

Seasonal Variation in Fat percentage and Water content of Muscle Tissue of some Fishes Endemic to Derbendikhan Reservoir

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Abstract:

Fat percentage and Water content in muscle tissue of 600 individuals under six commercially important fishes of *Carassius auratus*, *Cyprinus carpio*, *Barbus esocinus*, *Barbus grypus*, *Capoeta damascina*, and *Silurus triostegus* from Derbendikhan Reservoir within Sulaimani governorate, were analyzed,. Total fat content of the muscle in *Barbus esocinus* was of the highest value (76.27 %) and the lower water content (8.14%) among other studied fish, during summer season. The fat content was inversely related to water content in muscle of studied fish for different seasons. The aim was to evaluate fat percentage and water content in fish muscle tissue then relating them to the seasonal variation in addition to its health benefits to consumers in order to get best fish oils among seasons and among species.

الخلاصة

تم قياس نسبة المؤية للدهون و كمية الماء الموجودة في عضلات 600 نموذجا تعود الى ست انواع من الاسماك (*Barbus esocinus* البز), (*Cyprinus carpio* الكارب الشائع), (*Barbus grypus* الشبوط), (*Capoeta damascina*) و (*Silurus triostegus* الجري) المستوطنة في بحيرة دربندخان الواقعة ضمن محافظة السليمانية. اظهرت النتائج بان كمية الدهون في عضلات سمكة البز *Barbus esocinus* كانت اعلى (76.27%) وان كمية الماء الموجودة كانت (8.14%) مقارنة بانواع الاخرى من الاسماك التي تمت دراستها خلال فصل الصيف. ان كمية الدهون تتناسب عكسيا مع كمية الماء في عضلات الاسماك للفصول الاربعة . هدف من اجراء البحث هو تقييم كمية الدهون % و المحتوى الماء في عضلات الاسماك و ربط هذه العلاقة مع تغيرات الفصلية هذا بالاضافة الى التأثيرات الصحية للمستهلكين للحصول على اعلى نسبة للدهون الموجودة ما بين الاسماك والفصول.

Introduction

Indicators are available to measure most biological aspects of the state of a wild marine fish stock ,e.g .abundance ,rates of mortality ,length and age compositions ,annual recruitment, growth ,bodily condition ,and sexual maturity .Such indicators are termed “population indicators” when they apply to a population or stock of one species ,the alternative being “community indicators” ,when they apply to more than one species (Rochet,et.al.2005; Woillez,et.al,2009). Physiological indicators such as liver weight or lipid content which have direct relevance to energy usage, reproduction and so on (Anonymous2003).

Since chemical composition can vary widely, not only from fish to fish of the same species, but also within an individual fish, precision is impossible. The processor, the nutritionist, the cook and the consumer all have a direct interest in the composition of fish. While the consumer is interested mainly in the edible part of the fish, that is the flesh or muscle, the fish meal manufacturer is concerned with the composition of the whole fish, and the processor of fish oils wants to know what is in the liver. (Murray and Burt,2001) .Growth ,food intake ,and food conversion in Eury plastic fish exposed to different temperature and salinities was studied by (Kinne,1960). Oil-rich fish which accumulate fat reserves when actively feeding during the summer generally deplete them

during sexual maturation, and this is often enhanced by the energy requirements of the migrations that commonly precede or accompany sexual maturation and spawning. Henderson *et al.*,1984;Trenkel and Cotter,2009).

Fish is one of the most valuable sources of high grade protein available to man in this hungry world, and a knowledge of its composition is essential if the fullest use is to be made of it. Fish muscle is of two kinds, light muscle and dark muscle. In white fish such as cod and haddock there is a small strip of dark, or red, muscle just under the skin on both sides of the body, running beneath the lateral line. In fatty fish such as herring and mackerel the strips of dark muscle are much larger in proportion and contain higher concentrations of fat and certain vitamins (Castro-Santos and Haro., 2005).

Water Content : The main constituent of fish flesh is water, which usually accounts for about 80 per cent of the weight of a fresh white fish fillet. Whereas the average water content of the flesh of fatty fish is about 70 per cent. The water in fresh fish muscle is tightly bound to the proteins in the structure in such a way that it cannot readily be expelled even under high pressure.

