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Comparative Morphometrical Study of Gills of Carp Fish (Cyprinus Carpio L.) and Catfish (Silurus Triostegus (Heckel)) In Tigris River Water

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ABSTRACT :

The aim of this study is to know the morphological and anatomical differences of gills of fish between the two speciescarp fish (Cyprinus carpio carpio) and catfish (Silurus triostegus (Heckel)) that live in the Tigris River in mousl city.Twenty-four samples of carp and twenty-four samples of cat fish were taken from three different areas of the Tigris River in the city of Mosul, where the gills were removed, prepared, and the necessary measurements were made.,where calculation of arch length, number and length of gill rakers, the length of filament and head morphometric, the carp fish its consider herbivores, have longer gill arches than cat fish. the raker gills of catfish exhibit considerable variances in the ultrastructure of their surfaces, which are identified adaptive changes in relation to fish food and feeding ecology because its consider carnivores . the length of raker in the carp fish higher than catfish because the nature of food Because it needs more filtration of food,the gills filament have no different in the length because they live in the same river and contain the same concentration of oxygen . the head morphometric show difference between two species and this differed depended to type.

Introduction:

The importance of fisheries in Iraq extends throughout history back to nearly 4000 years, when the Sumerians drafted the oldest civil fishing law,(Jawad et al., 2017).Iraq depends on inland and marine fisheries because there was no particular interest in Previously, aquaculture was practiced. In order to grow this industry, aquaculture in Iraq depends on the availability of water, as well as good soil and suitable sites,Despite the abundance of water, freshwater aquaculture production is confined to common carp pond culture. (Cyprinus carpio carpio)(Rombough, 2007).

In 2007, the total production derived from freshwater and marine aquaculture was estimated at (16 000 tons)(Crumlish, 2015).

Carp Fish(Cyprinus carpio L.) is a hardy, fast-growing fish that is often referred to as a "natural specialist" or "ecological engineer" due to its adaptability to a wide range of ecological

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conditions(Yaqoob, 2021). is an essential element in the food chain, as it isconsidered one of the white meat, a protein content known to be easily digested, and is an economically important fish species. In recent years, it has been increasingly used as a source of food and fishing. Carp has also been suggested as a test object in many toxicity assays because it is relatively insensitive and as a result it survives and accumulates pollutants even in highly contaminated sites(Chang & Snyder, 2004).

cat fish(Silurus triostegus (Heckel)) is a good source of various nutrients compared to its low calorie content, and it may also provide many health benefits, as protein is one of the main sources of energy in the diet, and it is important for building and repairing tissues and muscles, and building units of many hormones, enzymes, and other molecules. The other, one serving of running fish, or the equivalent of 100 grams, provides between (32-39%) of the daily protein requirement, and nutrient-rich protein sources that running fish may help reduce weight by enhancing the feeling of satiety. And a Good options for those who need a few calories while getting enough nutrients(Kristinsson & Rasco, 2000).

The gills are Which has a role in a variety of key functions in fish, including breathing(gas exchange), ionic regulation, osmosis regulation, acid-base balance, ammonia secretion, hormone production, modulation of circulating metabolites and immune defense.(Rombough, 2007),It stays in close contact with the outside environment, and is particularly sensitive to changes in water quality(H. Saber, 2011).

Fish gills are very sensitive to the physical and chemical changes of the aquatic medium such as temperature, acidification of the water supply due to acid rain, salts and heavy metals, and any change in the composition of the environment which is an important indicator of the toxic substances carried by the water and forms a semi-permeable barrier between the organism and the external environment. As a result, the gills are extremely vulnerable to disease and environmental stress.(Oğuz, 2015), where there is a close relationship between gill morphological change and stress(G. Peters & Schwarzer, 1985).The morphology of the gills was described as a good indicator of the water quality and the general health status of the farmed fish(N. Peters, 1984).

Most fish have four pairs of gill archesextending from the floor to the roof of the buccalcavity. Each of the four pairs is supported by a cartilaginous and/or bony skeleton with associated striated abductor and adductor muscles facilitating movement of gillsto favorable respiratory positions. The gills arecovered and protected by an operculum,Each gill arch bears a number of gill filaments,Gill filaments have acentral cartilaginous support, afferent and efferentarteriolesand it responsible for the gas exchanges between the fish and water,One or more rows of stiff strainers line the inner surfaces of the gill arches called gill rakers.Before food

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is delivered into the esophagus and then into the stomach or intestine, they sift and collect particulate food material and place larger food pieces. (Genten et al., 2009).

