

Research Article

Estimations of chemical contents of the musculoskeletal system in two cyprinid fishes of *Arabibarbus grypus* and *Leuciscus vorax*

Mohammed Wissam Haider AL-MUHANNA¹, Kadhim Obaid Mutar AL-HUMAIRI^{2*}, Akeil Jameil MANSOUR³

¹Department of Biology, College of Education for Pure Sciences, University of Karbala, Karbala, Iraq.

²College of AL-Musaib Technical Al-Furat, AL-Awsat Technical University, Babylon, Iraq.

³Department of Biology, College of Education for Pure Sciences, University of Basrah, Basrah, Iraq.

*Email: com.kdm@atu.edu.iq

Abstract: The study aimed to investigate the chemical content (protein, lipid, moisture, and ash) and estimate the total calories of lateral muscles in two cyprinids of *Arabibarbus grypus* and *Leuciscus vorax*. Species collected from Al-Hindiya River from July to September 2020. Protein content values in *A. grypus* ranged from 17.53 to 19.83%, while in *L. vorax*, it ranged from 16.85 to 18.61%. The lipid content values were 4.846, 26 and 4.63–6.26% in *A. grypus* and *L. vorax*, respectively. *Arabibarbus grypus* had a moisture content of 76.21–71.65% and *L. vorax* 73.24–75.43%. The ash contents of *A. grypus* ranged from 0.84 to 1.25%, while that of *L. vorax* ranged from 1.4 to 2.09%. Both species can be classified as medium lipid-content fish based on their lipid content values.

Keywords: *Barbus*, Freshwater, Fish muscles, Chemical content.

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Introduction

Fishes are important because of being a renewable resource for human protein (Al-Fadly et al. 2011). This food source possesses higher protein (18.5%) compared to other sources such as beef (16.8%), eggs (13.6%), and milk (3.8%) (Al-Khafaji et al. 2008). Fish protein is also important for digestion because having many amino acids compared with those in other animals (Tilami & Sampels 2017; Humairi et al. 2019). Fish lipids are characterized by their high level of unsaturated fatty acids (79-83%), while the ratio of saturated fatty acids is low, ranging from 17-21% (AL-Muhanna 2018). According to Mansour (2018b), the value of fish can be determined by the amount of fat in their chemical composition, and it can be classified into 3 groups according to their lipid rates: fatty fish with more than 10%, median species with a lipid of 2.5-10%), and fleshy fish with less

2.5% lipid.

Water is the main component in fish muscle and is due to the freshness of the fish and it is called inside the fish's body the moisture content (Al-Baldawy 2019). In addition, fish are rich in vitamins, especially lipid-soluble vitamins such as A and D vitamins, and they are also a rich source of mineral salts such as calcium, phosphorus, magnesium, iodine, and others (Al-Tae 2005). Ash content in muscles reflects the large numbers of these minerals (Kumar et al. 2017). This study aimed to investigate the chemical content (protein, lipid, moisture, and ash) and estimate the total calories of lateral muscles in two cyprinids of *Arabibarbus grypus* and *Leuciscus vorax*.

Materials and methods

Two species of *A. grypus* and *L. vorax* were sampled

Table 1. Protein, lipid, moisture, and ash values of muscle regions R1 and R2 regions of *A. grypus*.

Length mm	R1 (Mean ± SE)				R2 (Mean ± SE)			
	Protein %	Lipid %	Moisture %	Ash %	Protein %	lipid %	Moisture %	Ash %
100 - 300	18.52±0.22	4.84±0.29	75.46±0.31	0.84±0.02	17.53±0.18	5.26±0.29	75.21±0.28	0.86±0.05
	18.81±0.20	5.01±0.22	74.84±0.33	0.87±0.03	17.84±0.19	5.43±0.22	74.67±0.30	0.91±0.02
	19.32±0.19	5.23±0.23	74.56±0.29	0.91±0.02	19.02±0.21	5.85±0.23	74.06±0.27	1.02±0.03
	19.54±0.13	5.45±0.26	73.82±0.30	1.04±0.05	19.24±0.23	6.05±0.26	72.85±0.31	1.21±0.02
	19.83±0.23	5.65±0.27	73.27±0.29	1.23±0.02	19.31±0.17	6.27±0.27	71.65±0.33	1.25±0.04

Table 2. Protein, lipid, moisture, and ash values of muscle regions R1 and R2 regions of *L. vorax*.

