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ANTIMICROBIAL ACTIVITY AND PHYTOCHEMICAL SCREENING OF *Adansonia digitata* STEM BARK EXTRACT ON SOME CLINICAL ISOLATES

***Ajiboye, A.E., Sadiq, S.O., Adedayo, M.R.**

Microbiology Unit, Department of Biosciences and Biotechnology, College of Pure and Applied Sciences. Kwara State University, Malete, Kwara State, Nigeria.

*Corresponding author's e-mail: adeyinka.ajiboye@kwasu.edu.ng; Tel.: +2348061102397

E-mail addresses of other authors: SSO- sadiqkola250@gmail.com; AMR- majekodunmi.adedayo@kwasu.edu.ng

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ABSTRACT

Adansonia digitata is a massive and deciduous tree with a height of about 24 m and of significant economic importance. The antimicrobial and phytochemical screening of the aqueous and ethyl-acetate extract of stem bark of the plant were determined on some clinical isolates. The stem bark of the plant was collected and washed properly before drying at 28 °C. The pulverised stem bark was extracted with water and ethyl-acetate and screened for phytochemicals (qualitative and quantitative) using standard methods. The clinical isolates used were identified as *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli* and *Candida albicans*. The antimicrobial activities of the crude extracts were carried out using the agar well diffusion methods. The minimum inhibitory concentration (MIC), minimum bactericidal and fungicidal concentrations were carried out using standard methods. The aqueous extract exhibited a higher zone of inhibition against *S. aureus* (14.00 ± 0.57 mm) at a concentration of 200 mg/ml while a zone of inhibition of 11.66±0.33 mm was observed for *E. coli* using ethyl-acetate extract. *Candida albicans* had a zone of inhibition of 11.66±0.88 mm and 11.00±0.57 mm using aqueous and ethyl-acetate extracts respectively at 200 mg/ml. The MIC was 200 mg/ml for the crude extracts against the clinical isolates. The qualitative ethyl-acetate phytochemical screening revealed the presence of phenol, flavonoids, tannins, alkaloids, saponin and terpenoids. Phenol had the highest concentration of 2.02±0.25 mg/ml while terpenoids had a value of 1.38±0.02 mg/ml. Aqueous and ethyl-acetate extract of *A. digitata* possess significant antimicrobial activity against *E. coli, S. aureus* and *C. albicans*. However, *K. pneumoniae* showed resistance to ethyl acetate extract.

Key words: *Adansonia digitata*, Antimicrobial activity, Clinical isolates, Phytochemical screening

INTRODUCTION

In recent times, microorganisms are becoming resistant to antibiotics which have necessitated the use of alternatives to serve as antimicrobial agents. Several plant parts which contain secondary metabolites which are effective against the disease-causing agents are been used. Steps are being taken in the utilization of antimicrobial peptides and compounds from plants and animals (Touré, *et al.,* 2000), imitating the natural lipopeptides of bacteria and fungi (Blomhoff *et al*., 2010) and approaching the uncultivated portion of microbiota through the meta-genomic methods (Besco *et al*., 2007).

Other strategies may include drugs engineered to possess dual target activities, such as a rifamycin–quinolone hybrid antibiotic. The easier and more economical approach of all the afore-mentioned is the use of plants which have encouraged many researchers to focus on phytomedicine (i.e. use of plant in treatment of infections). Many plant parts such as leaves, stem, roots, seeds and fruit pulps have been used against infectious microorganisms; among them are *Adansonia digitata* (Baobab), *Grewia trichocarpa, Launaea cornuta and Zanthoxylum* among many others (Anani *et al.,* 2000). In recent times, resistance of several species of microbes to different antibiotics has been a major problem faced by clinicians. The resistance could be as a result of frequent mutation of the organisms which has led to the increase in the spread of bacterial infections to man and animals.

