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Research Article

Phytochemical Evaluation and Lethal Concentration of Aqueous Extract of *Adansonia digitata* Fruit Pulp in *Clarias gariepinus*

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ABSTRACT

The study was aimed at assessing the lethal concentration $_{50}$ (LC_{50}) of aqueous extract of *Adansonia digitata* fruit pulp (AEADFP) in *Clarias gariepinus*. *Adansonia digitata* fruit pulp was obtained at the Faculty of Veterinary Medicine, Ahmadu Bello University (A.B.U), Zaria, Nigeria. Proximate nutrient composition was determined according to the Association of Official Analytical Chemist. Maceration method was employed for *Adansonia digitata* fruit pulp extraction using distilled water, and thereafter, screened for phytochemical constituents. A total of 200 African catfish (*Clarias gariepinus*) weighing between 185 ± 5 g (27-36 cm) were used for determination of LC_{50} of AEADFP using standard procedure at the aquaculture animal house Unite of Department of Veterinary Pathology, A.B.U., Zaria. Twenty (20) fish were used for range finding test, while 180 fish for LC_{50} evaluation. The experimental fish were observed for clinical signs of toxicity and mortality. The result of proximate nutrient composition of *Adansonia digitata* fruit revealed the presence of carbohydrate, lipid, protein, ash, moisture, and crude fiber. Qualitative phytochemical evaluation revealed the presence of tannins, flavonoids, phenol, terpenoid, glycosides, saponins, anthraquinone, steroids, reducing sugar and alkaloids, while quantitative phytochemical assay showed that total Phenol and alkaloid had highest and lowest concentration, respectively. There was neither mortality nor any clinical sign of toxicity observed for the 96 hours post-administration to AEADFP up to 5000 mg/L. Conclusively, AEADFP had nutritional and bioactive compounds that are important in biological processes. The lethal concentration of AEADFP is above 5000 mg/L; hence, relatively safer for use in medicinal purposes.

Keywords: *Adansonia digitata, Clarias gariepinus,* Lethal Concentration $_{50}$, Phytochemistry of fruit Pulp

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INTRODUCTION

Medicinal plants have long been used for the treatment of certain diseases (Kharchoufa *et al.,* 2021). Plant-derived medicines are used in all societies and cultures, hence, plants have always

played a key role in healthcare systems worldwide. In most developing countries, the indigenous modes of herbal treatment are a part of the culture and the dominant method of healing therapy. These remedies, with a considerable extent of effectiveness, are generally accepted, economically viable, and mostly, are the only available source (Porwal *et al.,* 2017). In most tropical countries of Africa, the high cost of Western medicine and poor health sector as well as the resurgence of phyto-medicine, has necessitated reliance on the use of traditional plant medicine in the treatment of ailment, often without consideration of the toxic effects that these plant products cause to the body (Ibraheem *et al.,* 2021). Many plants have also been reported to be toxic to both humans and animals. It should, therefore, be emphasized that for any traditional use of the medicinal plant, its safety should be ascertained (Sani *et al.,* 2022). One of the reasons for the increasing interest in herbal medicines is the belief that because these medicines are natural and have been traditionally used, they are safe and harmless. Nevertheless, their natural origin is not a guarantee of safety, as many reports concerning the risks associated with the use of herbal products have noted (Makena *et al.,* 2021). *Adansonia digitata* and its related species belong to the family of Malvaceae. The tree is of African origin and known for its medicinal and nutritional value (Kamanula, 2018). It has excellent antioxidant and anti-inflammatory properties; various parts of the tree are used to treat different types of ailments (Ebaid *et al.,* 2019). Medicinally, the leaves of *A. digitata* are used in the treatment of diarrhea, dysentery, fever, malaria, fatigue, kidney, and bladder diseases (Shehu *et al.,* 2021). Hence, this research work was designed to evaluate the median lethal concentration of aqueous extract of *A. digitata* fruit pulp in *Clarias gariepinus* to ascertain the safety of its use in the treatment of conditions of aquatic animals.

