Sudan University on Science and Technology

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Physiochemical Characteristics of Four commercial Nile Fish

Thesis submitted for fulfillment of partial B.Sc in faculty of science and technology of animal production department of fisheries Science and wildlife.

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Quran

بسماللهالرحمنالرحيم

قال تعالى:

"وهو الذي سخر البحر لتأكلوا منه لحما طريا وتستخرجوا منه حلية تلبسونها وترى الفلك مواخر فيه ولتبتغوا من فضله ولعلكم تشكرون "

صدق الله العظيم

سورة النحل الاية {14}

DEDICATION

To our Mothers for theircontinuousencouragement and blessing and to whom we are always indebted.

To ourFathers for theirencouragements.

To our brothers, sisters, relatives and friends supporting .

To all whom we love…

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All our greatest thanks first to Allah almighty the most merciful who gave us the health,strength and patience to conduct this study.

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Abstract

This study was undertaken to investigate composition and filleting yield of four commercial freshwater fish species landed in Elmawrada fish market at Khartoum State to know the is it nutritional value and possible conversion into value added food products, according to their composition variation. The study was conducted at the Central Laboratory of Fish Biology at Sudan University of Science and Technology, Sudan. Fourteen fresh samples of (Nile Tilapia, Cat fish, Bagrus sp and Nile perch) were taken from El-Mawrada fish market, Omdurman. The samples stored in ice container and transferred to the Soba Laboratory Center in south Khartoum State for preparation and process to measure characteristics and proximate composition of fish muscles and carcass. The fish samples analyzed presented highest to lowest amounts of fillet (f) in the order: *Lates niloticus*> C. spp> B. bayad; and lowest amounts of fillet found in *Oreochromis niloticus*. Statistical analysis will be performed using the Analysis of variance one way (ANOVA) and Duncan's multiple Range Test, to determine differences between treatments means at significance rate of $P < 0.05$. The standard deviation of treatment means was also estimated. All statistics will carryout using Statistical Analysis program (SPSS,16).

Keywords: proximate, Nile fish, filleting, Body Waite.

الخلاصة

الهدف من الدراسة الحالية التركيب الوزني والتركيب الكيمائي لأربعة انواع من أسماك النيل التجارية التي جمعت من منطقة انزال الاسماك بسوق الموردة اجريت الدراسة الحالية بمعمل الاسماك قسم علوم الاسماك والحياه البريه كلية علوم وتكنولوجيا الانتاج الحيواني بجامعة السودان للعلوم والتكنولوجيا .اربعين عينه طازجة من اسماك البلطي النيلي والقرموط والبياض العادي والعجل تم جمعها من سوق الموردة امدرمان وتم حفظها بالثلج وثم نقلت الي معمل الاسماك. تم قياس الاطوال واخذت الاوزان المطلوبه لكل جزء من السمكه وتم اخذ عينات من لحوم الاسماك وارسلت الي معمل التغذية كلية الزراعه جامعة الخرطوم للتحليل الكيمائي اظهرت النتائج وجود فروقات معنويه عالية عند مستوى معنوية(0,05) وزن الراس والاحشاء والهيكل العظمي واللحم بين الانواع بواسطة تحليل التباين تم تحليل البيانات المتحصل عليها احصائيا بواسطة برنامج (SPSS 16)للحصول علي مستويات التركيب الوزني والكيمائي.

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CHAPTER ONE

INTRODUCTION

1.1Background of the Study

Fish is consumed by a large percentage of population in the world due to its high quality protein. It contains the most important nutritional components and serves as a source of nutrients for human beings (Sutharshiny S, Sivashanthini K 2011). Majority of the nutrition lists recommend that human beings should consume fish every day (Balk E, et al, .2004). Regular consumption of fish can reduce the risk of cancer, including colon, breast and prostate(Sidhu KS 2003), lower the risk of Dementia, and Alzheimer's diseases (Grant WB 1997); and prevent the cardiovascular diseases.

1.2 Problems of the Study

The lack of sufficient protein is one of the most widespread nutritional deficiencies in many tropical countries (Eyo AA 2001). All of the essential amino acids needed for good protein nutrition are present in fish meat. The protein content of fish is also important when considering quality and texture of the fish meat (Majid Aet al 2011).

