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Research Article

Helminthic Parasites Prevalence and Basic Parameters of Different Fish Species in Zobe Reservoir in Dutsin-Ma, Katsina State

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ABSTRACT

Helminth infection in fish has been reported to enormously disrupt aquaculture production, and its economic viability as well as raise community health concerns, so there is a need to assess our environment for fish safety and security. This study was carried out at Zobe Reservoir from October 2023 to January 2024. The fish species examined were *Amblyopsis spelaeus*, *Barbonymus swchanenfeldii*, *Bregmaceros, Pomfret*, *Marcusenius brucii,* and *Oreochromis niloticus*. Three hundred fish specimens were sampled, each for both ecto and endo helminths, length-weight relationship, and condition factor were Analyzed/measured using standard methods. The result obtained for parasitological examinations showed a higher prevalence in ectohelminthic compared to endohelminthic parasites recovered, of which *Oreochromis niloticus* has the highest parasitic infection prevalence of 60% and *Bregmaceros* has the lowest 6.0% parasitic prevalence. Ectohelminthic parasites recovered include *Benedina, Proteocephalus*, *Gyrodactylogyrus,* and *Dactylogyrus* while Endoheminth found were *Astiotrema*, *Aspidogaster*, *Monobothrium*, *Diphylbothrium*, *Nilonema* and *Termisentic*. The length-weight relationship and conditional factors for all individual fishes indicated a strong correlation and was found to exhibit both allometric and isometric growth patterns with b values ranging from (2.84 – 3.29) and K values ranging from (0.79 – 3.50). The mean physicochemical parameters analyzed including temperature (28.8±1.53), pH (7.9±0.9), turbidity (51.5±23.05), electric conductivity (488±98.1), dissolved oxygen (7.4±3.0) and biological oxygen demand (6.4±3.0). The result indicates that the water quality of the reservoir was quite poor in aiding fish survival from pathogenic helminthic parasites. The study recommends continuous awareness in this community and also the general public, on the prevention of helminth infestation.

Keywords: Condition factor; Helminthic parasites; Infestation; Length-weight relationship; Prevalence; Physicochemical parameters; Zobe Reservoir

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INTRODUCTION

Fishing is an ancient human tradition. It is a traditional activity involving the hunting and gathering of aquatic products for foods (FDF, 2005).Fish is one of the most valuable sources of protein food worldwide, people obtain about 25% of their animal protein from fish and shellfish by increasing intensification of fish product and lack of health management measures have led to many disease problems of bacteria, virus, fungi and parasitic origin (Mahmud *et al.,* 2011). Its growth is directly related to the quality of water. Hence, water quality monitoring can be used as an index to assess the status of aquatic ecosystem in which the fish lives (Olarenwaju *et al.,* 2017; Li *et al.,* 2022*;* Xie *et al*., 2023). Balance in physical, chemical and biologic properties of the water bodies (pond, lake and reservoir) is an essential tools for successful production of fish and other aquatic resources (Mohammed *et al.,* 2016) and (Tumwesigye *et al.,* 2020).

Parasites are invertebrate organism; some are free-living and can become opportunistic parasites while the obligate parasites require hosts for their

survival and productions. Both the opportunistic and obligate parasites are found in fish hosts but most parasitic diseases in fish hosts are generally caused by obligate Parasite (Ejere *et al*., 2014). Parasitism is assumed to cause harm to the hosts, but manipulation of the hosts is also suggested to have an effect on the parasite itself (Poulin *et al.,* 2005). External and internal parasites weaken the fish immune system and create conditions favorable to infectious disease, in severe cases these disease can also be deadly (Brewer and Greve, 2019).

Parasitic infections in fish have been reported to enormously disrupt aquaculture production and its economic viability. The occurrence rates of infection are closely related to the environmental conditions of the water body as well as the general health of fish. Water quality deals with the physical, chemical and biological characteristics about all other hydrological properties (Ahmed *et al.,* 2016). Various physicochemical and biological factors are used as determinant of water quality as they may directly or indirectly affect suitability of aquatic environment and invariability favors comfortability of parasites (Yerima *et al*., 2017).