Adansonia digitata is commonly known as Baobab, the plant belong to the family Bombacaceae and genus *Adansonia* (Sidibe and Williams, 2002). *A. digitata* is commonly found in West Africa and Asia, its family comprises of about 30 genera, six tribes and about 250 species (Sidibe and Williams, 2002). The name baobab was coined from Arabic word bu – hibab which means "fruit with several seeds" (Chadare *et al*., 2009). The tree is found

majorly in African savannah than any other trees due to its gigantic size. Some communities have traditions that prohibits the inhabitants from cutting down the tree. In places where extensive deforestation takes place, the baobab trees still remain standing (Besco *et al*., 2007). The plant parts range from the leaves, fruit pulp, seeds and bark of stem and roots as documented by Shulka *et al*. (2001); Prohp and Onoagbe (2012); Abdullah and Muhammad (2019). Due to its high nutritional value, the leaves can be used to prepare soups while the seeds are used as a thickener for local soup. They serve as raw material for making ropes, hats, bags amongst others. It has been documented that the plant leaves are being used to treat diseases of the kidney, inflammations, asthma, diarrhoea among others (Kubmarawa *et al*., 2007). Studies by Datsugwai and Yusuf (2017) have also emphasized the effectiveness of the plant against pathogenic bacteria.

The plant has been attracting many pharmaceutical companies due to its numerous traditional uses in treatment of various forms of ailment. Report has shown that the European commission has authorized essentiality of *Adansonia digitata* fruit pulp as novel food (Besco *et al*., 2007; Buchmann *et al*., 2010). In West Africa the plant bark is used for treatment of fever and as an antidote (Chadare *et al*., 2009). Medicinal plants are increasingly gaining ground, probably due to increase rate of resistance to modern drugs and antibiotics by the pathogens responsible for causing gonorrhea, tuberculosis and other diseases and high cost of drugs for maintenance of health (Shukla *et al*., 2001). People in developing countries still rely on traditional healing method and medicinal plants for their daily healthcare, in spite of the advancement in modern medicine (Hudson *et al.,* 2000). Baobab is an important medicinal plant in tropical Africa and India, all parts of the plant have been reported to be used in treatment of various forms of ailment such as antiviral, anti- inflammatory, antioxidant, antipyretic, antimicrobial and anti trypanosoma activities (Sidibe and William,2002; De Caluwe *et al*., 2010). Quite a number of research has been executed on the antibacterial activities of different parts of *Adansonia digitata* on clinical isolates and its effect on fungi has not been sufficiently studied hence the need to study its antimicrobial effects on both bacteria and fungi. This deficiency has necessitated this research on *Candida*. Yeasts of medical importance such as *Candida albicans* are posing a threat to human health. The unicellular yeast is known to cause several infections which disrupt the microbiome of the body; these include candidiasis, thrush, and candidemia among others as reported by several researchers. The plant seeds have been reported to compose of significant quantities of amino acid such as lysine, and macro elements such as calcium and iron (Kamatou *et al.,* 2011) which are essential nutrients in human diet. Qualitative phytochemical analysis of the plant has revealed the presence of organic compounds in the plant which include reducing sugar, flavonoids, steroids, phenol and cardiac active glycosides (Abiona *et al*., 2015; Magashi and Abdulmalik, 2018)). According to reports by Kubmarawa *et al*. (2007) and Agbafor and Nwanchukwu (2011), bioactive compounds such as flavonoids, tannins, alkaloids e.t.c. are responsible for antimicrobial activities in the plant. This study aimed at determining the antimicrobial activities of aqueous and ethyl-acetate stem bark extracts of *Adansonia digitata* against some clinical isolates. The quantitative phytochemical analysis of the stem bark of the plant was carried out to determine the concentration of some of the phytochemicals inherent in it.

MATERIALS AND METHODS

Collection and Preparation of Plant Sample

The stem bark of *Adansonia digitata* tree was collected at the Kwara State University, Malete. This was authenticated at the Plant Biology Department, University of Ilorin, Kwara State, Nigeria and was assigned an identification number - UILH001/905. Samples were washed with distilled water and dried at 28 $^{\circ}$C, after which the stem bark was crushed with a clean mortar and pestle and was pulverized into fine powdery form using electric milling machine.