MATERIALS AND METHODS

Study Area

The research was conducted at the Department of Veterinary Pathology, Ahmadu Bello University Zaria, Kaduna State, Nigeria. Zaria is located within the Northern Guinea Savannah Zone of Northwestern Nigeria. It lies between latitude 7^{o} to 11^{o} N and longitude 7^{o} 44 E. It has an average rainfall of between 1,000 to 1, 250 mm and an average temperature of between 17 ^{o}C to 33 ^{o}C, and vegetation made of predominantly trees and grasses (Dauda *et al.,* 2023).

Ethical Clearance

The research was approved by Ahmadu Bello University, Zaria, Committee on Animal Use and Care (ABUCAUC) with approval number: ABUCAUC/2021/140. All experimental procedures were carried out according to international guidelines for the use of animals for biomedical research and welfare (Ochei and Kolhatkar, 2000).

Fish and Acclimatization Condition

A total of Two hundred (200) *Clarias gariepinus* weighing 185 ± 5 g (27-36 cm) were purchased from the Flourishing Center Fish Farm. The experimental fish samples were transported live in a 25litre capacity plastic container almost filled with water overnight to Zaria, Nigeria, and allowed to acclimatize for 14 days in a plastic tank containing borehole water, at the aquaculture animal house, Department of Veterinary Pathology, A.B.U Zaria, Nigeria. Fish were fed Coppens® commercially prepared fish feed for aquaculture (Coppens International bv. 5700 AM Helmond, Holland). Out of the 200 samples of fish, 20 were used for range finding study, while the remaining 180 fish were used for acute toxicity study.

Plant Material

Collection and Authentication of *Adansonia digitata* of Fruit Pulp

The dry fruit pulp of *Adansonia digitata* was obtained from the tree at the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria, Kaduna State, Nigeria in November 2021. A sample of the fruit was taken to the herbarium of the Department of Botany, Faculty of Life Sciences, Ahmadu Bello University Zaria, Kaduna State, Nigeria for authentication. The voucher specimen number corresponding to ABU02516 was assigned to the sample. The fruits were cracked open manually harvested and allowed to dry at room temperature for further processing according to Ogunleye *et al.* (2019).

Proximate Nutrient Composition of *A. digitata* Fruit Pulp

The fruit pulp of *A. digitata* was analyzed for proximate nutrient composition at the Institute of Agricultural Research (IAR), *Ahmadu Bello University*

Zaria, using the standard analysis method of the Association of Official Analytical Chemists (AOAC, 1990) as follows: The moisture content of the sample was determined by air oven method at 150 ℃, crude protein was obtained using micro-kjeldahi method. Crude lipid was determined by the soxhlet extraction method using petroleum ether as an extracting solvent. The ash content was by a muffle furnace at 550 ℃ for four (4) hours until a constant weight of ash was obtained. The crude fibre was determined by exhaustive extraction of soluble substance in the sample using 1.25 % H_2SO_4 and 1.25 % NaOH solution after the residue was ashed and loss in weight was recorded as crude fiber. Carbohydrate content was determined by difference 100 – (% moisture + % protein+ % fat + % minerals).

Preparation of Adansonia digitata Aqueous Fruit Pulp Extract

Preparation of aqueous extract was carried out at the Department of Pharmacognosy, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria. Five hundred (500) grams of powdered dried fruit pulp of *A. digitata* was placed in a conical flask and 1500 L of distilled water was added and left to stand for 72 h. The mixture was then filtered using 850 nm and 150 nm pore-size sieves, respectively. The third stage of filtration was done using Whatman filter paper no.1 and cotton wool was put in the filter paper to obtain a pure solution. It was then frozen and dried using a freeze-drying machine according to the method of Ogunleye *et al.* (2020).