1.3 Significance of the Study

Knowledge of the proximate composition of fishes is essential to estimate their nutritional value and to plan the most appropriate industrial and commercial processing (Hanna GM, 1980). Generally, fresh fish weight is 70 to 80% water, 20 to 30% protein, and 2 to 12% lipid (Love RM 1980). However, in different environmental conditions, the composition of the fish may differ in relation to the differences in water quality, feeding conditions, sex, and state of maturityand capture condition (Javaid MY, Salam A, Khan MN, Naeem M 1992).

Fish having energy depots in the forms of lipids thatindicates the quality of fish, the fish oil contain high amount of polyunsaturated fatty acid that reduce the serum cholesterol to prevent a number of coronary heart diseases. Fish meat is also a rich source of minerals and the most abundant micro-elements are Zinc (Zn), Iron (Fe) and Copper (Cu) (Saadettin G, et al,. 1999).

Due to the tremendous change in the climate condition, season and industrial growth, there could be wide differences in the biochemical constituents of the fishes. Hence it becomes essential to document the proximate composition of the fishes periodically in a region.

1.4 The Objectives

1. To investigate body weight composition
2. To filleting yield of four commercialfreshwater fish species landed in Elmawrada fish market at Khartoum State
3. to know the energy value and possible conversion into value added food products, according to their compositional variation.

CHAPTER TWO

LITERATURE SURVEY

2.1Chemical composition

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).

Data on chemical composition of many of the freshwater fishes of our country is not available and hence an attempt has been made to analyze as many as thirty-six species. The chemical composition of fish varies widely from species to species and season to season. There is also individual variation in the same species. Knowledge of chemical composition is essential in order to compare its value as food with other protein foods (Stansby, 1954**)** has elaborated on the importance of chemical analysis.

Various studies have examined the effects of temperature, light, salinity, pH and oxygen concentration on the proximate composition of fish but these factors would seem to have very limited effects. On the other hand, endogenous factors are genetic and linked to the life stage, age, size, sex and anatomical position in the fish (Huss, 1995).

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

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

Numerous studies on tilapia show that body composition approximates the diet composition, but little information has been produced by comparing the entire and the fillet composition of different genetic groups (Lugo et al., 2003).

Proximate composition of body muscles of *Puntius stigma* (male and female) analyzed shows that the moisture content was found to be higher in female, while protein, fat, ash, carbohydrate and minerals contents were higher in male. Moreover, different sexes were observed to have varying chemical composition (Biro *et al.*, 2009).

2.2 Filleting Yield

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 the fish (composition, frequency) and the environment in which it is found (salinity, temperature). The main exogenous factor affecting proximate composition is diet. Various studies have examined the effects of temperature, light, salinity, pH and oxygen concentration on the proximate composition of fish but these factors would seem to have very limited effects. On the other hand, endogenous factors are genetic and linked to the life stage, age, size, sex and anatomical position in the fish (Huss 1995). These endogenous factors govern the majority of principles that determines the composition of fish (Huss 1995).

Fish meat 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 (Evangelos et al., 1989; Chandrashekar and Deosthale, 1993; Steffens 2006). There are, therefore, a 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 1998a; Arts et al., 2001; Fawoleet 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 the deficiency in these principal nutritional elements induces a lot of malfunctioning; as it reduces productivity and causes diseases (Mills 1980). Besides being used as food, fish is also increasingly demanded for use as feed. However, information concerning the chemical composition of freshwater fishes in general is valuable to nutritionists concerned with readily available sources of low-fat, high-protein foods such as most freshwater fishes (Sadiku and Oladimeji 1991; Mozaffarianet al 2003; Foranet al 2005) and to the food scientist who is interested in developing them into high-protein foods, while ensuring the finest quality flavor, color, odor, texture, and safety obtainable with maximum nutritive value. It is also useful to the ecologists and environmentalists who are interested in determining the effects of changing biological/environmental conditions on the composition, survival, and population changes within fish species. 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 (Özkan 2005). Likewise, different cooking methods affect the quality of fish meat (Prapasri 1999).

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 (FAO 1995a).

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).