Complain from farmers and consumers of observed signs of ecto and endohelminthic parasites in the fish bodies have led to the rejection of infected fish. Anthropogenic activities such as excessive application of fertilizer, industrial waste and over exploitation may results to water pollution which leads to susceptibility of fish to infection.

The scanty data and documents on parasites disease in Zobe Reservoir fish species bring about this work and this study will therefore investigate the helminth parasites on different species of fish in Zobe Reservoir, and assess the effects of water quality parameters on fish productivity with emphasis on intervention strategies of improving public health, food safety and security.

MATERIALS AND METHODS

Study Area

This study was conducted at Zobe Reservoir, Dutsin-ma Local Government Area of Katsina State. It's located between the latitude 12°N and between the longitudes 7°E in Figure 1. Its covers an approximate area of 968.544km^2 and has two major tributaries which comprised of Rivers Karaduwa and Gada. The Dam was constructed on River Karaduwa and extends to about 7 km long and a surface of about 4, 500ha. Annual rainfall in the area varies from 600-700mm; mean annual temperature is about 25^{o}C (Adedeji, 2005). For the purpose of this study three bigger villages around the dam site were selected and they are Garhi, Makera, and Tabobi. The Dam is utilized for irrigation, domestic, agriculture and fishing purpose.

Study Design and Sample Size

The study design used was cross sectional in nature, samples were collected for the period of the study from October, 2023 to January, 2024. The sample size was obtained using formula adopted by Danyaro *et al*. (2018) and Sadauki *et al.* (2022).

$N = Z^2PQ/d^2$

Z= Point of normal distribution curve equivalent to 95% confidence interval (1.96) p= prevalence rate from previous study: 48.5 = 0.485 (Sadauki *et al.,* 2022) q=1-p (constant) d = Precision limit or proportion of sampling error which is at 5% confidence limit

$$N = \frac{3.841*0.485*0.776}{0.005} = 289$$

The sample size was approximated to 300 fish samples

Sample Collection and Identification

A total of three hundred (300) samples comprising of six species (*Oreochromis niloticus, Amblyopsidae species, Bregmaceros, Barbonymus schwanenfeldii, Pomfret* and *Marcusenius brucii*) each were collected fortnightly from the study area during morning hours (7:00am – 9:00am) for period of four (4) months. The fish samples were transported alive to the biological sciences laboratory, Federal University Dutsin-Ma, Katsina State. Ina cooler plastic under ice-blocks and are sorted/identified using a pictorial guide of commercially important freshwater fishes of Nigeria by NIFFR, as well as the use of a field guide for Nigeria freshwater fish by Olaosebikan and Raji (2013).

Sex Determination

Sex determination of fish was done by physical observation of the urogenital papillae. It is long or distended in male while in the female it is round and reddish in the matured ones, visual observation of the gonads in male and ovaries in the female as confirmed by Imam and Dewu (2010).

Morphometric Measurement

The standard length was measured with a meter rule to the nearest 0.1centimetre (cm) while the weight was measured using a top loading sensitive weighing balance to the nearest 0.01gram (g) as described by Mgbemena*et al*.(2020).