Qualitative and Quantitative Phytochemical Analysis

Qualitative Analysis

The fruit pulp extract of *A. digitata* was screened for the presence of active constituents including alkaloids, flavonoids, saponins, tannins, terpenoids, cardiac glycosides, phenol, steroids, carbohydrates, and anthraquinones using standard procedures as described by Akinsanya *et al.* (2016) and Erwa *et al.* (2019).

Tannins

A ferric chloride test was used to test for tannins. About 0.5 g of the dried aqueous extract was diluted with distilled water in a ratio of 1:4 and a few drops of 10 % ferric chloride solution were added. A blue or green colour indicates the presence of tannins (Akinsanya *et al.,* 2016).

Saponins

To test for saponins, about 0.5 g of the dried aqueous extract was boiled. The mixture was filtered, and 2.5 ml of the filtrate was added to 10 ml of distilled water in a test tube. The test tube was corked and shaken vigorously for about 30 s, and then it was allowed to stand for half an hour. A honeycomb forth was an indicator of the presence of saponins (Erwa *et al.,* 2019).

Carbohydrates

Carbohydrate was tested by adding a few drops of Molisch's reagent to 2 ml each of the water extract in two tubes. A small quantity of concentrated sulphuric acid was then added and allowed to form a lower layer. A purple ring at the interface of the liquids indicated the presence of carbohydrates. Each mixture was then shaken and allowed to stand for 2 min and diluted with 5 ml of water. A purple precipitate showed the presence of carbohydrates (Ogunleye *et al.,* 2019).

Glycosides

Glycoside was detected by adding Fehling's reagent to 0.1 g of the dried aqueous extract, and the mixture was boiled for 2 min. A brick-red colouration indicated the presence of glycosides (Makena *et al.,* 2021).

Flavonoids

The Shinoda test was used to test for the presence of flavonoids. This was carried out by adding 0.5 g of the dried aqueous extract to four pieces of magnesium fillings, followed by a few drops of concentrated hydrochloric acid. A pink or red colour indicates the presence of flavonoids (Ibraheem *et al.,* 2021).

Alkaloids

For alkaloids testing, five test tubes were used for the sample. A few drops of the following reagents: manager's reagent, Dragendorff's reagent, Mayer's reagent, and 10 % Picric acid solution were added respectively to each of the five test tubes. The presence of precipitate in at least 3 or all of the above reagents indicated the presence of alkaloids (Ogunleye *et al.,* 2019).

Anthraquinones

To 1 mL of extract, 1 mL benzene was included; the addition of 1 mL of ammonia solution (10 %) was followed. A red color appearance upon ammonia solution addition was indicative of anthraquinones' presence. A 2 % HCl drop was added to the plant extract. The formation of Red precipitate was indicative of anthraquinones (Ibraheem *et al.,* 2021).

Steroids

Salkowski test: 10 mL chloroform was added to 1 mL of each extract in a test tube. After that 10ml concentrated sulphuric acid was dissolved in this test tube. Two layers were formed; the lower layer expressed yellow color along green fluorescence while the upper layer showed red. The formation of these layers indicates steroids were present (Makena *et al.,* 2021).

Terpenoids

To 2 mL of each extract, 1 mL 1 % HCl was added and kept for 5-6 hours. After that, 1ml of Trim-Hill reagent was added and then in a water bath up to boiling temperature, heated for 5-10 minutes. The bluish-green color appearance was indicative of terpenoids (Braca *et al.,* 2018).

Phenols

Ellagic acid test: The addition of 5 % Glacial acetic acid was done dropwise in the one micro litter extract. The addition of 5 % $NaNO_2$ was done to the above mixture. Phenol presence was indicated by the color formation of muddy brown. To the 1 mL of extract of plant 2 mL distilled water was added and then 10 % $FeCl_3$, only a few drops were added. The formation of blue-green color shows phenol presence (Ibraheem *et al.,* 2021).

Quantitative Analysis

Quantitative estimation of total alkaloid, total flavonoid, and total saponin content were analyzed using standard spectrophotometric method according to Mumtaz *et al.* (2016).

