ARTICLE / INVESTIGACIÓN

Analyzing the nutritional value of *Acanthopagrus latus* and *Coptodon zilli* muscles from the Al-Hindiya River in the Iraqi region of Karbala

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Abstract: The present study dealt with the determination of the protein, fat, moisture and ash chemical content for two species of bony fish (Teleosts) that belonged to two different families, namely *Acanthopagrus latus* (Sparidea) and *Coptodon zilli* (Cichlidae). Also, the total energy (calories) to the protein and fat contents in the muscles of the two studied fish and for two regions for each species. Samples were collected from the Al-Hindiya river in Karbala Province between August and October 2020. The current results noted an apparent difference in the mean values of chemical contents for the studied length groups, which ranged between 100-400 mm, and for two regions of the body, as the rates of protein content in A. latus were 17.42-18.60% while their rates ranged in C. zilli between 17.20-18.54%. The rates of fat content in A. latus were 6.40-7.50%, whereas ranged between 5.70-6.30% in C. zilli and the rates of moisture content ranged from 74.60 to 70.16%, while In C. zilli fish, the rates ranged between 75.40-72.40%, and the ash content ranged from 1.42 to1.80% and 1.14-1.34% in A. latus and C. zilli fish respectively. Both fish were considered medium-fat content fish depending on its value in their muscles.

Key words: Nutritional value, fish muscles, *Coptodon zilli*, *Acanthopagrus latus*.

Introduction

Fish is one of the oldest natural resources that man has exploited and benefited from, thus in-creasing its demand for its flavor and high nutritional value in addition to its ease of adaptation and suitability as an essential food component[1]. The study of the chemical composition of fish rep-resents an important aspect, as it can determine its nutritional value. Plans have been drawn up to study the possibilities of its use since it contains a high percentage of proteins. These proteins range from 15-20% and include all the essential amino acids. They meet the organism's needs and contain fats ranging from (15-22%)[2]. These fats contain essential fatty acids that the body needs[3]. They are rich in mineral elements such as phosphorus, sulfur, copper, iron, and fluorine, which are included in forming hormones and enzymes that benefit human health[4]. Oda[5] explains that by studying the chemical composition of the fat content, we can know what the fish contains from them, thus giving us their actual nutritional value. On this basis, the fish are divided into three sections based on their fat content, namely: Fatty fish in which the lipid content is more than 10% and medium-fat fish with a fat content ranging between (2.5-10%), and non-fat or meaty fish with a fat content of less than (2.5%). The ash content of fish consists of many salts found in the soft part of the tank. In a way that the body can benefit from it when consuming it as food[6]. As the ash content is the accurate indicator of the mineral content of fish, we notice a higher percentage in marine fish compared to river fish[7].

Materials and methods

Sampling

Two locally important fish species (*Acanthopagrus latus* and *Coptodon zilli*) were chosen and collected for the determination of the chemical components of muscles in. Samples of fish collected from the Al-Hindiya River in Karbala province – Iraq, from August to October 2020. They were transported to the laboratory to perform the tests associated with estimating the chemical com-position of the studied fish muscles. Two body regions from the studied fish were chosen, the first being the trunk region below the dorsal fin (R1) and the second region representing the caudal peduncle (R2). Protein, fat, moisture and ash contents were determined in each specimen's muscles according to (8),(9). The caloric value energy for protein and fat content of fish's muscles was es-timated according to the method of (10).

Statistical Analysis

Statistical analyses were conducted using the IBM SPSS Statistical 25 software. The data of chemical components obtained from muscle fibers for two different regions in the studied fish were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's multiple comparison test. Variations were considered to be significant when the P value < 0.05.