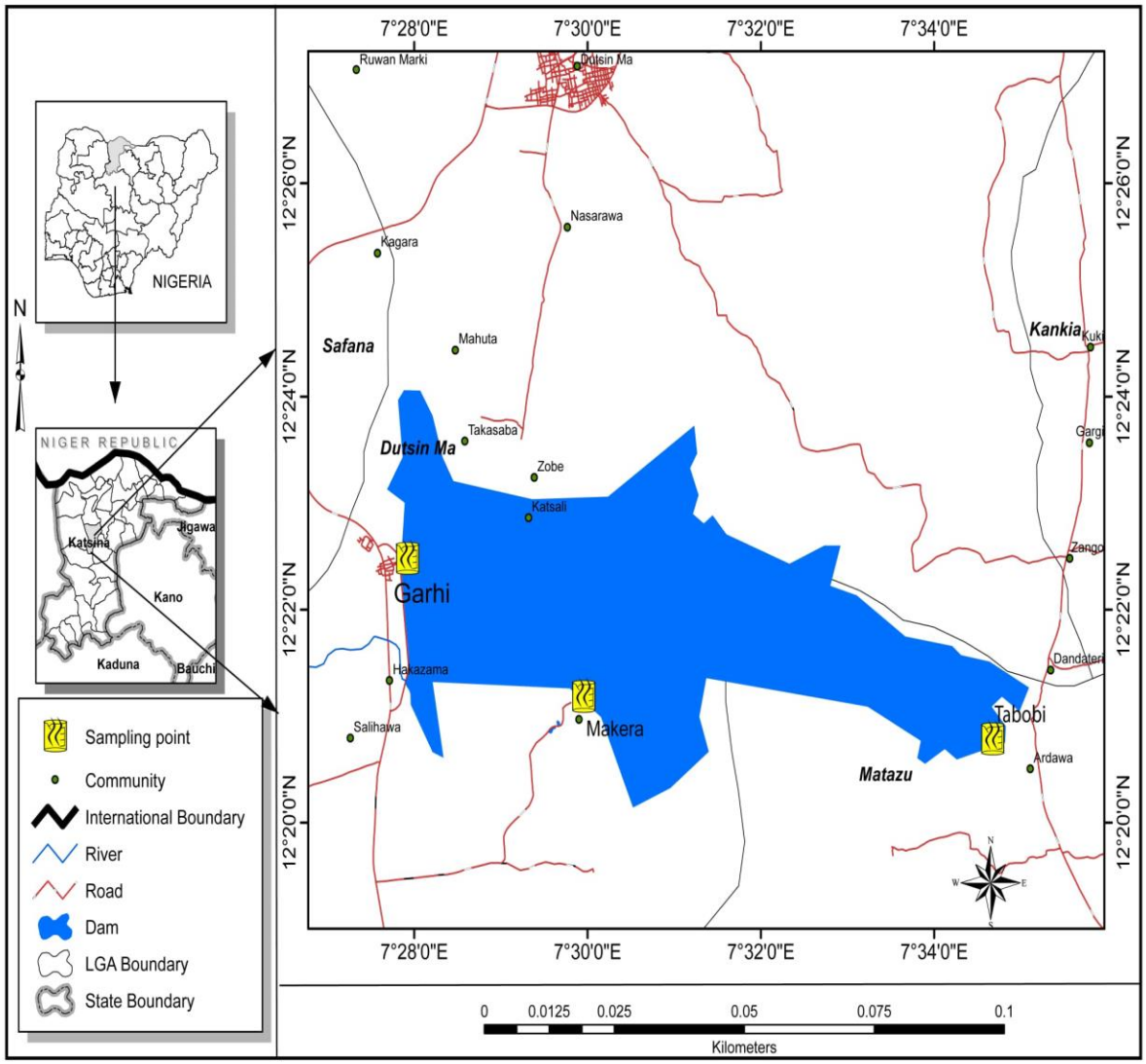

Figure 1: Map of Dutsin-ma showing the sampling site (G.I.S UMYU, 2024)