Collection and Maintenance of Clinical Isolates

Clinical isolates were obtained from the Department of Microbiology and Parasitology, University of Ilorin Teaching Hospital, Kwara State, Nigeria. The organisms obtained were: *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia*

coli and *Candida albicans* which were maintained on nutrient agar and potato dextrose agar slants for bacteria and fungi. The prepared slants were refrigerated at 4 °C. The organisms were inoculated in normal saline and stored for use (Bamidele *et al*., 2013).

Preparation of Ethyl-acetate extracts

Five hundred millilitres of ethyl-acetate was poured into 100 g of dried powdered stem bark and shaken for 6 hours with rotary shaker, the extract was filtered thereafter with a muslin cloth and through Whatman filter paper. The filtrate was concentrated by evaporating in a water bath at 45 °C (Orji *et al.,* 2012).

Preparation of Aqueous Extracts

One hundred grams of dried powdered stem bark was soaked in 500 ml distilled water for 72 hours, and filtered through a Whatman filter paper followed by cotton wool. The filtrate was concentrated by evaporation using a water bath at 45 °C (Orji *et al.,* 2012). The sterility of the extracts was carried out before use.

Preparation of Culture Media

Potato dextrose agar (PDA), nutrient agar and Mueller Hinton agar were prepared according to the manufacturer's instructions.

Preparation of McFarland Standard Solution

Half of a millilitre of 1 % barium chloride was added to 99.5 ml of 1% H_2SO_4 in the preparation of 0.5% McFarland standard (equivalent to 1.5 x 10^8 cfu/ml) and turbidity was measured at 530 nm using spectrophotometer (CLSI, 2009).

Standard Antibiotics Disc Used

Broad spectrum antibiotics such as Ciprofloxacin (CIP 5 µg), Ampicillin (AMP 10 µg), Ofloxacin (OFL 5 µg) and Nystatin drops (3 µg) were used as positive controls.

Antimicrobial Sensitivity Testing

The agar well diffusion method was used. Sterilized Mueller Hinton's agar and potato dextrose agar were dispensed into the Petri dishes and allowed to set; 0.5 ml of standardized inocula was poured onto the solidified agar surface and swirled so as to spread over the surface. A sterilized cork borer of 6 mm diameter was used to bore holes into the agar plate and the prepared concentrations of extracts were poured into each hole and labelled. Extracts were left to diffuse for 30 minutes and incubated at 37 °C for 18 hours for bacteria and 28 °C for 72 hours for fungi. The zones of inhibitions were measured in millimetre (mm) using transparent ruler. This was repeated in triplicates for each organism (Bamidele *et al*., 2013).

Minimum Inhibitory Concentration (MIC)

Prepared extracts were reconstituted, and three fold dilution were made in accordance to antimicrobial sensitivity test i.e. 200 mg/ml, 100 mg/ml and 50 mg/ml were made from the extract using the same solvent as per extraction (aqueous and ethyl-acetate). Eight millilitres of sterile nutrient broth for bacteria and potato dextrose broth for fungi were inoculated with 2-3 drops of inoculum after addition of 0.8 ml of extract of each concentration, thus making three tubes of each extract for an organism. Broths free of organism and extract with the other inoculated with organism were used as controls. Test tubes containing nutrient broths were incubated at 37 °C for 24 hours while those with PDA were incubated at 28 °C (room temperature) for 72 hours (Bamidele *et al*., 2013). The tube with the lowest concentration with no evidence of growth was taken as the MIC.

Minimum Bactericidal Concentration (MBC)

Sterile Mueller-Hinton agar plates were separately inoculated with bacterial inocula from each of the test tubes that showed no evidence of growth. The plates were further incubated at 37 °C for 24 hours. The lowest dilution that yielded no bacterial growth was regarded as MBC (Orji *et al.,* 2012).

Minimum Fungicidal Concentration (MFC)

Sterile Potato dextrose agar plates were separately inoculated with samples from each of the test tubes that showed no evidence of growth. The plates were further incubated at 28 °C for 72 hours and observable lowest dilution that yielded no fungal growth was regarded as MFC (Orji *et al.,* 2012).