The aim of study:

due to the absence of anatomical compared to these species in the Tigris River, these types of fish represent the importance of the study in the country's economy because it represents an important and abundant source of protein. It aimed to:

Main objectives

Establishing a database for researchers to support their scientific results.

Secondary goals

Determination of the standard morphological differences of gills of carp (Cyprinus carpio L.) and cat fish (Silurus triostegus (Heckel)) that live in the waters of the Tigris River

Material and methods:

Collection of sample:

Forty eight fish collected from different region in the trgirs river in the mosul city included (Al-Rashedeyah,Hawealkanesah,Wanah region) from about twenty threeDecember 2020 to fifteenmarch 2021 , adulttwenty fourCyprinus carpio fish and adult twenty Silurus triostegus (Heckel) for both gender and healthy weight between (1,5kg to 2kg) were used for this study(Vohra et al., 2021).

Preparation of sample:

The length of fish was done (laterally) from the mouth to the tail with the tail fin as pic(1) and different direction (dorsally, ventrally , laterally)once and without tail fin another time **Fig**(1).

The head morphometric measurement were done for both species of fish according to(Jawad, 2012)as in **Fig**(2)

Fig 1 :the figure explain the measurement that use on the fish were (A) consider the length of lateral side with the fin, while the (B) show measure A-c in the carp fish head.

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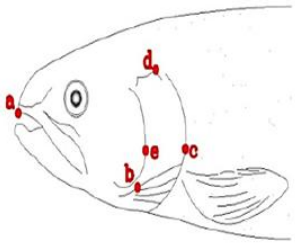
Fig 2: these figure was explain the haed morphpmetric that use for the carp and cat fish.



Fig(2)

All gill arches from both sides of each fish were dissected and placed in 0.9 percent normal saline while the rakers and filaments were preserved. The gill arches were parted, mucus was scraped away with a scalpel at a 45° angle, and the measurements listed in Table(1) were taken for each arch's lateral side.

Measuring tape for length of archs and by e-veriner for length of raker and length of filamentfrom proximal, middle and distal part of each archaccording to (2018 ,دعيج)

structure	Measurement
Arch	Length of each gill arch
Racker number	Total number of gill raker of each gill arch
Racker length	Length of gill racker
Filament length	Length of all filament of each gill arch

Table (1):a table explain anatomical measurement of gilss fish.

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Statistical analysis :

Statistical analysis was done for the collected data using student t-test analysis with (IBMSPSS,version 25, UK) and the results mentioned as meant S.D at $p < 0.005$.

Parameters included were length of fish with and without fins ,gills arch length and gills filament length and racker number and length,and fish weights.

The result :

The Anatomical examination of fish gills for both kind of fish showed that both species of fish had (5) gill arches, the 5^{th} one did not have filaments and called pharyngeal arch because it lead to pharynx.

Gill arches in cat fish was larger and longer than in carp fish .whereas the mean length arch was (90mm) in cat fish and (70mm) in carp fish as in **Fig** (3). while the rakers in carp fish presented in pair rows along the length of arch internally and they were more in number and less in ossification than cat fish , except the 5^{th} gill arch that had one row of rakers and less in number as in **Fig** (4).

The mean of number of rakers in carp fish was (31), while in cat fish was(13)as in **Fig** (5).

The raker in the proximal part in carp was longer than the proximal part in the catfish. Where the mean length of proximal raker was (5mm) in carp fish and in the catfish (3mm) as in the Fig (6).

Results of filaments showed no significant difference between the carp and catfish at p=value <0.05 .

morphometric heads Result showed that length of the line from A to C in catfish group is higher than carp fish group while the line from D to B showed that length in catfish higher than carp fish furthermore the line of E to C had a significant differences where measurement was longer in carp fish animal group.**Fig(7)** .

Fig 3: the figure show the raker gills in catfish (A) and the raker of carp fish (B)

A B

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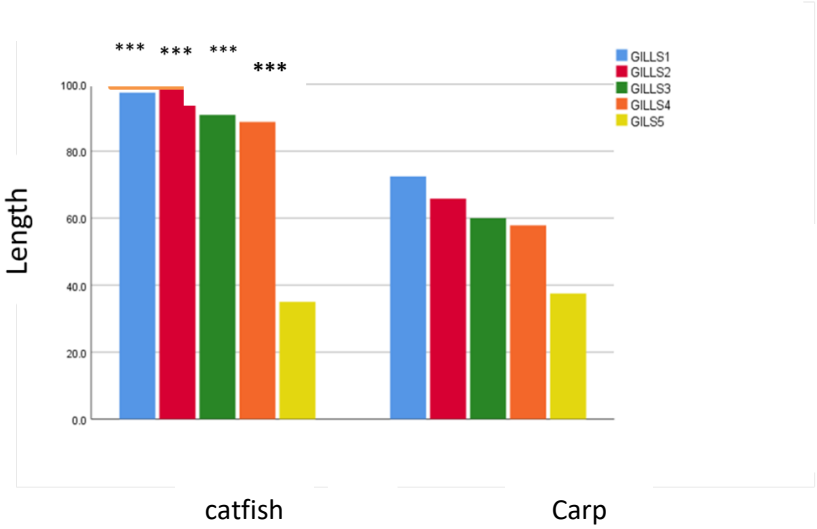
Fig 4: the figure show the difference of length of gills arch of the carp fish group and catfish group.

