# EFFECTS OF STARVATION ON THE PROXIMATE CHEMICAL COMPOSITION OF THE JUVENILES BUNNYI *BARBUS SHARPEYI*

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**ABSTRACT**

Juveniles bunnyi *Barbus sharpeyi* were subjected to starvation for a period of 11weeks, the proximate chemical analysis of body composition showed that the main effect of starvation was found on the depletion in lipid content, followed by gradual protein decreasing, coincided with an increase in both moisture and ash content. Muscle lipid was the more storage of reserve than that of viscera, that's why the lost weight from muscles was more. This shows that energy utilized was derived from lipid catabolism in muscle more than viscera. Both condition factor (K) and viscera somatic index (VSI) tend to progressive decrease as starvation period proceded, and there was an inverse relationship between moisture and lipid content in whole specimen.

## INTRODUCTION:

The variation in the chemical composition of fish is closely related to feed intake, migratory swimming and sexual changes in connection with spawning. Fish may have starvation periods in relation to natural or physiological reasons (such as migration and spawning) or because of external factors such as shortage of food. Fish which have energy depots in the form of lipids will rely on it (Love,1970 ).Several workers (Jobling,1980; Miglavs and Jobling,1989 and FAO,2000) have considered that these variation in the chemical composition can be used to assess rates of energy metabolism and the depletion of energy reserves during starvation .

Fasting(45days)caused a significant decrease in mRNA expression of in red muscle but not in white muscle ,and was accompanied by significant decrease in the plasma levels of insulin and glucose in brown trout and rainbow trout (Capilla, *et. al*.2002).

Starvation affects the morphology of intestine, changes occur in the structure of the alimentary tract and these may lead to decreased motility of the gut (Windell,1966; Elliott, 1972).

The chemical composition of many local fish species have been studied by (Hindi, *et. al*., 1989; Ahmed,*et.al*.1992 and Mahdi, *et. al*. 2006). Effects of starvation on proximate chemical composition of *Liza abu* was undertaken by Yesser, *et. al*.(1999).

This study described the major biochemical components in juveniles bunnyi and may be useful in giving some insight into the potential recovery rate of fish during and after starvation such that occurs during overwintering shortage of food .

## MATERIALS AND METHODS:

Juveniles of 2-3 g. in weight were caught by cast net from the Marine Science Center Aquaculture Station.

They were held in a 60x30x30 cm. aquaria, supplied with old tap water for acclimatization to laboratory condition for at least three days before they used in the experiment. The water temperature was not regular but changed slightly between 21-23 ºC., most of the water was changed every 48 hours, during this period, no food was given and attention was given to remove any dead fish immediately .Eight fishes were sampled three days after capture to carry on (biochemical analysis prior to starvation), a non starved individuals. Thereafter, the specimens were captured in intervals of three days up to a maximum of 11 weeks in order to assess the changes in the proximate chemical composition of body tissues during increased period of starvation. The fishes were too small to provide sufficient quantities of liver for analysis, so that the viscera including liver were removed and weighted. The mean condition factor (K) and mean viscera somatic index (VSI) of each fish for each period were calculated as follows:

$$\text{Viscera somatic index(VSI)} = \frac{\text{Weight of viscera (g.) x 100}}{\text{Body weight (g.)}}$$

Body fish without viscera and viscera were dried separately to constant weight at 105 ºC and ground to a fine powder to provide samples for analysis. Lipid was extracted in Soxhlet apparatus using chloroform : methanol (2:1) as a solvent. Nitrogen content was determined by a standard micro–Kjeldahl technique, and protein estimated as (N x 6.25) and ash by burning in a muffle furnace for 6 hour at 600 ºC. (A.O.A.C.,1975).