Determination of Tannins

Total tannin was determined following the method reported by Amorim *et al.* (2008). To 0.1

ml of the extract 7.5 ml of distilled water, 0.5 ml of Folin-Ciocalteu phenol reagent and 1 ml of 35% sodium carbonate solution were added. Production of blackish blue colouration indicated the presence of tannins

Test for Flavonoid

Total flavonoid content was determined using the method reported by Kale *et al.* (2010). 0.5 ml of the extract was dispensed into test tube, followed by 1.5 ml of methanol, 0.1 ml of aluminium chloride (10%), 0.1 ml of 1 M potassium acetate and 2.8 ml of distilled water. Red or orange colouration indicates the presence of flavonoids.

Test for Saponnin

One gram of extract was dissolved in 4 ml of water. Production of persistent foam for 10 min was indicative of the presence of saponins.

Test for Alkaloid

The total alkaloid content of the samples was determined according to the method described by Singh *et al.* (2004). An aliquot of 1 ml of the extract was mixed with 1 ml of 0.025 M $FeCl_3$ in 0.5 M HCl and 1 ml of 0.05 M of 1, 10-phenanthroline in ethanol. The mixture was incubated for 30 minutes in hot water bath at 70 ± 2 °C. White precipitation indicated the presence of alkaloids.

Test for Phenols

To 0.5 g of ethyl-acetate extract was added 3 drops of 1% (w/v) solution of ferric chloride followed by 1% (w/v) gelatin in sodium chloride of the same concentration. The formation of a precipitate indicates the presence of phenols.

Test for Terpenoids

About 0.5 g of extract was mixed with 2 ml of chloroform and 3 ml of concentrated H_2SO_4 was carefully added to form a layer. A reddish brown colouration at the interface indicates the presence of terpenoids.

Quantitative Phytochemical Screening

Determination of Total Phenol Content

The total phenol content of the extracts was determined according to the Folin–Ciocalteu method as reported by Chan *et al.* (2007). About 1.5 ml of Folin–Ciocalteu reagent was added to 300 µl of extract in a test tube, followed by 1.2 ml of Na_2CO_3 solution (7.5% w/v). The mixture was allowed to stand for 30 minutes at 28 °C before the absorbance was measured at 765 nm against a blank.

Determination of Total Flavonoid Content

Total flavonoid content was determined using the method as reported by Kale *et al.* (2010), 0.5 ml of the extract was dispensed into test tube, followed by 1.5 ml of methanol, 0.1 ml of aluminium chloride (10%), 0.1 ml of 1 M potassium acetate and 2.8 ml of distilled water. The mixture was allowed to stand at 28 °C for 30 minutes, before absorbance was read at 514 nm.

Determination of Tannin Content

Total tannin was determined following the method reported by Amorim *et al.* (2008). To 0.1 ml of the extract 7.5 ml of distilled water, 0.5 ml of Folin-Ciocalteu phenol reagent and 1 ml of 35% sodium carbonate solution were added. The mixture was then diluted to 10 ml with distilled water, properly shaken, and kept at 28 °C for 30 minutes after which the absorbance was measured at 725 nm. Blank was prepared with water.

Determination of Total Saponin Content

Total saponin was determined following the method described by Makkar *et al.* (2007). About 0.25 ml of the extract was dispensed into a test tube with 0.25 ml vanillin reagent and 2.5 ml of 72% aqueous H_2SO_4 were added to it. The reaction mixture in the tube was heated in a water bath at 60 °C for 10 minutes. Then the tubes were cooled in ice for 4 minutes and allowed to cool to room temperature. Subsequently, the absorbance was measured in a UV/Visible spectrophotometer at 544 nm.

Determination of Total Alkaloid Content

The total alkaloid content of the samples was determined according to the method described by Singh *et al.* (2004). An aliquot of 1 ml of the extract was mixed with 1 ml of 0.025 M $FeCl_3$ in 0.5 M HCl and 1 ml of 0.05 M of 1,10-phenanthroline in ethanol. The mixture was incubated for 30 minutes in hot water bath at 70 ± 2 °C. The absorbance of the red coloured complex formed was measured at 510 nm against reagent

blank.