Examinations, Recovery and Morphological Identification of Samples for Parasites

Fish samples were taken out of the plastic container and placed on a clean dissecting board. Mechanical stunning method was employed in sacrificing un-death fishes (Biu and Nkechi, 2013).The external surface (skin and fins) were cut out and placed under a microscope for examination. Gills were cut out and placed into separate Petri dishes and observed with hand lens for ectohelminthic parasites while for endohelminthic parasites recovered, the fishes were dissected to expose the alimentary canal. Their alimentary canals were removed and sectioned into various parts; oesophagus and stomach, intestine and rectum. Their guts were used for parasitic examination because this is where food is most abundant for the parasites. Each section was placed separately in Petri dishes containing 0.9% normal saline. Each section was slit longitudinally and examined for parasites under a dissecting microscope at 10X and 40X magnification. The appearance of any worm was easily noticed by its wriggling movement in the saline solution under a microscope. Parasites found were counted, and thereafter fixed and preserved in 5% formalin. Representative parasites were stained overnight with weak solution of Erich's haematoxylin (Paperna, 1996). Then the slime substance on the skin of the sampled fish were removed and kept in a sterile container labelled for each station, followed by the addition of few quantity of saline solution for examination using hand lens (Moons, 2021). Parasites seen were counted manually under the microscope as described by Sures (2008).

The sorted specimens were kept in 70% ethyl alcohol for long-term storage (Mikail and Neslihan, 2020).Morphological identification of specimens to the least possible taxon was done with the aid of

pictorial guide of Medihat *et al.* (2020) and the identification keys of Paperna (1996).

Water Sampling Procedures and Duration

Water samples were collected in a 300ml sample collection bottle by lowering the bottle slowly into the water at the depth of about 0.5meters and allowed to fill and covered tightly as adopted by Abba *et al.(*2018) from Zobe Reservoir fortnightly during morning hours (7:00am – 9:00am) for a period of 4 months (October, 2023. to January, 2024.) The entire water samples were analyzed in the laboratory.

Physicochemical Parameters

Water quality parameters were investigated and determined in the site using SOPS of APHA (2012), La Motte Tracer (pocketester) code 1766 and LaMotte Fresh Water Aquaculture Test Kit (Model: AQ2, Code: 3633-03). Water temperature (^oC), turbidity (cm), pH of water, Dissolved oxygen (mg/l), Electric conductivity and Biological oxygen demand (mg/l) were all measured using digital thermometer, turbidity meter, digital pH meter, D.O meter and multi-meter respectively and data recorded in the laboratory as described by Abba *et al. (*2018).

Determination of Length Weight Relationship

The length weight relationship of fish species was determined using the formula described by Wang *et al.* (2012) and Kahraman *et al.* (2014). As follows:

$W= aL^b$..... (1)

Equation 1 above and the data were transformed in to logarithms before calculations

Therefore equation becomes:

Log W = a + b Log L..... (2)

Where W= weight in gram

L= Total length in Centimeter

'a'= intercept/ constant

'b'= slope/an exponent

The 95% confidence interval (CI) of b was computed using the equation:

CI: b ± (1.96 x SE)..... (3)

Where SE is the standard error of b

Determination of condition factor (k)

The condition factor (k) was estimated for individual fish species using the formula by Mehanna and Farouk, (2021) and Froese (2006) as follows:

$K= 100W/L^3$..... (4)

Where W= weight

L= total length

Data Analysis

Data collected from this study were entered into Microsoft Excel 2007 and were analyzed using statistical package for Social Sciences (SPSS-version 21).

Isolation and Identification of helminth parasite were done using a field guide by (Paperna, 1996; Moravee, 2006 and Medihat *et al.,* 2020).

Prevalence of both ecto and endo helminthic parasites were obtained using descriptive statistics in percentage (%).

Physico-chemical parameters were analyzed using analysis of variance (ANOVA).

Linear regression and correlation analysis was used to determine the length weight relationship and condition factor (k) was calculated using Fulton's formula.

For all statistical analysis, a significant level (p-value) less than 0.05 was considered as statistically significant.

RESULTS

Six different fish species were sampled for this research at the fishing location and sampled were collected from the fisherman immediately after fishing. The sampled fish included *Amblyopsis spelaeus, Bregmaceros, Barbonymus schwanenfeldii, Pomflet, Oreochromis niloticus* and *Marcusenius brucii* with 50(16.67%) each. Helminthic parasites recovered and identified from these fish species includes *Astiotrema, Aspidogaster, Monobothrium, Nilonema, Proteocephalus, Benedina, Dactylogyrus, Termisentic, Enterogyrus, Diphylbothrium, Gyrodactylogyrus and Monobothrium* while Ambylopsis was infected with none as shown in Table (1).

