\text{Sample weight}} \times 100$$

Sample weight

3.5.4 Ash content determination

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

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

Sample weight

3.6 Statistical analysis

Results were analyzed using the SPSS computer program, (ANOVA) one way version 19 $p > 0.05$.

CHAPTER FOUR

RESULTS

Table (4.1) shows the body weight composition of the studied fish species

parameters fish spp	Total.L (M±SD)	Standar d. L(M±SD)	Total.W (M±SD)	Head.W (M±SD)	Viscera. W (M±SD)	Skin.W (M±SD)	Skeleton.W (M±SD)	Fillets.W (M±SD)
Labeo niloticus	32.7±2.8	26.1±1.6	307.8±3.9	44.7±1.8	31.9±1.6	28.2±2.5	44.2±2.2	151.7±1.8
Synodontis schall	26.8±1.8	20.1±1.5	258.8±2.8	102.5±3.8	25.7±3.7	16.5±1.2	31.3±1.9	99.8±3.7
Sig	**	**	**	**	**	**	**	**

M=mean ,SD=stander deviation , **= highly significant difference

Table (2) shows the chemical composition of the studied fish species

Parameters fish spp	Moisture M±SD	Protein M±SD	Fat M±SD	Ash M±SD
Labeo niloticus	71.2±0.2	22.2±0.5	4.5±0.6	2.1±0.6
Synodontis schall	73.5±0.6	22.2±0.8	2.0±0.3	2.3±0.5
Sig	**	Ns	**	**

M=mean ,SD=stander deviation , **= highly significant difference

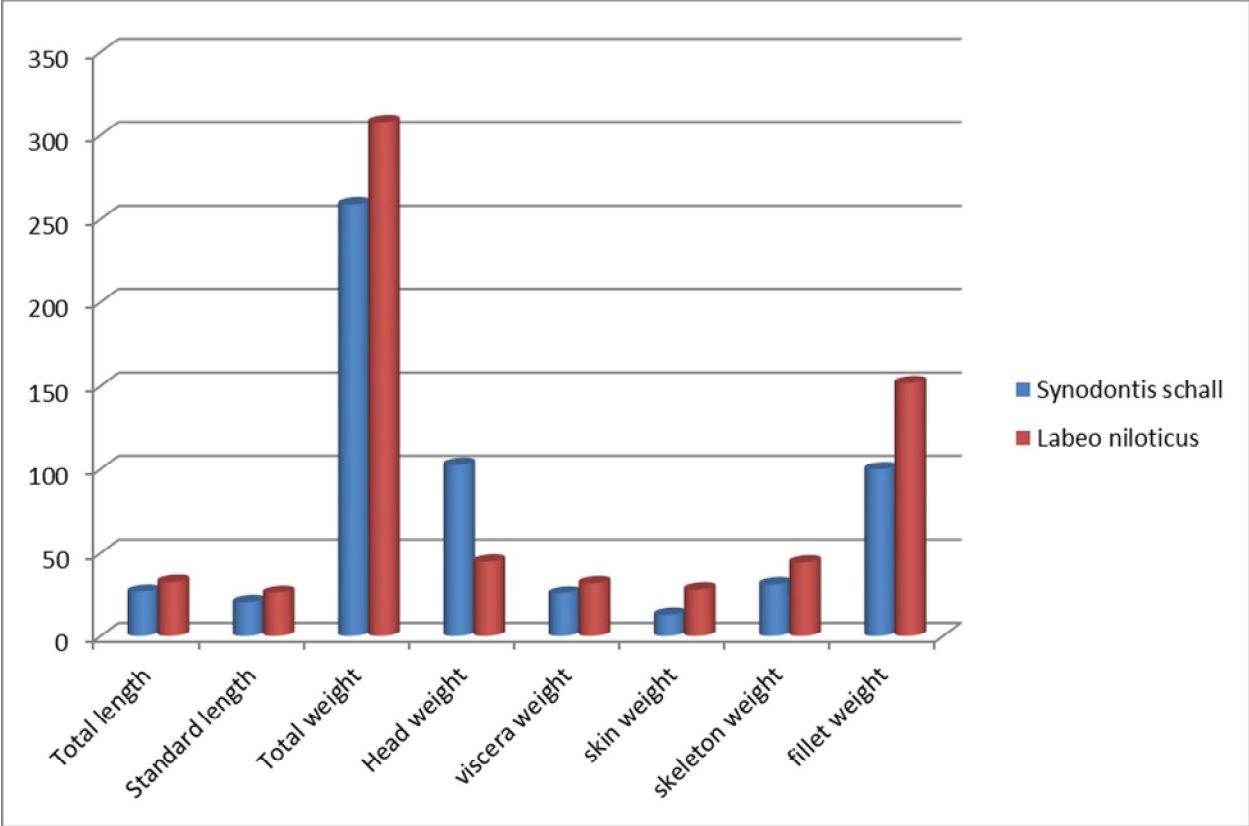


Figure (1) shows the body weight composition of the studied fish species

CHAPTER FIVE

DISCUSSION

The species investigated in the present study *Labeo niloticus* and *Synodontis schall* are popular market fishes in rural and urban areas, and belong economically to the different traditional grades, according to consumer and fishermen preference in Sudan.

Body weight composition of the fish is important aspect in fish processing which gives an idea in amount of the pure fillets and the fish by product.

Average of total weight of *Synodontis schall* fish was 258.8g, significantly lower ($p < 0.01$) than that of *Labeo niloticus* (37.8g). All studied parameters have the same order except in head weight which is high significantly in *Synodontis schall* that may be due to differences in age and body nature and sex, seasons, size and geographical locality of catch (**Zenebe et al., 1998b**).

Chemical composition, moisture, Proteins and lipids contents as well as the Ash content were the major constituents, which had been considered in evaluating the nutritional value of the species studied.

The nutritional elements showed variable values in the species analyzed; with moisture recording the highest values and Ash recording the lowest and good percentage in protein. This makes the Nile fishes important living resources of dietary protein as other sea and freshwater fish (**Vlieg and Murray, 1988; Zuraini et al., 2006**).

Variations in proximate chemical composition of *Labeo niloticus* and *Synodontis schall* are summarized in Table(2). The results obtained are in partial agreement with that previously reported by **Guner et al. (1998)**. Guner et al. (1998) reported that fat content of shad is 15.91% which is higher than what was found in our study. The protein content of shad is reported to be 22.42% by **Guner et al. (1998)**, which is in the same range obtained in this study.

Therefore, it is essential to determine the chemical composition and evaluated for different species of the Nile fish in relation to body weight composition. The chemical composition could influence the post-harvest processing and storage and could assist in determining the suitability of the different species to specific processing and storage techniques

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS:

CONCLUSIONS:

- The results suggest that the proximate composition and body weight composition of fish species greatly varies within the studied Spp. This might be due to physiological reasons and changes in environmental conditions, i.e., spawning, migration, and starvation or heavy feeding. Species-specific physiological characteristics might greatly affect the proximate composition. This study provides valuable information on variations in proximate composition of fish species studied in order to take necessary precautions in processing from a manufacturer point of view.
- No significant difference in protein content.
- *Labeo niloticus* have the highest fillets yield.

RECOMMENDATIONS:

- More studies are needed in this topic with different Nile fish species
- Compare this study with future studies.

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