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Haematological profile, blood group and genotype of *Heterobranchus bidorsalis*

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ABSTRACT

Serological indices of male and female *Heterobranchus bidorsalis* were studied to determine the haematological profiles, blood group and genotype. The mean standard deviation values for the red blood cells (RBC), white blood cells (WBC), packed blood volume (PCV), haemoglobin concentration (Hb), mean cell volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC), were determined using standard procedure. 5.05 ± 0.17 × 10^{10}/L for male and 5.2 ± 0.26 × 10^{10}/L for female; 6.858.33 ± 828.86 × 10^{9}/L for male and 6.910 ± 801.46 × 10^{9}/L for female; 51.93 ± 14.82% for male and 53.4 ± 10.11% for female; 18.43 ± 4.36 g/dl for male and 53.4 ± 10.11% for female; 18.43 ± 4.36 g/dl for male and 16.5 ± 3.75 g/dl for female; 3.64 ± 0.82 pg for male and 3.1 ± 0.58 pg for female; 32.75 ± 1.37 g/dl for male and 32.7 ± 1.35 g/dl for female, respectively. Eighty three percent of the samples of males and females had blood group O^{+} while about 17% were AB+ respectively and were similar to the pattern in humans. There were no difference in genotypes in both males and females.

Keywords: Haematological indices, blood group, genotypes, *Heterobranchus bidorsalis.*

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INTRODUCTION

Fish live in very intimate contact with their environment, and are therefore very susceptible to physical and chemical changes, which may be reflected in their blood components (Wilson and Taylor, 1993). In fish, exposure to chemical compounds can induce either increases or decrease in hematological levels. Blood tissues truly reflect physical and chemical changes occurring in organisms. Therefore, detailed information can be obtained on general metabolism and physiological status of fish in different groups of age and habitat. Early diagnosis is also possible when evaluating hematological data, particularly blood parameters (Folmar, 1993; Golorina, 1996; Luskova, 1997).

The health of fish has often been reported in terms of the relationship between the weight and length increase. However, there is a need to understand the physiological concept of fish health in relation to blood and the quality of dietary protein fed. Any changes in the constituent component of blood sample when compared to the normal values could be used to interpret the metabolic state of animal and state of health (Babatunde et al., 1992). Low hematological indices are indications of anemic conditions (Haruna and Adikwu, 2001).

The count of red blood cells is quite a stable index and the fish body tries to maintain this count within the limits of certain physiological standards using various physiological mechanisms of compensation. Van vuren (1986) observed that when the water quality is affected by toxicants, many physiological changes will be reflected in values of one or more of the hematological parameters. Blood cells responses are important indicators of the changes in the internal and or external environment of animals. In fish, exposure to chemical pollutants can induce either increases or decreases in hematological levels. Their changes depend on fish species, ages, the cycle of the sexual maturity of spawners and disease (Luskova, 1997; Golovina, 1996).

Furthermore, it should be noted that hematological indices are of different sensitivity to various environmental factors and chemicals (Lebedeva et al.,

Table 1. Mean hematological parameters results of the male and female *H. bidorsalis.*

Parameters	Male	Female
Weight (g)	335.83 ± 66.52	257.5 ± 60.41
Length (cm)	40.42 ± 5.45	34.3 ± 5.04
PCV (%)	51.93 ± 14.82	53.4 ± 10.11
RBC ($10^6 mm^{-3}$)	5.05 ± 0.17	5.2 ± 0.26
WBC (10^9/L)	6.858.33 ± 828.86	6.910 ± 801.46
Hb (g/dl)	18.43 ± 4.36	16.5 ± 3.75
MCV (*fl*)	109.17 ± 24.68	102.4 ± 17.64
MCH (pg)	3.64 ± 0.82	3.1 ± 0.58
MCHC (g/dl)	32.75 ± 1.37	32.7 ± 1.35

1998; Vosyliene 1999a, b). Previous hematological studies on the effect of nutrition (Rehulka, 2000), infectious diseases (Rehulka, 2002a) and pollutants (Rehulka, 2002b) revealed that erythrocytes are the major and reliable indicators of various sources of stress (Rainza-paiva et al., 2000; O'Neal and Weirich, 2001). The use of hematological characteristics in evaluating the health status of fish as a tool for its management under captive rearing is well established and the knowledge of the hematological profile of a fish also indicates its dietary efficiency and physiological response to environmental stress.

