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PHYSICO-CHEMICAL AND SOME HEAVY METALS CONCENTRATION ANALYSES ON THREE COMMON SPECIES OF FISH IN TUNGAN KAWO RESERVOIR KONTAGORA, NIGER STATE, NIGERIA

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ABSTRACT

Developing countries like Nigeria are faced with increased in generation of domestic, industrial and agricultural wastes, with a large percentage moving. This study evaluates the physico-chemical and some heavy metals concentration in three common species of fish from Tungan Kawo reservoir Kontagora, Nigeria; using standard methods between (July 2018 – February 2019); at four different sampling stations of human activities on the water. Five heavy metals were evaluated (Lead, Copper, Manganese, Iron and Chromium) in the fish samples. Phosphate (0.4 – 2.5) mg/L, Nitrate (3.2 – 7.5) mg/L, Temperature (27 – 32.4) ^{0}C, Dissolved Oxygen (2.4 – 5.2 mg/L), Conductivity (81 – 125 µS/cm), Biochemical Oxygen Demand (1.9 – 4.4 mg/L), Alkalinity (mg/L**)** and Total Dissolved Solids (117 – 198) ppm were within the standard for drinking water and survival of fish. However, the pH (6.3 – 9.8) was above the standard for NIS and WHO drinking water but can support aquatic life. Iron (0.64 ± 0.072 mg/kg) was the most highly concentrated in *Synodontis clarias* while lead (0.01 ± 0.013 mg/kg) was the lowest in *Oreochromis niloticus and Coptidon zillii (formerly Tilapia zillii*. This current finding indicates that the water is safe for both aquatic life and domestic purpose but not suitable for direct human consumption without being properly treated. However, there is the need for regular monitoring of the heavy metals load in this water body and the aquatic organisms because of the long term effects.

Keywords: *Kontagora reservoir, physicochemical parameters, Heavy metals, Fish, Human activities*

INTRODUCTION

Water is one of the most precious liquid that exists on the earth; however, the introduction of pollutants into the aqua system has set off a complicated series of biological and chemical reactions. In Nigeria, the freshwater are used for the disposal of refuse, human sewage, irrigation, abattoir waste water etc. This has caused tremendous threat to the biota (Arimoro, 2007). Patrick *et al.* (2015) stated that physiochemical parameters are one of the many routine practices of determining the health of the ecosystem and the survivability of the living biota within it. It is very essential and important to test the water before it's used for human purposes (Patil *et al.*, 2012). Selection of parameters testing of water solely depends upon what purposes we are to use that water for, to what extent need its quality and purity (Patil *et al.* 2012). Polluting aquatic environments with heavy metals has become a world-wide problem in recent years, because they are not biodegradable and most of them have toxic effects on organisms (MacFarlane, 2009). This has long been recognized as a serious pollution problem (Farombi *et al*., 2007). There are various sources of heavy metals in the ecosystem such as anthropogenic activities like draining of sewage, dumping of domestic wastes, recreational activities and storm water runoff, thereby rendering it environmentally unstable (Malik *et al*., 2010). These heavy metals find their way into aquatic systems through Agricultural practices like the use of fertilizers, herbicides and pesticides for the control of pests in cultivation of crops. Other activities such as mining industry as well as growth of the human population have increased the discharge of wastes into lakes and rivers rendering it environmentally unstable (Malik *et al*., 2010). It may also occur in small amounts naturally through the leaching of rocks, airborne dust, forest fires and deforestation (Ozmen *et al*., 2004). The family Cyprinidae which has a widespread distribution and is widely consumed by human beings in the world today, due to their high protein supply and omega-3 fatty acids that help reduce the risk of certain types of cancer and cardiovascular diseases (Ayanwale *et al*., 2018). These fishes can as well accumulate heavy metals through the food chain (Mansour, 2002). Fishes are widely used as bio-indicators for the determination of heavy metal pollution in aquatic ecosystems (Alibabić, 2007; Ahmad, 2010). The concentrations of heavy metals in tissues and organs of fishes could indicate their concentrations in water (Ogbeibu *et al*., 2002). Fishes are notorious for their ability to accumulate heavy metals in their muscles and since they play important role in human nutrition, they need to to be carefully screened to ensure that unnecessary high level of some toxic trace metals are not being transferred to man through fish consumption (Adeniyi and Yusuf, 2007). Fish normally collect heavy metals from food, water and sediment (Yilmaz *et al*., 2007) and their positive effects can be invalidated by the presence of heavy metals toxic in fish. Several adverse human health effects of heavy metals, including serious threats such as renal insufficiency, liver damage, heavy cardiovascular disorders and death, have long since been known (Meche *et al*., 2010). However, Kontagora Reservoir was constructed with the major objective of providing good drinking water to its township and its environment; nevertheless, the reservoir has become an excellent source of fish apart from being used for domestic purposes and also dry season farming (irrigation) which is a common practice around this Reservoir. Hence, there is urgent need to evaluate the physico-chemical and some heavy metals concentration in three common species of fish from Tungan Kawo reservoir Kontagora.

