MORPHOMETRIC, MERSITIC AND SOME BLOOD PARAMETERS OF Barbus grypus SHABOUT (Heckel 1843) IN SULAIMANI NATURAL WATER RESOURCES, IRAQ

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This study was taken to determine morphometric, meristic and hematological parameters of the B. grypus (H, 1843) in Sulaimani natural water resources of Sulaimani city, Iraq. 30 fish were used in this study and allocated to three groups that depend on fish length. Total lengths were 26.71 ± 0.85, 34.82 ± 0.82 and 43.78 ± 0.9, standard lengths were 26.27 ± 0.64, 29.43 ± 0.73 and 37.35 ± 0.91 for (20-30cm, 30-40 cm and 40-50 cm), respectively. Numbers of rays on dorsal fin were 7.5 ± 0.18, 7.8 ± 0.25 and 8.08 ± 0.05; numbers of scales were 5, 5 and 5 ± 17 for (20-30cm, 30-40 cm and 40-50 cm) lengths, respectively. The values of WBC were (1345.1 ± 314.22, 15133564 ± 2851414 and 19536900 ± 4594589 /mm³), the values of RBC were recorded as 13885000 ± 2653096, 1317132.3 ± 91643.55 and 2077000 ± 139033/mm³. The values of Hemoglobin (Hb) were 11 ± 0.95, 6.24 ±0.18 and 6.96 ± 0.25 g/dl. The values of PCV of were 45.4 ± 3.2, 25.6 ± 0.52 and 27.9 ± 0.97 % for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. According to the results in the present study suggest that meristic characters were affected by many environmental factors such as light, temperature and dissolved oxygen, while hematological parameters were affected by age.

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INTRODUCTION

One of the newest and important aquaculture candidates is Barbus grypus (Heckel 1843). Shabout is a species that can be founded it in river also can be founded in estuaries, getting a maximum size of approximately two meters and more than 50 kg. The ecology of this species is euryhaline and eurytherme and nutritionally omnivorous and extensively spread in Iran, Turkey, Syria and Iraq (Nikpei, 1996). Spawning in this species generally occurs between May and mid June (Geldiay and Balik, 1988). Till now, in the literature has a few studies on its the biological characteristics (AI-Hakim et al., 1981; Khalaf et al., 1984; Epler et al., 2001; Sahinoz et al., 2007; Oymak et al., 2008; Khadjeh et al., 2010). Morphometric study of fish explains the fish shape in the easiest probable fashion, removing information that is not relevant and so facilitating relationship between different fish species. Thus, morphometric is the study of variation in shape and its covariation with other variables of interests (Bookstein 1991; Dryden and Mardia 1998). Morphometricians use information of morphology to recognize the shape pattern variation within and among sample (life stages, populations, species etc.) as well as in framing and testing hypothesis concerning the variation origins of those in the pattern of growth. However, taxonomists and systematists use morphological information to illustrate and in diagnose of species. Analyses of enumerable body feature (meristic) have been broadly used for studying of fish stock structure. The majority enumerated features are external, involving fin spine number and fin rays, gill rakers and scales. Identification of fish stock has a long history throughout meristic analysis; nearly all fish species that take place as various stocks and that have been the subject of fishery management, also have received at least some analysis of meristic (Waldman, 2005). Another biomarker that has been used in diagnoses is the profile of hematology. For intensive fish rearing of with least losses, it is essential to be responsive of the fish health status. Variables in blood are helpful criteria to show physiological disturbances in intensively farmed fishes and can supply significant information for disease diagnosis and prognosis. Dawson (1979) noted that hematology a vital tool to study the rate and consequence of the toxins with-out losing the animals. The changes in blood of fish earlier to the onset of more outstanding morphological and physiological changes can be indicative of unfavorable aquatic medium (Eisler, 1967). For instance, variations in quality and quantity in hematological parameters as well as the red blood cell (RBC) and white blood cell (WBC) numbers, hematocrit (HCT, also recognized as packed cell volume (PCV)), the hemoglobin amount (Hb) are the most important findings as regards diagnosis (Şahan et al., 2007). Even though evaluation of spermatological and hematological characteristics of some fish species have been studied in few studies (Imanpoor and Farahi, 2011), there are no available data on B. grypus in Sulaimani natural water resources. The present study aimed to give a preliminary data about the morphometric, meristic description and some blood parameters of the B. grypus in Sulaimani freshwater fish.