Determination of Total Terpenoid Content

The total terpenoid content of extracts was determined using vanillin-H_2SO_4 method (Doneva *et al*., 2006). To 5 ml aliquots of the extract, 2.5 ml of 2% vanilin-H_2SO_4 reagent was added in a test tube. The mixture was agitated and cooled in an ice bath. Development of colour was achieved by incubating the tubes in water bath at 60 °C for 20 minutes. The tubes were cooled at 25 °C for 5 minutes and the absorbance was read at 608 nm within 20 minutes, against a reagent blank.

Statistical Analysis

The data obtained were expressed as mean and standard error of means of triplicate readings. The analysis was done using SPSS statistical package, version 16.0. It was further analyzed using ANOVA and values were considered significant at $p<0.05$

RESULTS

Antimicrobial Sensitivity Test

Table 1 shows the result for antibacterial activities of both aqueous and ethyl-acetate stem bark extract of *A. digitata* against the test organisms. *Staphylococcus aureus* showed highest zone of inhibition: 14.00±0.57 mm at 200 mg/ml while *Klebsiella pneumoniae* showed the lowest zone of inhibition: 11.00±0.01 mm using aqueous extract but no zone of inhibition using ethyl-acetate extract. The antifungal activities of aqueous and ethyl-acetate stem bark extract of *A. digitata* against *Candida albicans* revealed a zone of 11.66±0.88 mm with the aqueous extract at 200 mg/ml. No zones of inhibition were observed at 50 mg/ml with the aqueous and ethyl-acetate extracts.

Table 1: Antimicrobial Sensitivity Testing of Aqueous and Ethyl-acetate Stem Bark Extract of *A. digitata* against the Clinical Isolates

	Concentration of Aqueous extract (mg/ml)/Zones of Inhibition (mm)			Concentration of Ethyl -acetates extract (mg/ml)/Zones of Inhibition (mm)		
Clinical isolates	200	100	50	200	100	50
Escherichia coli	11.66±0.33^a	9.66±0.33^b	8.33±0.88^b	11.66±0.33^b	9.33±0.3^c	7.33±0.33^b
Staphylococcus aureus	14.00±0.57^b	10.66±0.33^b	9.00± 0.01^c	11.33±1.20^b	9.00±0.57^c	7.33±0.03^b
Klebsiella pneumoniae	11.00±0.01^a	8.33 ± 0.33^a	7.66± 0.33^b	0.00±0.00^a	0.00±0.00^a	0.00±0.00^a
Candida albicans	11.66±0.88^a	8.33±0.33^a	0.00±0.00^a	11.00±0.57^b	7.66±0.33^b	0.00±0.00^a

Values represented in the table are means of triplicate readings and standard error of mean of zones of inhibition of clinical isolates. Values within the column having different superscripts are significantly different at $p< 0.05$.

Antibiotic disc Sensitivity Test

The antibiotics sensitivity testing on the bacterial and fungal isolates are shown in figure 1. *K. pneumonia*e showed the highest susceptibility to Ciprofloxacin while *E. coli* showed the lowest susceptibility. *E. coli* had the highest susceptibility to Ampicillin while *Staphylococcus aureus* had the lowest susceptibility. Sensitivity of *C. albicans* to Nystatin is shown in figure 1.