MATERIALS AND METHODS

Description of the study area

Tungan Kawo Reservoir is located in Kontagora, Niger State and it was officially commissioned in May 1991 by Niger State Water Corporation (NSWC). The Reservoir lies between latitude 10˚21"58.51˚N - 10˚23"28.50˚N of the equator and between longitude 5˚19"29.23˚E - 5˚20"59.23˚E (Geo-loation Sensor, 2018) in Tungan Kawo village, northwest of Kontagora (Figure 1). The main objective of the Reservoir is to provide water for domestic use to Kontagora Township, with a total storage capacity of 17.7 million cubic metres by Aquaculture and Inland Fisheries Project, AIFP (2004) and a surface area of 143 square kilometres. The Reservoir has its source from Kontagora River, a seasonal river (Ibrahim *et al.* 2009). The people residing close to the Reservoir and its environs are predominantly farmers and have remained so for years (Abdullahi *et al*. 2015).

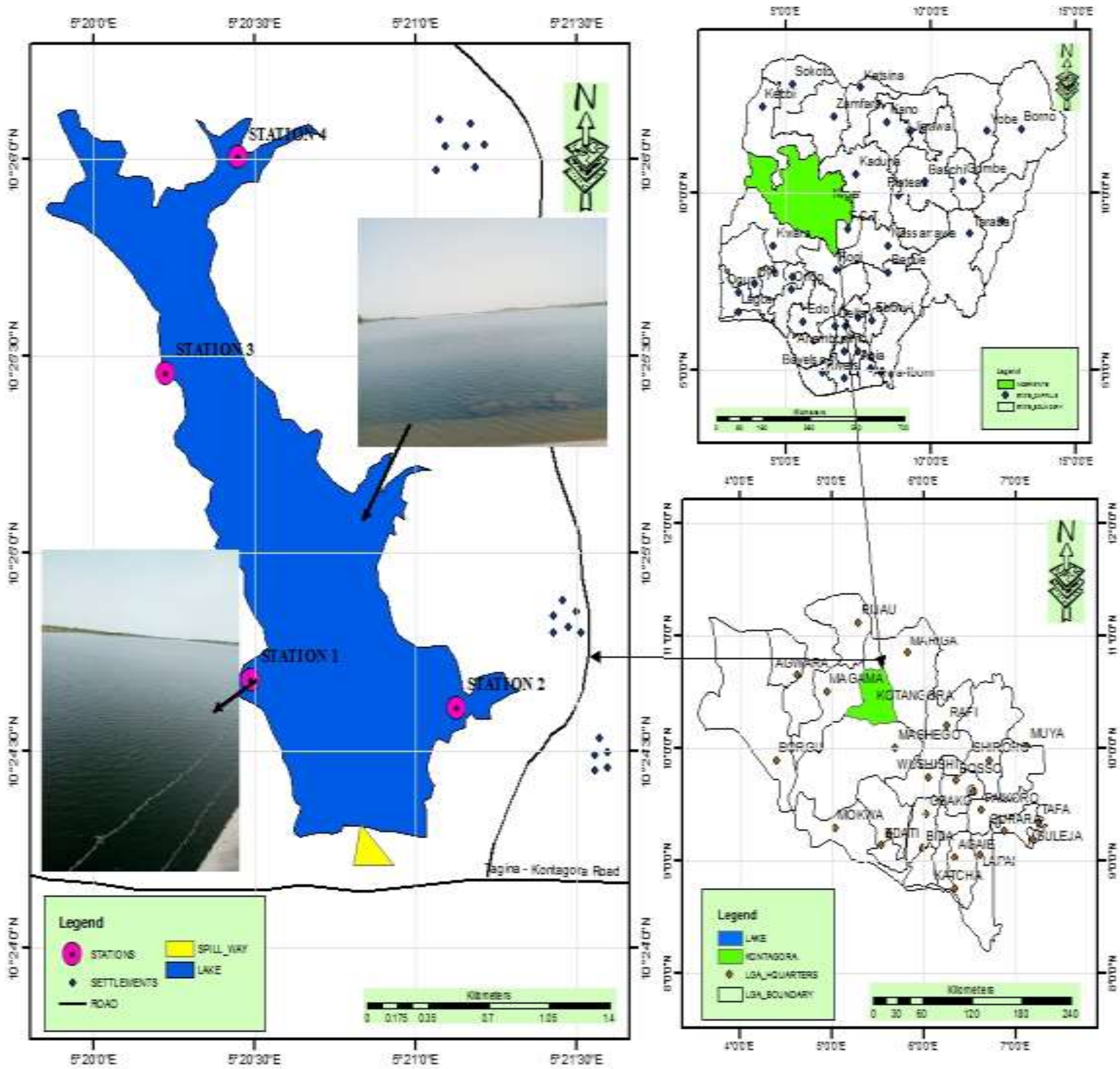

Figure 1: hydrological map of Tungan kawo reservoir

Source: Remote sensing/ graphically information system, FUTMINNA (2019).

Sampling techniques

Water samples for physicochemical parameters were collected monthly between the period of July 2018 to February, 2019, between 8.00 Am and 12pm of the day from the three sampling using 500 ml capacity specimen bottles. The water was fixed immediately using standard procedure of APHA (2014), before getting to the laboratory for further analysis.

Sampling Strategy

Samples of water and sediment were collected from four different sampling stations along the reservoir (study site) as follows: Station 1 (Kwatan Mustafa); Station 2 (Babban Kwatan); Station 3 (Kwatan Abdullahi) and Station 4 (Gonna Hajiya).

Physico-chemical Parameters Analyses

Temperature