The haematological profile of few tropical African catfish species are well documented (Kori- Siakpere; 1985; Fagbenro et al., 1993; Erondu et al., 1993; Etim et al., 1999). In spite of these information on the haematological profile of African catfish (*Clarias gariepinus*), there is little information on the basic hematological profile of *H. bidorsalis*. This information will enable fish culturists to know the expected hematological parameters in the fish. Few studies have been done on the blood group and genotype of fish. Ayorinde et al. (2009) worked on the blood group of *Heterotis niloticus* and discovered that the fish had 92% Rh-O^+ and Rh-O^-. The aim of this study is to determine the comparative haematological profile, blood group, genotype of male and female *H. bidorsalis.*

MATERIALS AND METHODS

Twelve adult live H. *bidorsalis* (6 males and 6 females) were obtained from fish landing site at Lake-Geriyo, Jimeta Local Government Area of Adamawa State, Nigeria. All fishes were considered healthy on the basis of their appearance and the absence of obvious signs of disease. Sexual selection was done by observation of the genital organs. Blood was collected from the caudal vein of each fish using separate heparinized disposable syringes and hypodermic needles. The determination of blood parameters was according the methods of Daramandy and Davenport (1985) and Svobodova et al. (1991).

Blood group was determined with the test tube techniques based on tests agglutination. The fish blood was collected with a syringe and drop on the tile in three different places, then on each of the blood sample, anti-sera A, B, and D was dropped respectively and mixed. The tile was rocked for about 3 to 5 min. Blood groups were recorded based on coagulation of blood.

Serological profile

Blood grouping was performed by test tube techniques based on agglutination tests, while the genotype was determined by haemoglobin electrophoresis (Delany and Garratty, 1969).

RESULTS

As shown in Table 1, the result of the Packed Cell Volume (PCV) among the male showed significant difference ($p < 0.05$). The highest value was 53.4% in the female and 51.93% in the male. There was correlation between the weight of the fish and the PCV. There was significant difference in the haemoglobin ($p < 0.05$); the highest was 18.43 ± 4.36 g/dl in the male, while the least was 16.5 ± 3.75 g/dl in the female.

There was no significant difference in RBC, the highest was 5.3 (10^{12}/L), while the least was 4.8 (10^{12}/L). The WBC showed significant difference, the highest was 6858.33 (10^9/L) in the male while the least was 6000 (10^9/L) also the MCV, show 25 weight significant difference, the highest was 138 while the lowest was 75.9. The MCH showed no significant difference the highest was 4.61 pg while the lowest was 2.53 pg. The result of the MCHC showed significant difference ($p < 0.05$).

The results of the serological profile of *H. bidorsalis*, the blood group and genotype are presented in Table 2. Among the sampled fish 83.3% had O^+ while 16.7% were AB^+. There was no groups A or B, the most prevalent was O^+. The genotype observed in all the samples was AA (100%). None of the fish samples had AS or SS genotype.

DISCUSSION

The results of the PCV obtained in this work for male and female *H. bidorsalis* is 331.6 and 320.6 and it is higher

Table 2. Percentage blood group and genotype of male and female *H. bidorsalis.*

Male blood group	Percentage blood group	Female blood group	Percentage blood group
O+	83.3	O+	83.3
AB+	16.7	AB+	16.7
Male genotype	**Percentage genotype**	**Female genotype**	**Percentage genotype**
AA	100	AA	100

than those obtained from *H. longifilis* which is 219.58 and 94.1. The PCV results of this work is higher than that obtained from *H. longifilis* (Akinwande et al., 2005), *Clarias gariepinus* (Adeyemo et al*.,* 2003; Omitoyin, 2006). *H. bidorsalis* seems to have more blood volume than these other spices. The difference could be due to differences in the species.