Length mm	R1 (Mean±SE)				R2 (Mean±SE)			
	Protein%	lipid%	Moisture%	Ash%	Protein %	lipid%	Moisture%	Ash%
100 - 300	17.63±0.17	4.63±0.18	75.43±0.32	1.42±0.05	16.85±0.17	4.82±0.27	74.82±0.34	1.62±0.02
	17.82±0.21	4.81±0.24	74.64±0.27	1.61±0.04	17.23±0.20	5.12±0.25	74.15±0.31	1.81±0.05
	18.23±0.17	5.08±0.25	73.63±0.32	1.80±0.03	17.62±0.18	5.46±0.21	73.08±0.32	1.89±0.04
	18.45±0.23	5.23±0.21	73.81±.34	1.91±0.06	18.01±0.22	5.87±0.20	73.42±0.29	1.98±0.03
	18.61±0.25	5.41±0.20	73.24±0.31	2.02±0.08	18.23±0.19	6.03±0.24	73.11±0.28	2.09±0.02

Table 3. Total protein and lipid energy content in the R1 region muscles of *A. grypus*.

Protein %	Energy Kcal/g	Lipid %	Energy Kcal/g	Total energy kcal/g
18.52	74.01	4.81	43.22	117.20
18.84	75.23	5.04	45.03	120.20
19.24	76.82	5.23	46.96	123.70
19.56	78.04	5.45	48.62	126.60
19.81	79.24	5.62	50.45	129.61

from Al-Hindiya River during July and September 2020. Fish were transported to the lab to estimate their muscles' chemical contents. Two regions of fish, including (1) under the dorsal fin (R1) and (2) the posterior part of the dorsal fin (R2) were sampled. The protein, lipid, moisture, and ash of muscles were measured based on AOAC (1999) and Jabeen & Chaudhry (2011). Caloric energy values for lipid and protein content of skeletal muscle were estimated based on the method described by Listrat et al. (2016).

Statistical Analysis: IBM SPSS 25 software was used to perform the statistical analysis. The chemical content of muscles from two regions of both species was compared using ANOVA (one-way) and Tokay's at the level of significance $P < 0.05$.

Results

The results of lipid, protein, moisture, and ash contents in muscles of R1 and R2 regions of both species of fish showed differences in their values and

length groups (100-300mm) (Tables 1, 2). Protein content in *A. grypus* ranged from 17.53 to 19.83%, and it was 16.85-18.61% in *L. vorax*. The lipid contents were 4.84-6.27 and 4.63-6.03% in *A. grypus* and *L. vorax*, respectively. Moisture content was 71.65-76.21% in *A. grypus* and 73.24-75.4333% in *L. vorax*. The ash content ranged from 1.42-2.099 and 0.84-1.255 in *L. vorax* and *A. grypus*, respectively.

The results of the total calories of lipid and protein in R1 and R2 regions of the studied species showed differences in their values and between length groups. The calories of protein were between 70.01-77.20kcal/g in *A. grypus*, while it was ranged 74.40-67.20kcal/g in *L. vorax*. The energy values of the lipid content in *A. grypus* ranged 43.22-55.8kcal/g, and it was 41.40-54.00kcal/g in *L. vorax*. The total calories (energy) of lipid and protein were 116.80-133.0kcal/g in *A. grypus*, and 115.40-126.80kcal/g in *L. vorax* (Tables 3-6).

