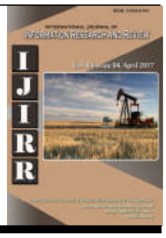

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RESEARCH ARTICLE

EFFECTS OF SEASON ON THE PACKED CELL VOLUME (PCV) OF SOME WILD FISH SPECIES INFECTED WITH TRYPANOSOMES IN NORTH-WESTERN NIGERIA

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ABSTRACT

Hematocrit values (PCV) of infected and unninfected wild fish species were investigated in 11 months period (covering early rainy, late rainy, early dry and late dry Seasons) from 10 locations in Sokoto Kebbi and Zamfara States, in semiarid region of Nigeria. Interseasonal difference in prevalence was observed (P<0.05), while inter and intraseasonal reduction in hematocrit were observed from eleven locations. Only PCV of *Clarias gariepinus* and *Synodontis nigrata* from Lugu and Rabah locations showed statistical significance (P<0.05) respectively. Difference between PCV of infected and uninfected *Tilapia zilli* and *Mormyrus rume* were not significant (P> 0.05). The significant difference in PCV of infected *C. gariepinus* and *S. nigrata,* suggested manifestation of pathologic effect of piscine trypanosomes. Significant values were also observed among uninfected fish from few locations, indicating other factors associated with anemia in those locations apart from trypanosomes. The seasonal effect in PCV is relative to water volume and population of leeches.

INTRODUCTION

The semi-arid region of Nigeria, is characterized by short rainy season of 3 months duration, and records 250 – 500 mm of rainfall, with variable ambient temperatures of 25 – 36°C. (Lekan and Idowu, 2011). The climate comprises of distinct wet season (April – October) and dry season (November to March) (Sawa *et al*., 2015). Arable crop farming, animal rearing, mining and fishing are predominant occupations of the people. The inland water bodies in the region comprise of dams, lakes, streams and rivers which support the growth of over 260 wild fish species (Babatunde and Aminu.,1998). Wild fish is harvested with little input, hence considered as cheapest source of animal protein to support the teeming populace. To sustain production therefore, conservatory efforts through restocking, appropriate use of fishing gears, regulation of cultural practices to check the excesses of fishermen and effective disease surveillance should be vigorously pursued, to ascertain the health status of wild fish in these water bodies. For fish to attain maximum productive capacity in the wild, potential predisposing factors of disease must be identified, appreciated and possibly controlled.

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The numerous water bodies in the region are grossly infested with parasitic leeches that constitute serious health hazard to aquatic mammals, fishermen and indeed the fish species. Apart from beneficial applications in surgery (Mory *et al*., 2000; Aruna *et al*., 2016), leeches are now identified as vectors of piscine trypanosomes in marine and freshwater fishes (Paperna, 1996: Gupta and Gupta, 2012). While trypanosomosis remained debilitating disease of man and animals in Africa, Asia and America, piscine trypanosomes are ubiquitous in nature, though pathological effects could not be appreciated with certainty, due to other incriminating disease factors in aquatic environment. These agents ranges from toxic agricultural pesticides (Hii *et al*., 2007), heavy metals such as copper (Fideli *et al.,* 2010), viral agents (Sano, 1995), folic acid deficiency (Adham *et al* 2000) to internal and external parasites (Oosthuizen, 1991: Osman *et al*., 2009) among others, whose pathological effects are manifested by one form of anemia or the other, and indeed characteristic of trypanosomal infections. To narrow claim for trypanosome as sole etiological factor for anemia under these conditions could be difficult, but not impossible, with numerous analytical and logical tools. Piscine trypanosomosis is considered among important internal disease problems as documented globally (Osman, *et al*. 2009, Hussein *et al*. 2010, Gupta and Gupta 2012).

Hematocrit value gives a fair representation of the level of hemoglobin and indeed anemia (Bahshkar *et al*., 1984: Gupta and Gupta, 2012: Islam and Woo, 1991). PCV, therefore, gives a vivid picture on the status of circulating blood, moreso where the size and species of fish involved do not guarantee adequate quantity of blood for detailed qualitative assessment. The study is aimed at determining hematocrit values of trypanosomes infected and uninfected wild fish from different locations at different seasons of the year.