Fat percentage: the fat content of fish can vary very much more widely than the water, protein or mineral content. Whilst the ratio of the highest to the lowest value of protein or water content encountered is not more than three to one.(Murray and Burt,2001)

Materials & Methods

Fish samples for the study of seasonal variations in the fat and water content composition of muscle tissue of five commercial fish *Carassius auratus*, *Cyprinus carpio*, *Barbus esocinus*, *Barbus grypus*, *Capoeta damascina*, and *Silurus triostegus* of the same habit were obtained at regular monthly interval for four seasons (Winter, Spring, Summer, and Autumn 2009).Muscle samples were taken from the dorsal part of the body, fat % was determined in fish muscles extracts using a suitable solvent under the operating condition ,continuous soxhlet extraction device was used according to(Combe,1926), and (ROPME,1983).Water content was determined using the equation(1) of (Murray and Burt,2001). Statistical analysis was carried out using the SPSS program version 15.

$$\% \text{Water content} = 80.1 - .94 * \% \text{fat} \dots \dots \dots (1)$$

Results and Discussion

The present investigation deals with the determination as well as the seasonal variation of Fat % and water content in dorsal muscle tissues of five commercial fish *Carassius auratus*, *Cyprinus carpio*, *Barbus esocinus*, *Barbus grypus*, *Capoeta damascina*, and *Silurus triostegus*. The knowledge of proximate composition of fishery species is fundamentally important for the application of different technological processes, the characteristics post-mortem of species, as an aspect of quality of raw material and giving an idea of sexual stage. Yeannes and María (2003). Results indicated that fat% was ranged from (32.93 % -76.27%) as a minimum and maximum values respectively in *Barbus esocinus*. While, water content of the same fish was ranged from(8.41%-49.14%) as the minimum and maximum values. Seasonal variations was agreed with (Islam& Jouadder ,(2005) who studied seasonal variation in proximate composition of fresh water Gobi ,*Glossogobius giuris*, and revealed that water content was varied

seasonally, the present study indicated that minimum %Fat was 51.21% determined in *Barbus esocinus*, while the maximum value recorded was 62.32 % in *Capoeta damascina* on the other hand, the % water content was 21.52 % and 31.96% as the minimum and maximum values respectively during Winter season as shown in (fig.1a-1b). During Spring, (Fig.2a-2b), the minimum value recorded for % Fat was 43.79 % in *Capoeta damascina* while the maximum value was 73.04% in *Barbus esocinus*. Water content was in 11.44% -38.93% as a minimum and maximum occurred in *Barbus esocinus* and *Capoeta damascina* in respective. Summer season showed in (fig.3a-3b) that Fat% of the fish muscles was ranged from 35.2% - 76.27% in *Carassius auratus* and *Barbus esocinus* respectively. Water content was from 8.41%-47.01 % in muscle of *Carassius auratus* and *Barbus esocinus*. In Autumn, (fig.4a-4b), the fat content was ranged from 32.93% -73.04% in *Barbus grypus* and *Barbus esocinus*, in contrast, the maximum and minimum water content of the same fish species were 49.14% - 11.44 %. Mean comparison of each of % Fat and % water content as shown in table(1) revealed that the maximum mean value of 76.27 % was in summer but, water content was of minimum 8.41%. on the other hand, the minimum fat content was 32.93% in Autumn while the maximum water content was 49.14 % of the same season. The composition of a particular species often appears to vary from one fishing ground to another, and from season to season, The coefficients of diffusion of water, associated with states of high and low hydration respectively in fish muscle are sensitively dependent on the amount of fat present. (Jason, 2006). The whole results revealed that seasons affected on each of water content and % fat as in (Wallace, 1991). Generally different phases of maturation were associated with marked quantitative fluctuations of each ingredient in different tissues. (Jafri, 1969)

Table(1): Minimum and maximum values of Fat% and Water content % of fish species in different seasons

Seasons	Minimum Fat%	Maximum fat %	Std.Error for Fat%	Minimum %water content	Maximum % Water content	Std.Error For water content%
winter	51.21	62.32	2.6	11.44	31.96	2.8
spring	43.79	73.04	3.3	11.44	38.93	3.4
summer	35.2	76.27	3.5	8.14	47.01	3.3
autumn	32.93	73.04	3.3	11.44	49.14	3.8
Total mean	32.93	76.27		8.41	49.14	