## RESULTS AND DISCUSSION:

The main effects of starvation on proximate chemical composition of fingerlings *B.sharpeyi* during prolonged starvation were progressive decrease in lipid (Figure 1), coupled with an increase in moisture and ash content(Figure 2 &3), and fairly rapid initial decrease in protein content (Figure 4).These effects were observed on the composition of body fish without viscera as well as viscera. Statistical analysis of the results showed that there is a significant variation between groups of data, it was calculated using Students t-test. The lipid content in body fish without viscera depleted at rate of 94.7% ($p< 0.01$) in relation to initial value.The viscera components have similar changes to certain extent, as lipid content decline to 64.7% in relation to initial value. In contrast the water content and ash in body fish without viscera increase with increasing starvation period, reaching 80.02% ±1.5 and 5.6% ± 0.2 after 11 weeks respectively, a rise of 6.21% and 16.62% ($P< 0.01$) respectively relative to initial value. Slight decrease in protein, with slight increase in both moisture and ash content .The mean initial value of condition factor (K) and viscera somatic index (VSI) were 1.04 ± o.8 and 5.68 ± 0.2 respectively, they fell to 0.52 ± 0.4 and 2.4 ± 0.09 after 11 weeks of starvation, a drop of about 50% and 57.7% respectively (figure 5 and 6).Progressive decrease in body weight, a drop of about 53.9 %, this loss could be explained by the loss of protein and fat content. Because the tissues of viscera are so depleted during the period of a fast, it might be expected that this would lead to a reduction in digestive efficiency (Jobling,1980).The increase in the percentage of ash are caused by loss of organic matter (Love,1970).The proximate composition of juveniles *B.sharpeyi* changes during prolonged starvation and the analysis of muscles revealed that fat reserves were a particularly important form of energy storage. The interrelationships between the main

constituents during fasting vary in different species, according to the location of fat, juveniles *B.sharpeyi* closely resemble those in location of stored lipid in white muscle, such as *Cyprinus carpio*, (Love, 1970) ; rainbow trout *Salmo gairdneri,*(Robinson and Mead, 1973) ; brown trout *S. trutta*, (Elliott, 1976) ;*Tilapia nilotica*, (Satoh, *et. al*., 1984) and *Liza abu*, (Yesser, *et al.* 1999). These fishes are considered as a typical active species as fatty or semifatty fish. A different situation was found in non fatty fish or sluggish—dwelling fish such as plaice, (Johnston and Goldspink, 1973; Jobling, 1980) and European bass, (Stirling,1976), where the principal source of stored lipid is in the liver, in these fishes, the response of the muscle to starvation is quite different(Love, 1970).

A similar increases in water content of 74.4 % was observed by Stirling (1976) in the starved juveniles European bass. . However, higher water contents of 88.5 % has been recorded in the muscle of plaice (Johnston and Goldspink, 1973). In the present study, negative correlation between moisture and lipid content, r=-0.94, the regression was highly significant ($p<0.01$) , the pattern of moisture variations in the muscles of mature and non starved bunny was also related inversely to the change in the amount of lipid (Hindi,*et.al*.1989).Larval *Clupea harengus* also showed an increase in moisture with a decrease in lipids (Ehrlich, 1974).Similar changes in proximate chemical composition during starvation have been reported in other species such as brook trout *Salvelinus fontinalis*(Phillips,*et.al*.1966); *Oncorhynchus nerka* (Breet,*et.al*. 1969) and *L. abu* ( Yesser, *et.al*.1999).

The different organs in fish are not all depleted at the same rate during starvation, the weight loss varied in organs of *C. carpio* during two months of starvation (Love, 1970). Creach and Cournede (1965) found that the organs were affected in the following order : Intestine, liver, kidney, spleen, muscle and heart. It appears that tissue essential for the animals existence, such as nervous tissue and heart muscle, are little affected, even during severe starvation. Present study noticed that the gut of juveniles *B. sharpeyi* after 11 weeks was thinwalled, semi transparent and filled with normal gastrointestinal fluid, Similar changes have been observed in other starved fish (Windell, 1966; 1978; Elliot, 1972 ). They considered that starvation reduced the ability of the gut to synthesize and secrete digestive enzymes. Lipid, protein, condition factor (K) and viscera somatic index (VSI) were inversely related to moisture content in whole specimens. Similar inverse relationship were observed in whole sockeye salmon (Breet, *et.al*.,1969); in white muscle of plaice (Johnston and Goldspink ,1973; Love, *et.al*.,1974) . The pattern of moisture variations in the muscles of mature bunnyi was related inversely to the change in the amount of lipid (Hindi, *et.al*.,1989)and in six freshwater fish species,from southern Iraqi Marshes (Mahdi ,*et., al*.,2006).

