

# A Comparative Study for Calculating the Diameters of the Red and White Muscle Fibers in *Luciobarbus Xanthopterus* (Heckel, 1843) And *Leuciscus Vorax* (Heckel, 1843) In Karbala Governorate.

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## Abstract

The current study included a study related to the life of fish as a comparative study to choose the best species for fish farming, which is to calculate some of the histological characteristics of skeletal muscles red and white by calculating the diameters of muscle fibers of both types red and white in two different regions of the body (R1 and R2) There are two types of bony river fish in the Shatt al-Hindi waters with different dietary habits, namely : *Luciobarbus xanthopterus* (Heckel, 1843) and *Leuciscus vorax* (Heckel, 1843), which belong to the cyprinidae, The results of the phenotypic histological examination of the muscle tissue showed that the diameters of the red muscle fibers were of small sizes and almost identical in shape where the values of their averages in *L. xanthopterus* ranged between (42.45 -46.38 micron) while their rates were between (31.24 – 46.41 micron) in *L. vorax*, While the diameters of the white muscle fibers were large and varied and irregular in mosaic shape if the values of the averages of their diameters ranged in *L. xanthopterus* between (69.77 – 73.87 micron) while their average values were (57.25 – 69.32 micron) in the *L. vorax* This means a clear difference in the values of the average values of the diameters of red and white muscle fibers in the regions of the body studied (R1, R2) in both types, Meaning that the values of the rates of the diameters of the red and white muscle fibers decrease towards the back (caudal peduncle) for its importance associated with the swimming of both types of fish .

**Keywords:** *Luciobarbus xanthopterus* (Heckel, 1843), *Leuciscus vorax* (Heckel, 1843), muscles, The diameters of the muscle fibers are red and white.

## 1. Introduction

Fish is the best important source of human food because it contains nutrients that are part of the health aspect of it [Khalili Tilami et al. \[1\]](#), As the muscles of fish are a rich source of proteins, they determine the quality and nutritional value of fish products [\[2\]](#), Iraq is characterized by many water bodies, as these bodies contain [\[3\]](#) species of freshwater fish, The number of bony fish reached nearly (30,000) species in different aquatic environments, including the Cyprinidae one of the large families that is economically important [\[4\]](#), as it includes (2420) species [\[5\]](#), It is one of the important elements of internal trade in Iraq , and is characterized by having pharyngeal teeth and a number of tentacles around the mouth, some of which are missing, but the shape of its body is from fusiform to compressed, including the *Luciobarbus xanthopterus* (Heckel, 1843) which feeds on many types of zooplankton, plants, diatoms, mollusks and aquatic insect [\[6\]](#), it is mixed feeding Omnivores ,and the *Leuciscus vorax* (Heckel, 1843), that was recently classified within the genus *Leuciscus*, This genus includes the type of *L. vorax*, which is found in rivers and lakes in Mesopotamia, including Iraq [\[7\]](#), as it is Carnivores mainly for its diet on shrimp, aquatic insects and small fish

[\[6\]](#), Muscle tissue in fish represents the largest part of the body mass, approximately (30 – 60 %) of the body mass in fish, It represents the muscular system consisting of fast and slow muscles [\[8\]](#), The classification of muscle fibers depends on several bases, including color, location, diameters of muscle fibers, and proportions of muscles in each type, The local studies that dealt with the study of the diameters of muscle fibers in local fish are : A study on fish [Mansour \[9\]](#) on fish *Cichlidae*, and a study on fish *Luciobarbus xanthopterus* and *Tilapia zillii* .

## 2. Materials and Working Method

### Sampling

(50) samples were taken for each type of fish of the current study from the Euphrates River (Shatt al-Hindi) during the period from the beginning of September (2021) until the end of December (2021) using gill nets of different dimensions, The samples were transferred to the graduate laboratory in the Department of Life Sciences by cork containers filled with ice to maintain the freshness of the fish until reaching the laboratory, The fish were washed and divided according to the classification sources, and phenotypic measurements were taken, represented by measuring the total length to the nearest

(1 mm), and the weight to the nearest (0.1) grams, in preparation for conducting the tests referred to within the current study as shown in the two (tables 1 and 2).

