



A Comparative Study of the Chemical Composition and Nutritional Value of Muscles in Different Zones in the Body of two Species of Teleosts; Greenback Mullet, *Planiliza subviridis* (Valenciennes, 1836) and Abu Mullet, *Planiliza abu* (Heckel, 1843)

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Abstract

The current study was conducted to estimate the chemical composition of the muscles of different regions in the body of the studied fish to assess the nutritional value of their muscles. The fish studied included two species of teleosts fish belonging to the Mugilidae family; Greenback mullet, *Planiliza subviridis* (Valenciennes, 1836) and Abu mullet, *Planiliza abu* (Heckel, 1843). The components of the chemical composition of the muscles included: protein, fat, moisture and ash as well as to estimate the nutritional value (energy) of both protein and fat content. Samples were collected from the Qurna market - north of Basra - Iraq in August / 2018. The results showed differences in the values of the chemical composition of the muscles of the two studied species. The values of protein content ranged between 20.54 - 20.10% and 19.53-18.32% in *P. subviridis* and *P. abu* respectively, while the lipid content values ranged between 3.76-5.76% *P. subviridis* while ranged between 5.43- 7.72% in *P. abu*. The moisture content had higher values ranging between 71.08 - 70.17% and 71.84 - 70.17% in *P. subviridis* and *P.abu* respectively while the ash content ranged between 2.57 - 2.30% and 2.80 - 2.55% in *P. subviridis* and *P. abu* Respectively. The results showed that total energy value in *P. subviridis* were 124.12KCal / g compared to *P. abu* which recorded 134.9 kcal / g. The statistical results indicated positive relationship between fish weight and protein, lipid and ash content in the studied fish, while there was an inverse relationship between moisture content and fish weight in the studied species. The statistical results showed no significant differences $P>0.05$ between the protein, moisture and ash content in two body regions in the studied species, while revealed significant differences $P<0.05$ in lipid content in the studied fish.

Keywords: *Planiliza subviridis*, *Planiliza abu*, Fish muscles, Chemical composition.

Introduction

Fish muscles are very important in human food and are essential for the maintenance and vitality of the health side; this is due to the presence of major and minor components in the chemical composition of the muscles. The main components include proteins, lipids, moisture (water) and ash, while the secondary components include carbohydrates, vitamins and minerals [1, 2].

The chemical composition of the fish muscles varies greatly from species to another, this difference is due to several factors, including the starvation and food intake periods [3] species, size, stage of life and muscle position in the body [4] temperature, salinity and season [5, 6].

Recent studies suggest that proteins are the basic building materials of the body, so fish and fish products are the most important sources of animal protein because fish proteins contain all essential amino acids in human consumption and health maintenance [7,10].

The present fish species are the economic fish in Iraq, namely Abu mullet, *Planiliza subviridis* (Valenciennes, 1836) and Greenback mullet, *Planiliza abu* (Heckel, 1843) both species belong to the Mugilidae family, so the current study aims at conducting a comparative study to estimate the chemical composition of the muscles in two different regions of these two species body to estimate their nutritional value.

Material and Methods

Sampling

Forty commercially fish species were chosen for estimation the chemical composition of muscles, these were *p. subviridis* and *P. abu* fish, and they were collected from Qurna market - north of Basrah city - Iraq in August / 2018. They were transported to the laboratory to perform the tests associated with estimating the chemical composition of the studied fish muscles .Muscle samples were taken from two regions of the studied fish body: R1 represents the anterior region (trunk) and R2 is the posterior region (peduncle caudal). Protein, lipid, Moisture and ash contents were determined in each specimen's muscles according to the (AOAC) Association of Official Analytical Chemists procedures [11]. The energetic value (calorific value) of fish muscle was estimated by [12].

Statistical Analysis

For the purpose of statistical comparisons between the components of the chemical composition of the muscles of the body regions in the fish studied, one-way analysis of variance (ANOVA) was used in the statistical program SPSS version 16.Also the Pearson correlation was used to study the relationship between fish weight and chemical composition components of the fish species studied.