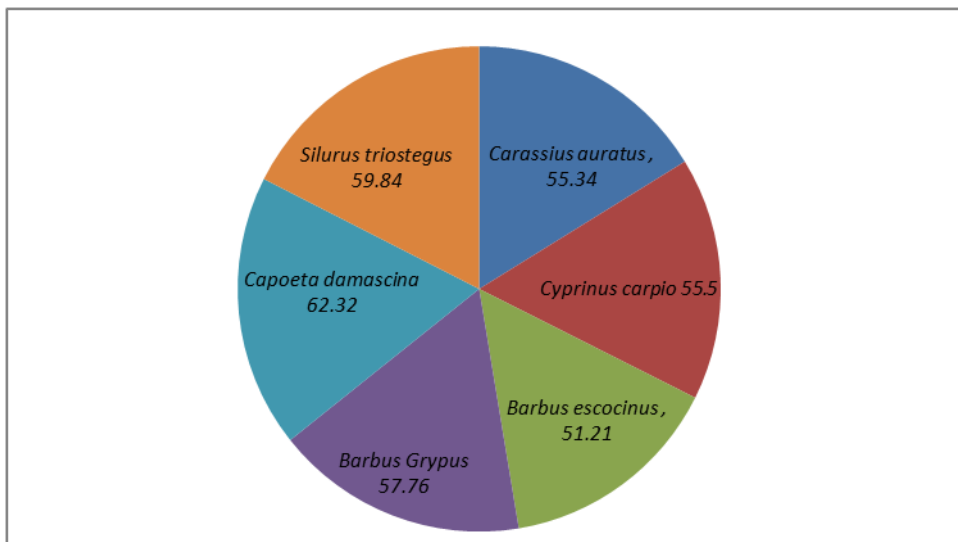


Fig.(1-a):Shows the mean % fat of different fish species in Winter season

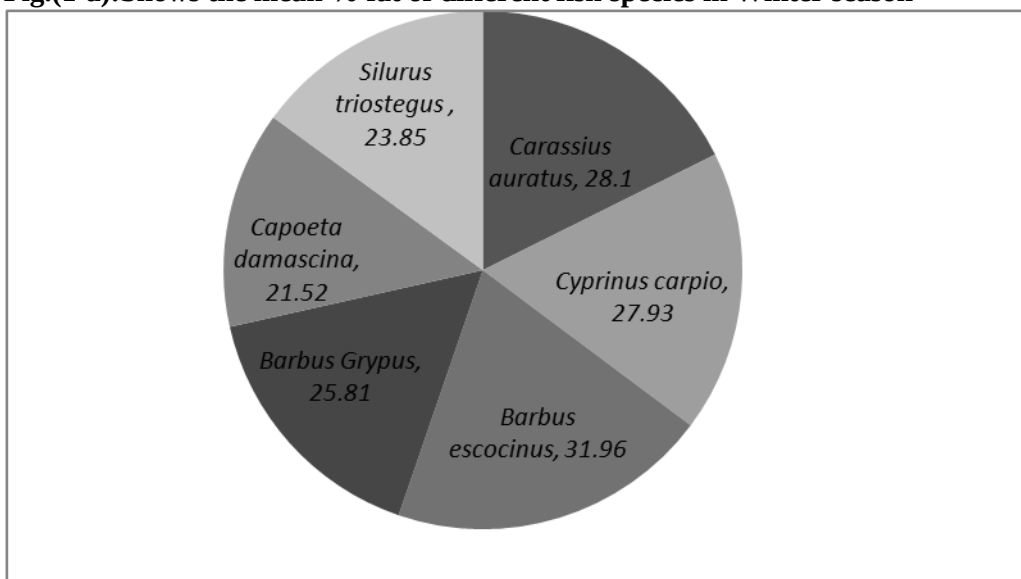


Fig.(1-b):Shows the mean % water content of different fish species in Winter season