Alkaloids

For Alkaloid, 2.5 g of the pulverized fruit pulp sample was placed in a 250 ml beaker and 100 ml of 10 % acetic acid and ethanol was added. The mixture was covered and allowed to stand for four (4) hours. It was then filtered, and the filtrate was concentrated in a water bath until it reached a quarter of its original volume. Concentrated ammonium hydroxide was added until precipitation was complete. The mixture was allowed to settle, and the precipitate was collected on a weighed filter paper and washed with dilute ammonium hydroxide. The precipitate alkaloid was dried and weighed. The percentage alkaloid was calculated by difference. The analysis was done in triplicates (Ogunleye *et al.,* 2019).

Flavonoids

In the case of flavonoid, 2.0 grams of the pulverized fruit pulp sample was repeatedly extracted with 100 ml of 80 % aqueous methanol at room temperature. The mixture was then filtered through a filter paper into a pre-weighed beaker. The beaker containing the filtrate was transferred into a water bath allowed to evaporate to dryness and weighed. The percentage of flavonoids was calculated by the difference in the weight of the beakers. The procedures were carried out in triplicate (Ogunleye *et al.,* 2019).

Saponins

To detect the amount of saponins present in the extract, 2.0 grams of pulverized fruit pulp sample was weighed in a 250 ml conical flask. 10 ml of 20 % ethanol was added. The mixture was heated in a hot water bath for 4 hours with continuous stirring at about 55 ^oC, it was then filtered with filter paper. The residue was re-extracted with 20 ml of 20 % ethanol. The combined extract was reduced to about 5.0 ml in a water bath at 92 ^oC. The concentrated extract was then transferred into a 250 ml separating funnel and 10 ml of diethyl ether was added to the extract and shaken vigorously. The aqueous layer was recovered while the diethylether layer was discarded. The purification process was repeated. 60 ml of n-butanol extract was washed twice with 10 ml of 5 % NaCl. The remaining solution was then heated in a water bath in a pre-weighed beaker. After evaporation, the residue was dried in the oven at a low temperature to a constant weight. The procedure was repeated two more times to obtain three different results. The percentage of saponin was calculated by difference (Makena *et al.,* 2021).

Phenols

The quantity of phenol was determined using the spectrophotometer method. The plant sample was boiled with 50 ml of $(CH_3CH_2)_2O$ for 15 min. 5 ml of

the boiled sample was then taken into a 50 ml flask, and 10 ml of distilled water was added. After the addition of distilled water, 2 ml of NH_4OH solution (Ibraheem *et al.,* 2021).

Toxicity Bioassay

Acute Toxicity and Clinical Signs of Abnormal Behaviour

A range-finding test to determine the five concentrations of aqueous extract of *Adansonia digitata* fruit pulp (AEADFP) as described by Ikeogu (2020) was performed. Mortality was used as an endpoint of toxicity, and this was determined according to Abalaka *et al.* (2015). A preliminary range finding test was carried out by randomly dividing 20 *C. gariepinus* into 5 groups (n=4) and labelled accordingly. Graded concentrations of AEADFP were administered until a dose that was close to the LC_{50} was achieved. The result obtained provided a guide for the acute toxicity study. An acute toxicity test was carried out (n = 180) using six groups of 30 fish per group using the static non-renewable bioassay procedure of Abalaka *et al.* (2015). Aquariums of 40 litres capacity (76 cm × 38 cm × 38 cm) were used per each group. Each aquarium was covered with nylon mesh tied firmly with rubber strap to prevent the fish from jumping out. The various concentrations used were G1 (0 mg/L), G2 (3000 mg/L), G3 (3500 mg/L), G4 (4 000 mg/L), G5 (4500 mg/L) and G6 (5000 mg/L) for 96-hour period. Fish showing no respiratory movement and response to tactile stimuli were considered as dead and removed immediately.