MATERIALS AND METHODS

Sampling
Barbus grypus fish were caught by using gill net by fisherman in natural waters in Sulaimani city. Fish were selected in different sizes and allocated for three different groups by body length (20-30 cm, 30-40 cm and 40-50 cm). Thirteen specimens of wild B. grypus were sampled. After catching blood samples for hematological parameters were collected. These fish were brought to the laboratory of fish animal science department, college of agricultural science, university of Sulaimani, then all the morphometric parameters were measured individually.
Morphometric characters

Nearly thirteen external morphometric variables were measured on the head and body of each fish specimen using electronic digital balance, wooden measuring tray and other measuring scales to the nearest 0.1 cm. All morphometric characters that were measured presented in Table 1.

Table 1. Morphometric traits of *Barbus grypus* for three different groups of length (20-30, 30-40 and 40-50 cm)

| Morphometric Traits          | Acronyms | Descriptions                                                                 |
|------------------------------|----------|-----------------------------------------------------------------------------|
| Body weight                  | BW       | Whole fish weight                                                           |
| Total length                 | TL       | Distance from the tip of snout to the tip of upper lobe of the caudal fin    |
| Standard length              | SL       | Distance between the tip of snout and the base of the caudal fin rays         |
| Fork length                  | FL       | Distance from the tip of snout to the centre of fork in the caudal fin       |
| Head length                  | HL       | Distance from the tip of snout to the posterior margin of Operculum          |
| Body depth                   | BD       | The vertical distance from the dorsal margin of the body to the ventral     |
|                              |          | margin of the body measured at the base of the pectoral fin where it         |
|                              |          | attaches to the body                                                        |
| Pre orbital length           | POL      | Distance from the tip of snout to the anterior margin of eye                 |
| Eye diameter                 | ED       | Diameter of orbit along the body axis                                       |
| Post orbital length          | PoOL     | Distance between the posterior margin of eye and the posterior margin of     |
|                              |          | operculum                                                                   |
| Pre dorsal length            | PDL-I    | Distance from the tip of snout to the origin of first dorsal fin             |
| dorsal fin base              | DFL-I    | Distance between the origin and insertion points of first dorsal fin         |
| length                       |          | dorsal fin                                                                  |
| Upper jaw length             | UJL      | The length from the anteriormost point of the premaxilla to the posterior   |
|                              |          | edge of the maxilla                                                         |
| Pre pectoral length          | PPCoL    | Distance from the tip of snout to the origin of left pectoral fin            |
| Pectoral fin length          | PcFL     | Distance between the origin and posterior tip of left pectoral fin           |
| Pre pelvic length            | PPvL     | Distance from the tip of snout to the origin of left pelvic fin              |
| Pre anal length              | PAL      | Distance between the tip of snout and the origin of anal fin                 |
| Anal fin length              | AFL      | Distance between the origin and insertion points of anal fin                 |
| Caudal fin length            | CFL      | Distance between the origin and posterior tip of caudal fin                  |
| Caudal peduncle depth        | CPD      | Minimum vertical distance across the caudal peduncle                         |
Meristic characters

For all fish were counted the numbers of spines and rays for all fins of the fish body. Also, for the pectoral fin were counted spines and rays from both left and right sides of fish body. All meristic characters that were measured presented in Table 2.

Table 2. Meristic characters of Barbus grypus used for the present study

| No. | Acronym | Meristic character                        |
|-----|---------|------------------------------------------|
| 1   | DF      | Number of fin rays on dorsal fin          |
| 2   | DFS     | Number of spines on dorsal fin            |
| 3   | PcFR    | Number of fin rays on pectoral fin        |
| 4   | PcFS    | Number of spines on pectoral fin          |
| 5   | PvFR    | Number of rays on pelvic fin              |
| 6   | PvFS    | Number of spines on pelvic fin            |
| 7   | AFR     | Number of rays on anal fin                |
| 8   | AFS     | Number of spines on anal fin              |
| 9   | CFR     | Number of rays on caudal fin              |
| 10  | CFS     | Number of spines on caudal fin            |
| 11  | S       | Number of scales on fish                  |

Hematological Analysis

Blood samples were collected by using caudal vein, which insert a needle attached to a syringe for suctioning blood from the caudal vein. Whole blood samples were collected in small plastic vials containing heparin and stored under cooling condition prior to analysis by using the hematology analyzer BC-2800 is a compact, fully automatic hematology analyzer with 19 parameters, USA origin for complete blood count (CBC) test for determination of:

- RBC (Red Blood Cell; mm)
- WBC (White Blood Cell; mm)
- PCV (Packed Cell Volume %)
- MCH (Mean Corpuscular Hemoglobin)
- MCHC (Mean Corpuscular Hemoglobin Concentration; g/l)
- Hb (Hemoglobin; g/l)

Statistical analysis

Data collected for all parameters were analyzed by one way anova in a completely randomized design (CRD). Means with significant differences were compared by Duncan’s multiple range tests, according to p<0.05 significance. Statistical analysis results are shown as mean values in tables. The statistical calculations of the results were completed using XLSTAT. Different letters were given to different treatments.