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

The fish has a skeletal or cartilaginous structure which provides support for the body. The muscles which form the edible part account for most of the weight of the fish. The skin forms a cover, often with an outer layer of scales, & secretes slimy mucus, which lubricates the fish & seals the surface. The gills are the main part of the breathing mechanism & take up oxygen from the water. The organs in the abdominal cavity, including the stomach, intestine and liver are known as the guts. Removal of the guts is normally the first step in handling & preservation (Huss 1995).

The lipid content of fillets from lean fish is low and stable 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 of the fillet. As a rule of thumb, the amount of fat can be estimated from an analysis of the water content in the fillet(Huss 1995).

Obanu and Ikeme (1988) carried out 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.

Eyo (1991) 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 highly significantly different to each other ($p<0.01$).

Mac (1992) carried out studies on meat, yield and nutritional value determination of O. niloticusand S. galilaeous, he found that the processing characteristics of this species have decreasing order of fillets, head, skeleton, viscera and skin.

Remijo (1992) reported that the Labeosppexhibit the decreasing order of fillets, head, viscera and skin.

Ali et al, (1992) studied body characteristics; yield assessment and proximate chemical composition of commercial fish species namely Latesniloticus, O.niloticus, Sarotheradeomgalilaeous, LabeoniloticusandLabeohorie. 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.

Adebona, (1981) pointed that the percentage of bone and gut forChrysichthyswas (47.8%) and for Bargus(46.2%), where as that of Tilapia was (35%).

Ogunja, (1991) studied the estimated catch and percentage composition remove about 40 % fillet, thus leaving about 60% carcass (skeleton and gut) with about 15- 35% flesh still attached.

Jock, (1996) revealed, in his study on the percentage of fillet, head, viscera and skeleton of four different fish species (Bagrusbagrus, BagrusdomakBarbusbynni and Synodontisspp) at Nuba Lake, was as follows 46.86%, 5%, 4.48% and 20% - 45.90%, 27.83%, 5%&15.67% - 44.80%,13.04%, 7.37% and 21.36% 43.3%, 14.17%, 11.40% and 18.43% respectively.

Siham, (1999) showed that the percentages of head, viscera, skin, skeleton and fillet of Protopterusaethiopicus, MalapateruruselcctricusandTetradonfahakhbought from Elmorada fish market were as follows 16.59%, 10.88%, 28.99%,10.26% and 29.2 - 19.26%, 17.9%, 16.02%, 13.35% and 27.29% - 5%, 24.58%, 13.76%, 21.66%, 6.61% and 30.56% and respectively.

Abdelraheem, (2010) reported that the percentages of protein, lipid, ash and moisture of three fish species (Distichodusniloticus, LabeoniloticusandClaras spp.) were as follows 21.30%, 21.30%, and 21.30% - 1.20%, 2.3% and 1.07% - 19.33%, 19.33% and 18.60% - 78.66%, 78.66% and 72.33% respectively.Moreover, he studied the body weight composition of three fish species(Distichodusniloticus, LabeoniloticusandClaras spp.) Averages of total length (cm), standard length (cm) total weight (g). His findings were as follows: (39.75), (33.25) and (676.33) for Distichodusniloticus(29.33), (23.33) and (251.50) for Labeoniloticus, and (41.25), (37.17), (497.33) for Claras spp.

2.3.1 Moisture Content:

Moisture content 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 stage and subsequent stability was mentioned by (Parker and Vanstone 1966).

Remijo (1992) reported that the moisture content of fresh *labeospp* fish was (70.4-71.2%).

Ahmed (2006) carried out comparison of nutritive value of *Fassiekh* using *Hydrocynus spp.* and *schilbe spp*. She mentioned that the moisture content of the fresh fish was in the range of (72.9 – 81.92 %).

Clucas and Ward (1996) reported that flesh from healthy fish contained (70-80 % water).

Ali *et al* (1996) stated that the moisture content in deep frozen fish of *labeo spp.* was 76.7%.

2.3.2Crude protein

The 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) And Baltic code during spawning season. For this particular species its extends from January to June, July (Borreson 1992).

Ahmed (2006) reported that the protein content 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*labeospp* fish was 20-21%. Johnston (1994) found that fresh fish protein is about 15.2%.

2.3.3 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 lipids present teleost fish species may be divided in two major groups; the phospholipids and the triglycerides. The phospholipids make up the integral structure of the unit membranes in the cells; thus they are often called structural lipids. The triglycerides are lipids used for storage of energy in fat depots, usually within special fat cells surrounded by a phospholipids membrane and a rather week collagen network (Ackman 1980).

