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Survey of internal protozoan parasites of fresh water fish on *Oreochromis niloticus* in White Nile in Sudan

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Research Paper

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The aim of the study is survey of internal protozoan of one species of fish at White Nile (Sudan). A total of 1200 samples from 300 specimens of *Oreochromis niloticus* were investigated for internal protozoa. The fish samples collected in the period from (October, 2013 to March, 2014) from three positions: Kosti, Jabal Awalia and Khartoum. The (1200) samples were taken from Blood (from tail area), Liver, Kidney and Gonads. The study revealed Trypanosoma sp. from Blood, also Myxobolus sp., Myxosporea sp. and Cryptobia sp. recovered from Liver, Kidney and Gonad of Oreochromis niloticus. The total infected samples (from Blood, Liver, Kidney and Gonads) in Kosti are 164 samples, in Jabal Awalia are (119 samples) and in Khartoum are 157samples and generally the total infected samples from the White Nile Sudan are 440 samples in total of 1200 samples. The prevalence of protozoan parasite in Kosti is 85% in total while that for Jabal Awalia is 70% in total and in Khartoum is 85%. Also the density of protozoan parasite is highest in Kosti. The Kidney have the highest density (60%) and most of the parasite is *Cryptobia*.

Key Word: Survey, Parasites, Internal Protozoa, *Oreochromis niloticus*.

INTRODUCTION

Fish is important to human populace in trade and economy; it is of importance in the diet of different countries especially in the tropics and subtropics where malnutrition is a major problem (Alune and Andrew, 1996; Osuigwe and Obiekezie, 2007). As the human population inevitably increases, the demand for fish as source of protein will grow (Abolarin, 1996). In recent times, there has been tremendous increase in the development of fish farming and culture attributable to the increased need for affordable animal protein especially in the tropics (Davies et al., 2006).

Tilapia is fresh water fish belonging to the family Cichlidae; they are native to Africa but were introduced into many tropical subtropical and temperate region of the world during the second half of the 20th century (Pillay,1990).

The total world production of tilapias and other cichlids reached 2.6 million ton in 2004 and continued to rise to up to 3.6 million ton in 2008 (FAO. 2010). Nile tilapia, *Oreochromis niloticus* is a highly favored culture fish with acceptance and among leading farmed species around the world (Ighwela et al., 2011).Parasitic infection and diseases are some of the factors hindering high productivity in fish farming (Doglel et al., 1961; Kayis et al., 2009). Parasites are the most diverse and common pathogens the aqua-culturist may likely encounter and parasitic diseases are very common in fish all over the world and are of particular importance in the tropics (Roberts and Janovy, 2000) and Protozoan among other parasites cause immeasurable damage to the fishing

industry (Doglel et al., 1961).

Fish parasites are numerous and many phyla in the animal kingdom have representative that are parasitic to fish. There are by far more parasite species that infect fish than any other group of infectious disease (Blazer, 1996).

Fish parasites result in huge economic losses as they increase mortality; increase farm inputs via increased treatment expenses and cause reduction in growth rate and possibly weight loss during and after the period of parasitic disease outbreak.

All these militate against expansion of aquaculture. (Kayis et al., 2009). The most commonly encountered fish parasites are protozoa (Klinger and Francis-Floyd, 2000).

The topic of fish disease is so complex that it would need a whole book to discuss it thoroughly. Fortunately, most of the proprietary medicines available are broad spectrum, killing most disease organism.

It there for does not usually matter if you are unable to identify the precise disease affecting your fish, as the treatment will usually help (Brian, 1996).

Parasite infection in fish refers to a diseased condition in fish resulting from organism living in or on the fish (Bassey, 2011).

The relationship between the fish and parasite is referred to parasitism. In this relationship, one benefits while the other suffers. The host suffers and the parasite benefits. Various types of host exist.