MATERIALS AND METHODS

A total of 1536 fish, belonging to 10 families (*Clariidae, Polypteridae, Chichilidae, Gymnacae, Bagridae, Mochokidae, Lepidosirenidae, Mormyradae, Centropmidae and Cyprinadae*), were collected from 10 locations in 3 States of northern Nigeria, namely Sokoto, Kebbi and Zamfara and were screened for trypanosomes over a period of 11 months, (June 2013 to April 2014). The locations lie between 3^0 35 E 7^0 2 E latitude and 10^0 N 14^0 N longitude which include Rabah, Goronyo, Lugu, Kwalkwalawa and Shagari in Sokoto State; Malisa, Argungu, and Yauri, in Kebbi State; Bakolori, T/Mafara, and Natu in Zamfara State (Muhammad, 2014).

Parasitological methods in accordance with OIE (2013) and Woo (1970) were adopted for preservation, identification of parasites and determination of hematocrit (packed cell volume) respectively, at Veterinary Parasitology Laboratory, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto. Records of infected and uninfected fish species were summarized on monthly and quarterly basis, to reflect the four seasons of the year (early rainy, late rainy, early dry and late dry seasons). Z- test was used to determine differences in interseasonal infection rates, while the mean hematocrit values for infected and uninfected fish species at each location were compared using student t-test, to determine the Inter and Intraseasonal differences in PCV with Open Epi statistical software.

RESULTS

Blood of infected and uninfected fish, from five (*Clarias gariepinus, Tilapia zilli, Synodontis nigrata, Mormyrus rume* and *Bagras bayad*) out of ten species of fish were used for PCV comparison. Monthly records of fish screened and prevalence recorded are presented in Figure 1.

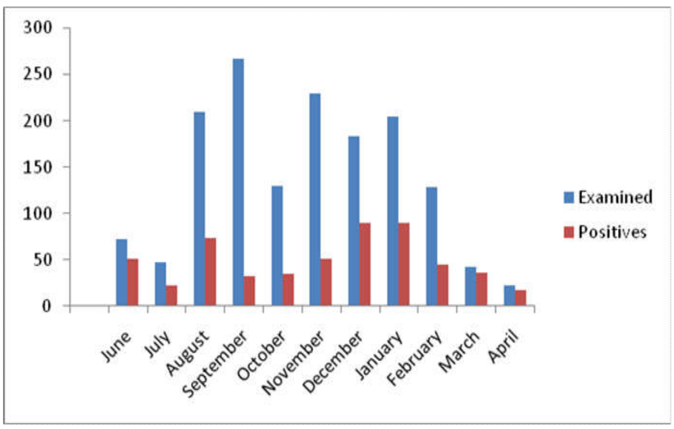

Figure 1. Monthly Prevalence of Piscine Trypanosomes

Table 1. Comparison of the prevalence rates of piscine trypanosome infections by season in northwest Nigeria, Using the Z-Test for Proportions

Seasons	Z test	P value
ERS vs LRS	8.329	P < 0.05*
ERS vs EDS	4.928	P < 0.05*
ERS vs LDS	1.726	P < 0.05*
LRS vs EDS	-5.349	P < 0.05*
LRS vs LDS	-7.427	P < 0.05*
EDS vs LDS	-3.459	P < 0.05*

*Significant at 5% (P < 0.05)
Key
ERS=Early Rainy Season
LRS=Late Rainy Season
EDS=Early Dry Season
LDS=Late Dry Season

The month of September recorded highest number of sampled fish, while April had the lowest number. December in the peak of dry season recorded the highest prevalence. From these monthly records, seasonal prevalence were computed in three months intervals, commencing from June as Early Rainy season, and subsequently Late Rainy, Early Dry and Late Dry seasons were determined respectively.