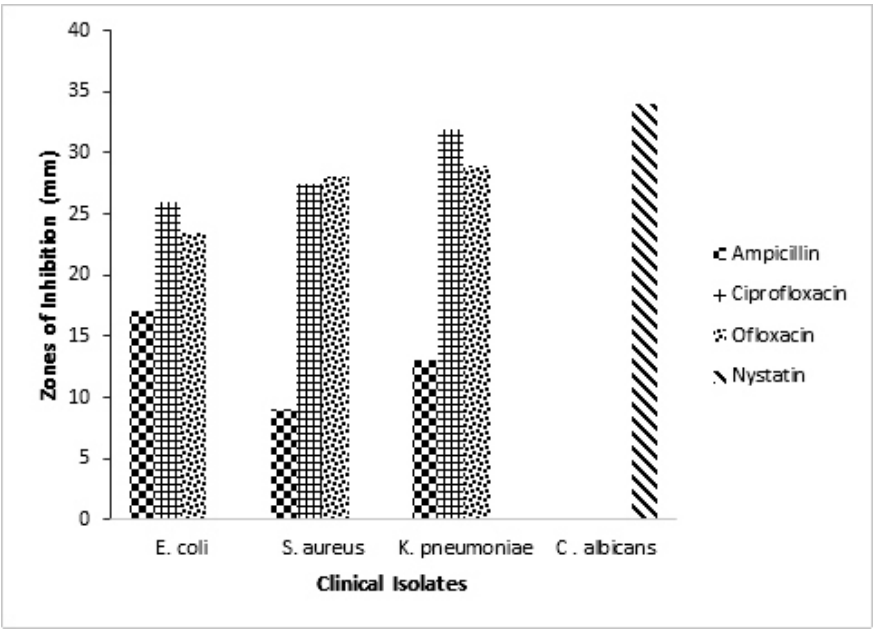

Figure 1: Zones of Inhibition of Standard Antibiotics on the Clinical Isolates

Minimum Inhibitory Concentration (MIC)
The minimum inhibitory concentrations of aqueous and ethyl-acetate extracts of stem bark of *A. digitata* against the clinical isolates are presented in table 3. The MIC was 200mg/ml for all the isolates

Table 2: Minimum Inhibitory Concentration of Aqueous and Ethyl-acetate Stem Bark Extract of *A. digitata* against the Clinical Isolates

	Extracts/Minimum inhibitory concentration (mg/ml)	
Clinical Isolates	Aqueous	Ethyl-acetate
E. coli	200	200
S. aureus	200	200
K. pneumoniae	200	200
C. albicans	200	200

Minimum Bactericidal and Fungicidal Concentrations of the Extracts
The minimum bactericidal and fungicidal concentrations of the extracts against the clinical isolates are shown in table 4. There was growth on plates of 200 mg/ml hence MBC and MFC are of concentrations greater than 200 mg/ml.

Table 3: Minimum Bactericidal and Fungicidal Concentration of Aqueous and Ethyl-acetate Stem Bark Extract of *A. digitata* against the Clinical Isolates

	Extracts/Minimum bactericidal and fungicidal concentration (mg/ml)		
Clinical Isolates	Aqueous 200	Ethyl-acetate 200	MBC/MFC
E. coli	+	+	>200
S. aureus	+	+	>200
K. pneumoniae	+	+	>200
C. albicans	+	+	>200

+ = Growth

Phytochemical Screening

The phytochemical analysis of ethyl-acetate fractions revealed the presence of phenol, tannins, alkaloids, flavonoids, terpenoids and saponin in the stem bark of *A. digitata* tree and the quantities are significantly different from one another with phenol being the most dominant out of all the phytochemicals.

Table 4: Qualitative and Quantitative Phytochemical Screening of Ethyl-acetate Stem Bark Extract of *A. digitata*

Phytochemicals	Reaction	Quantity (mg/ml)
Phenol	+++	2.02 ± 0.25^{e}
Saponin	++	1.28 ± 0.01^{c}
Tannin	+	0.95 ± 0.01^{b}
Terpenoid	++	1.38 ± 0.02^{d}
Flavonoid	+	0.62 ± 0.01^{a}
Alkaloid	+	0.65 ± 0.01^{a}

Values represented in the table are mean of triplicate readings and standard error of means of quantitative screening.
Values within the column having different superscripts are significantly different at $P< 0.05$
Key note: ++ + = Most abundant, ++ =More present, + = Present