Air and water temperatures were measured at each station in degrees centigrade using mercury in glass bulb thermometer (0 – 110 ^{0}C). Readings were taken at level of the eye meniscus. Air temperature was determined by holding the thermometer above water for about 2 minutes until it stabilized before reading according to EPA (2002). The water temperature was determined by lowering the thermometer into the water and reading was taken, when established, following the method of EPA (2002).

Electrical Conductivity (EC), Total Dissolved Solid (TDS) and pH

This was determined following the method of APHA (2014). At the field, pre-calibrated microprocessor pH/EC/TDS meter $(Jenwey: 4010\ model)$ was used. The pre-calibrated pH, TDS and Conductivity meter electrode was washed out by distilled water and then the cell constant of the conductivity meter was checked. The electrode meter was dropped inside and waited for at least 10 seconds. Then Electrical Conductivity (EC), Total Dissolved Solid (TDS) and pH readings were collected from the microprocessor meter and were recorded into a notebook.

Dissolved Oxygen (DO)

The determination of dissolved Oxygen (DO) was done in situ using a portable dissolved oxygen analyzer $(Model\ JPB-607)$ following (APHA, 2014) method; Procedure: DO meter was standardized by distilled water and buffer solution. Then drop inside the water and wait for at least 1 minute, after which reading was recorded from DO meter and written down into the notebook. In the same way, the procedure was repeated in all the sampling sites but before every measurement DO meter was sink into distilled water.

Biological Oxygen Demand (BOD)

This was determined according to APHA (2014) method. At the field, the reagent bottles set aside for BOD was filled with water samples and wrapped with black polythene bags to avoid any form of light penetration. The samples was then transported to laboratory and kept in a dark cupboard. After five (5) days, the procedure for carrying out dissolved oxygen was repeated to check the amount of oxygen that has been used up by microorganisms.