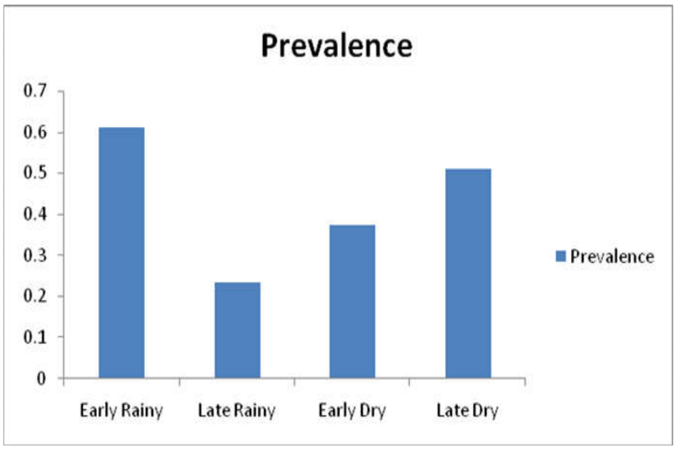

Figure 2. Seasonal prevalence

These records are summarized in Figure 2 which showed early rainy with highest prevalence (60%), while late rainy season recorded least prevalence of 24%. The interseasonal prevalence rates (Table 1) revealed statistically significant differences ($P < 0.05$) among the four seasons of the year. Table 2 presented mean PCV of infected and uninfected fish species that had relatively large number of samples from different locations. Though reduction in PCV was observed among 3 species from eleven locations, only samples for *C. gariepinus* from Rabah and Lugu and *S. nigrata* from Lugu showed statistical significance ($P < 0.05$). Higher values of PCV were also recorded from uninfected fish in 5 locations (*C gariepinus* from Goronyo and Yauri: *T. zilli* from Rabah: and *S. nigrata* from Rabah and Natu dam). There were no samples for *T zilli* from Shagari and *S nigrata* from Yauri, for possible comparison. The seasonal differences in PCV of infected and uninfected fish for 3 species of fish are presented in Table 3. These records revealed reduction in PCV as observed among infected *C gariepinus* in all the seasons, but only early rainy/ early dry seasons showed significant differences ($P<0.05$). Whereas infected *T. zilli* exhibited reduction in ERS and LDS, such values weren't statistically significant ($P >0.05$).

Table 2. Mean PCV values (±SD), by location, of Infected and Uninfected Wild fish from Sokoto, Kebbi and Zamfara States Nigeria

Genus	Location	Infected	n	Uninfected	n	P-Values (Infected *vs* Uninfected)
Clarias	Malisa	22.2±4.1	11	22.0±1.5	6	0.910
	Rabah	28.54±7.25	44	32.16±9.8	57	0.033*
	T Mafara	30.07±9.4	55	33.0±10.69	45	0.109
	Lugu	24.4±7.65	130	27.5±7.71	145	0.001*
	Argungu	27.2±5.8	5	28±7.5	57	0.817
	Kwalkwa	34.8±12.2	24	35.0±10.8	76	0.939
	Goronyo	30.6±7.2	30	29.6±9.82	71	0.616
	Yauri	42.5±10.6	2	33.4±7.3	48	0.094
Tilapia	T/Mafara	35.8 ± 9.4	20	39.34 ± 5.39	32	0.060
	Lugu	33.1±11.5	56	38.4 ± 19.82	29	0.122
	Rabah	32.6 ± 7.06	83	32.3 ± 7.31	39	0.820
	Shagari	NA	3	48.66 ± 3.01	14	NA
	Argungu	28±0	2	33 ± 5.3	38	0.190
Synodontis	Lugu	24.8±14.76	15	38.2±7.84	60	0.001*
	T/Mafara	35±3.55	4	36.2±4.15	10	0.622
	Yauri	NA	7		20	NA
	Rabah	38±0	3	30±2.82	2	>0.9999
	Natu	39±1.90	6	35±11.37	5	0.410
	Argungu	36±7.63	6	37.9±8.38	10	0.708

*Significant at 5% (p<0.05)

Table 3. Mean PCV values (±SD), by season, of Infected and Uninfected Wild fish from Sokoto, Kebbi and Zamfara States Nigeria

Species	Season	Infected	Non Infected	Infected *vs* Uninfected	
				t- value	P- value
C gariepinus	Early Rain	29.0±9.77(46)	35.4±13.27(36)	2.4377	0.0176*
	Late Rain	30.6±9.68(90)	31.3±8.79(279)	0.6097	0.5400
	Early Dry	24.9±7.25(151)	26.9±6.27(108)	2.3701	0.0186*
	Late Dry	28.7±7.27(27)	29.2±7.20(45)	0.2835	0.7778
S nigrata	Early Rain	17.0±9.09(6)	27.0±7.92(2)	1.4885	0.2700
	Late Rain	0.0±0.00(0)	12.3±0.83(15)	NA	NA
	Early Dry	36.8±7.90(14)	36.8±7.70(31)	0	>0.999
	Late Dry	37.0±0.00(1)	42.0±6.47(9)	-0.7330	0.4840
Tilapia zilli	Early Rain	30.4±10.54(16)	27.8±10.05(8)	0.5877	0.5654
	Late Rain	38.3±9.19(3)	34.1±5.74(21)	0.7704	0.5216
	Early Dry	36.3±7.75(24)	36.4±6.86(81)	-0.0569	0.9540
	Late Dry	31.3±6.54(53)	28.9±13.62(10)	0.5454	0.5974

