Haematological and biochemical indices of *Clarias garipeinus* collected from River Nile, Sudan

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Abstract

The objective of this study was to investigate the reference values for haematological and biochemical ranges for *Clarias garipienus* (Family *Claridae*, local name *Garmoot*) collected from White Nile River. The findings for erythrocytes number was 2.17 ± 0.3 x10mm3, haemoglobin 6.29 ± 0.46 g\dl, packed cell volume (PCV) 18.9 ± 1.4 %, mean corpuscular volume (MCV) 88.2 ± 11.7 ft and mean corpuscular haemoglobin (MCH) 29.4 ± 3.9 pg. The total plasma protein; glucose, uric acid and urea levels were 4.1 ± 0.7 g/dl, 76.7 ± 4.9 mg/dl, 1.6 ± 0.4 mg/dl and 22.5 ± 3.5 mg/dl, respectively.

A correlation matrix was established to compare the degree of association among the biochemical and haematological indices. A positive correlation was observed among weight, length, MCV, and MCH, as well as between length and packed cell volume. The blood glucose level was positively correlated with weight and length, whereas the total plasma was negatively correlated with haemoglobin. The RBCs count was positively correlated with haemoglobin and negatively correlated with MCV and MCH.

Introduction

The African Catfish (*Clarias garipeinus*, Family *Claridae*, local name *Garmoot*) is a North African catfish that is widely introduced and cultured in many tropical and subtropical regions of the World. It is a potamodromous fish that migrates within streams and rivers (Teugels, 1986). This fish constitutes the largest group of cultured species after carp, salmonids and tilapia, and it grows well under various culture systems. It's net production was estimated to be 10 – 12 t/ha/yr, 7.3 – 15 t/ha/yr and 14.2 – 14.3 t/ha/yr under dominated polyculture, polyculture integrated with chicken and monoculture systems, respectively. However, the productivity of this fish per unit area basis could be increased with the simultaneous stocking of surface feeder other fish species such as silver carp (*Hypophthalmchthys molitrix*) and catla (*Catla catla*) (Mokhlesur and Imre, 1992).

The study of the physiological and haematological characteristics of cultured fish species is an important tool in the development of aquaculture system, particularly in regard to the use in detection of healthy from diseased or stressed animal (Rainza-Paiva *et al*., 2000; O'Neal and Weirich, 2001). The changes in the blood characteristics of *Clarias gariepinus* caused by stress due to exposure to environmental pollutants, diseases or attack by pathogens have been studied by a number of authors (e.g. Onusiriuka and Ufodike, 2000; Ezeri, 2001; Gabriel *et al*., 2001). These indices have been effectively employed in monitoring the responses of the fish to the stressors and evaluating its health status under such adverse conditions. Reports on the normal haematological and biochemical blood parameters of many aquaculture fish species, such as *Clarias*

gariepinus, and the effect of some factors, such as sex, source and acclimation on these parameters do not exist in the Sudan. Therefore, there is a justifiable need to establish reference haematological and biochemical values of the important fish species in Sudan. This study aims to establish reference ranges for haematological and biochemical values for healthy *Clarias gariepinus* collected from River Nile, Sudan.

Materials and Methods

Locality: The experiment was conducted on the Fisheries Laboratory, Department of Fisheries and Wildlife Biology, College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology, Khartoum North, Sudan.

Fish*:* Wild fishes of *Clarias garipienus* (*Garmoot*) were obtained from fishermen working beside the River Nile, 5 km west of Khartoum town. The used fish were ranging in weight from 330 – 1750 grams and the length was ranging from 46 to 57 cm.

Blood Sampling and haematological techniques: Blood samples were collected by severing the caudal peduncle of the fish using heparinized tubes. Blood plasma was obtained by centrifuging 5 ml of whole blood for 3 min and then the supernatant plasma was collected and stored in plastic tubes at -20 $\dot{C}$ for analysis.

Haemoglobin (Hb) concentration was determined by the cyanmethaemoglobin method (Dacie and Lewis, 1976) while the packed cell volume and the total plasma protein were determined according to the procedure described by Siwicki and Anderson (1993). The red and white blood cell counts were determined using Neubauer Chamber. Mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) were obtained according to the method described by Kelly (1984). Glucose, Uric acid and urea were determined using UV spectrophotometer (Schimatxu UV-1200) following the procedure of Henry (1974) and Bergmeyer (1986).

Results

Summary of haematological and biochemical indices were presented in Table 1. Red blood cell (RBC) and white blood cell (WBC) counts were 2.17 $\pm$ 0.3 x 10^6 /mm^3 and 56.46 $\pm$ 13.5 x 10^3, respectively. The haemoglobin (Hb) concentration was 6.29 $\pm$ 0.46 g/dl while the packed cell volume (PCV) was found to be 18.9 $\pm$ 1.4%. The mean cell volume (MCV) and mean cell haemoglobin (MCH) were found to be 88.2 $\pm$ 11.7 Ft and 29.4 $\pm$ 3.9 Pg, respectively.

The total plasma protein; glucose, uric acid and urea levels were found to be 4.1 $\pm$ 0.7 g/dl, 76.7 $\pm$ 4.9 mg/dl, 1.6 $\pm$ 0.4 mg/dl and 22.5 $\pm$ 3.5 mg/dl, respectively.

A correlation matrix was established to compare the degree of association among the biomatrix data and haematological indices and among each of them and biochemical values (Table 2 and 3).