RESULT

Morphometric characters

Fish body weight for first group was 223.5±10.8 g, second group was 257.3±19.45g and 591.5±37.07 g for third group of fish, there was a significant difference between groups three with two other groups. The standard length (SL) for (20-30 cm) length was 26.27±0.64 cm, 29.43±0.73 for (30-40 cm) length and 37.35±0.91 for (40-50 cm) length, there were significant differences among them.

The head lengths were increased with increasing body length and it there were 6.22±0.09, 6.66±0.15 and 7.71±0.16 for (20-30 cm), (30-40 cm) and (40-50 cm), respectively. The head length in (20-30) and (40-50 cm) length were greater than body depths which were 5.75±0.15cm and 7.54±0.15. However, the head length in (30-40 cm) was smaller than body depth that was 7.2±0.23.
The length of eye diameter in (20-30 cm) length was 0.69±0.06 that significantly different with (30-40 cm) and (40-50 cm) lengths which were 0.82±0.04 and 0.85±0.04. All the morphometric characters are summarized in Table (3).

Table 3. Descriptive statistics of morphometric traits for (20-30 cm), (30-40 cm) and (40-50 cm) length fish groups

| TRAITS (cm) | 20-30 cm (N= 10) | 30-40 cm (N= 10) | 40-50 cm (N= 10) |
|-------------|------------------|------------------|------------------|
|             | Mini. | Maxi. | Mean ± SE | Mini. | Maxi. | Mean ± SE | Mini. | Maxi. | Mean ± SE |
| Body weight (g) | 184 | 241 | 223.5±10.8 b | 183 | 334 | 257.3±19.45b | 474 | 755 | 591.5±37.07a |
| Total length | 23.1 | 29.6 | 26.7±0.85b | 31.5 | 37.5 | 34.8±0.82 b | 41.5 | 48 | 43.8±0.9a |
| Standard length | 24.5 | 29.4 | 26.27±0.64 c | 26.8 | 32 | 29.43±0.73 b | 33.8 | 41 | 37.3±0.91a |
| Fork length | 24.3 | 31.3 | 27.9±0.72c | 28 | 34.2 | 31.71±0.76 b | 37 | 43.3 | 39.5±0.84a |
| Head length | 6 | 6.7 | 6.22±0.09c | 6 | 7.3 | 6.66±0.15b | 7.2 | 8 | 7.71±0.16a |
| Body depth | 5.5 | 6.5 | 5.75±0.15b | 6.8 | 7 | 7.2±0.23a | 7 | 8 | 7.54±0.15a |
| Eye diameter | 0.5 | 1 | 0.69±0.06b | 0.7 | 1 | 0.82±0.04a | 0.7 | 1 | 0.85±0.04a |
| Post orbital length | 24.1 | 32.33 | 2.25±0.88b | 24.8 | 30.2 | 2.39±0.78b | 34 | 37 | 2.68±0.63a |
| Pre orbital length | 2 | 2.5 | 2.76±0.08b | 2 | 2.5 | 2.79±0.06b | 2.5 | 3 | 3.15±0.07a |
| Upper jaw length | 1 | 2.5 | 1.85±0.16b | 2.5 | 4.2 | 2.59±0.25a | 2.5 | 3.5 | 2.95±0.14a |
| Lower jaw length | 0.5 | 1.6 | 1.13±0.16c | 1.3 | 2 | 1.55±0.07b | 2.1 | 3 | 2.73±0.12a |
| Pre dorsal length | 12.2 | 13.6 | 12.78±0.23c | 12 | 15.5 | 14.18±0.4b | 14 | 18 | 16.7±0.63a |
| Post dorsal fin length | 14.8 | 19.5 | 11.88±0.69b | 11 | 13.5 | 16.81±0.47a | 13.5 | 19.4 | 16.98±0.81a |
| Pre pectoral length | 6 | 6.5 | 6.25±0.06b | 5.53 | 7 | 16.46±0.2b | 8 | 9 | 8.45±0.16a |
| Pre pelvic fin length | 12.1 | 14.2 | 13.41±0.30c | 14 | 15.5 | 14.72±0.19b | 17.3 | 19.5 | 18.37±0.29a |
| Pre anal fin length | 18 | 22.3 | 19.79±0.59 c | 19 | 32.5 | 22.96±1.40b | 26.5 | 30 | 28.38±0.54a |
| Post anal fin length | 10.5 | 12.6 | 11.19±0.27a | 4.5 | 5.7 | 5.19±0.28b | 6.3 | 8 | 7.08±0.28c |
| Caudal peduncle length | 6.1 | 7.2 | 6.58±0.12b | 5.8 | 8 | 6.63±0.25b | 8 | 9.5 | 8.49±0.21a |
| Caudal peduncle depth | 2.5 | 3 | 2.8±0.06c | 2.5 | 4 | 3.72±0.21b | 5 | 6 | 5.47±0.15a |
| Pectoral fin length | 4.1 | 5.6 | 4.85±0.18c | 4 | 5.2 | 4.19±0.22b | 4.8 | 6.4 | 5.93±0.27a |
| Pre anus length | 16.5 | 16.5 | 18.23±0.48c | 19 | 23 | 20.95±0.55b | 24.5 | 30 | 27.35±0.65a |