The parasite reaches its adulthood in or on the definitive or final host. Secondary (intermediate) host harbors parasite but hinders its development until it passes to a definitive host. A temporary host harbors the parasite briefly.

Parasites from temporary host become independent soonest. Reservoir host serves as a source of parasite for other host. Protozoan and Metazoans are examples of fish parasites. Protozoan is a unicellular organism while metazoans are multi cellular organisms (Bassey, 2011).

In general protozoa are one of the major sectors of fish parasites that have been long neglected because of its inherent difficulty in study in compared to other larger parasites.

Among protozoa, ecto and endo-parasitic protozoa occupy a very important sector as one of the hazardous threats to fish health. These parasites attack the fish causing massive destruction of skin and gill epithelium. Even moderate infection of these organisms on small fish may prove a fatal disease, since the infection may cause the fish to stop feeding (Meyer, 1968; Hoffman, 1970).Fish parasitic protozoa gain a lot of attention (Ali, 1992; Ali et al., 2003-2007; Abdel-Meguid, 1995; Abdel-Ghaffar et al., 1998, 2008).

Accordingly the aim of this study is to conduct a general survey of internal protozoan parasites in blood, liver, kidney and gonads on *Oreochromis niloticus* in White Nile in Sudan.

MATERIALS AND METHODS

Samples collection and sources of fish

300 fresh water fishes (*Oreochromis niloticus*) were collected from three different sites from the White Nile; Kosti (300 km south of Khartoum), Jabal Awalia (25 km south of Khartoum), Khartoum (the capital of Sudan) as 100 fishes for each site. The fish samples collected in the period from (October, 2013 to March, 2014). The (1200) samples were taken from Blood (from tail area), Liver, Kidney and Gonads. A total of 300 fresh water fishes (*Oreochromis niloticus*) were investigated for internal protozoa.

Materials

Dissecting tools.
Slides.
Filter paper.
Photo microscope.
Distilled water.
Light microscope.
Methanol (Fixation).
Giemsa (Staining).

Methods

Blood Smear

Firstly the fishes were brought out of water and the total length was taken. The tails was cut by sharp to obtain blood from caudal vain or artery with pressure. A drop of blood 5 ml was placed on the edge of microscope slide and touched with another slide (spreader) at 45 angle and moved quickly forward to do the smear, then the smear was left to dry.

Liver, kidney and ovary smear

The routine dissection method was adopted, as a ventral incision was made from the anus to the pectoral region and another vertical from the anus to the lateral line. The side flap was lifted and the internal organ exposed. The operculum was removed to expose the gill (Buck, 1972).Then taken the samples from: liver, kidney and gonads and put them in the filter paper to absorb the fluids and blood. Then by forceps the impression smear was done and left to dry.

Fixation

The methanol was added to fix the dried smear and

Table 1. Infected and not infected samples in Kosti.

	Negative (not infected)	Positive (infected)	Total
Blood	77	23	100
Liver	79	21	100
Gonads	50	50	100
Kidney	30	70	100

Table 1. Infected and not infected samples in Jabal Awalia.

	Negative (not infected)	Positive (infected)	Total
Blood	89	11	100
Liver	68	32	100
Gonads	65	35	100
Kidney	59	41	100

leaved to10 min.

Staining

One ml of stain mixed with 9 ml of distilled water carefully, and then the smear was stained by Giemsa stain and leaved to 10 minutes and washed by slow runny water then leaved to dry.

Microscopic examination

The smears were placed under light microscope. The slide was first viewed with x10, x40 objective lenses and then with oil immersion lens (x100 objective and x10 eye-piece) of the examination of liver, kidney, gonad &blood and identification the protozoan parasites in Department. of Zoology Faculty of Science, University of Khartoum.