Water Quality Test During Acute Study

Physicochemical parameters including temperature, pH, electrical conductivity (EC), total dissolve solute (TDS), alkalinity, and dissolved oxygen of fish culture water were determined according to APHA (2014), at the Department of Water Resources and Environmental Engineering, Ahmadu Bello University, Zaria, Nigeria. The quality of these parameters was ensured throughout the 96 hours of the experiment.

Evaluation of Acute Toxicity

Median Lethal Concentration and Clinical Signs of Abnormal Behaviour

LC_{50} for AEADFP was calculated using the formula of Enegide *et al.* (2013)

The half-lethal concentration of LA = Highest conc. – $\sum a \times b / n$

Where: **a:** Constant factor of difference between groups

b: Mean value of dead fish between each of two successive groups

n: Number of fish per group

RESULTS

Proximate Nutrient Composition of *Adansonia digitata* Fruit Pulp

The proximate nutrient composition of *Adansonia digitata* fruit pulp showed the presence of carbohydrates, lipids, protein, ash, moisture, and crude fiber (Table 1).

Phytochemical constituents of aqueous extract of *Adansonia digitata* fruit pulp

The qualitative phytochemical evaluation of aqueous extract of *Adansonia digitata* fruit pulp (AEADFP) revealed the presence of tannins, flavonoids, phenol, terpenoid, glycosides, saponins, anthraquinone, steroids, reducing sugar and alkaloids (Table 2) while quantitative phytochemical assay showed that total Phenol was highest and alkaloid had the lowest concentration (Table 3).

Water Quality Parameters

Although there was a slight variation in some of the physicochemical parameters of the different treatment groups during acute study; all the values obtained were within the range recommended by WHO, (2017). pH and DO have their highest mean values of 7.3 ± 0.3 mg/L and 5 ± 0.58 mg/L; respectively, in group A, while their lowest values of 5.3 ± 0.33 mg/L and 3.3 ± 0.17 mg/L, respectively, were recorded in the highest concentration of AEADFP used (group E) (Table 4).

Median Lethal Concentration (LC_{50}) for 96-hour Exposure to Aqueous Extract of *Adansonia digitata* Fruit Pulp (AEADFP)

The acute toxicity bioassay result for AEADFP is presented in Table 5. There was neither mortality nor any clinical sign of abnormality found in all the groups (0 to 5000 mg/L of AEADFP) during the dose-response test for the 96-h exposure period. The result of 96-h LC_{50} value for AEADFP was found to be above 5000mg/L.

Table 1: Proximate composition of baobab fruit pulp (*Adansonia digitata L.*)

Constituents	Percentage Composition (%)
Moisture	3.51
Ash	5.14
Lipid	5.94
Protein	5.45
Crude Fiber	3.23
Carbohydrate	78.89

Table 2: Qualitative phytochemical constituents of aqueous extract of *Adansonia digitata* fruit pulp

Phytochemical constituents	Inference
Tannins	+
Flavonoids	+
Phenol	+
Terpenoid	+
Glycosides	+
Saponins	+
Anthraquinone	+
Steroids	+
Reducing sugar	+
Alkaloids	+

Key: + = Presence

Table 3: Quantitative phytochemical constituent of aqueous extract of *Adansonia digitata* fruit pulp

Phytochemical constituents	Inference (%)
Flavonoids	4.55
Saponins	0.32
Total Phenol	16.11
Alkaloids	0.09

Table 4: Physicochemical Parameters for the Different Treatment Groups for AEADFP

GROUPS	TEMP (^{O}C)	pH (mg/L)	DO (mg/L)	TDS (mg/L)	Alkalinity (mg/L)	EC (µS/cm)
A	27±0.6	7.3±0.3	5.0±0.6	102±3.9	29±2.1	163±20
B	27±1.2	7.1±0.3	4.1±0.1	157±23	27±1.2	173±16
C	28±0.6	7.0±0.1	4.0±0.3	143±8.8	26±0.7	190±21
D	28±1.2	6.7±0.2	3.9±0.1	130±5.8	26±0.5	212±18
E	28±1.2	5.7±0.3	3.2±0.2	170±6.0	25±0.9	259±22
F	29±0.9	5.3±0.3	3.2±0.2	121±4.9	24±0.9	180±21
FEPA 1991	N.P	6.0 – 9.0	3 -10	2000	N.P	N.P
WHO 2017	27 - 32	6.5 – 9.2	5.0	500	20 - 30	160-1600
P value	0.8656	0.0665	0.0712	0.0597	0.0640	0.2320