The RBC of an organism determines the carrying capacity of dissolved oxygen. The result of the RBC of this work for male and female *H. bidorsalis* is 30.3 and 31.2, and it is lower than that of *C. gariepinus* which is 72.72 and 57.69 for both male and female as reported by Omitoyin (2006). The reason for the differences may be due to differences in species or it may be due to environmental factors. The RBC of *H. bidorsalis* of this which is 30.3 and 31.2 for both male and female were higher than that of the work done by Fagbenro et al. (2005) on *P. obscura* which is 2.00 and 0.71 for male and female, and it could be due to environment factor or it might be due to differences in species. The result of the MCV obtained in this work is 655 and 614.3 for male and female were higher than those obtained from Rainbow trout which are 164.61 and 192.42 (Velisek et al., 2007). The result of the WBC obtained in this work is 41.150 and 41.460 for male and female *H. bidorsalis* which is higher than that of *H. longifilis* which is 28.3 and 7.9 (Erondu et al., 1993).

The result of the PCV obtained in this work was 331.6 and 320.6 for male and female *H. bidorsalis* which is higher than that obtained in *C. gariepinus* which is 24.00 and 15.00 for male and female as reported by Omitoyin (2006). The result of the MCH obtained in this work is 21.86 and 18.83 for male and female, it is lower than that obtained from *C. gariepinus* which is 66.14 and 65.09 as reported by Ayoola (2011).

The result of RBC obtained in this work is 30.3 and 31.2 which is higher when compared to that obtained from rainbow trout which is 1.43 and 0.23 as shown by the work of Velisek et al. (2007). Report shows that the result of the WBC that was obtained from this work is 41.150 and 41.460, and is lower when compared to that obtained from common carp which 81.56 and 80.30 for both male and female as reported by Velisek et al. (2007). The result of Hb obtained in this work is 110.6 and 207.7 for male and female *H. bidorsalis* which is higher when compared to that of common carp which is 74.25 and 86.71 for male and female (Velisek et al., 2007). The result of the PCV obtained in this experiment is 331.6 and 320.6 is higher than that obtained from *H. longitilis* which is 35.43 and 33.05 (Osuigwe et al., 2005). The result of MCV obtained in this work is 655 and 614.3 for both male and female and it is higher when compared to that of C*. gariepinus* which is 24.00 and 15.00 for male and female (Omitoyin, 2005); the differences might be due to differences in species or it might be due to environmental factors. The result of MCHC obtained in this work is 196.51 and 196.29 for male and female is higher than that of C*. gariepinu*s which is 33.33 and 33.33 for male and female (Omitoyin, 2006). The result of MCV obtained in this work is 655 and 614.3 for male and female is higher than that of *C. gariepinus* which is 193 and 168.0 for male and female (Adeyemo et al., 2003), this changes might be due to differences in species and it might equally be due to environmental factors. The result of the RBC obtained in this work was 30.3 and 31.2 were higher than those reported for *H .bidorsalis* 1.99 and 0.52 for male and female (Fagbenro et al., 1993). The blood group in this study revealed only two types in the species (O+ and AB+). The result agrees with the work on *H. niloticus* where the predominant blood groups in males and female were O+ and O^- (Ayorinde et al., 2009). The genotype of male and female *H. bidorsalis* was the same (AA). This result was the same with male *Parachanna obscura* 88% AA and female 12% AS (Odo et al., 2012). The results showed that fishes have similar genotype and blood groups like humans.

Conclusion

The result of this work could serve as an important starting point for other studies on the serological indices of *H. bidorsalis*. The blood group and genotypic parameters could also be used as baseline information for *H. bidorsalis* from other ecological zones of Nigeria.

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