Statistical Analysis

Data were entered in MS Excel for descriptive statistics. The prevalence of the protozoan parasites was defined as the total number of fish infected with the parasite divided by the number of fish examined (Margolis et al., 1982). The parasite distributions were described using prevalence and intensity (Ford, 1988). Prevalence was calculated using the formulae:

$$\text{Prevalence } \% = \frac{\text{Number of fish with parasite}}{\text{Total number of fish analyzed}} \times 100$$

Infection intensity was calculated using the formula:

$$\text{Infection intensity} = \frac{\text{Total number of occurences of parasite}}{\text{Number of fish infected with parasite}} \times 100$$

Photography

By leitz daimx 20 fitted with digital camera (Sony DSC-W190) camera, was used to photograph the parasite slide. The photography was carried at the department of Zoology Faculty of Science, University of Khartoum.

RESULTS

The result obtained in this study revealed the presence of, *Trypanosoma sp.* in Blood; *Cryptobia sp.*, *Myxobolus sp.* and *Myxosporea sp.* in Liver, Kidney and Gonads of *Oreochromis niloticus* from the White Nile (Kosti, Jabal Awalia, and Khartoum).

The total infected samples of Blood from the three positions is (60 samples), (73samples) from the Liver, (127samples) from the Gonads and (180samples) from the Kidney from the three positions (Kosti, Jabal Awalia and Khartoum) (Table 4) (Figure 4).And the total infected samples (from Blood, Liver, Kidney and Gonads) in Kosti (Table 1) (Figure 1) are (164samples), in Jabal Awalia (Table 2) (Figure 3) are (119samples) and in Khartoum (Table 3) (Figure 3) are (157samples) and generally the total infected samples from the White Nile Sudan (Table 4) are (440samples in total of 1200 samples).

The prevalence of protozoan parasites (Figure 5). in Kosti is 85% in total while that for Jabal Awalia is 70% in total and in Khartoum is 85%. Also the density of protozoan parasites is highest in Kosti (Table 4) (Figure 4). The Kidney has the highest density (60%) (Figure 6 and 7) and most of the protozoan parasites is *Cryptobia sp.*.

DISCUSSION

This study aimed to investigate internal parasite of some organs of *Oreochromis niloticus*. The results obtained in this study revealed that *Trypanosoma sp., Cryptobia sp.*, *Myxobolus sp.* and *Myxosporea sp.* were recovered in different position in *Oreochromis niloticus.*

Trypanosoma sp. Were found in blood of *Oreochromis niloticus* and the same result obtained by (Lom, 1979; Lom and Dyková, 1992; Woo, 1987; Khan, 1976) who

Table 1. Infected and not infected samples in Khartoum.

	Negative (not infected)	Positive (infected)	Total
Blood	74	26	100
Liver	80	20	100
Gonads	58	42	100
Kidney	31	69	100

Table 4. Infected samples in White Nile Sudan.

	Kosti	Jabal Awalia	Khartoum	Total infected	%
Blood	23	11	26	60	20%
Liver	21	32	20	73	24.3%
Gonads	50	35	42	127	42.3%
Kidney	70	41	69	180	60%
Total	164	119	157	440	