Calculation: $BOD = DO1 - DO5\ (mg/l)$

$DO1 = Initial\ dissolved\ oxygen\ at\ the\ first\ day$

$DO5 = Dissolved\ oxygen\ reading\ after\ 5-days$

$Result\ expressed\ in\ milligram\ per\ litre\ (mg/l$
)

Total Alkalinity

This was determined by titration methods following the method of APHA (2014**).** The collected water was measured to 50 ml and poured into a clean 150 ml conical flask, and then 3 drops of phenolphthalein indicator was added. The sample was titrated with 0.05ml of H_2SO_4, until the colour disappeared. To the colourless solution, 3 drops of methyl orange indicator was added and titrated further until the colour change from yellow to permanent reddish or orange red colour and the titrated values were recorded and used to compute the alkalinity.

Total Hardness

The water sample was thoroughly shaken and 25 ml was taken and diluted to 50 ml with distilled water. 2 ml of Phosphate buffer solution was added to bring the pH of the water sample to 10. Three drops of ferrochrome black indicator was also added. This was titrated with 0.01 Mol/L EDTA to a blue colour end point. Hardness was then calculated in line with APHA (2014) method.

Phosphate – Phosphorus (PO_4-P)

This was determined by colorimetric method. To 2 ml aliquot of the water sample in a 25 ml volumetric flask was added and one drop of phenolphthalein indicator followed by 2 ml of ammonium molybdate also 1 ml of freshly diluted stannous chloride solution. These was made up to 25ml volume with distilled water and mixed thoroughly. After 5 - 6 minutes and before 20 minutes, the colour intensity (absorbance) will be measured at a wavelength of 660 nm in a Spectrophotometer (OPTIMA SP 300, U.K.) following the method of APHA (2014).

Nitrate –Nitrogen (NO_3-N)

The reaction with the nitrate and brucine produces yellow colour that can be used for the colorimetric estimation of nitrate. The intensity of colour is measured at 410 nm. The method is recommended only for concentration of 0.10 – 2. Mg/L. All strong oxidizing and reducing agent interfere. Sodium arsenide is used to eliminate interference by residual chlorine; sulphanilic acid eliminates the interferences and chloride interference is masked by addition of excess NaCl.

High concentration of organic matter also may interfere in the determination.

Analyses of fish samples, and determination of Heavy metals

Heavy metals analyzed included, Lead, Copper, manganese, Iron and Chromium. Analyses for heavy metals were conducted in accordance with standard procedures by APHA (2014). This involved the drying of fishes to constant weight in an oven at 105^0C, grinding of dry fishes to very fine particles and digesting it using 10 ml of nitric acid (HNO_3) and 10ml hydrochloric acid (HCl) was added together that was heated for 75 minute on a water bath at 150^oc until odour is clear. The fish sample were then removed & allowed to cool for about 25 minute under room temperature. The cooled sample was then filtered into $100cm^3$ volumetric flask and the filtrates were made up with distilled (Olafisoye *et al.* 2013). The prepared sample solution were then transferred into the pre-cleaned labeled sample bottles in readiness for Pb^+, Cu^+, Mn^+, Fe^+, and Cr^+ using Atomic Adsorption Spectrophotometer (AAS) analysis (*model: wfx-110A*).

Data Analysis

One way Analysis of Variance (ANOVA) followed by Duncan Multiple Range (DMRT) test was used to determine the differences between the sampling station and months using SPSS IBM (Version 21 for window) statistical package at P<0.05 level of significance.

RESULTS

Physicochemical parameters of Tungan Kawo Lake,

The mean, standard error and range of physicochemical parameters measured during the study period in Tungan Kawo Reservoir, Kontagora, between July, 2018 and February, 2019 is summarized in Table 1. Water temperatures fluctuated between (27-32.4 ^{0}C) in station four. However, it indicated no significant difference (P > 0.05) across all the sampling stations. The pH values ranged from (6.6 – 9.8) mg/L in Station one. Electrical Conductivity (µS/cm) revealed no significant difference (P > 0.05) with a highest mean value (105 ± 5.28) in station four while the least was recorded in station two with the mean of (96.4 ± 3.92) mg/L. The mean value for Total Dissolved Solids (ppm), Alkalinity, hardness and Phosphate ranged from 115 ppm to 198 ppm, 16 mg/L to 34 mg/L, 20 mg/L to 54 mg/L and 0.35 mg/L to 2.5 mg/L respectively and were also not significantly different (P > 0.05) in all stations sampled. The Biological Oxygen Demand (BOD) level ranged from 1.9 mg/L to 4.4 mg/L while high levels of Nitrate were recorded in the four Stations at some points (ranged between 3.6 mg/L to 7.5 mg/L. However, dissolved oxygen, BOD and nitrates were significantly different (P < 0.05) along the Stations, but there was wide variation.