Key: Group A (distilled water), Group B (AEADFP 3000 mg/L), Group C (AEADFP 3500 mg/L), Group D (AEADFP 4000 mg/L), Group E (AEADFP 4500 mg/L), Group F (AEADFP 5000 mg/L)

N.P = Not provided, TEMP = temperature, DO = dissolved oxygen, TDS = total dissolved solids, EC = electrical conductivity, pH = potential hydrogen. Values in each column with different superscripts are significantly different at $P < 0.05$

Table 5: Median lethal concentration (LC_{50}) of aqueous extract of *Adansonia digitata* fruit pulp after 96-h exposure to the test fish

Exposure Conc. (mg/L)	No. of live fish	No. of dead fish	A	b	a x b
0	30	0	0	0	0
3000	30	0	0	0	0
3500	30	0	0	0	0
4000	30	0	0	0	0
4500	30	0	0	0	0
5000	30	0	0	0	0
					∑a x b = 0

Half lethal concentration of AEADFP = Highest conc. – ∑a x b /n. LC50 = 5,000 – 0/30 = 5000 mg/L. Where: a: Constant factor of difference between groups. b: Mean value of dead fish between each two successive groups. n: Number of fish in each group (Enigide *et al.,* 2013)

DISCUSSION

The results of proximate analysis of *A. digitata* fruit pulp revealed the presence of carbohydrates, lipids, protein, ash, moisture, and crude fiber in varying percentages. This finding is in agreement with the previous reports of Edogbanya (2016) and Erwa *et al.* (2019) who observed all these metabolites in different parts of *A. digitata*. The presence of various phytochemicals in the baobab fruit pulp, and the varying percentages recorded in the present study conform with the work of Bayon *et al.* (2019), who reported the presence of tannins, terpenoid, flavonoids, saponin, reducing sugar, alkaloids, anthraquinones, steroids, terpenoids, cardiac-active glycoside, and phenols in baobab (*A. digitata*) leaves. These results were suggestive of the possible cellular protective effect of *A. digitata* fruit pulp against oxidative damage. Phytochemicals found in plant cells are very crucial in the maintenance of electrolyte levels, antioxidant activities, and protection against infections (Zagga *et al.*, 2018). Similarly, the result of the quantitative phytochemical analysis showed that the aqueous extract of *A. digitata* fruit pulp is the richest in total phenol (16.11 %), with alkaloids (0.09 %) being the lowest. The relatively high quantity of these bioactive compounds in the fruit pulp could be due to the phenomenon that, various parts of the plant exhibit different capabilities of retaining mineral content and other substances for its utilization (Bayon *et al.*, 2019).

The preliminary step in the evaluation of pharmacological activity is the evaluation of toxic features of the plant extract or isolated compounds (Fannami *et al.,* 2023). In animal research, acute toxicity provides information that can be utilized to classify, label, and calculate the dose of a novel chemical. The 96-hour LC_{50} obtained in this study for AEADFP in *C. gariepinus* was above 5000 mg/L. However, to the best of our literature search, there was no earlier report on the LC_{50} of any part of *Adansonia digitata* in aquatic studies for comparison. Therefore, our findings can only be compared with the outcome of acute toxicity studies from other non-aquatic animal species. For instance, Muhammad *et al.* (2016) and Ibraheem *et al.* (2021) reported an LD_{50} of > 5000 for methanolic extract of *A. digitata* leaf and fruit pulp in broiler chicken and albino rats, respectively. Also, Shehu *et al.* (2021) reported that no mortality or clinical sign of abnormality was recorded in both the acute and sub-acute exposure to ethanolic and aqueous extracts of stem bark of *A. digitata* in albino Wister rats after oral administration of 5000 mg kgG^{-1} of each of the extracts. The safety of *A. digitata* leaf extract at 5000 mg kgG^{-1} b.wt., was also confirmed by the findings of Eghoi and Paul (2016), who observed mortality only after 46 hrs of administration in mice that received 6000 mg kgG1 b.wt., of the plant leaves extract. The non-toxic effect of *A. digitata* explains why most of its parts, seeds, fruit pulps, stembark, and leaves are consumed by many communities (Kamanula, 2018). As a standard, any substance that is not toxic at less than or equal to 5000 mg kgG1 body weight is considered relatively safe (Suleiman *et al.,* 2014). There was no clinical sign of abnormal behavioral changes observed in the present study.