The lipid content (% body weight) in fish tends to increase with age (and size), decline during the winter, migration and spawning and reach its maximum value at the end of the primary feeding period of the year. As an energy stock, it tends to be in the form of neutral fats - triglycerides. Phospholipids, free fatty acids, sterols etc. comprise only a small fraction of lipids (Weatherley& Gill 1987).

Some tropical fish also showed a marked seasonal variation in chemical composition. West African shad (*Ethmalosadorsalis)* showed fat range of 2.7%(wet weight)over the year with maximum in July

(Watts,1957).It has also observed that oil content of these species varies with size, large fish containing about 10%more oil than smaller one (Watanabe 1987).

Nile Tilapia exhibits sexual dimorphic growth where males grow significantly faster, larger and more uniform in size than females. Males and females had significantly different final weights owing to supplementations of three different oils (Biro *et al* 2009).Clucas and Ward (1996) reported that flesh from healthy fish contained 1-22% fat.Ahmed (2006) found that fat content ranged between 1.4 – 2.2 %.Remijo (1992) reported that the fat content in fresh *labeospp* fish is 3.5-5.4%.Johnston (1994) found that fresh fish fat content varied widely from species to species and from season to another. It was 5.6% in lean fish.

2.3.4 Ash content:

Most of the known inorganic elements or minerals can be detected in the human and fish body, but only fifteen of those known to be essential to man need to be derived from food **(Clucas and Ward 1996).** According to **Ahmed (2006);** the ash content of the fresh fish ranged between 1.1 – 1.7%.

CHAPTER THREE

MATERIAL AND METHODS

3.1 The Study Area

This study was conducted at the Central Laboratory of Fish Biology at Sudan University of Science and Technology, Sudan.

3.2 Material and Methods

- Meter
- Balance
- Knives
- Table
- Paper
- Pen
- Basked
- Stool
- Gloves

3.3 Sampling Procedures

Laboratory at college of Agriculture, Khartoum University for preparation and process to determining proximate composition of fish muscles and carcass.Fourteen fresh samples of (Nile Tilapia, Cat fish, Bagrussp and Nile perch) were taken from El-Mawrada fish market, Omdurman.Samples of each specieswere stunned manually and measurements of weight andlength were taken. These samples of the differentspecies were then cut open at the side to carefullyremove the gut. Filleting was carried out by cuttingthrough from the opercula region down to the caudal endon both side of the fish sample. The head was severedfrom the frame and weighed separately.

Hence, theweight of the head, gut, frame and fillet were taken. Apooled mean of these weights were calculated and usedto estimate the percentage of each part of the dress out -Fillets, head, gut and frame relative to the weight ofwhole fish.samples from each speciesstored in ice container and transferred to the nutrition.

3.4 Proximate Composition

Moisture content, crude protein, fat and ash were determined for wet sample according to standard methods of Association of Official Analytical Chemists **(AOAC) (1990**) as follows:

3.2.1 Moisture Content Determination

The samples were first weight (Initial weight) then dried in an electric oven at 1050C for 24-30 hours to obtain a constant weight. The moisture content was calculated as follows

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

3.2.2 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:

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

Whereas:

Va = volume of HCL used in titration

Vb = 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

Wt= weight of sample

N= normality of NaoH

3.3.3 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 0C before finding the weight of the extract fat. Fat percentage was then calculated as follows:

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

3.3.4 Ash Content Determination:

Ash was determined by heating 1 gm at 5500C in muffle furnace until a constant weight was obtained. Ash content percentage was given by the following formula:

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

NFE = (100 – Moisture + Crude Protein + Crude Fat + Ash)

3.4 Statistical Analysis

Statistical analysis will be performed using the Analysis of variance one way (ANOVA) and Duncan’s multiple Range Test, to determine differences between treatments means at significance rate of $P < 0.05$. The standard deviation of treatment means will be also estimated. All statistics will carry out using Statistical Analysis program (SPSS, 16).