DISCUSSION

Sensitivity test of aqueous and ethyl-acetate stem bark extracts of *A. digitata* were carried out on the clinical isolates, the result shows that *S. aureus* was susceptible to the aqueous extract at all the concentrations used having the highest zones of inhibition. This result is significantly different from zones of inhibition of *E. coli* and *K. pneumoniae* at some of the concentrations. This is similar with the research carried out by Abiona *et al.* (2015) who studied the antimicrobial activity of the leafy part of the plant. Reports by Yang *et al.* (2006) affirmed that aqueous extracts of *A. digitata* exhibited a greater inhibition on *Staphylococcus aureus*. This study affirms that aqueous extract of stem bark of *A. digitata* has significant antibacterial activity on the test organisms which is also similar to the report of Abdullah and Mohammed (2019). *E. coli* showed the highest susceptibility to the ethyl-acetate extract of the stem bark of *A. digitata*. The zones of inhibition of *E. coli* were not significantly different from that of *S. aureus* but significantly different from *K. pneumoniae* at all concentrations used. The fungal isolate was susceptible to the two extracts but the aqueous and ethyl-acetate extracts did not exhibit antifungal activity against *C. albicans* at the lowest concentration; Antifungal effect of the plant extracts can be compared with studies on other medicinal plant extracts (Balasundaram *et al.*, 2011). However, the higher the concentration of the extracts, the more pronounced the antimicrobial activities. This is in agreement with the study of Akintobi *et al.* (2016) who concluded that the effectiveness of an extract is dependent on its concentration.

The susceptibility of the test organisms to antibiotics revealed the effectiveness of Ciprofloxacin against *K. pneumoniae* which is in accordance with the findings of Ajiboye *et al.* (2016). However, the antibacterial effect of broad and narrow spectrum antibiotics against several bacteria cannot be over emphasized and have been reported by several researchers. Plant extracts and antibiotics have been reported to have antibacterial properties against bacterial pathogens, howbeit plant extracts are gaining new grounds in phytomedicine. *C. albicans* also showed sensitivity to the antifungal, Nystatin. The Minimum Inhibitory Concentration of the extracts against the test organisms were at the highest concentration used. However, a concentration higher than 200 mg/ml for the aqueous and ethyl-acetate extracts is needed to have a bactericidal and fungicidal effect on the test organisms. The qualitative and quantitative phytochemical analysis of the stem bark of *A. digitata* reveals the plant contained some phytochemicals. Total phenol which was

significantly different from the other phytochemicals at $p < 0.05$ was the most abundant, followed by terpenoid and saponin. Tannin, flavonoid and alkaloid were also present in lesser quantity. This is similar to the study of Ahmad and Beg (2001) on antimicrobial and phytochemical studies of medicinal plants against multi-drug resistant human pathogens. Phenolics have been described as an abundant bioactive compound in plants by Assogbadjo *et al.* (2005). They play significant role in plant defense against pathogenic organisms, hence their application in controlling human pathogenic infections. They possess anti-oxidant, anti-inflammatory, anti-carcinogenic characteristics and also protect from oxidative stress and some diseases (Park *et al.,* 2001) Tannins are also utilized as antiseptic and this activity is due to presence of the phenolic group. In Ayurveda, formulations based on tannin-rich plants have been used for the treatment of enteric diseases like diarrhoea (Sesso *et al.,* 2003). Flavonoids are essential group of polyphenols that are constituents of many plant parts. They are water soluble and have diverse functions which can account for the antimicrobial effectiveness of the plant (Nkafamiya *et al.,* 2007). The presence of the phytochemicals inherent in the stem bark of *A. digitata* may be responsible for their antimicrobial activities (Ogundare *et al*., 2006; Magashi and Abdulmalik, 2018). The variation noticed may be due to factors which may include climatic condition, geographical location, extraction technique and extractive solvent.

CONCLUSION

Result obtained from this study has revealed that aqueous and ethyl-acetate extracts of stem bark of *Adansonia digitata* has antimicrobial properties against *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli* and *Candida albicans*. However, this property may be due to the presence of significant amount of phytochemicals such as saponins, tannins, flavonoids, alkaloids and glycosides present in the stem bark of the plant. This also implies that the stem bark of *A. digitata* has potentials to be used as an antimicrobial agent

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