Calculate the diameters of the red and white muscles To measure the diameters of muscle fibers of both types, red and white, samples of the studied fish were used, and cross-sections were taken with a thickness (1-1.5 cm) containing the two types of muscles from the body of the fish from two areas (R1, R2) Measurements were taken of the diameters of (50) muscle fibers for each type, and because some of them were not circular, the average length and width of each muscle fiber was taken to represent the diameter through the technique of embedding in paraffin wax, dyeing with Hematoxylin-Eosin, and fixation on microscopic slides and using the Ocular –micrometer with a magnification (10 X) according to the method he used [10].

### 3. Statistical Analysis

The statistical analysis was carried out by calculating the regression equations using (SPSS 16) and using the Excel program to calculate the (r) correlation coefficient between the variables for the study samples.

### 4. Result and Discussion

The results of the histological examination of the current study showed that there is a difference in the sizes of the diameters of the red and white muscle fibers, as the diameters of the red muscle fibers are almost identical and small, while the diameters of the white muscle fibers are of large sizes, in a mosaic arrangement, and varying in size [11]. The results of the current study showed a clear difference in the values of the average diameters of red muscle fibers for the studied length groups of the two studied species, as the average values of the *L. xanthopterus* between (42.45-46.38 micron), while the average values (31.24-46.41 micron) of the *L. vorax* were as shown in (tables 1 and 2), it was noted that the average diameters of the red muscle fibers increased as the length

of the fish increased in both species, and this was shown by the coefficient values that were (0.97, 0.98) in the *L. xanthopterus* and *L. vorax* respectively, As shown in (figures 1 and 2) When analyzing the results statistically to clarify the differences recorded in the rates of the diameters of the total red muscle fibers calculated for the length groups studied, it was noted that there were no significant differences ( $p < 0.05$ ) in both types as shown in (table 3), So The results of the current study showed a clear difference in the values of the average values of the diameters of the white muscle fibers for the length groups studied for the two studied types as the average values of the *L. xanthopterus* between (69.77-73.87 micron), while the average values (57.25-69.32 micron) of the *L. vorax* were as shown in (tables 1 and 2), it was noted that the average diameters of the white muscle fibers increased as the length of the fish increased in both species [12], and this was shown by the coefficient values that were (0.98 and 0.99) in the *L. xanthopterus* and *L. vorax* respectively, As shown in (figures 2 and 3) When analyzing the results statistically to clarify the differences recorded in the rates of the diameters of the total white muscle fibers calculated for the length groups studied, it was noted that there were significant differences ( $p < 0.05$ ) in both types as shown in (table 3) As for the rest of the regions in the diameters of the red and white muscle fibers, there were significant differences ( $p < 0.05$ ) in both types, as shown in (Table 4), There is a strong direct relationship between the rates of red and white muscle fiber diameters and the lengths of fish as a result of the continuous growth of muscle fibers coinciding with the addition of new muscle fibers and an increase in the size of muscle fibers and this leads to an increase in muscle fibers with their thickness to reflect increased motor activity and continuous growth of fish [13], The results of the current study showed that the values and averages of the diameters of the red and white muscle fibers decrease towards the posterior (caudal peduncle) in both types within the studied length groups [14].

**Table (1): shows the average values of the total lengths, weights, and diameters of the red and white muscle fibers in the body regions (R1 and R2) of the *L. xanthopterus*.**

Total diameter of the white muscle fibers (microns)	Total diameter of the red muscle fibers (microns)	The average diameter of the white muscle fibers. (Microns)		The average diameter of the red muscle fibers (Microns)		Fish (weightg)	Total length (mm)	No. of fish	Length group (mm)
		R2	R1	R2	R1				
69.77	42.45	67.38±1.67	72.17±1.71	39.75±1.93	45.16±1.81	541.32±1.41	315.12± 2.12	10	300-329
71.85	44.45	69.56±1.43	74.29±1.55	41.62±1.59	47.29±1.79	727.51±1.97	373.13±2.42	10	330-359
70.89	43.26	68.33±1.53	73.46±1.63	40.21±1.63	46.32±1.67	639.42±1.82	352.22±2.32	10	360-389
72.88	45.44	70.36±1.38	75.62±1.46	42.47±1.82	48.42±1.54	816.61±1.72	416.71±2.31	10	390-419
73.87	46.38	71.61±1.47	76.14±1.67	43.16±1.87	49.61±1.78	961.72±1.62	433.16±2.29	10	420-449