Results

Tables (1, 2) show the different values of the components of chemical composition of muscles in R1 and R2 in the body of the studied species .The protein content ranged

between 20.18-20.92% in R1 and in R2 between 19.65-20.46% in *P. subviridis* (Table 1) while its value was between 18.20 - 20.76% and 16.80 - 20.34% in R1 and R2 in *P. abu* respectively (Table 2). Therefore, the total protein content was 20.32% in *P. subviridis* while 18.92% in *P. abu* (Table 3). The statistical results revealed a positive correlation between fish weight and protein content in R1 and R2 in both fish studied, where r values were equal 0.980 and 0.988 in R1 in *P. subviridis* and *P. abu*, while were recorded 0.989 and 0.969 in R2 in *P. subviridis* and *P. abu* respectively (Table 4).

However, the statistical results revealed no significant differences $P > 0.05$ between the studied body regions (R1 and R2) in the studied fish in protein content (Table 5).

The current results indicated a difference the studied species in lipid content values in body regions (R1 and R2). Lipid content values ranged from 3.40 - 4.20% in R1 and 4.45-6.48% in R2 in *P. subviridis* (Table 1) whereas ranged between 4.20-7.24% and 6.70-8.25% in R1 and R2 in *P.abu* Respectively (Table 2).So, the total lipid content was 4.76% in *P. subviridis* while 6.58% in *P. abu* (Table 3).

As a result of these differences in lipid content values, the statistical results showed significant differences $P < 0.05$ between the studied species (Table 5). The results also revealed a positive relationship between fish weight and lipid content values in R1 and R2 in studied fish, Where (r) values were equal 0.993 and 0.925 in *P. subviridis* while were recorded 0.976 and 0.920 in *P. abu* respectively (Table 4).

Table 1: Chemical composition of muscles of R1 and R2 of *P. subviridis* . ±SD

Chemical composition in R1					Chemical composition in R2			
Weight g	Protein %	Lipid %	Moisture %	Ash %	Protein %	Lipid %	Moisture %	Ash %
250 ±20.55	20.28±0.10	3.40±0.08	72.14±0.16	2.16±0.06	19.65±0.14	4.45±0.15	71.74±0.12	2.08±0.02
300±25.15	20.30±0.04	3.52±0.14	71.40±0.22	2.24±0.04	19.88±0.10	5.68±0.14	70.86±0.23	2.10±0.08
350±32.22	20.46±0.12	3.74±0.12	70.80±0.24	2.68±0.12	20.15±0.17	5.92±0.12	70.34±0.13	2.24±0.10
400±18.56	20.82±0.08	3.94±0.13	70.64±0.16	2.84±0.14	20.36±0.14	6.26±0.10	70.16±0.14	2.42±0.12
450±30.44	20.92±0.08	4.20±0.12	70.40±0.15	2.92±0.12	20.46±0.08	6.48±0.12	69.88±0.16	2.65±0.16

Table 2: Chemical composition of muscles of R1 and R2 of *P.abu* ±SD

Chemical composition in R1					Chemical composition in R2			
Weight g	Protein %	Lipid %	Moisture %	Ash %	Protein %	Lipid %	Moisture %	Ash %
250 ±18.64	20.28±0.04	3.40±0.10	72.14±0.23	2.16±0.04	19.65±0.14	4.45±0.44	71.74±0.22	2.08±0.02
300±30.25	20.30±0.10	3.52±0.16	71.40±0.25	2.24±0.12	19.88±0.12	5.68±0.25	70.86±0.12	2.10±0.06
350±16.22	20.46±0.14	3.74±0.18	70.80±0.18	2.68±0.14	20.15±0.10	5.92±0.18	70.34±0.10	2.24±0.08
400±20.34	20.82±0.18	3.94±0.12	70.64±0.10	2.84±0.12	20.36±0.14	6.26±0.12	70.16±0.12	2.42±0.10
450±16.35	20.92±0.06	4.20±0.10	70.40±0.12	2.92±0.10	20.46±0.08	6.48±0.14	69.88±0.15	2.65±0.14