N.B.: Mini = minimum; Maxi. = Maximum
Mersitic characters

Numbers of rays on dorsal fin were 7.5±0.18, 7.8±0.25 and 8.0±0.05 for (20-30 cm), (30-40) cm and (40-50 cm), respectively. There was a significant difference between (20-30 cm) and (40-50 cm) length. On the other hand, there was no significant difference among three groups of length for number of spines on dorsal fin which was 1 for each groups of length. Numbers of rays on caudal fin were 18.9±0.12, 19.2±0.05 and 19.5±0.99 for (20-30 cm), (30-40) cm and (40-50 cm), respectively. There was no significant difference among groups. There were no spines on caudal fin for each group of fish length. Results for other traits were presented in Table 4.

Table 4. Meristic characters for three different lengths of *B. grypus*

| Meristic characters | N | Length   | Minimum | Maximum | Mean±S.E  |
|--------------------|---|----------|---------|---------|-----------|
| Number of fin rays on dorsal fin | 10 | 20-30 | 7 | 8 | 7.5±0.18 b |
| | 10 | 40-50 | 8 | 9 | 8.0±0.05 a |
| Number of spines on dorsal fin | 10 | 20-30 | 1 | 1 | 1 |
| | 10 | 30-40 | 1 | 1 | 1 |
| | 10 | 40-50 | 1 | 1 | 1 |
| Number of fin rays on pectoral fin | 10 | 20-30 | 13 | 15 | 14±0.28 b |
| | 10 | 40-50 | 14 | 16 | 15.3±0.1 a |
| Number of spines on pectoral fin | 10 | 20-30 | 0 | 0 | 0 |
| | 10 | 30-40 | 0 | 0 | 0 |
| | 10 | 40-50 | 0 | 0 | 0 |
| Number of rays on pelvic fin | 10 | 20-30 | 8 | 9 | 8.5±0.18 b |
| | 10 | 30-40 | 8 | 9 | 8.8±0.16 ab |
| | 10 | 40-50 | 9 | 9 | 9±0 a |
| Number of spines on pelvic fin | 10 | 20-30 | 0 | 0 | 0 |
| | 10 | 30-40 | 0 | 0 | 0 |
| | 10 | 40-50 | 0 | 0 | 0 |
| Number of rays on anal fin | 10 | 20-30 | 5 | 5 | 5±0 b |
| | 10 | 30-40 | 5 | 7 | 5.6±0.18 a |
| | 10 | 40-50 | 5 | 6 | 5.9±0.07 a |
| Number of spines on anal fin | 10 | 20-30 | 1 | 2 | 1.2±0.14 a |
| | 10 | 30-40 | 1 | 1 | 1±0 a |
| | 10 | 40-50 | 1 | 1 | 1±0 a |
| Number of rays on caudal fin | 10 | 20-30 | 18 | 19 | 18.9±0.12 a |
| | 10 | 30-40 | 19 | 20 | 19.2±0.05 a |
| | 10 | 40-50 | 19 | 25 | 19.5±0.99 a |
| Number of spines on caudal fin | 10 | 20-30 | 0 | 0 | 0 |
| | 10 | 30-40 | 0 | 0 | 0 |
| | 10 | 40-50 | 0 | 0 | 0 |
| Number of scales on fish | 10 | 20-30 | 5 | 5 | 5±0 b |
| | 10 | 30-40 | 5 | 5 | 5±0 b |
| | 10 | 40-50 | 5 | 6 | 5.3±0.17 a |
Hematological analysis