Discussion

Erythrocytes count at range 2.17 – 2.6 10^6/mm^3 in the studied *Clarias garipinus* were within the range described by Gabriel *et al.,* (2004) (2.3- 2.9 x10^6 /mm^3) and Adeymo *et al*. (2003) (1.5x10^6 /mm^3) and a similar observation was noted with another species such as tilapia as reported by Terry *et al*. (2000), Adam (2004), Nilza *et al.* (2003).

The mean values of packed cell volume (PCV) in *Clarias garipeinus* obtained from this study were within the range of the corresponding values described by Gabriel *et al.*

(2004); Munkittrik and Leatherland (1983); Gabriel *et al.* (2001). Several of these studies attempted to determine whether significant variations from normal values of these parameters do exist and could be attributable to some internal or external factors.

The range of corpuscular volume (MCV, 73.1-108.7 ft) and corpuscular haemoglobin (MCH, 24.4- 36.2 pg) obtained from this study were similar to findings of Terry *et al.* (2000), Nilza *et al.* (2003) and Gabriel *et al.* (2004). Also, higher levels of MCV (145.8 ft) than those findings were obtained by Adeymo *et al.* (2003).

The hemoglobin concentration (6.29 g/dl) in studied fish was similar to those reported by Adeymo *et al.*, (2003) and Gabriel *et al*., 2004), but was lower than those of Red Tilapia (7.3 g/dl), Nile Tilapia (10.4 g/dl), Curimbata (9.7 g/dl) and hybrid Tilapia (12.7 g/dl) as reported by Adam (2004), Terry *et al*. (2000). Teixeira (2000) stated that the reference values determined for haematological elements and biochemical tests may not represent precisely those of a certain population or animal species and should, therefore, be carefully interpreted once there was a wide range of physiological variations. According to these authors, these variations might be influenced by environmental conditions, gender, age, origin, breeding system and feeding.

The blood glucose, total plasma protein, uric acid and urea levels (76.74 $\pm$ 4.98, 4.08 $\pm$ 0.74, 1.57 $\pm$ 0.38 and 22.5 $\pm$ 3.45, respectively) of studied *Clarias garipinus* were similar to those reported by Tarares-Dias (2000). However, these levels were significantly higher than the levels of channel catfish, *Ictalus metas* O'Neal and Weirich (2001). These variations might be attributed to seasonal temperature changes which may affect the biochemical blood levels, although the data refer to fishes from tropical regions where temperature was more or less stable throughout the year Adeymo *et al.*(2003). The blood samples of studied fish were taken between March and April at temperature 30^{o} C, which might confirm this interpretation. The variations in the biochemical blood parameters might be due to the different biochemical metabolism in various seasons, as pointed by Chavin and Young (1970), Adeymo *et al.* (2003), Connors *et al.* (1978) and Best *et al*. (2001). Temperature affects the blood sugar, urea, uric acid and protein levels, but the pattern was inconsistent.

A positive correlation was observed among weight, length, mean cell volume and mean cell haemoglobin. Whereas a negative correlation was noted in haemolglobin and haematocrit. The blood glucose and total plasma protein, uric acid and urea were negatively was correlated with total weight and length, whereas total plasma protein was positively correlated with length.

The variation in haematological and biochemical parameters obtained in this study emphasizes the need of more study on large number of fish population at different seasons and different age, sex and environmental conditions to confirm these findings of healthy Sudanese *Clarias garipinus*.

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Table 1. Haematological and biochemical indices of *Clarias garipienus* collected from River Nile.

Parameters	**Range**	**Mean + SD**
Total Weight (g)	560 – 1755	1040 +
Total length (cm)	42- 63	51.74+
Standard length (cm)	38- 56	46.71+
Erythrocytes (10^6/mm^3)	1.0-2.6	2.17 + 0.3
White Blood Cell (10^3/mm^3)	31.95- 66.3	56.46 + 13.5
Haemoglobin (g/dl)	5.5- 6.7	6.29 + 0.46
Hematocrit (%)	16.5- 20.1	18.9 + 1.4
MCV (Ft)	73.08- 108.67	88.2 + 11.7
MCH (Pg)	24.35- 36.22	29.4 + 3.9
Glucose (mg/dl)	48.8- 100	76.7 + 4.9
Total Protein (mg/dl)	1.5- 9.3	4.1 + 0.7
Uric Acid (mg/dl)	0.5- 4.2	1.6+0.4
Urea (mg/dl)	5.6- 42.5	22.5 + 3.5

Table 2. Correlation coefficients among the haematological and biochemical indices of *Clarias garipienus* collected from River Nile.

Parameters	Correlation coefficients					
T. length	0.90**					
S. length	0.91**	0.99**				
Hb	-0.12	0.11	٠.١٢			
PCV	-0.12	0.11	0.12	1.00		
MCV	0.63	0.39	0.38	0.16	0.16	
MCH	0.63	0.39	0.38	0.16	0.16	1.00**
	T. weight	T. length	SL	Hb	PCV	MCV

** Correlation is significant at the 0.01 level.

Table 3. Correlation coefficients among the biochemical indices of *Clarias garipienus* collected from River Nile

Parameters	Correlation coefficients					
Total length	0.93**					
Standard length	0.94**	0.99**				
Total protein	-0.03	0.12	0.09			
Glucose	-0.58*	-0.48	-0.48	-0.08		
Uric Acid	-0.02	-0.21	0.23	0.58	0.11	
Urea	-0.42	-0.21	-0.23	-0.24	0.22	-0.10
	T. weight	T. length	S. length	T. Protein	Glucose	Uric acid

** **Correlation is significant at the 0.01 level,**
* **Correlation is significant at the 0.05 leve**l.