The current results revealed a convergence in the values of moisture content in the muscles of the studied regions in the studied fish. Their values ranged between 72.14-70.40% in R1 and 71.74-69.88% in R2 in *P. subviridis* (Table 1) while their values in *p.abu* ranged between 74.80 -68.30% in R1 and 72.30-67.10% in R2 (Table 2). Therefore, the total values of moisture content were 70.84-70.00% in *P. subviridis* and *P. abu* respectively (Table 3). As a result of this convergence in moisture content values, the statistical results showed no significant differences $P > 0.05$ between the studied species (Table 5).

The results indicated an inverse relationship between moisture content values and fish weight, as (r) values were -0.958 and -0.991 in R1 in *P. subviridis* and *P. abu* respectively (Table 4) whereas found -0.954 and -0.972 in R2 in *P. subviridis* and *P. abu* respectively (Table 4). Tables (1,2) show the approximate values of ash content of muscles in the studied species regions, which ranging between 2.16-2.92% and 2.30-3.52% in R1 in *P. subviridis* and *p.abu* respectively while were between 2.08-2.65% and 2.12- 3.48% in

R2 in *P. subviridis* and *P. abu* respectively, so the total ash content was approximately 2.43-2.68% in *P. subviridis* and *P. abu* respectively (Table 3), so the statistical test did not show significant differences $P > 0.05$ between the studied fish (Table 5). The statistical results noted a positive relationship between fish weight and ash content values, where it was 0.963 and 0.976 in R1 in *P. subviridis* and *P. abu* respectively (Table 4) while were recorded 0.965 and 0.870 in R2 in *P. subviridis* and *P. abu* respectively (Table 4).

Table (3) shows that the highest energy values (calories) were found in *P.abu*, which was 134.9 kcal / g while 124.12 kcal / g in *P. subviridis*. The results noted that the protein content energy was greater than the fat content in the studied species, where the energy values of the protein and fat content found 75.68 and 59.22 kcal / g respectively in *P.abu* fish (Table 3) while were observed 81.28 and 59.22 kcal / g for protein and fat content respectively in *P. subviridis* fish (Table 3).

Table 3: The total average of the components of the chemical composition of the muscles and energy value in *P. subviridis* and *P. abu*

Parameter	<i>P.subviridis</i>	<i>P.abu</i>
Protein %	20.32	18.92
Lipid %	4.76	6.58
Moisture %	70.84	71.00
Ash %	2.43	2.68
Energy of Protein Kcal / g	81.28	75.68
Energy of Lipid Kcal / g	42.84	59.22
Total energy of Protein and Lipid Kcal /g	124.12	134.9

Table 4: Correlation coefficients between fish weight and chemical composition of muscles of R1 and R2 in *P.subviridis* and *P.abu*

Parameter	<i>P.subviridis</i>	<i>P.abu</i>
Protein in R1	0.980	0.988
Lipid in R1	0.993	0.976
Moisture in R1	-0.958	-0.991
Ash in R1	0.963	0.976
Protein in R2	0.989	0.969
Lipid in R2	0.925	0.920
Moisture in R2	-0.954	-0.972
Ash in R2	0.965	0.870

Table 5: Statistical analysis of chemical composition of muscles of R1 and R2 in *P. subviridis* and *P.abu*

Parameter	R1 and R2 in <i>P.subviridis</i>			R1 and R2 in <i>P.abu</i>		
	F – values	Significant level	Differences	F – values	significant level	Differences
Protein	4.386	0.070	Non-significant	2.516	0.151	Non-significant
Lipid	27.248	0.001	Significant	11.277	0.010	Significant
Moisture	1.122	0.320	Non-significant	1.325	0.283	Non-significant
Ash	2.044	0.191	Non-significant	0.604	0.460	Non-significant