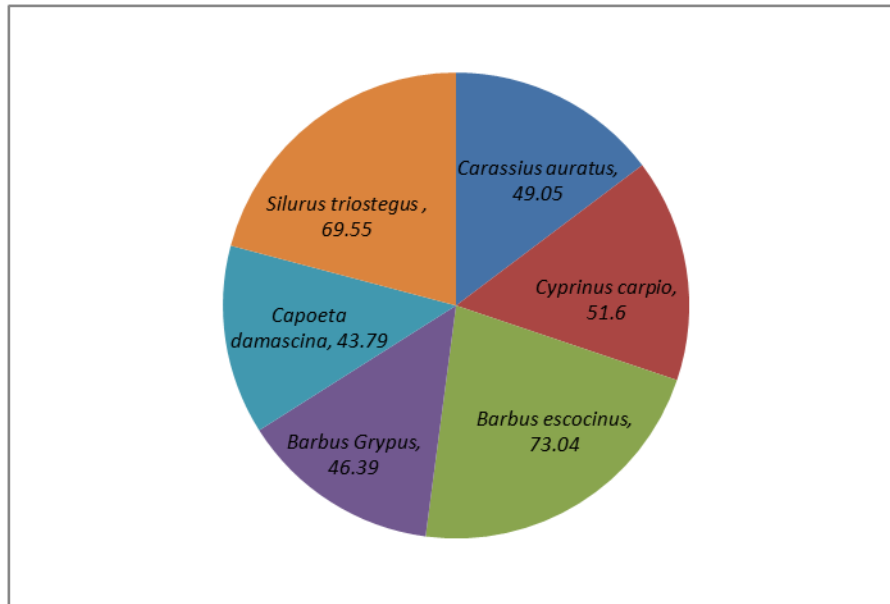


Fig.(2-a):Shows the mean % fat of different fish species in Spring season.

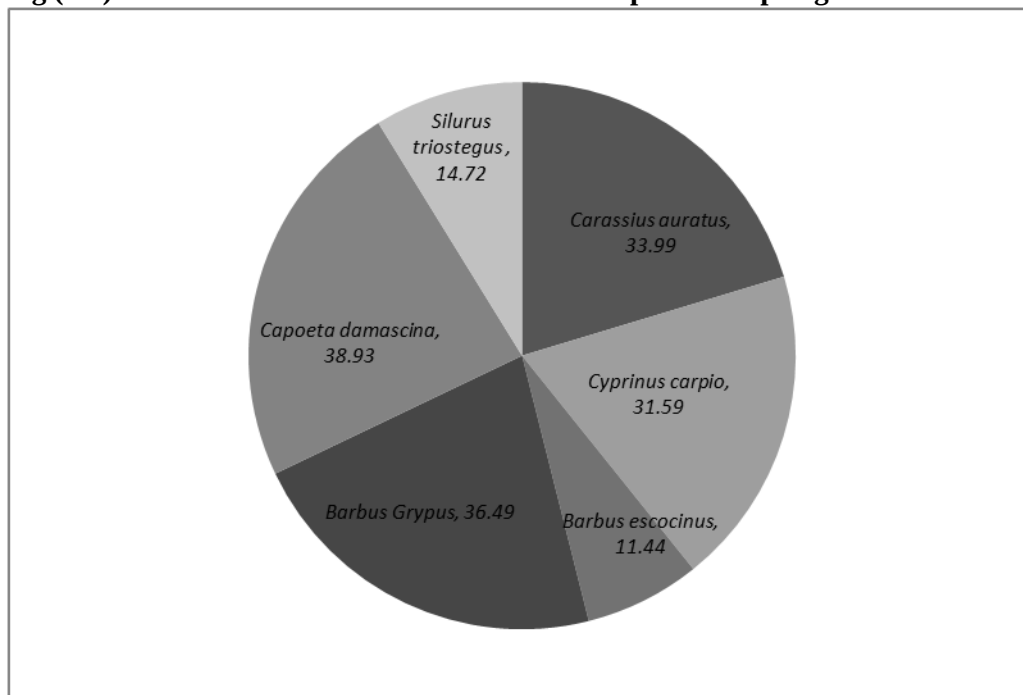


Fig.(2-b) :Shows the mean % Water content of different fish species in Spring season.