The hematological parameters of *B. grypus* 20-30 cm lengths were 1345.1 ± 314.22/mm³, 13885000 ± 2653096/mm³, 11 ± 0.95 g/dl, 42.3 ± 3.51 μm³, 69.46 ± 5.61 pg, 45.4 ± 13.68 % and 45.4 ± 3.2 % for WBC, RBC, Hb, MCV, MCH, MCHC and PCV, respectively. Also, blood parameters for 30-40 cm and 40-50 cm lengths were presented in Table 5.

Table 5. Hematological parameters for three different lengths *B. grypus*

| Hematological parameters | No. | Length | Minimum | Maximum | Mean ± S.E |
|--------------------------|-----|--------|---------|---------|-----------|
| WBC                      | 10  | 20-30  | 2246    | 4235    | 1345.1 ± 314.22b |
|                          | 10  | 30-40  | 6235648 | 2845710 | 15133564 ± 2851414 a |
|                          | 10  | 40-50  | 89000   | 1940000 | 19536900 ± 4594589 a |
| RBC                      | 10  | 20-30  | 850000  | 2320000 | 13885000 ± 2653096 a |
|                          | 10  | 30-40  | 900000  | 1654000 | 1317132.3 ± 91643.55 b |
|                          | 10  | 40-50  | 1370000 | 2077000 | 2077000 ± 139033b |
| HB                       | 10  | 20-30  | 6.5     | 15.7    | 11 ± 0.95 a |
|                          | 10  | 30-40  | 5.1     | 6.7     | 6.24 ± 0.18 b |
|                          | 10  | 40-50  | 5.95    | 8       | 6.96 ± 0.25b |
| MCV                      | 10  | 20-30  | 21.4    | 56.2    | 42.3 ± 3.51c |
|                          | 10  | 30-40  | 100     | 123.8   | 113.08 ± 2.79b |
|                          | 10  | 40-50  | 135.6   | 142.2   | 138.66 ± 0.73a |
| MCH                      | 10  | 20-30  | 41.5    | 88      | 69.46 ± 5.61a |
|                          | 10  | 30-40  | 15.7    | 35.1    | 28.17 ± 2.47 b |
|                          | 10  | 40-50  | 22.5    | 47.9    | 35.36 ± 3.02 b |
| MCHC                     | 10  | 20-30  | 148.2   | 264.8   | 45.4 ± 13.68 a |
|                          | 10  | 30-40  | 18      | 25      | 25.6 ± 0.89 b |
|                          | 10  | 40-50  | 21      | 23      | 25.6 ± 0.52 b |
| PCV                      | 10  | 20-30  | 29      | 61      | 45.4 ± 3.2 a |
|                          | 10  | 30-40  | 23      | 27      | 25.2 ± 0.51 b |
|                          | 10  | 40-50  | 24      | 32      | 27.9 ± 0.97 b |

**DISCUSSION**

Differences in meristic characters have been used as an essential tool in separating of populations in different fish species (Seymour, 1959; Anthony and Boyar, 1968). Variations in meristic between populations of fishes may be affected by genetic or environmental factors, or both (Bailey and Gosline, 1955). Many workers have recognized the variations in meristic characters to environmental factors such as light, temperature and dissolved oxygen through the period from fertilization to hatching (Taning, 1952; Wallace, 1973; Kwain, 1975).

Total lengths were 26.71 ± 0.85, 34.82 ± 0.82 and 43.78 ± 0.9 for (20-30 cm, 30-40 cm and 40-50 cm) length, respectively. (Doğu et al., 2014), stated that total length for *B. grypus* in Atatürk dam was 66.85 ± 1.5 cm. Standard lengths were 26.27 ± 0.64, 29.43 ± 0.73 and 37.35 ± 0.91 for (20-30 cm, 30-40 cm and 40-50 cm) length, respectively. Our finding was similar with (Borkenhagen, 2014), who stated that the standard length for *Arabibarbus grypus* was 19.7 cm.
Caudal peduncle lengths were 6.58±0.12, 6.63±0.25 and 8.49±0.219 for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. The data from present study was similar with (Borkenhagen, 2014) that reported caudal peduncle length for Arabibarbus grypus was 15.3 cm (as percentage of standard length). Caudal peduncle depths were 2.8±0.06, 3.72±0.21 and 5.47±0.15 for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. This finding was approximately close to (Borkenhagen, 2014), who noted that the caudal peduncle for Arabibarbus grypus was 9.8 mml.