In this study, although there were slight variations in the physicochemical parameters of the various treatment groups B to F. The differences were statistically non-significant as compared to the

control group A. The values of the physicochemical parameters of the water are within the ranges recommended by WHO (2017) and that of Nigeria Industrial Standard Technology (NIST) 2007. The fact that the water quality parameters recommended for the test fish did not differ statistically from the control, is proof that the changes observed in fish were toxicant-induced. The slight variations in the temperature among the various treatment groups could be due to impurities, pollutants, and toxicants capable of elevating the different physicochemical parameters (Madhavan and Elumalai, 2016). The non-significant decrease in mean pH among the treatment groups as compared to the control group A could be attributed to the solubility and possible toxicity of the plant extract when used at a higher dosage. This is in agreement with Odioko *et al.* (2016) in the acute bioassay of *Clarias gariepinus* exposed to sponge plant fruit extract which reported a lower pH. Contrarily, our finding disagrees with the earlier report of Muyiwa *et al.* (2020) who reported an increase in pH during acute toxicity study of *Adenium obesum* Stem Bark in *Clarias gariepinus*. Muyiwa *et al.* (2020) attributed pH to the production of basic products of metabolism, which precipitated an increase in acidity. The electrical conductivity (EC) values for all the treatment groups A to F were within the established normal range (160-1600 µS/cm) of the guideline for fish (WHO, 2017). Sudhir and Amarjeet, (1993) reported that lower conductivity in any bioassay reflects the level of total dissolved solids in water and the amount of total dissolved salts. The mean value for alkalinity observed in the present study agreed with the range value reported by Chris *et al.* (2022) for natural water. The highest value (29 ± 2.1mg/l) was reported in the control group A which reduced as the concentration of AEADFP increased. However, the variation in alkalinity for all the treatment groups as compared to control group were statistically in-significant. The observed reduction in dissolved oxygen (DO) with increase in the plant extract may suggest a possible depletion of available DO due to rapid consumption by the test fish. This coincide with the reported of Muyiwa *et al.* (2020) who also reported decrease DO, with increasing concentration of toxicant. The total dissolved solid (TDS) was lowest in the control group A (102 ± 3.9 ppm), and increase with increase concentration of AEADFP. Although all the values obtained were within the stipulated guidelines for water quality by WHO (2017). An increase in TDS during toxicity bioassay may subject the test organism to a threat in health and well-being (Audu *et al.,* 2014).

CONCLUSION

Conclusively, the result of phytochemical analysis of the aqueous extract of fruit pulp of Adansonia digitata revealed the presence of bioactive compounds that are essential in biological processes. Also, the value for lethal concentration 50 of the aqueous extract of *Adansonia digitata* fruit pulp obtained in the present study deduced that the plant extract is practically safe and can be used at higher concentrations in the management of diseases in *Clarias gariepinus*.

Although several studies on the medicinal properties and use of the different parts of *Adansonia digitata* using several animal models had been conducted with positive results, studies concerning the antioxidant effect of the plant should be translated into the fish model. This is because aquatic organisms are often at risk of toxicity to environmental toxicants.

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