*Significant at 5% (p<0.05)

Table 4. Inter-Seasonal difference in PCV of Infected and Uninfected fish from Sokoto, Kebbi and Zamfara States Nigeria

Species	Season	Infected		Uninfected	
		t-value	p-value	t-value	p-value
C. gariepinus	Early Rain vs Late Rain	-0.9064	0.5672	1.8035	0.0791
	Early Rain vs Early Dry	2.6339	0.0107*	3.7078	0.0006*
	Early Rain vs Late Dry	0.1494	0.8817	2.5220	0.0148*
	Late Rain vs Early Dry	4.8360	0.0001*	5.4960	<0.0000001*
	Late Rain vs Late Dry	1.0972	0.2772	1.7568	0.0835
	Early Dry vs Late Dry	-2.5026	0.0170*	-1.8680	0.0658
S. nigrata	Early Rain vs Late Rain	NA	NA	2.6230	0.2319
	Early Rain vs Early Dry	-4.6374	0.0016*	-1.6989	0.3389
	Early Rain vs Late Dry	-5.3894	NA	-2.5000	0.2423
	Late Rain vs Early Dry	NA	NA	-17.5067	<0.0000001*
	Late Rain vs Late Dry	NA	NA	-13.7038	0.0000007*
	Early Dry vs Late Dry	-0.0947	NA	-2.0297	0.0605
T. zillii	Early Rain vs Late Rain	-1.3335	0.2746	-1.6722	0.1288
	Early Rain vs Early Dry	-1.9196	0.0659	-2.3665	0.0455*
	Early Rain vs Late Dry	-0.3232	0.7500	-0.1970	0.8463
	Late Rain vs Early Dry	0.3612	0.7525	-1.5686	0.1255
	Late Rain vs Late Dry	1.3007	0.3230	1.1593	0.2709
	Early Dry vs Late Dry	2.7484	0.0091*	1.7147	0.1172

*Significant at 5% (p<0.05)

In fact, uninfected *T zilli* exhibited relatively higher PCV, as compared to infected counterpart. The interseasonal changes in hematocrit values are presented in Table 4. The Infected *T zilli* showed significant reduction in PCV in ERS / EDS but some uninfected fish also showed significant reduction in PCV during LRS/ EDS comparison.

Similarly significant reduction (P<0.05) was observed in infected *S.nigrata* between ERS / EDS only. Reduction among uninfected *S nigrata* was also manifested in LRS / ERS and LRS /LDS. Infected *T zilli*, manifested significant reduction in PCV from EDS / LDS combinations only (Table 4).

DISCUSSION

Analysis in PCV of infected and uninfected fish was considered from 3 out of the 5 species confirmed positive to trypanosomes, due to high number of positive cases in these species as presented in Figure 1. Reduction in PCV is indicative of pathogenic manifestation, and specifically anaemia from several possible etiological agents as observed in aquatic environment (Witeska, 2015). Depending on the pathogenicity of etiological agent, high prevalence of trypanosomes in fish blood as observed in early rainy season could be related to decrease in water volume and subsequent increase in leech population towards the end of dry season, and commencement of rainy season, (figure 2). A strong indicator of anemia is reduction in PCV, which has direct bearing with the status of circulating erythrocytes, ability of hemoglobin to carry oxygen or both, depending on the type of anemia and etiological factor. The reduction in PCV of infected, as compared to uninfected fish captured from the same environment and possibly at the same time, could be associated with certainty to trypanosome infection. Where such differences are observed among uninfected fish of the same species, other factors apart from trypanosomes are taken into consideration.