Prevalence of Ecto Helminthic Parasites of Fish Species in Zobe Reservoir

Table 2 revealed that out of six (6) different fish species sampled only three(3) species were found to be infested with ecto helminthic parasites with the overall Prevalence of 33.33% of which *promflet* has the highest parasites count of nine (9), while *O. niloticus* has the least count of seven (7).

Prevalence of Endo Helminthic Parasites in Fish Species from Zobe Reservoir

Endohelminthic parasites were of only four (4) species of fishes with the overall prevalence of (27.00%). *O. niloticus* had the highest number of recovered parasites count of (29) as well as the highest prevalence of 60.00% followed by *Barbonymus schwanenfeldii* and *Marcusenius brucii* with (17) counted recovered parasites each while *Bregmaceros* has the lowest count of (14) recovered endohelminthic parasites as shown in Table 3.

Physicochemical Parameters Mean and Standard Deviations of Zobe Reservoir

Table (4) below revealed that the values obtained for physicochemical parameters in Zobe Reservoir are significant differences ($P<0.05$) as a result of

fluctuations between the study months. The month of October and November shows no significant differences (P<0.05) in the values obtained as well as the month of December and January but between October and January there is significant differences (P<0.05) due to change in weather conditions.

Length Weight Relationship Analysis and Condition Factor of Zobe Reservoir Fish Species

The relationship between the length and weight of a fish is to assess the physiological well-being while condition factor provide information on the physiology stage of a fish in relation to its welfare. The correlation coefficient (r) range from 0.920-0.980 and this showed a strong correlation between the weight and length of the fish species while the slope (b) ranged from (2.99 -3.16) and this revealed that the sample fish exhibited from isometric to positive growth pattern while the condition factor (k) are greater one (>1) which indicated that all the fish species are in good health conditions as shown in Table 5.

Table 1: Fish Helminthic Parasites Identified from Zobe Reservoir

Fish Host	Parasite Species
Ambylopsis	NONE
Bregmaceros	*Astiotrema & Aspidogaster*
Promflet	*Proteocephalus & Benedina*
Barbonymus schwanenfeldii	*Dactylogyrus, Termisentic* & *Nilonema*
Marcusenius brucii	*Enterogyrus* & *Aspidoster*
Oreochromis niloticus	*Diphylbothrium, Gyrodactylogyrus, Monobothrium* & *Termisentic*

Table 2: Prevalences of Ecto Helminthic Parasites of Fish Species

Fish host	No. Examined	No. Infected	Prevalence (%)	Parasite species and number recovered
Promflet	50	5	10.00	*Proteocephalus*(7) *& Benedina*(2)
Oreochromis niloticus	50	30	60.00	*Gyrodactylogyrus* (7)
B. schwanen.	50	15	30.00	*Dactylogyrus* (8)
Total	150	50	33.33	24

Table 3: Prevalences of Endo Helminthic Parasites of Fish Species

Fish host	No. Examined	No. Infected	Prevalence (%)	No. Parasites recovered	Parasite species
Bregmaceros	50	3	6.00	14	*Astiotrema* (9) *& Aspidogaster* (5)
Barbonymus schwanenfeldii	50	15	30.00	17	*Termisentic* (10) *&nilonema* (7)
Marcusenius	50	6	12.00	17	*Enterogyrus* (7) *&aspidoster* (10)
Oreochromisniloticus	50	30	60.00	29	*Diphylbothrium* (8)*, monobothrium* (11) *&termisentic* (10)
Total	200	54	27.00	77(76.24%)	129

Table 4: Physicochemical Parameters Mean and Standard Deviations of Zobe Reservoir