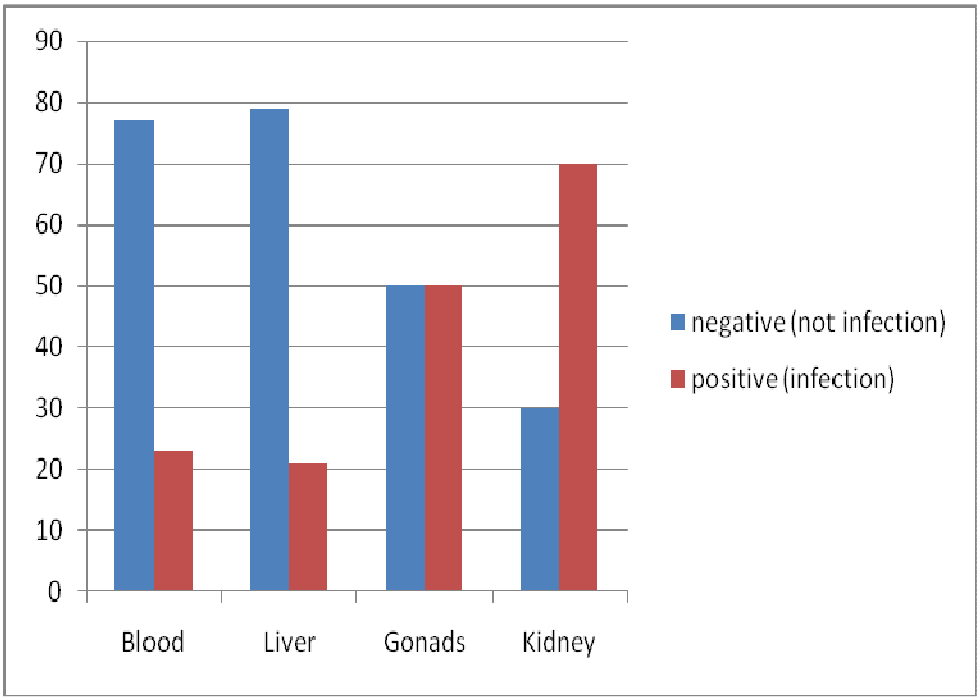

Figure 1. Infected and not infected samples in Kosti.

said that *Trypanosoma* have been described from the blood of both marine and freshwater fish species. Also (Woo and Block, 1984; Islam and Woo, 1991 and Smit *et al.,* 2000) said that *Trypanosoma* is regarded as one of the most important economical internal disease affecting freshwater fishes and transmitted by leeches as vectors. Trypanosomes have been reported in all major water systems of Africa (Wenyon, 1908; Hoare, 1932; Dias, 1952; Baker, 1960, 1961). (Pienaar, 1962; Negm-Eldin, 1997 and 1998) told that new species of trypanosomes from freshwater fishes have been described from South Africa and Egypt; and this is agreed with my result that I found *Trypanosoma* in *Oreochromis niloticus*. The parasite has a cosmopolitan distribution and it is found in both freshwater and marine fish (Hassan *et al.,* 2007; Smit *et al.,* 2000). The results in line with all above.

In my result I found *Trypanosoma sp.* In the blood of *Oreochromis niloticus* in White Nile Sudan, and this is in contrast with (Baker, 1960, 1961) who recorded that *Trypanosoma*, frequently infect *Clarias gariepinus*. Trypanosomes occur in *C. lazera*, in the Near East, but not in cichlids or cyprinids (Becker and Overstreet, 1979). The haemoparasite belonging to the genus *Trypanosoma* species have been reported to occur in Lake Victoria by Paperna (1996) in *Oreochromis variabilis (54%), O. esculenta (50%), Clarias gariepinus* and *Bagrus spp* x