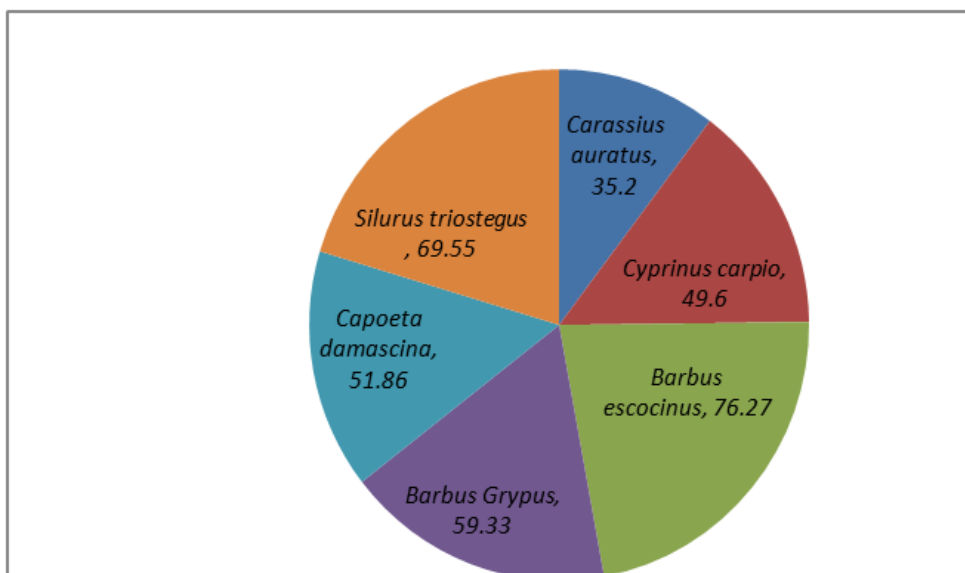


Fig.(3-a) :Shows the mean % Fat of different fish species in Summer season.

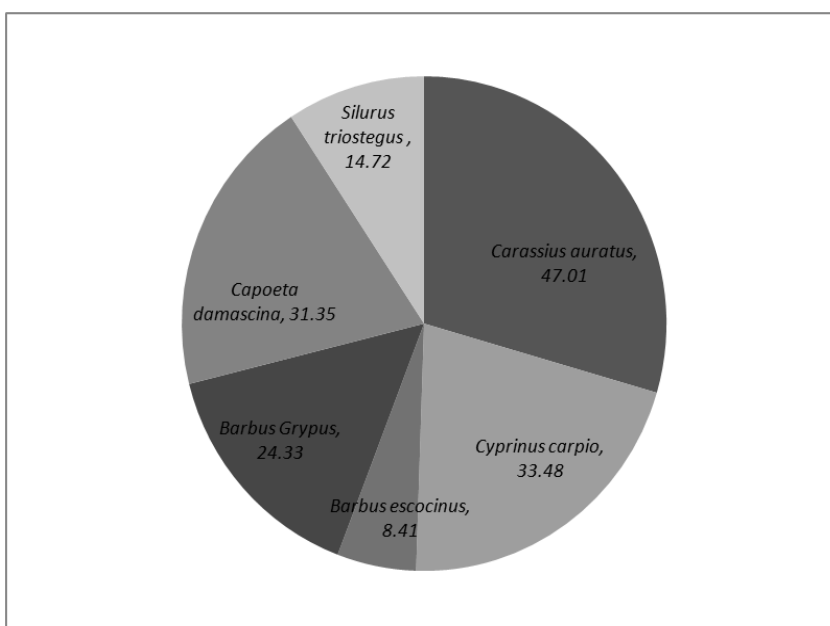


Fig.(3-b) :Shows the mean % Water content of different fish species in Summer season.