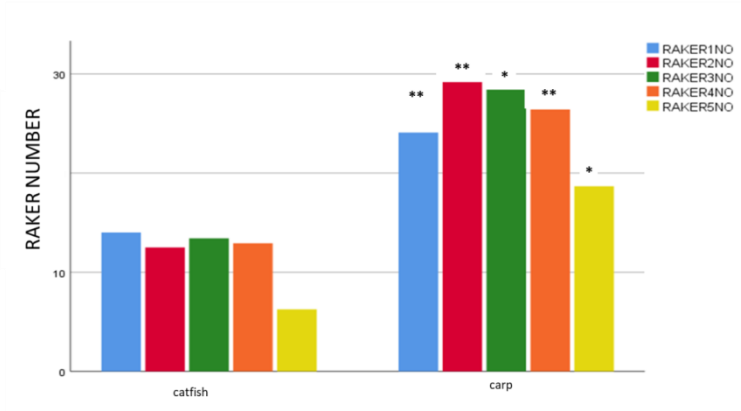


* There is a significant difference between the variables of the column at the degree of significance(P value ≤ 0.05)

** There is a significant difference between the variables of the column at thedegreeof significance(P value ≤0.01)

*** There is a significant difference between the variables of the column at the degree of significance(P value ≤ 0.001)

Fig 5: the figure explain the total number of raker in cat fish and carp.



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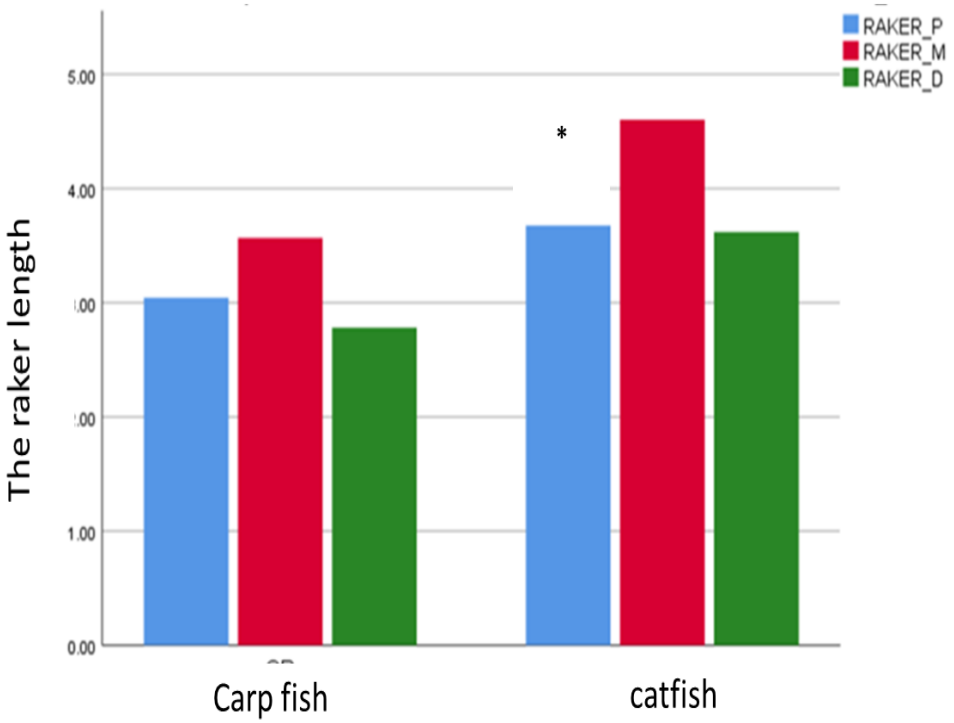
* There is a significant difference between the variables of the column at thedegree of significance P value ≤ 0.05

** There is a significant difference between the variables of the column at the degree of significance P value ≤0.01

*** There is a significant difference between the variables of the column at the degree of significance P value ≤ 0.001

Fig 6: the figure explain the proximal ,middle ,and distal part of the length of the raker