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Results

The results of the chemical content analysis for calculating the levels of protein, lipid, moisture and ash content of the lateral muscles in the studied body regions R1 and R2, and in both studied species, showed apparent differences in the values of their rates and the studied length groups, whose length ranged between (100-300 ml). As in Tables (1) (2), the levels of protein content ranged in *A. latus* fish (17.42-18.60%), while those of *C .zilli* fish ranged (17.20-18.54%), while the levels of lipid content in *A. latus* fish (17.42-18.60%), while the rates ranged in *C. zilli* fish (5.60-6.30%). The rates of moisture content in *A. latus* ranged between (74.60-70.16%), while it was (75.40-72.40%) in *C. zilli* fish, while the ash contents were (1.42% -1.80%) in *A. latus* fish, while in *C .zilli* fish, its rates ranged between (1.14-1.34%). The statistical analysis of the results to clarify the recorded differences proved the presence of significant differences when studying the protein, fat, ash and other contents. Differences in moisture content were not significant (P>0.05) in the R1 region in the two studied fish. Still, when looking at protein, fat and ash contents, the differences were significant (P<0.05) in the same region in the studied species(Table 7). While in the R2 area, the differences in protein and moisture content were non-significant (P >0.05), whereas they were significant (P < 0.05) in fat and ash contents in the two studied fish(Table 7). The results of the total energy of protein and fat content in the two regions and both species showed a difference in the values of their rates and length groups searched. The energy values of protein content ranged from (69.86-47.40% kcal / g) in *A. latus* fish, while their total values ranged from (68.80-74.16 % Kcal / g) in *C. zilli* fish. While the energy values for fat content in *A. latus* were (57.60-67.50% kcal / g) while in *C. zilli*, the values ranged between (50.40-56.70% kcal / g). The total energy of protein and fat content for the two studied regions ranged between (127.28-141.90% kcal/g) in *A. latus* fish, while it ranged (119.20-130.86% kcal / g) in *C. zilli* (Tables 3,4,5,6).

	R1				R2			
Length	Protein %	Fat %	Moisture %	Ash %	Protein %	Fat %	Moisture %	Ash%
100 – 300 mm	17.42 ± 0.21	6.40 ± 0.28	74.60 ± 0.32	1.42 ± 0.03	18.20 ± 0.19	6.64 ± 0.28	73.40 ± 0.26	1.50 ± 0.04
	17.66 ± 0.22	6.54 ± 0.20	74.20 ± 0.31	1.50 ± 0.02	18.40 ± 0.18	6.80 ± 0.21	73.24 ± 0.31	1.62 ± 0.03
	18.16 ± 0.18	6.60 ± 0.21	73.58 ± 0.27	1.54 ± 0.05	18.48 ± 0.22	6.86± 0.24	72.62 ± 0.28	1.70 ± 0.02
	18.20 ± 0.14	7.08 ± 0.23	72.48 ± 0.31	1.60 ± 0.04	18.56 ± 0.22	7.40 ± 0.23	71.20 ± 0.30	1.74 ± 0.05
	18.30 ± 0.24	7.30 ± 0.25	72.25 ± 0.28	1.72 ± 0.03	18.60 ± 0.18	7.50 ± 0.29	70.16 ± 0.34	1.80 ± 0.03

Standard error ±

Table 1. Chemical composition of the muscles in(R1, R2) regions in *A. latus*.

	R1				R2			
Length	Protein %	Fat %	Moisture %	Ash %	Protein %	Fat %	Moisture %	Ash %
100 – 300 mm	17.26 ± 0.16	5.60 ± 0.17	75.40 ± 0.31	1.22 ± 0.02	18.16 ± 0.18	5.80 ± 0.26	73.60 ± 0.33	1.14 ± 0.03
	17.30 ± 0.22	5.64 ± 0.21	74.60 ± 0.25	1.26 ± 0.03	18.20 ± 0.22	5.92 ± 0.23	73.50 ± 0.30	1.18 ± 0.04
	17.50 ± 0.18	5.72 ± 0.23	74.40 ± 0.33	1.28 ± 0.04	18.28 ± 0.19	6.12 ± 0.20	72.82 ± 0.31	1.24 ± 0.05
	17.52 ± 0.24	5.78 ± 0.22	74.20 ± 0.35	1.32 ± 0.07	18.40 ± 0.20	6.26 ± 0.22	72.60 ± 0.27	1.28 ± 0.02
	17.70 ± 0.26	5.82 ± 0.24	74.14 ± 0.30	1.34 ± 0.05	18.54 ± 0.17	6.30 ± 0.25	72.40 ± 0.29	1.32 ± 0.04

Standard error ±

Table 2. Chemical composition of the muscles in (R1, R2) regions in *C. zilli*.