Months/Year	Temp (°C)	pH	E/C(µS/cm)	Turb(NTU)	DO (mg/l)	BOD(mg/l)
October, 2023	29±1.06^{b}	8.4±0.65^{b}	380±90.2^{b}	33±28.46^{b}	7.4±3.0^{b}	5.8±2.7^{b}
November, 2023	31±0.96^{b}	8.1±0.63^{b}	402±96.1^{b}	50±22.02^{b}	5.2±2.5^{b}	4.6±1.94^{b}
December, 2023	28±1.05^{a}	7.8±1.00^{a}	520±109^{a}	60±13.08^{a}	8.0±3.1^{a}	7.4±3.0^{ab}
January, 2024	27±1.70^{a}	7.0±0.10^{a}	650±140^{a}	63±13.00^{a}	8.2±3.2^{a}	8.0±3.1^{ab}
Mean	28.8±1.5	7.9±0.9	488±98.1	51.5±23.05	7.4±3.0	6.4±3.0
P. Value	0.008*	0.302	0.151	0.832	0.022*	0.124

Keys: Temp=Temperature, pH=Hydrogen ions, E/C=Electric Conductivity, DO=Dissolved Oxygen, Turb= Turbidity and BOD= Biological Oxygen Demand.

Table 5: Length Weight Relationship Analysis and Condition Factor of Zobe Reservoir Fish Species.

FISH HOST	N	MTW	MTL	k	a	B	r	p	G.P
Ambylopsis	50	2.81	5.88	1.38	0.0089	3.10	0.959	0.05	+A
Bregmaceros	50	8.80	6.31	3.50	0.0050	3.19	0.940	0.05	+A
Promflet	50	11.18	9.78	1.19	0.0045	3.16	0.960	0.05	+A
B. schwanenfeldii	50	16.03	10.86	1.25	0.0040	3.09	0.930	0.05	+A
Marcusenius	50	7.41	8.85	2.15	0.0032	3.08	0.920	0.05	+A
O. niloticus	50	104.8	16.96	1.70	0.0120	2.99	0.980	0.05	I

KEYS: GP = Growth pattern (+A) Positive allometric (-A) Negative allometric (I) isometric MTL= Mean total length MTW= Mean total weight (a) = Intercept (b) = Slope P=Probability P=<0.05 (R) =Correlation coefficient and N= No. examined

DISCUSSION

The fish Species collected from Zobe Reservoir in this research study was found to be infected by helminth Parasites both in their external and internal organs and the Parasites recovered were identified to be: *Astiotrema, Aspidogaster, Monobothrium, Nilonema, Benedina, Dactylogyrus, Gyrodactylogyrus, Termisentic, Enterogyrus, Diphylbothrium and Proteocephalus* respectively. *Ambylopsis speleaus* was not found to be infected with any helminth Parasites for this study which might be due to it feeding habits or over exploitation, this is in line with the findings of Chris *et al.(*2023) who recorded that till date several species of *Ambylopsis* have yet to be reported with parasites in Arkansas, United States of America. According to Helfman *et al.* (2009) *Ambylopsis* might lack parasites due to their habitat which generally offers a poor food supply which is of advantage in their environment including extremely stable conditions, few competitors and few predators. All the parasites species isolated from the fishes examined didn't show any specify for fish species, the higher intensity/occurrences may be due to a product of factors influencing parasitism been it (biotic, aboitic and environmental factors) and this is in agreement with the report of (Kelly *et al*., 2010; Rohlenova *et al.,* 2011 and Onyishi and Aguzie, 2018) who stated that higher intensity of parasites and it's occurrences are as a result of feeding habit, immune suppression and host suitability for parasites establishment. The Parasites identified belongs to the taxonomy Nematodes, Cestodes and Trematodes only of which *Termisentic*, *Aspidogaster* and *Monobothrium sp*. had the highest level of occurrences rate while *Benedina* has the least occurrences rate for this study is in line Sadauki *et al*.(2022) on *Clarias gariepinus* in both Ajiwa and Zobe Reservoir and recorded *Benedina* to has low occurrences rate of 2(1.1%) and suggested that parasitic Prevalence increases as the fish grows increase.