Table 1: Mean and range values of physicochemical parameters of Tungan Kawo Reservoir, from July 2018 to February, 2019.

Environmental Variable	Station 1	Station 2	Station 3	Station 4	*NIS	**WHO
Water Temperature (^{0}C)	29.70±0.51[a] (27.2-32.1)	30.39±0.46[a] (28-31.8)	30.4±0.48[a] (27.9-32.1)	30.65±0.63[a] (27-32.4)	–	30-32
Ph	8.4±0.46[a] (6.6 – 9.8)	8.11±0.50[a] (6.3 – 9.5)	8.3±0.48[a] (6.5 – 9.6)	8.3±0.44[a] (6.4 – 9.7)	6.5-8.5	6.5-8.5
Electrical Conductivity (µS/cm)	104±5.09[a] (87 – 122)	96.4±3.92[a] (84 – 115)	104.3±5.40[a] (81 – 124)	105±5.28[a] (88 – 125)	1000	1000
Total Dissolved Solids (ppm)	151.48±8.42[a] (117 – 198)	144.73±5.61[a] (120 – 165)	143.88±5.59[a] (118 – 168)	147.64±4.13[a] (126 – 163)	500	600
Alkalinity (mg/L)	24±0.73[a] (22 – 28)	23±1.11[a] (20 – 29)	25±1.24[a] (18 – 30)	23.4±2.09[a] (16 – 34)	100	100
Dissolved Oxygen (mg/L)	4.0±0.33[a] (2.6 – 5.2)	3.89±0.28[a] (2.5 – 5.1)	3.6±0.29[b] (2.4 – 4.8)	3.78±0.29[b] (2.6 – 4.9)	–	7.5
BOD (mg/L)	3.25±0.30[a] (2.0 – 4.4)	2.83±0.26[b] (2.0 – 3.8)	2.63±0.26[b] (1.9 – 3.8)	2.83±0.26[b] (2.0 – 3.8)	–	6
Hardness (mg/L)	33.5±2.25[a] (25 – 46)	35.75±3.06[a] (26 – 52)	34.75±3.02[a] (28 – 54)	33.38±3.49[a] (20 – 51)	150	150
Nitrate (NO_3) (mg/L)	4.48±0.57[a] (3.2 – 7.5)	4.90±0.58[b] (3.5 – 7.5)	4.55±0.40[a] (3.4 – 6.5)	5.24±0.44[b] (3.6 – 7.5)	50	11
Phosphate (mg/L)	0.89±0.14[a] (0.6-1.5)	1.15±0.24[a] (0.4-2.5)	1.36±1.1[a] (0.4-2.0)	0.96±0.11[a] (0.5-1.5)	–	5

Values followed by the same superscript alphabets in the row are not significantly different at ($P > 0.05$) tested by Durcat Multiple Range Test. *Nigerian Industrial Standard, (2015) ** World Health Organization, (2011

Heavy metals in Fish samples of Tungan Kawo Lake

The Concentration of Lead, Copper, Manganese, Iron and Chromium in dominant Fishes measured from four different stations of Tungan Kawo Reservoir were presented in Table 2. The result obtained for lead showed a gradual increase in the concentration of lead ions from the three selected fishes with a mean value of 0.01 to 0.02 mg/kg. Lead concentrations were not significantly different (P > 0.05) between the species fish. The lowest Copper concentration (0.10 mg/kg) was recorded in *Synodontis clarias* while the highest value of 0.22 mg/kg was recorded from *Oreochromis niloticus*. Copper was not significantly different (P > 0.05) between *Synodontis clarias* and *Oreochromis niloticus*. However, Chromium showed a significant different (P < 0.05) between *Coptidon zillii* and *Oreochromis niloticus*; *Synodontis clarias* respectively. The lowest Manganese mean value of 0.19 mg/kg was recorded in *Oreochromis niloticus* while the highest Manganese mean value of 0.22 was observed in *Synodontis clarias*. Manganese was not significantly different (P > 0.05) between the fishes. The highest Iron mean value of 0.64 mg/kg was recorded in *Synodontis clarias* while the lowest Iron mean value of 0.54 mg/L was reported in *Coptidon zillii*. Iron was not significantly different (P > 0.05) between the fish's tissues. Chromium was detected in the fish tissue from the lake. It fluctuated between 0.15 to 0.22 mg/kg. The lowest value of 0.15 mg/kg was observed *Oreochromis niloticus*, while the highest value of 0.22 mg/L was recorded in *Synodontis clarias*. Chromium was not significantly different (P > 0.05) between in selected fishes.