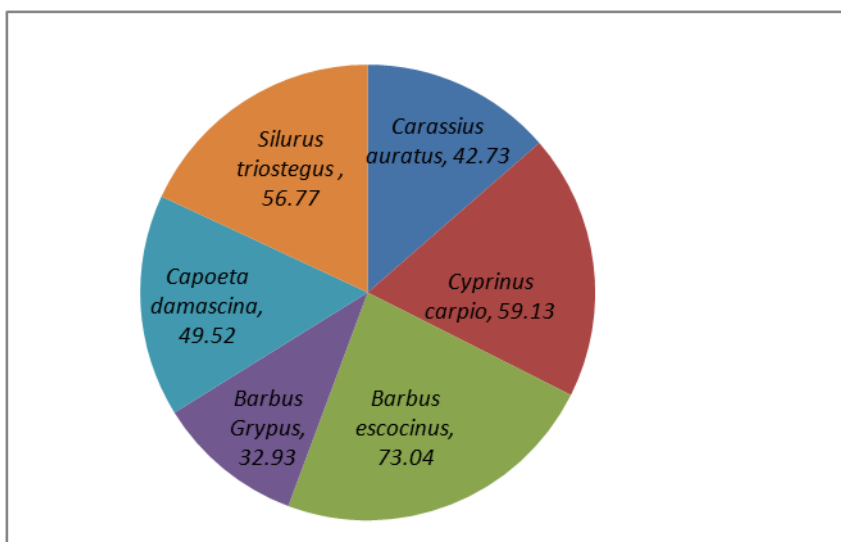


Fig.(4-a) :Shows the mean % Fat of different fish species in Autumn season

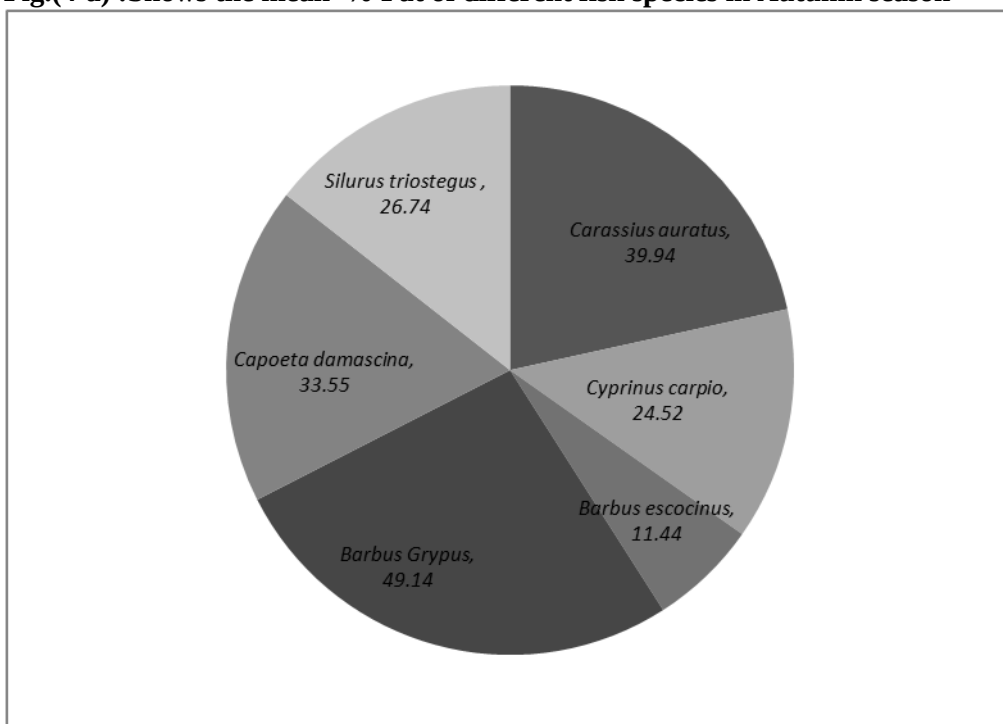


Fig.(4-b) :Shows the mean % Water content of different fish species in Autumn season.

In fact, total lipids also varied with season in fishes studied by Saoud, *et al.*, (2007), where the total amount of lipid consumed per weight of tissue varied monthly among the species and one species is not necessarily better than another all year. In general, the lipid content of fish flesh range from % 0.1- %67 on the other hand, the water content is range from %28 - %96. (Love, 1974). Results was also agree with that of Shreni, (1978) when fat content of the muscle showed two peak periods of accumulation—one during November and other during May–July. The fat percentage

increased with increasing body weight is another reason for increasing this factor in some fish Sekiguchi *et al.*(1978)

Conclusion and Suggestion

- 1- Fish muscle contain variable concentrations of fat and water content depending on the age, weight and other physiological factors ,in addition to time of fishing, as well as the seasonal variation.
- 2- Further studies must be carried out on the other fish properties, compositions....etc.
- 3- Preventing water pollution of this reservoir in order to get the best fish quality.

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