Protein %	Energy kcal/g	Fat %	Energy kcal/g	Total energy kcal/g
17.42	69.68	6.40	57.60	127.28
17.66	70.64	6.54	58.86	129.50
18.16	72.64	6.60	59.40	132.04
18.20	72.80	7.08	63.72	136.52
18.30	73.20	7.30	65.70	138.90

Table 3. Total energy of the protein and fat content in muscles R1 regions in *A. latus*.

Protein %	Energy kcal/g	Fat %	Energy kcal/g	Total energy kcal/g
18.20	72.80	6.64	59.76	132.56
18.40	73.60	6.80	61.20	134.80
18.48	73.92	6.86	61.74	135.66
18.56	74.24	7.40	66.60	140.84
18.60	74.40	7.50	67.50	141.90

Table 4. Total energy of the protein and fat content in musclesR1 regions in *C. zilli*.

Protein %	Energy kcal/g	Fat %	Energy kcal/g	Total energy kcal/g
17.20	68.80	5.60	50.40	119.20
17.30	69.20	5.64	50.76	119.96
17.50	70.00	5.72	51.48	121.48
17.62	70.48	5.78	52.02	122.50
17.70	70.80	5.82	52.38	123.18

Table 5. Total energy of the protein and fat content in musclesR2 regions in *A. latus*.

Protein %	Energy kcal/g	Fat %	Energy kcal/g	Total energy kcal/g
18.16	72.64	5.80	52.20	124.84
18.20	72.80	5.92	53.28	126.08
18.28	73.12	6.12	55.08	128.20
18.40	73.60	6.26	56.34	129.94
18.54	74.16	6.30	56.70	130.86

Table 6. Total energy of the protein and fat content in musclesR2 regions in *C. zilli*.

Region	Parameters	F. value	Siq. value	Differences type
R1	Protein %	6.069	0.039	Significant
	Fat %	36.552	0.000	Significant
	Moisture %	4.685	0.062	Non-Significant
	Ash %	24.727	0.001	Significant
R2	Protein %	1.771	0.220	Non-Significant
	Fat %	23.704	0.001	Significant
	Moisture %	1.645	0.236	Non-Significant
	Ash %	51.380	0.000	Significant

Table 7. Statistical analysis of the chemical composition of the muscle regions (R1, R2) in *A. latus* and *C. zilli*.

Discussion

Temperature is one of the essential and influencing environmental factors in fish life, and water temperature is affected by air temperature. The first directly affects the physical and chemical characteristics and the living conditions of the water surface[2,6,11]). The variation is attributed to the chemical composition of the fish as well as the fish being studied, the sex, the nature of the food, the feeding, or the fishing spot[12-14].

The study showed a clear difference in the values of the chemical composition of protein, lipid, moisture and ash in the study fish, in addition to the difference between the studied body areas. The protein and water in the fish's anterior region (R1) are more significant than in the posterior region (R2). At the same time, the proportion of fat and ash

in the rear part is more critical than in the front area, which is consistent with (15,16,17).

The results showed that there is a difference in the percentage of fat in the two studied types of muscles of the study fish, and this may be due to the difference in the type, sex, age, location of muscle fibers and specific factors related to fish feeding and migration[1,18,19].

The study's results showed that the percentage of moisture in the muscles of the study fish was inversely proportional to the proportion of fat, that is, the more moisture in the fish, the lower the fat percentage in it[6,8,20].

The difference between the contents of the ash percentage in the fish is due to the body's metabolism or nutrition[5,15,21]. The calories in fish are directly proportional to the rate of fat in their muscles, so the more calories, the percentage of fat increases because one gram of fat gives nine calories when oxidized. In contrast, protein and carbohydrates contain four calories[7,16,19].

Conclusions

The nutritional values of fish muscles depend on their protein and fat content, and these all change according to the conditions accompanying them, such as nutrition, seasonal variations, and physiological status. On this basis, The *A. latus* and *C. zilli* are considered medium-fat fish de-pending on the fat content in present fish muscles.

Author Contributions

All authors have read and agreed to the published version of the manuscript.

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