The overall Prevalence for both ecto and endo helminthic parasites of the fish species was (19.67%) for this study, the Prevalence was low compared to the Prevalence obtained from the findings of (Onyishi and Aguzie, 2018; Nwani *et al*., 2008&Uneke and Egboruche, 2015) who recorded the Prevalence of 64.5%, 41.0% and 75% respectively in their research work. It's suggested to be as a result of fast flow of water in the reservoir and is similar to report of (Oniye *et al.,* 2000; Ezenwaji, 2002 and Nwani, 2004) who stated that Relative fast flow of water in lactic habitats would inevitably reduce the hot parasites contact frequency and led to a low Prevalence. This study Prevalence is similar to Prevalence recorded by Anthony *et al.(*2014) of 18.5% this might be because the findings were carried out in same season. The Prevalence was higher than the prevalence obtained from findings of Atolabi *et al*. (2018) at Zobe Reservoir and recorded the prevalence of 16.30% and this difference in prevalence can be as a result of interplay and effects of biotic and abiotic factors in the reservoir and as well as the environmental impact in the study area.

The ecto-helminthic parasites prevalence in this study (33.33%) was lower compared to the prevalence recorded in the study of (Awa *et al.,* 2014; and Onwuliri and Mgbermana, 1987) as a result of weather or season of the research study.this current prevalence was higher than the prevalence recorded in (Omeji *et al*., 2014; Anothony*et al*., 2014 and Ahmed *et al*., 2007) this might be due to effect of anthropogenic activities within the study area. The present prevalence was similar to the prevalence recorded by (Bagudo *et al.,* 2019; Bichi *et al*., 2010 and Odedeji *et al.*,2015) which is due to relative environmental factors. Methange, 2010 and Kezial *et al.,* 2018 suggested that low condition factor of fish might increase parasites establishment in water bodies.

The prevalence of endo-helminthic parasites for this study was higher than the prevalence obtained in the study of (Oniye *et al*., 2014; Khalil *et al.,* 2009 and Nwani, 2004) and was suggested to be as a result of both biotic and abiotic factors as well as high stock density which are responsible for higher prevalence also fluctuation in prevalence. Study

prevalence was low compared to the prevalence recorded by Mikhail and Neslihan (2020) of 44.02% in Menzelet dam in Karhramanmaras province Turkey and was in disagreement with study of Atolabi *et al.*(2018) who reported 16.30% for *Acanthocephala* per *Cestodon zillii.* Variation in prevalence of helminth Parasites infection may be attributed to abiotic and biotic factors which are determinant of disease burden (Thompson and Larson, 2004).The occurrences and distribution of Parasites in the examined fish species was in agreement with the findings of Abdel-Gaber *et al*.(2019) and Sadauki *et al.,* (2022) In this study it was observed that helminth Parasites infection are higher in bigger fish as was seen in *Oreochromis niloticus* which has the highest prevalence and number of Parasites recovered, this is due to their longer period in water which makes them more expose to parasites. This is similar to the findings of (Ayanda,2009) and this is related with the findings of (Akinsanya *et al*., 2018; Sadauki *et al*.,2022 and Ashade, 2013) who reported that bigger fish compared to small fish species tends to be more expose to parasitic infection.

The physicochemical Parameters of the study area falls within the acceptable ranged and set limits of (NESREA, 2011; USEPA, 2009 and APHA, 2012). Although has variation in months due to change of weather conditions or climate change. The water temperature of the reservoir ranged between 27°C and 31°C which is good for fish culture in tropical area (WHO, 2008) which differ from the find of (Mustapha, 2008 and Ango *et al.,* 2013) as a result of different in season the research was conducted and result were similar to research findings of (Ibrahim *et al.,* 2009 and Antem *et al.,* 2002). Variation in water temperature for months could be attributed to change in weather condition such as sunshine durations and absorption of solar radiation by the reservoir water.