± standard erro

**Table (2): shows the average values of the total lengths, weights, and diameters of the red and white muscle fibers in the body regions (R1 and R2) of the *L. vorax*.**

Total diameter of the white muscle fibers (microns)	Total diameter of the white muscle fibers (microns)	The average diameter of the white muscle Fibers (Microns)		The average diameter of the red Muscle fibers (Microns)		Fish weight g(	Total length (mm)	No. of fish	Length group )mm(
		R2	R1	R2	R1				
57.25	31.24	54.39±1.89	60.12±1.73	28.31±1.52	34.18±1.62	361.76±1.66	312.16±2.67	10	300-329
60.69	34.40	57.62±1.73	63.77±1.53	32.39±1.32	36.42±1.52	426.72±1.43	346.72±2.76	10	330-359

63.29	38.29	60.17±1.64	66.42±1.65	36.22±1.36	40.36±1.21	542.31±1.72	375.16±2.56	10	360-389
66.37	42.41	63.46±1.72	69.29±1.62	40.65±1.55	44.17±1.32	651.71±1.56	418.19±2.43	10	390-419
69.32	46.41	66.51±1.53	72.13±1.64	44.53±1.41	48.29±1.46	719.13±1.69	439.30±2.32	10	420-449
± standard erro									

**Table( 3): Shows the differences recorded between the values of the total averages of the diameters of red and white muscles in the two studied types .**

Statistical Differences (0.05)	T Tabular value	Calculated T Value	The Studied Features
Non-significant	2.306	2.083	The total diameter of red muscle fibers (Micron)
significant	2.306	3.797	The total diameter of white muscle (fibersMicron)

**Table( 4) : Shows the differences recorded between the values of the diameters of red and white muscles in the body regions (R1 and R2) in the two studied types.**

Statistical Differences 0.05)(	Tabular T value	Calculated T Value	Region	The Studied Features
significant	2.306	2.499	R1	The total diameter of Red muscle fibers (micron)
Non-significant	2.306	1.701	R2	
significant	2.306	3.611	R1	The total diameter ofwhite muscle fibers (micron)
significant	2.306	4.000	R2	

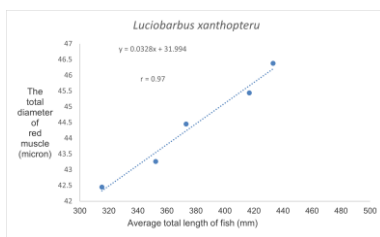


Figure (1): Shows the linear relationship between the average total length (mm) and the average total diameters of the red muscle fibers ( microns) in *L. xanthopterus*.

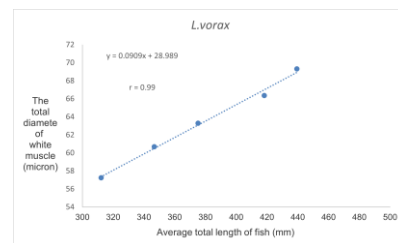


Figure (4): Shows the linear relationship between the average total length (mm) and the average total diameters of the white muscle fibers (microns) in *L. vorax*.

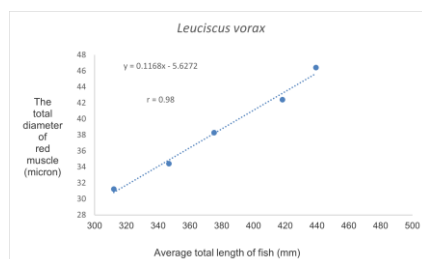


Figure (2): Shows the linear relationship between the average total length(mm) and the average total diameters of the red muscle fibers (microns) in *L. vorax*.

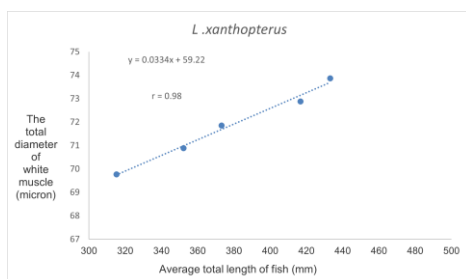


Figure (3): Shows the linear relationship between the average total length (mm) and the average total diameters of the white muscle fibers (microns) in *L. xanthopterus*.

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