* There is a significant difference between the variables of the column at the degree of significance(P value ≤ 0.05)

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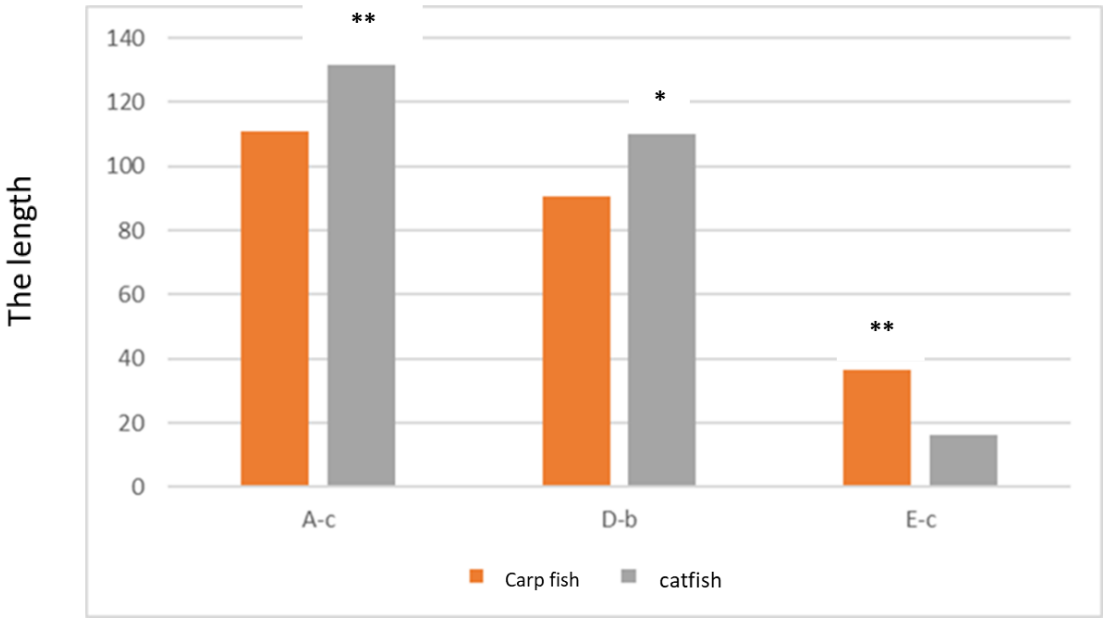
Fig 6:the figure show the head morphometric between carp fish group and catfish group.



* There is a significant difference between the variables of the column at the degree of significance(P value ≤ 0.05)

** There is a significant difference between the variables of the column at the degree of significance(P value ≤0.01)

*** There is a significant difference between the variables of the column at the level of significance(P value ≤ 0.001)

Discussion

The gills arch measurements of the carp group were close to what was mentioned,(Jenjan et al., 2013). in his research about the length of gills arch , which at the same time was shorter than what was found in the cat fish group.

The mean Rakers number of The carp group about 30 in the gills arch, while the mean raker gills number in the catfish 14, (*Jenjan, Hussein B.B. (2011)*, 2011). whose mention the number of raker in carp group about (19) because he used less Wight and age.

The mean raker gills length in the carp group in the proximal part is higher than the proximal part of catfish group ,(*Jenjan, Hussein B.B. (2011)*, 2011) whosemention the length of raker in the carp fishwhich results are close to the results of our research .

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The carp fish group raker composed of two row and less hard and blunt edged these findings agrees with,(U. Kumari et al., 2009) whose mention that shape of rakers formed according to carp feeding nature (herbivorous).while The raker in the catfish had one row in the first, second gills arch , the third had two row and its hard and pointed , these result similar to,(Usha Kumari et al., 2005). whose mention the reasons of these character is due to feeding and food ecology of the fish.

There is no significant difference between the carp group and catfish group in the filament length because they live in the same aquatic environment and same oxygen constriction that agree with (Jenjan et al., 2013). whose mention the oxygen effected on the growth and gas exchanges surface .

Head measurements were shown for a group of carp fish less in length than catfish group in when measure A-c and D-b , while E-c measure shown the catfish group higher than E-c of catfish (*Jenjan, Hussein B.B. (2011)*, 2011). whose mention the head morphometric of the carp fish in the less weight and age.

Conclusion:

This study has demonstrated the morphological changesin the gills structure between the carp fish group and catfish group that Live in the Tigris Riverin the mousl city in relation to type of feed and environment .

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Conflict of interest

The authors declare that conflict of interest exists

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