CHAPTER FOUR

RESULTS

Tables (4.1, 4.2,4.3, 4.4, and 4.5) and figures (4.1, 4.2) represent the proximate composition andbodyweight characteristics of the selected speciesanalyzed. The varied values of their presence in the body of the fishes analyzed were recorded. The fishsamples analyzed presented highest to lowest amountsof fillet (f) in the order: *Latesniloticus*>*Claiasspp*>*Bagrusbayad;* and lowestamounts of fillet found in *O.niloticus*.The resultsshowed that *O.niloticus* highest amount of fin and skeleton weight, while *C. spp*isa low fins and skeleton weight' fish. The lowest percentage of viscera was found in *L.niloticus*and the highest in *C. spp*. Thehead weight percentage was obtained for *O. niloticus*followed by *L. niloticus, B. bayad*and*Clarias sp*.

Table (1): Show proximate chemical composition of four commercial fishes.

Samples	Nutrients			
	Moisture	**Crude protein**	**Fat**	**Ash**
Bagrus bayad	74.00±0.02[c]	20.28±0.07[a]	4.21±0.02[a]	1.52±0.06[a]
Clariassp	77.81±0.08[a]	18.34±0.04[c]	2.15±0.01[c]	1.71±0.06[a]
Oreochromis niloticus	77.30±0.01[a]	18.17±0.08[c]	3.22±0.03[b]	1.32±0.04[a]
Lates niloticus	76.42±0.03[b]	19.25±0.08[b]	3.13±0.05[b]	1.29±0.02[a]

[a,b,c,] Means in the same column with superscript are significant different atlevel

(p<0.05).

Species	Nutrients				
	T.L	S.L	T.B.W	H.L	(K)
L. niloticus	37.58±4.3[c]	31.50±4.0[c]	616.67±226.0[b]	10.91±1.0[b]	1.1619[b]
Clariasspp	46.33±2.0[b]	40.83±1.7[a]	650.0±60.9[a]	10.58±0.3[b]	0.6536[c]
O. niloticus	30.33±7.4[d]	24.58±5.8[d]	601.66±469.3[c]	7.91±1.6[c]	2.1564[a]
Bagrusspp	48.91±3.9[a]	35.91±2.9[b]	530.83±115.6[d]	11.0±1.04[a]	0.4536[c]

[a,b,c,d]Means values in the same column with superscripts are significantly different at level (P<0.05)

Table (2): Show condition factor of four commercial species in Sudan.
K=100*w/l³
Whereas:T.L = Total length, S.L = Standard length. T.B.W = Total body weight, H.L = Head length, K= condition factor.

Table (3):Show body weight characteristics for four commercial species.

Species	Nutrients			
	Head weight (g)	Viscera weight (g)	F+ sk weight (g)	Fillet weight (g)
L. niloticus	135.83±51.3[a]	39.17±19.8[c]	118.33±47.8[b]	304.17±106.6[b]
Clariasspp	134.16±17.7[a]	81.67±12.5[a]	115.0±16.40[c]	319.17±41.1[a]
O. niloticus	126.67±86.9[b]	63.33±44.9[b]	148.33±133.3[a]	260.0±223.0[c]
Bagrusspp	111.67±28.2[c]	36.67±9.8[d]	95.83±17.15[d]	263.33±70.1[d]

[a,b,c,d]Means values in the same column with superscripts are significantly

different at level (P<0.05)

Table (4): comparison of percentage carcass yields of four commercial species.

	Nutrients
Viscera (%)	**F+ sk (%)**
6.12±1.24[a]	19.13±2.16[a]
12.58±1.87[b]	17.64±1.43[a]
11.45±2.50[b]	22.89±4.14[b]
6.90±1.08[a]	18.19±1.12[a]
*	