Table 2: Heavy metals concentration in (mg/kg) of dominant fish samples from Tungan Kawo Reservoir, Kontagora from July 2018 to February, 2019.

Samples	**Pb$^+$**	**Cu$^+$**	**Mn$^+$**	**Fe$^+$**	**Cr$^+$**
F1	0.01±0.013^a	0.13±0.015^b	0.19±0.024^a	0.62±0.044^a	0.15±0.019^a
F2	0.01±0.013^a	0.10±0.007^{ab}	0.22±0.021^a	0.54±0.031^a	0.19±0.153^a
F3	0.02±0.018^a	0.08±0.012^a	0.22±0.018^a	0.64±0.072^a	0.22±0.065^a
WHO*	0.10	1.30	0.40	1-3	0.05-0.15
FAO**	0.50	2.00	5.00	1.00	0.05

Values followed by the same superscripts alphabets in the row are not significantly different at (p > 0.05) tested by DMRT, **F1**- *Oreochromis niloticus*., **F2**- *Coptidon zillii*., **F3**- *Synodontis clarias.*, * World Health Organisation, (2011), ** Food and Agriculture Organization, (2010).

DISCUSSION

The uniqueness of any aquatic environment is controlled by its physical, chemical and biological components, which directly or indirectly influence its productivity (Sharma *et al*., 2007). The pH recorded in this study shows the acidity of the water to be highly alkaline. The pH values recorded in this study did not have a predictable seasonal pattern although a number of high pH values (>8) were recorded in some stations during the rainy season due to landscape runoff in the area which tends to pick up toxic chemicals like calcium carbonate into the reservoir. This is because the reservoir was surrounded with rocks such as limestone which increased the pH (Abdullahi *et al*., 2015). The work was also consistent with Auta *et al*., (2016) findings on the Izom River Gurara, which documented the greater average range (6.8–9.7) for the study period. Thus, the pH range obtained in this study is above the acceptable level of 6.5 to 8.5 for the recommended levels for drinking water (WHO, 2011 and NIS, 2015). However, it can support aquatic life (Ayanwale *et al.*, 2018).

The Tunga Kawo reservoir temperature ranges from 27 ^{0}C to 32 ^{0}C. The highest temperature was recorded in August, the lowest in April. This is because of the shallowness of the sampling station and the volume of water in contact with air. This report resembles work of Keke *et al*. (2015) and Masese et al. (2009) who have reported that the average surface air temperature and surface water temperatures are typical for African tropical rivers and that fish grow best at 25 0 C until 32 0 C. According to this, the data obtained are followed by the work of Okunlola *et al.* (2014) and Oyakhilome *et al.* (2012), which documented an ideally suited mean temperature value (27.53 ^{0}C to 31.65 ^{0}C). However, the finding contradicted the work of Adama (2016) in Kainji Lake, who reported a higher mean of 36.23 ± 0.8 ^{0}C of water temperature. In view of the fact that changes in geographical characterizations might cause the high increase of water temperature.

The oxidisation-reduction condition of many chemical substances such as nitrate and ammonia, sulfate and sulphite, ferrous and ferric ions has been affected by dissolved oxygen (DO) in water. However, the DO documented in these studies was within the permissible limits of drinking water (NIS, 2015). The work is in agreement with Ayoade *et al*. (2007) and Abubakar *et al.* (2015) who worked on Dadin-kowa reservoir and recorded a DO (2.73 to 4.92 mg/L) which indicates a thriving basis for aquatic organisms.