Numbers of rays on dorsal fin were 7.5±0.18, 7.8±0.25 and 8.08±0.05 for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. The data in this study was confirmed by (Borkenhagen, 2014), who stated that the number of rays on dorsal fin was between7 to 9 rays.

Numbers of scales were 5, 5 and 5±17 for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. These data were very close to (Borkenhagen, 2014), they reported the number of scale for Arabibarbus grypus was 4 for 41 fish out 57 fish.

The values of WBC in this study (1345.1±314.22, 15133564 ±2851414 and 19536900± 4594589 /mm³) for three different groups of fish length that were higher than stated values of (Doğu et al., 2014) in B. grypus (30.01 ±4.11 X10³/mm³). Aydin et al. (1998) in S. glanis (17.00 ±1.29 x10³/mm³), Yavuzcan et al. (1997) in Oreochromis niloticus (7.02 ±0.99 x10³/mm³).

The values of RBC were recorded as 13885 3.00 ±0.01 % and 2077000±139033/mm³.

The values of PCV of B. grypus were 33.14 ±1.88 and 42.3±3.51, 113.08 ±0.01 % and 1317132.3±91643.55 and 2077000±139033/mm³, respectively. The data in this study was confirmed by (Borkenhagen, 2014), who stated that the number of blood cells was approximately 30.32 ±0.80 %, 30.66 ±0.49 %, 31.20 ±0.85 % and 33.14 ±1.88%, respectively (Örün and ErdemLi, 2002; Aydin et al., 1998; Yavuzcan et al., 1997; Gbore et al., 2006).

The values of MCH of B. grypus were noted as 3.45±0.77 and 3.55±0. 52 x10⁹/mm³, respectively. On the other hand, Talal et al. (2011) stated that the values of MCH in B. xan-thopterus and B. sharpeyi as 3.45±0.77 and 3.55±0.52 x10⁹/mm³.

The values of MCV of B. grypus were caught in Sulaimani natural water resources were found as 42.3±3.51, 113.08±2.79 and 138.66±0.73 µm³ for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. Our data was similar with (Doğu et al., 2014) (147.27 ±4.93 µm³) and C. trutta (149.71 ± 2.28 µm³). While, Khadjeh et al. (2010) found higher (261 ±4.87 µm³) MCV values in similar species.

The values of MCH of B. grypus were noted as 69.46±5.61, 28.17±2.47 and 35.36±3.02 pg in this experiment for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. Similar data were stated in B. grypus (45.70 ±0.88 pg), C. trutta (45.40 ±1.80 pg), C. carpio (49.10 pg), C. au-ratus (42.00 ±1.40 pg), T. zilli (46.48 ±2.49 pg) and C. gariepinus (51.39 ±0.04) (Khadjeh et al., 2010; Örün and ErdemLi, 2002; Grof and Zinki, 1999; Gbore et al., 2006).

The values of MCHC of B. grypus were reported as 45.4±13.68, 25.6±0.89 and 27.9±1.18 % for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. Our data were confirmed by (Doğu et al., 2014) that they reported The MCHC values in B. grypus was 26.47±0.84. Cyprinidae species like C. trutta, S. glanis, C. lazera, O. niloticus and T. zilli were stated as 30.32 ±0.80 %, 30.66 ±0.49 %, 31.20 ±0.85 %, 31.00 ±0.01 % and 33.14 ±1.88%, respectively (Örün and ErdemLi, 2002; Aydın et al., 1998; Yavuzcan et al., 1997; Gbore et al., 2006).

The values of PCV of B. grypus were 45.4±3.2, 25.6±0.52 and 27.9±0.97 % for (20-30cm, 30-40 cm and 40-50 cm) length, respectively. These data of B. grypus were similar with Khadjeh et al. (2010) (36.9 ±0.7).

CONCLUSION

In conclusion, this study is the first study on B. grypus in Sulaimani natural water resources that include investigations of morphometric, mersitic and hematological parameters. The results represent a precious baseline dataset and supply background information in this species that has large potential in aquaculture.

COMPETING INTEREST

We declare that they have no competing interests.
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