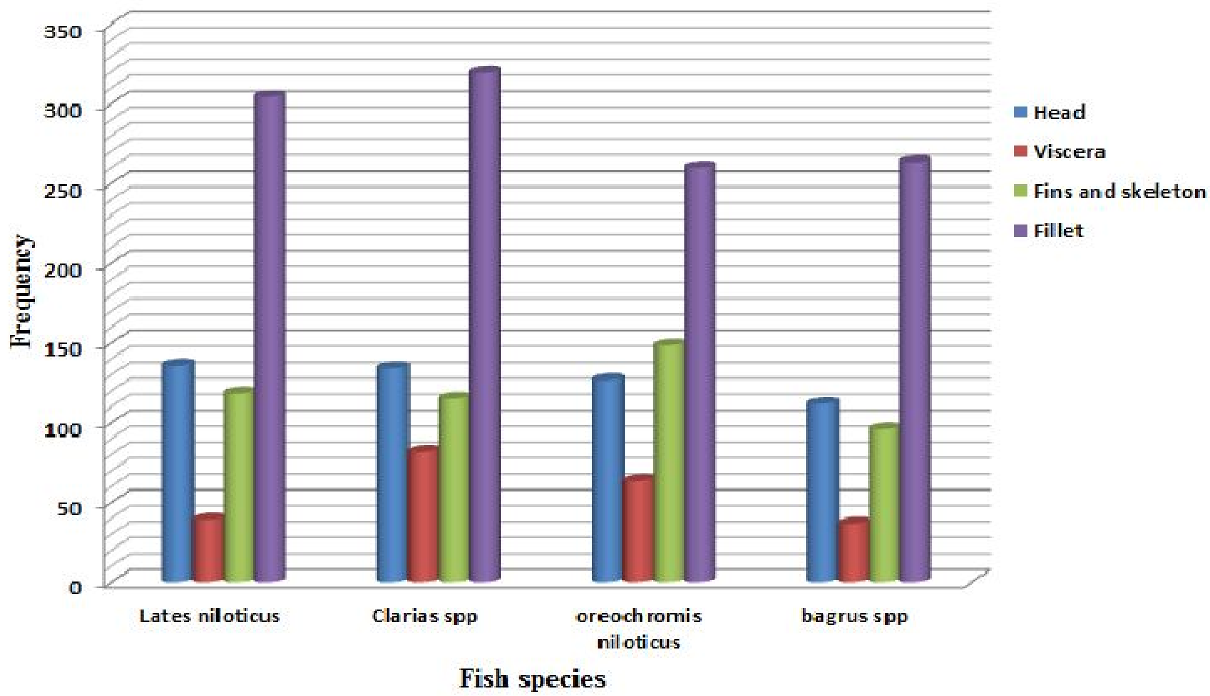

Figure (1):show body weight composition% of four commercial species.