Other factors of consideration in fish are the physiological state as seen in age and gender differences, apart from the degree of pathogenecity of the species of trypanosome involved. *Trypanosoma theileri* in cattle is considered among the largest morphotypes but relatively harmless, while *Trypanosoma congolense* being smaller in size, is considered highly pathogenic. From the previous study conducted in the same environment (Muhammad *et al.,* 2016), it was observed that *T. zilli* were predominantly infected with larger, *C. gariepinus* with medium, while *S. nigrata* with smaller sized trypanosomes. In this study, infected *T. zilli* from most of the locations, had PCV relatively unchanged or even higher, indicating non pathogenecity of such larger group, or possibly exposed to toxicity of endosulfan, often used by farmers as pesticide (Hii *et al*., 2007). Evidence of pathogenic effect is manifested in *C. gariepinus* from Rabah and Lugu, and *S. nigrata* from Lugu dam with high statistical significance (Table 2). These observations are in conformity to earlier works reported (Bhaskar *et al*.1984; Gupta and Gupta, 2012, Fujimoto, *et al*., 2013: Shahi, *et al*., 2013). These records indicated differences in pathogenic effect among infected fish and trypanosome species. Inter and intraseasonal differences observed with statistical significance as observed (Tables 3 and 4) further confirmed seasonal effect on PCV, which is relative to increasing leech population at their spawning seasons (Nagao, 1957; Ronald, *et al*. 1997; Abowei and Ezekiel, 2011) or decrease in water volume, with subsequent increase in chances of attack by leeches (Muhammad, 2014). These seasonal effects of pathologic manifestation under natural conditions are however contrary to Paperna (1996) and Ferreira and Avenant (2013).

Conclusion

The significant reduction in packed cell volume of infected *C. gariepinus* and *S. nigrata*, indicated pathogenic effect of the trypanosomes in these species, while the larger morphotypes as observed in *T. zilli*, were relatively non pathogenic. The study also showed that piscine trypanosomes have seasonal effect on the wild fish of north western Nigeria.

REFERENCES

Abowei, J.F.N. and Ezekiel, E.N. 2011. A review of acanthocephala, leeches parasites, crustaceans and some other parasites of miscellenous taxa infections in African fish.*International Journal of Animal and Veterinary. Advances*.3(5): 337-351

Adham, K.G., Hashem, H.O., Abu Shabana, M.B. and Kamal A.H. 2000. Vitamin C. deficiency in catfish, *C. Gariepinus. Aquaculture Nutrition*,6:129 -139

Aruna T, Deepak K Tofia, B., and Rakhanda Anwar A 2016. .Leech therapy in the maneagement of congested free flaps. *Universal Research Journal of Dentistry.* 6(1) 25 - 28

Babatunde, D.O. and Aminu, R. (eds). 1998. *Field Guide to Fishes of Nigerian Freshwater*. New Bussa, Nigeria Federal Collage of Freshwater Fisheries Technology. New Bussa, Kianji:106p.

Bhaskar, R.A.O., Susan Bhashkar, R.A.O. and Israel, K. 1984. Haemoglobin level of fish *Heteropneustes fossilis* due to trypanosomea infection*. Current Science* 53(6). pp 340.

Ferreira, M.L. and Avenant O.A. 2013. Notes on the occurrence of trypanosoma sp. *(Kinetoplastida: Trypanosomatidae)* in fresh water fishes from South Africa. *Onderstepoort Journal of Veterinary. Research* 80(1).529 http//dx.org/10.4102/ojvr.v80/1.529

Fideli, D., Carloni, M and Falcioni, G. 2010. Oxidative damage in trout erythrocyte in response to in vitro copper exposure. *Marine Environmental Research,* Elseier, 69(3):Pp.172..

Fujimoto, I., Rodrigo, Y., Mikaelle, S., Neves, Ruda F.B., Santos, Natalino C. Souza., Marcia V.S. do Couto, Josiane N.S, Lopes., Daniel G. Diniz, & Jeorge C. Eiras. 2013. Morphological and hematological studies of *Trypanosoma spp*. infecting ornamental armoured catfish from Guama River – PA, Brazil: *An. Acad. Bras. Cienc*.Vol 85(3): 1-9

Gupta, N. & Gupta, D.K. 2012. .Erythropenia in Piscine Trypanosomiasis. *Trends in Parasitology Research ,* 1 (1): 2319- 3158(online)

Hii, Y.S., Lee, M.Y. and Chuah, T.S. 2007. Acute toxicity of organochlorine insecticide endosulfan and its effect on behavior and some hematological parameters of Asian swamp eel, *Monopterus albus zulew*. *Pesticide Biochemistry and Physiology* 89, 46-53

Hussein, A.N.A., Rabie S.A., Mohammed N.E. and Hussein N.M. 2010. Light and electron microscopic studies of trypanosomes parasites infecting freshwater fishes in Qena Governorate Egypt. *Egypt Acaemic. Journal of Biological. Science* 2(1): 17 – 31.