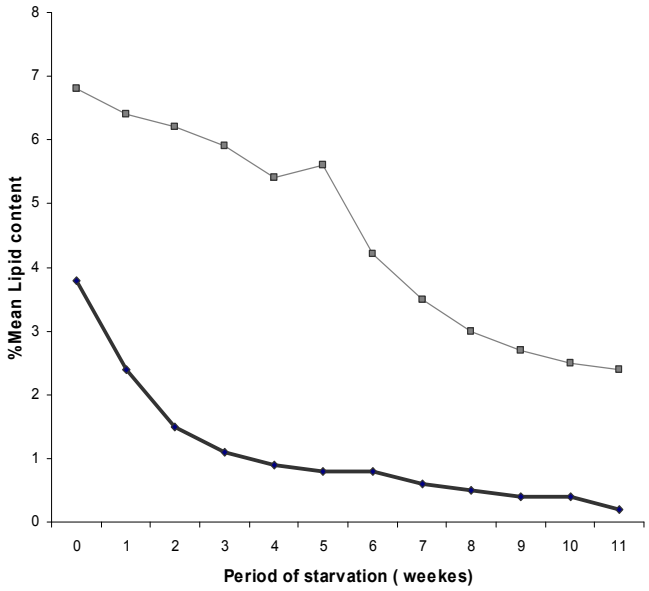


Figure 1. Changes in lipid content **in** Juveniles *B. sharpeyi* as the body fish without viscera ( ----- ) and viscera ( …… ) during period of starvation.

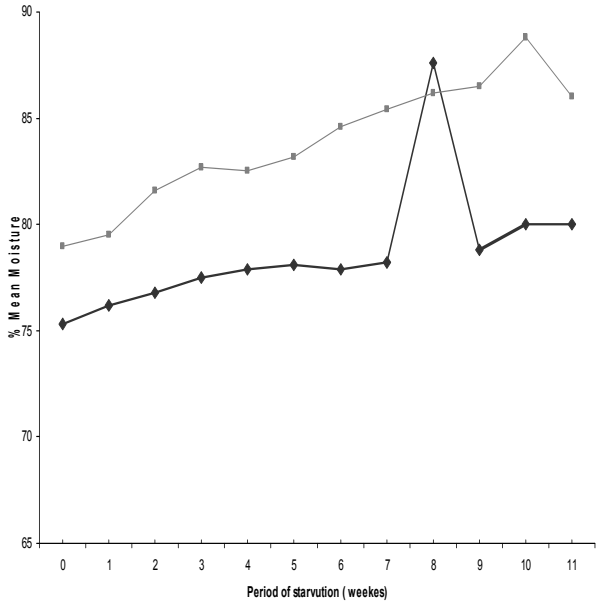


Figure2. Changes in moisture content in Juveniles *B. sharpeyi* as the body fish without viscera ( ___ ) and viscera ( ..... ) during period of starvation .

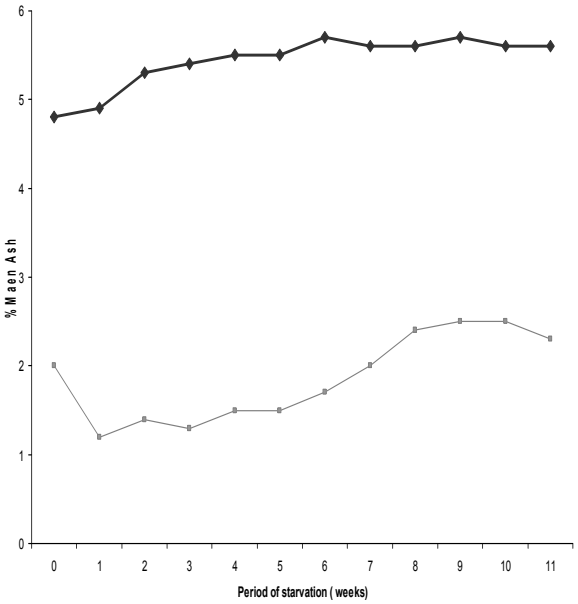


**Figure3. Changes in ash content in Juveniles *B. sharpeyi* as the body fish without viscera ( ----- ) and viscera ( ..... )during period of starvation.**