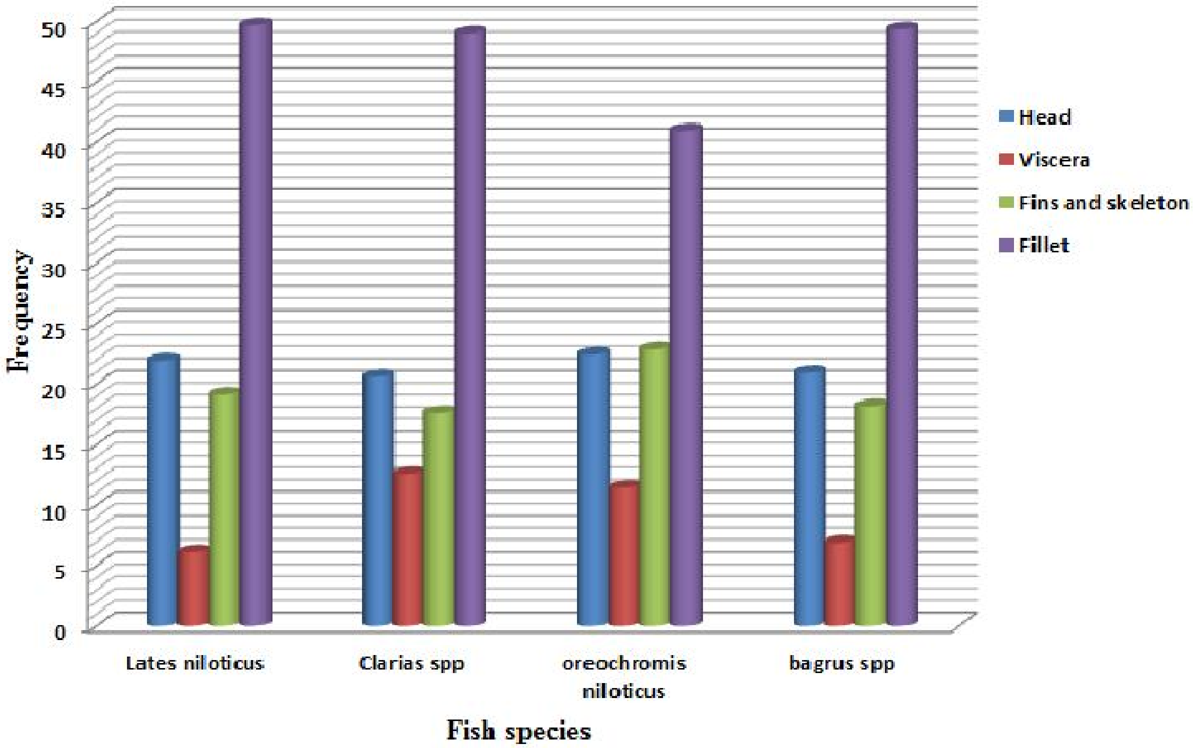

Figure (2): show body characteristics in % of four commercial species

CHAPTER FIVE

Discussion

The species investigated in the present study: *Latesniloticus*, *Bugrusbayad*, *Oreochromisniloticus,* and*Claris garpeinus*, are the popular market fishes in Sudan, and belong economically to the different traditionalgrades, according to consumer and fishermen preferencein Sudan. Proteins, lipids and moisture contents as wellas the caloric values were the major constituents, whichhad been considered in evaluating the nutritional value ofthe species studied. The nutrients showedvariable values in the species analyzed; with crudeprotein recording the highest values and lipid recordingthe lowest. This makes the Nile fishes important livingresources of dietary protein as other sea and freshwaterfish (**Zuraini***et al* **2006**). Highlipidfishes had less water and more protein than low-lipidfishes. This is in agree with the report of **Steffens (2006),** that protein forms the largest quantity of dry basesfish.

The variations recorded in theconcentration of the different nutritional components inthe fish examined could have been as a result of the ratein which these components are available in the waterbody (Yeannes and Almandos 2003), and the ability ofthe fish to absorb and convert the essential nutrients fromthe diet or the water bodies where they live. This is supportedby the findings of **Ricardo***et al* **(2002), Adewoye***et al* **(2003) and Fawole***et al***(2007).**

Lates niloticus had the highest fillet percentage of 49.75 while *O.niloticus*had the lowest filletpercentage of 40.9%.

*Bagrusbayad*and*Clariassp*had 49.3% and 49.01% respectivelyas shown in Table 4 .When fish are manually filleted,flesh attached to the bones are usually discarded aswaste which account for between 40-60% of the totalweight of fish depending on the fish species (Eyo 2001).

Eyo (2001) alsoreported 42.74% fillet for *Clariasgariepinus*with 54.83% of inedible parts. Adequatestunning manually is also required and allows easy filletingand fillet dress out percentages accepted could be from33-40% (Morris 2013).

Large scale processing plants for filleting will benecessary to produce properly packaged and hygienicfillets for export, because fillets must be prepared withgreat care under strict hygienic conditions. Also whenselecting fish species for culture it is desirable to considerthe dress out weight after removal of visceral, scalesskin and head.

The finding of the present study regarding the chemical composition showed significance different ($p<0.05$)in moisture, crude protein, fat and Ash content between studies fish collected from El-Mawrada fish market which serves as the principle basis in evaluating the nutritional value of the fish. The proximate chemical composition analysis clearly revealed that, a distinct variation on the chemical composition of the four fish species this finding was agreement with (Ogata& Shearer 2000) who's stated thatthe fish chemical composition can be affected by many factors, including species, environmental conditions, fish size, level of protein in the diet, and feeding rate.

The results showed that Bagrus bayad had high protein contentand*Oreochromis niloticus* had lowest protein content.

CHAPTER SIX

Conclusion and recommendations

6-1 Conclusion

According to finding obtained from the present study it could be concluded that the chemical compositions show significance different ($p<0.05$) in moisture , crude protein , fat and Ash content between studied fish collected from Al-Mawrada fish market which serves as the principle basis in evaluating the nutritional value of the fish.

6.2 recommendation

Based to the results obtained from this study it could be recommend that:

- It is essential to determine and evaluate body weight and proximate Composition different species of Nile fish species.
- Further studies were needed to determine the Amino Acids and Fatty Acids of the Nile fish.
- Further studies were needed to determine the untrained value of fresh water fish.

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