The BOD level in this study showed that Tunga Kawo was moderately clean. The higher BOD value in Station 1 can be due to the higher rate of organic matter decomposition. Similar to the report from Lewis (2002) and Idowu *et al.* (2013), which documented that tropical water at higher temperatures does not have the capacity to retain oxygen in comparison to water at lower temperatures and at higher temperatures in microbial metabolic rates. Contradicts findings Keke *et al*. (2015) reporting a high level of easily degradable and organic matter entering the river from the downstream work in Kaduna River in Zungeru where BOD is increased by1.00–5.00 mg/L.

Electrical conductivity has demonstrated that the water in all areas is fresh, but indicates that human activities have a negligible effect in the region. Conductivity sources can include an abundance of dissolved salts due to poor irrigation and rain water runoff minerals. Similarly, the findings of Idowu *et al.*, 2013 and Abubakar *et al*. (2015) recording a mean value of 432 ± 8.64 due to continuous discharge into the reservoir are consistent with this.

This study recorded the mean value of the total alkalinity (19.25 to 29.5 mg/L) and when compared, it favours well with the range given for lakes and reservoir by WHO, (2011); thus, this implies an indicator of a good quality of the reservoir water. This agrees with the work of Suguna (1995) who reported that total alkalinity above 40 mg/L suggest high productivity of a lake.

Due to the presence of high calcium and magnesium ions in the sewage waste as well as sulphate and nitrate, the highest levels of total hardness in water have been recorded over the dry season. This could be as a result of low water levels and the concentration of ions. However, this report contradicts the work of (Kolo and Oladimeji, 2004) who works in Shiroro Lake and Ufodike *et al*. (2001) from the Dokowa Mine Lake recorded a higher mean value during the dry season as compared to the wet season. Total Dissolve Solids (TDS) values in this study to be in the range of 117 to 198 ppm this implied that dissolved salts coupled with uptake of ions as shown to lower the TDS values in the dry season. Similarly, Uddin *et al*. (2014) recorded the mean value of 129 to 131 ppm in dry season and 106 to 111 ppm in wet season in Jamuna River, in Bangladesh since runoff from roads that have been salted during the wet season settled in the river.

The high concentration of nitrate (6.75±0.48mg/L) and phosphate (1.75±0.25 mg/L) documented in this study indicates evidence of leaching and run-off of fertilizers from nearby farmlands, washing with detergents and soaps into the lake could have also caused the high concentration of phosphate ions. This process may lead to eutrophication of the lake with seasonal algal bloom and changes the uniqueness of water properties. This is in line with the finding Mustapha *et al.* (2008) in Oyun Reservoir reported that human activities are the chief leading factor of any lake excess enrichment. Similarly, also agrees with the findings of (Akponine and Ugwumba, 2014) works on Ibuya River in old National Park, Sepeteri, Oyo State, Nigeria. The overall mean values of phosphates recorded (0.40 mg/ L) were generally low when compared to the standard of 3.2 to 630 mg/L, however, this study, recorded a slightly low mean values which were within acceptable limits recommended by WHO, 2011 and NIS limit, (2015) respectively. However, this contradicts the work documented by Yakubu *et al.* (2014) who work on Agaie/Lapai dam in Niger State, Nigeria; observed low nitrates level which might be attributed to high photosynthetic activities by aquatic plants since the vegetation of the study sites vegetation reflected that of savannah zone, dominated by grass but with scattered trees.

The metal accumulation in fish organs gives evidences that exposure to mainly due to anthropogenic input could be used to evaluate the health condition of the environment from which they were collected. In this study, Lead and Cd were found causes longterm harm in adults, including increased risks of high blood pressure, kidney damage, and neurological effects.This is line with the report of Okoye *et al*. (1991) who noted that bottom feeders are known to pick up particulate matter more than the surface feeders. Similar observation was reported by Adefemi *et al.* (2004) on two species of fish, *Oreochromis niloticus and Clarias gariepinus* sampled from Ureje dam in Ado Ekiti, Ekiti State. Moreover, *Oreochromis niloticus* and *Coptidon zillii* tend to accumulate copper in flesh as observed by Akan *et al*. (2012) from River Benue, Nigeria. Similar results were reported by Öztürk *et al.* (2009) from Avsar Dam Lake recorded a higher concentration of Fe^{+}, Mn^{+} and Pb^{+} accumulation in the muscle of *Cyprinus carpio* samples. This finding affirms with the report of Mshana (2015). Who examined the concentrations of heavy metals in *C. gariepinus*, *O. esculentus* and *O. rukwaensis* samples in Lake Luika and Songwe River in Tanzania. Lead ($Pb^{+)}$ mean of 0.55±0.018 µg/g during dry season in C. *gariepinus* and mean of 0.17±0.003 µg/g. during the rainy season in *O. esculentus* and *O. rukwaensis* fish sample. The higher levels of lead in Lake Luika and Songwe Rivers indicate that gold mining in the catchment area may contribute to the higher concentration of heavy metals in fish muscles.