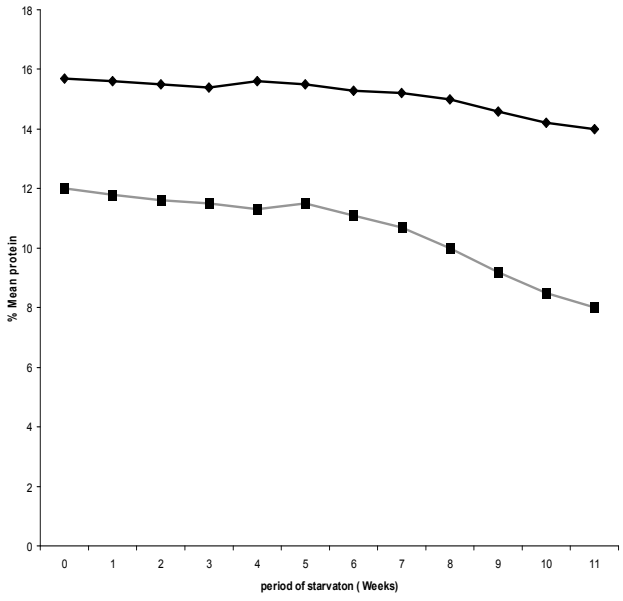


**Figure 4. Changes in protein content in Juveniles *B. sharpeyi* . as the body fish without viscera ( ----- ) and viscera ( ..... )during period of starvation**

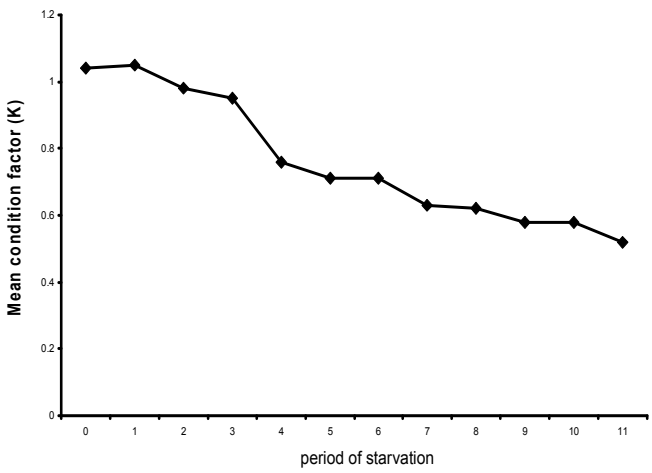


Figure 5. Chenges in mean condition factor(K) in juveniles B. sharpeyi during period of starvation.

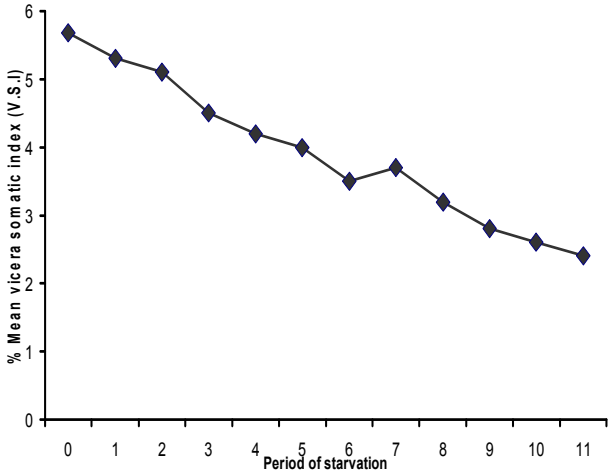


Figure 6.Changes in vicera somatic index (V.S.I) in juveniles B.sharpeyi during period of starvation

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# تأثير التجويع على محتوى التركيب الكيميائي لأصبعيا ت أسماك البني

# *Barbus sharpeyi*

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## الخلاصة

عرضت صغار اسماك البني *Barbus sharpeyi* الى التجويع لمدة أحد عشر أسبوعاً ، أظهرت نتائج التحليل الكيميائي للعضلات والأحشاء الداخلية انخفاض محتوى الدهن بصورة رئيسية يتبعها انخفاض تدريجي في محتوى البروتين مع ارتفاع كل من محتوى الرطوبة والرماد رافقه فقدان في وزن العضلات والأحشاء. وكان الانخفاض في وزن العضلات أكثر مما هو عليه في وزن الاحشاء مما يؤكد على إن العضلات في اسماك صغار البني هي الأماكن الرئيسية لخزن الدهن والطاقة لذا فأن مساهمة العضلات في الطاقة أكثر من الأحشاء الداخلية . لوحظ انخفاض في كل من معامل الحالة و دليل الاحشاء الجسمي viscera somatic index (VSI) and condition factor( K) مع طول فترة التجويع. وكانت العلاقة عكسية بين الرطوبة ومحتوى الدهن.