Islam, A.K.M.N. and Woo, P.T.K. 1991. Anemia and its mechanism in goldfish *Carassius auratus* infected with *Trypanosoma danilewskyi. Diseases of Aquatic Organisms*. 11.(1).pp 37 -43

Lekan, O, and Idowu, B, 2011. Water Resource Management in the Semi arid region of Nigeria. *Canadian Journal of Developmental Studies.* 13(4), p 209–226.

Mory R N., Mindell, D, B and David, A. 2000. The leech and the physician Biology etymology and medical practice with *Hirudinea medicinalis. World Journal of Surgery* 24(7): 878 - 883

Muhammad, S. 2014. *Studies on Piscine Trypanosomes and Morphological Characterization of Etiological Agents in*

Wild Fish species of Sokoto, Kebbi and Zamfara *States*. Ph.D thesis in Veterinary Medicine. Usmanu Danfodiyo University Sokoto, Nigeria.

Muhammad, S., Chafe, U.M., Bello, M.R., Adamu, Y.A., Mohammed, A.A. and Bello, A. 2016. A study on the prevalence of piscine trypanosomes in Sokoto, Kebbi and Zamfara States Nigeria. *Scholarly Journal of Agricultural Science.*, 6(8) pp. 270 – 276

Nagao, Z. 1957. Observations on breeding habit in a freshwater leech *Herpobdella lineata O.F. Muller Bulletin*. *Journal of Fac .Sci. Hokkaido Univer. Serv*. V1, 13(14) pp. 190 – 196

OIE. 2013. Office Internationale des Epizootes, World Organisation for Animal Health. *Terrestrial Manual: Trypanosomosis (Tsetse transmitted)*. Version adopted by the 81st World Assembly of delegates of the OIE, 29th May, 2013. Paris: Chapter 2:4, 18 11p. www.fao.org/40318.

Oosthuizen, J H. 1991. An annotated checklist of the leeches Annelid Hirudinea of Kruger National Park with a key to spp. *Koedoe* 34(2): 25- 38.

Osman, H.A.M, Fadel, N.G and Ali, A.T. 2009. Biochemical and histopathological alterations in catfish, *C gariepinus* infected with trypanosomiasis, with special reference to immunization. *Egyptian Journal Comparative & Clinical Pathology* 22 (3): 164 – 181.

Paperna, I. 1996. *Parasites and Infectious Diseases of Fishes in Africa. Update,* CIFA Tech paper 31, Rome FAO.220 p.

Ronald, W., Davies, N.J. McLoughlin and Oosthuizen, J.H. 1997. The life cycle and feeding of the African Freshwater leech *Helobdella conifer* (Glossiphoniidae). *South African Journal of Zoology.* 32(1), 1 – 4. Doi. 101080/02541858, 11448418.

Sano, T. 1995. Viruses and viral diseases of salmonids. *Aquaculture,*132:43-52

Sawa, B.A., Ati, O.F., Jaiyeoba, I.A. and Oladipo, E.O. 2015. Trends in aridity of the arid and semi-arid regions of northern Nigeria. *Journal of Environmental and Earth Science*, 5(10): 61 - 68

Shahi, N., Yousuf, A.R., Rather, M.I., Ahmad F, and Yaseen, T. 2013. First report of blood parasites in fishes from Kashmir and their effect on Hematological profile. *Open Veterinary Journal* 3(2); 89 – 95 .

Witeska, M. 2015. Anemia in teleost fishes. *Bulletin of European Association of Fish Pathologists.*35 (4) :148 - 160

Woo, P.T.K. 1970. The Haematocrit centrifuge technique for the diagnosis of African trypanosomiasis. *ActaTropica*, 27: 384-386.

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