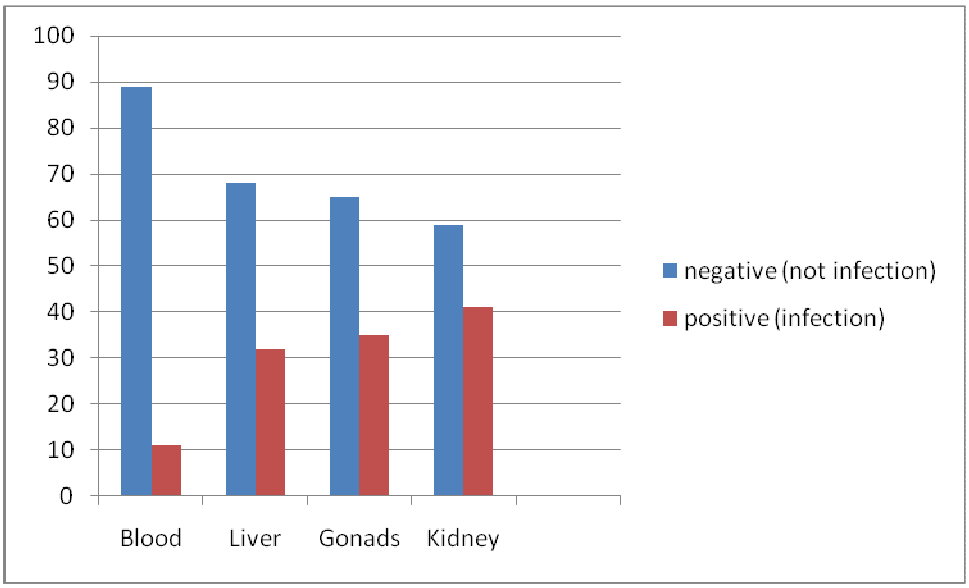

Figure 2. Infected and not infected samples in Jabal Awalia.

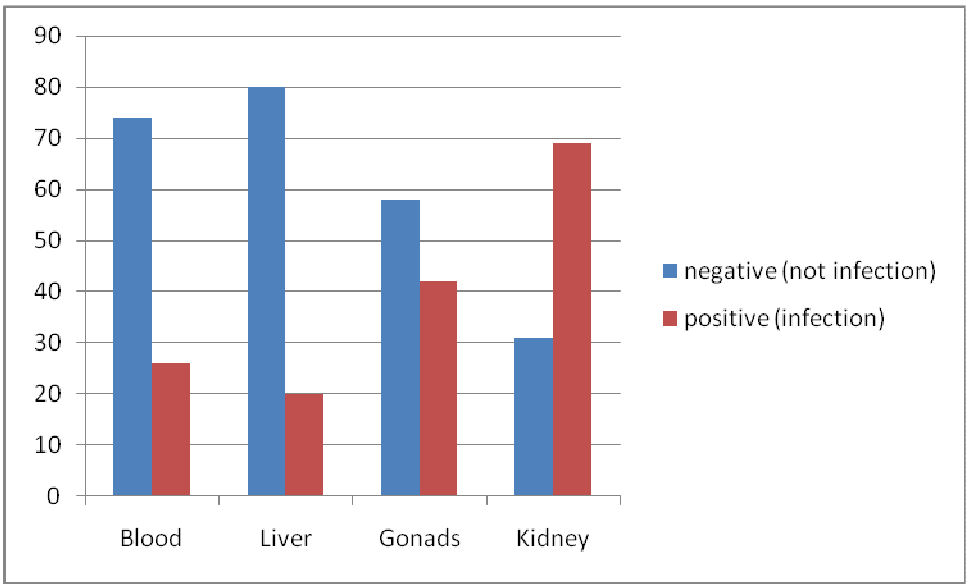

Figure 3. Infected and not infected samples in Khartoum.

(Paperna, 1996). *Oreochromis niloticus* infection has been reported in Lake George in Uganda but not Lake Victoria (Baker, 1961; Paperna, 1996).

Also *Cryptobia sp.* Found in *Oreochromis niloticus* in Liver, Kidney and Gonads and this is in line with Landsberg and Paperna, (1986) who recorded that *Cryptosporidium* is a common parasite of the stomach in wild and cultured cichlid fry (*Oreochromis* spp.) in Israel. Also (Hoare, 1932; Dias, 1952) reported that it found in various freshwater and marine fish; in Africa: in Cichlidae, *Clarias* spp., *Bagrus* spp., Synodontidae, Mormyridae, Mugilidae and *Protopterus aethiopicus*. But (Woo, 1987) reported that *Cryptobia* are not exclusively vascular parasites and (even sometimes the same species) also occur as ectoparasites on the fish body surface and in the digestive tract.