The hydrogen ion concentration (pH) range from neutral to alkalinity throughout study period and is similar to findings of (EPA, 2010; WHO 2008; Wang *et al*.,2022; Murdock *et al.*,2002) Any value outside the range 6.5-8.5 may have sour taste and could be corrosive to metals.

Electric conductivity for this research is a bit higher than the set limit by (WHO, 2008 and APHA, 2012) and this is similar to findings of Oben, (2002) as a result of pollutants particles for industrial waste/run-off and suggested that amount of polluting particles.

Water turbidity reflects transparency and is important criterion for assessing the quality of water. The mean turbidity of this study is higher than set limits of WHO and this indicates that the entire reservoir contains pollutants and could pose problems to aquatic lives and is similar to findings of (Akan *et al*.,2008; Mebrahtu and Zerabruk, 2011; Pal *et al.,* 2013) Higher turbidity stimulate hatching of larvae (Gupta and Gupta, 2006).

Dissolved oxygen (D.O) of this study fall with the acceptable ranged set up (USEPA, 2009; APHA, 2012) and was similar to the research findings of Oniye *et al.* (2002) Mustapha (2008) and Anago *et al*. (2013) it suggested that D.O values obtained from this research is good and promote the growth and survival of fish in the reservoir.

Biological Oxygen Demand (BOD) mean values obtain was higher than the limit stipulated by NESREA, (2011) this is as result high biological activities this agrees with the findings of (Usman, 2016) who report higher BOD Values in dry season and was not in line with the findings of Abubakar *et al*. (2017) and Abida & Harkrishna (2008) as a result difference in the season which the research was conducted and suggested that high biological activities such as decomposition of dead, decaying organic matter and Photosynthesis etc. as a result of massive microbial population are not safe for drinking and survival of aquatic organism.

The weight length relationship (WLR) for this study revealed that all the sampled fish species exhibited positive allometric growth pattern except for *O. niloticus* who showed isometric growth pattern, this is similar to the study of Kumola and Ndimela (2011)and that of Hassan (2017) at Ologe lagoon, Lagos State and Dama Reservoir, Nasarawa State respectively. According to Zafar *et al*. (2003*)* and Odedeji *et al.* (2007) reported that fish weight is considered to be a function of length. Fish can attain either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is associated with no change in body shape as organism grows. Negative allometric growth implies the fish becomes more slender as it increases in weight while positive allometric growth implies the fish becomes relatively stouter or deeper bodied as it increases in length (Riedel *et al.,* 2007). Change in WLR is as a result of differences in sampling season, geographical areas and as well as feeding habit. This is in line with findings of Wang *et al.* (2017) and Weliange & Ameresinghe (2007) who confirmed that environmental factor in relation to interplay can influence change in length weight relationship.

Condition factor of all the fish species examined are in good health condition and this agrees with the findings of Adeyemi (2011) who recorded K values between 1.23 and 2.36 at Idah Area of River Niger, Kogi State and disagrees with the findings of Mzungu *et al*. (2018) and Nazeef *et al*.(2018) both recorded K values less than 1 and this might be as a result of either stress, biotic, abiotic, overcrowding,

environmental factor, water quality parameters etc and can leads to fluctuation in fish condition factor, this is in line with reports of several researchers such as Alex *et al*. (2012), Nehemia *et al*. (2012) and Khallaf *et al*. (2003) they all suggested that variation in condition factor of fishes are attributed to difference in stress level, season, sex, water quality parameters and availability of feeds. WLR can be used to predict weight from length measurement made in fish yield assessment (Alex *et al.,* 2012; Mehanna and Farouk 2021).

CONCLUSION

The results from this research work reveals that several factors such as biotic, abiotic and environmental factor as well as feeding habit has greatly contributed/influenced changes in physicochemical parameters, condition factor and weight length relationship of the examined fish species of which led to increase parasites establishment in water and exposure to helminthic parasites infections.

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