Discussion

The fish growth is accompanied by several changes in the fish body, including biochemical changes in the chemical

composition of the basic components of muscles which including protein, lipid, moisture and ash in addition to the secondary components which include

carbohydrates and non-protein materials [13]. As a result of these changes, there are differences occur in the values of the main chemical components in the muscles that vary from species to another according to many factors including age, size, sex, environment and season [6, 14, 15] Therefore, the current study results revealed differences in the values of the main components of the chemical composition of the muscles of the studied species. The current results revealed that the protein content was the second component in the chemical composition which contains high values after the moisture content in the fish muscles [16].

The results also showed differences in the values of protein content in the studied body regions in the studied species, Where *P. subviridis* have higher values than *P. abu*, these differences in values are due to factors including sex, size, age and physiological status [17,18] or the environment and season [19] or muscle location in the body [4, 20,18]. Observed that the values of protein content in *Notopterus* (Palas) ranged between 15.63-19.30% .This changes in values is due to physiological and environmental factors [19].

Found that the values of the protein content ranged between 17.24-17.65% in the Nile tilapia (*Oreochromis niloticus*), and these ratios are associated with the change of season [20]. Pointed to difference the values of protein content in four different regions of Pirarucu (*Arapaima gigas*) which were 17.8% in dorsa, 18.9% in Venter, 25.8% in ventrecha and 18.8% in tail, these variations in values due to the difference location of the muscles in the body. Several studies have shown that there are a group of factors that influence lipid content values in fish. They may be factors associated with reproductive activity [21] muscles location in the body [4] environmental factors such as temperature and food abundance [22] biological factors include species, sex and age [23].

However, current fish showed significant variations in lipid content values in muscles, May due to the species, size, muscles location and red muscle fibers ratios that reflect the amount of lipid in their muscle fibers, where the *P. abu* had greater values compared to the *P. subviridis* [24]. Classified the fish to four categories according to lipid content: High lipid (>8%) Medium lipid (4 to 8%),

Low-lipid fish (2 to 4%) and Lean fish (< 2 %).Based on this classification, *P. subviridis* and *P. abu* can be put in a medium- lipid group. The amount of water in a fish's body is called moisture content [25]. Moisture content is also the main component of chemical composition in fish muscles, which has higher values than other components [16, 17, 26] Generally, moisture content values range from 28-90% [27, 26].

Pointed out that the values of moisture content in freshwater fish ranged from 71-78 % while they were 73-79 % in marine fish. Therefore, the values of moisture content in the current fish showed slight differences but showed no significant variations. These variations may be due to species, sex and season. In addition, the values of high moisture content are associated with a decrease in lipid content values [27] .Ash content is a reflection of the concentration of minerals or trace elements in any food, including fish muscles [28].

The ash content is the low (minor) component of the chemical composition in fish muscles compared with other chemical components[16 , 26].Many studies on the chemical composition of different fish muscles have shown that ash content values were few and varied from species to another. This variation is due to factors such as sex, age, size, muscle location, season and environmental [6] .Also, ash content is associated with the body metabolism and feeding [26, 29].

Therefore, the present study results showed slight differences in ash content values but were not significant among the studied fish.These variations are could be to due species, size, muscles location and feeding. The calories value is a measure of energy and the level of primary productivity, and energy value is a reflection of changes in physiological activity in growth organizations, as well as the effect of environmental factors, feeding habits and food type in fish [30, 31, 30].

Pointed out differences in energy values in the muscles of some fish. The y were found that the energy value was 4.02 Mg K⁻¹ in Coral trout while it was 3.31 Mgk⁻¹ in the Grouper fish, pointing out that the reason may be due to the food type, so the current fish showed that energy values in *P. abu*

were 134.9 kcal / g while 124.12 kcal / g in *P. subviridis*. These variations could be due to differences in energy values to protein content and lipid, which reflecting the type and quantity of muscles in the body regions studied.

Conclusion

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