The result also recovered *Myxobolus sp.* And *Myxosporea sp.* Found in liver, kidney and gonad of

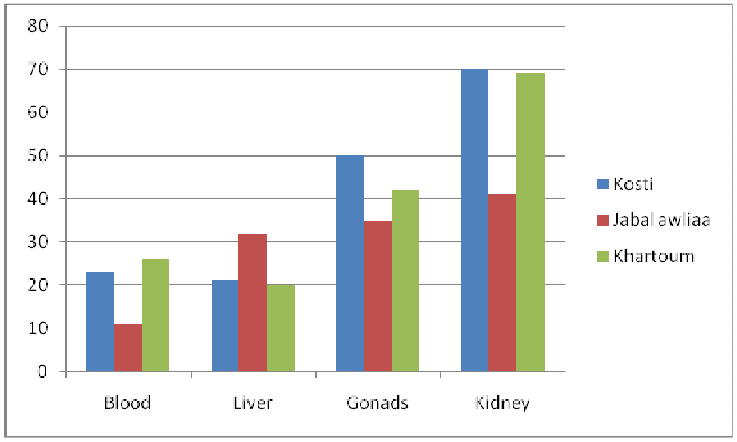

Figure 4. Infected samples in White Nile Sudan.

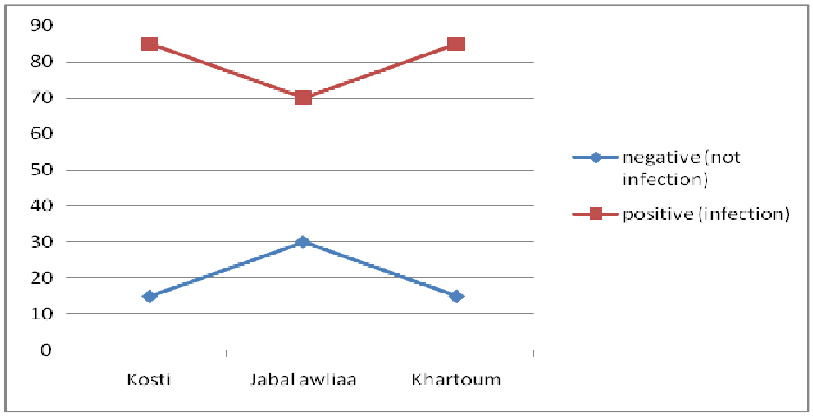

Figure 5. Carve of the total infected and not infected samples in the three locations.

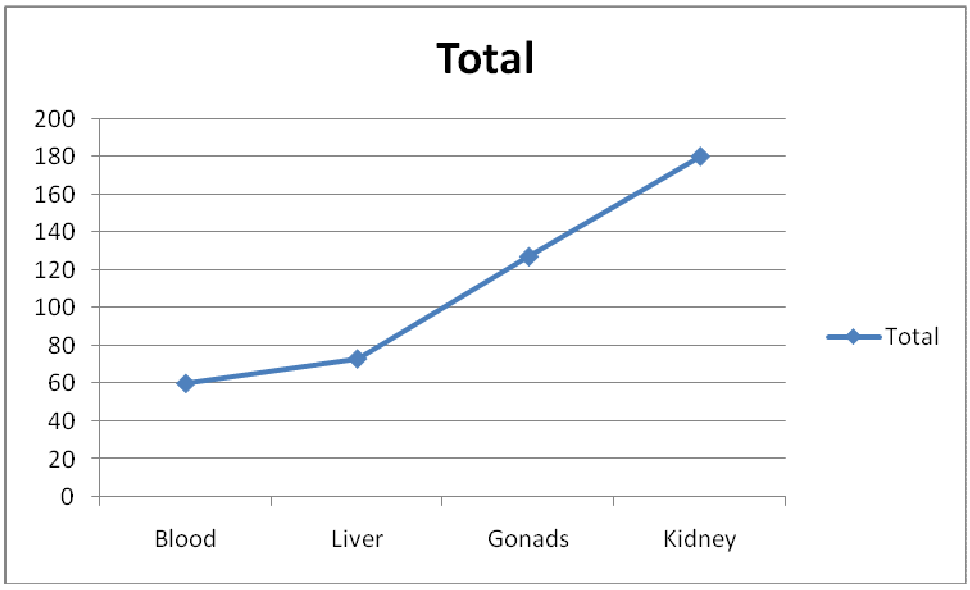

Figure 6. Carve of the total infected samples in the three locations.