This is also in conformity with the work of Oyakhilome *et al.* (2009) on three species of fish, *Clarias gariepinus, Clarias anguillaris* and *Oreochromis niloticus* sampled from Owena Multi-Purpose Dam, Ondo State. The result obtained shows *Clarias gariepinus* and *Clarias anguillaris* have more of heavy metals than *Oreochromis niloticus* in spite of their large weight. However, when in excessively high concentration, it may be due to bioactive metals which pose serious threats to normal metabolic processes. Similarly, the report from Oguzie, (2003) who recorded higher concentrations of heavy metals in the water during the wet season due to increased surface runoff and agricultural pollution, especially chemical fertilizers containing Ni and Pb. Heavy rainfall leads to farm draining. Large amounts of pesticides containing metal compounds are brought to the surface via runoff from the farms to the river and highly contribute to agricultural pollution, especially chemical fertilizers containing Ni and Pb. However, several reports found that mean heavy metal concentrations in fish were higher in the dry season (Idodo-Umeh, 2003 and Oguzie, 2003). This is because higher concentrations of metals in fish during the dry season were due to high temperatures, which increased the activity, ventilation, metabolic rate and feeding sessions (Nussey *et al*., 2000). Lead causes renal failure and liver damage in humans. This result was lower compare to the findings of Doherty *et al*. (2010) (0.395 – 0.62ppm) and Okoye *et al*., (1991) (9 ppm) of lead from some fishes in Lagos Lagoon. Farombi *et al*. (2007) reported 0.73 - 4.12ppm in *Clarias gariepinus* from Ogun River, which are higher. The reason for this extremity in values is might be due to the addition of civic wastes and industrial effluents as the sewage of the city is directly discharged into the river along with the industries which are also discharging their effluents directly into the river. This is in agreement with the studies (Akan *et al*. 2012) who reported that the level of heavy metals increasing in the rivers due to discharge of industrial effluents and civic pollution of various kinds. This is in turn deteriorating the water quality making it unsuitable for both aquatic and human life.

The concentration of dissolved iron in fresh water bodies is very low. But, due to the constant pollution at the reservoir, it has damage plants growth and which inturn affect the fish which feed on it. The consumption of these metals in excess could impact health hazards to human It has also been observed that iron is the dominant metal in the muscle of *Clarias gariepinus* (Farombi *et al*. 2007). This contradict with the report of Adaka *et al*., (2017) who observed lower concentration Of Cu, Fe, Pb, Cd and As, respectively in three common edible fish species these include *Tilapia zillii*, *Citharinus citharus* and *Heterotis niloticus*. This study heavy metals concentration in fish tissue samples were slightly below but Fe and Cr exceeded the limits of WHO, (2011) and FAO, (2015) respectively.

CONCLUSION

The physicochemical parameters for Water Temperature (^{0}C), Conductivity (µS/cm), Total Dissolved Solids (ppm), Alkalinity (mg/L), Dissolved Oxygen (mg/L), BOD (1mg/L), Hardness (mg/L), Nitrate (mg/L), Phosphate (0mg/L) were within standard for drinking water and survival of fishes, however, the pH was above the standard for NIS and WHO drinking water but can fairly support aquatic life.

The result obtained from selected fishes documented show a low heavy metal concentration. Pb^+, Fe^+, mn^+ and Cr^+ concentration was high in *Synodontis clarias* when compared to *Oreochromis niloticus* and *Coptidon zillii* whereas *Oreochromis niloticus* accumulate more of copper compared to *Synodontis clarias and Coptidon zillii.* The levels of heavy metals found in this study did not exceed the limits set by World Health Organization (WHO) and Food and Agriculture Organization (FAO) thereby making the fishes healthy for human consumption.

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