Table 4. Total protein and lipid energy content in muscles in the R1 region of *L. vorax*.

Protein %	Energy Kcal/g	Lipid%	Energy Kcal/g	Total energy kcal/g
17.63	70.01	5.23	46.80	116.80
17.84	71.04	5.42	48.60	119.80
19.01	76.00	5.84	52.20	128.20
19.26	76.80	6.06	54.00	130.80
19.38	77.20	6.25	55.81	133.00

Table 5. Total protein and lipid energy content in muscles in the R1 region of *L. vorax*.

Protein %	Energy Kcal/g	Lipid (%)	Energy Kcal/g	Total energy kcal/g
17.63	70.40	4.61	41.40	111.80
17.85	71.20	4.84	43.20	114.40
18.24	72.80	5.03	45.00	117.80
18.43	73.60	5.24	46.80	120.40
18.63	74.40	5.46	48.60	123.00

Table 6. Total protein and lipid energy content in muscles of the R2 region in *L. vorax*.

Protein %	Energy Kcal/g	Lipid (%)	Energy Kcal/g	Total energy kcal/g
16.82	67.20	4.82	43.20	110.40
17.23	68.80	5.14	45.90	114.70
17.69	70.00	5.41	48.60	119.00
18.00	72.00	5.82	52.20	124.20
18.28	72.80	6.04	54.00	126.80

Table 7. Statistical comparison of chemical contents of the skeletal muscle in R1 and R2 regions of *A. grypus* and *L. vorax*.

Region	Parameters (%)	F. value	Sig. Value	Differences type
R1	Protein	12.153	0.008	Significant
	lipid	1.000	0.347	Non-Significant
	Moisture	0.215	0.655	Non-Significant
	Ash	51.882	0.000	Significant
R2	Protein	4.803	0.060	Non-Significant
	lipid	1.087	0.328	Non-Significant
	Moisture	0.002	0.966	Non-Significant
	Ash	59.259	0.000	Significant

Discussion

The results of the current study revealed significant differences in the protein content of the studied fish, and also in two regions of each fish in terms of the protein content i.e. in the anterior region of fish (R1), the protein was greater than the posterior region. These differences may be due to several factors, including external factors such as environmental differences and seasonal variations or internal factors such as age, food, or physiological status (Mansour & Al-Muhanna 2019; Al-Muhanna et al. 2019). The protein content in fish undergoes major changes influenced by a number of factors, including the stage of maturity of the fish, the extent of food availability,

the temperature of the water, and the gonad cycle.

The lipid content is inversely proportional to the water content, so the higher the water content, the lower the lipid content (Pawar & Sonawane 2013; Mansour 2018bc). Therefore, the results of the current study showed that there was a difference in the lipid content in both studied species and it was greater in the posterior region of fish (R2) than the anterior part. The results of the current study indicated a difference in the moisture content in the studied body regions (R1 and R2), i.e. the anterior part had greater moisture than the posterior ones, and the difference between the two studied species was also recorded. This may be due to reasons such as

growth, maturity, and nutrition (Marcu et al. 2010; Naeem & Ishtiaq 2011; Al-Muhanna et al. 2019).

The current results revealed that the ash content differs between the regions of the studied body (R1 and R2) i.e. the posterior region had greater ash. This may refer to the quality of food and the nature of nutrition, as the ash represents the fish content of mineral salts such as calcium, phosphorous, iodine, sodium, Iron, magnesium, copper, and other important minerals (Mohammed 2013; Oda 2015; Mansour 2018b). The amount of calories depends on the lipid content of the fish in its muscles. The high lipid content in the fish increases its calories, but produces low energy because its oxidation is one-fourth of lipid (Pawar & Sonawane 2013; Al-Hamadany 2016; Mansour 2018a). Therefore, the results showed a difference in the total calories (energy) values of the protein and lipid content in the two studied species. Based on the results, *A. grypus* and *L. vorax* are medium fishes according to their lipid values.

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