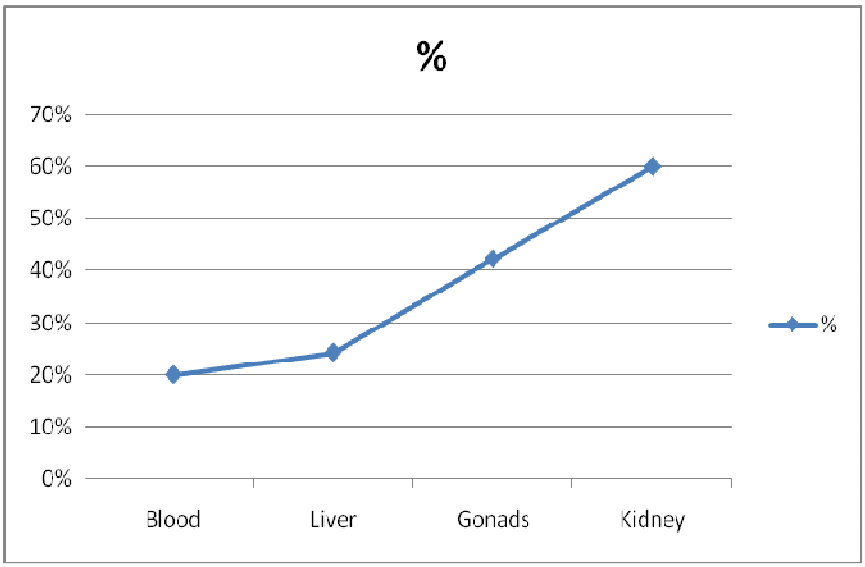

Figure 7. Carve of the percentage of the infected samples in the three locations.

Oreochromis niloticus and this result agree with (Paperna, 1973) who reported that infections are best known from cichlids, but also occur in fish from other families. And Kent et al. (2001) reported that *Henneguya* and *Myxobolus* form a polyphyletic clade comprised of both marine and freshwater species, and there a few studies have examined geographic variation of infection with marine *Henneguya species*.

Paperna, (1973) reported that *Myxobolus* cysts occur in the pharyngo-branchial cavity of (*Ctenopoma spp.*), the interior organs, muscles and viscera. Such infections are best known from cichlids, but also occur in fish from other families.

Ogawa et al. (1992) said that *Myxobolus sp.* Found in melanomacrophage centre in the kidney and the spleen. Cone and Easy, (2005); Moshu, (1992) mentioned that *Myxobolus 7 ullock7ti* in *Fundulus 7 ullock7ti* and *Sphaerospora lucioperca* in *Stizostedion lucioperca* are cases of ovaric infection in addition to other fish organs. But Pasmans et al. (2006) said that *myxosporeans* have not been described in gonads as frequently as in other organs.

CONCLUSION

The Conclusion summed up from this study is that positive result by protozoa infection in *Oreochromis niloticus* from the White Nile (Kosti, Jabal Awalia, and Khartoum) appearance in Blood, Liver, Kidney and Gonads. These include (*Trypanosoma sp., Cryptobia sp., Myxobolus sp. And Myxosporea sp.*). And the total infected samples (from Blood, Liver, Kidney and Gonads) in Kosti are (164samples), in Jabal Awalia are (119 samples) and in Khartoum are (157 samples) and generally the total infected samples from the White Nile Sudan are (440 samples in total of 1200 samples).

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