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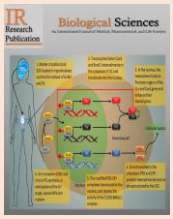

Comparative antibacterial studies of *Ficus sycomorus, Khaya senegalinesis* and *Azadirachta indica* leaves extract

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ABSTRACT

Since the introduction of penicillin in the 1940s, antibiotics have become one of the cornerstones of modern medicine. Infectious diseases caused by bacterial pathogens represent a greater percentage of public health concern. In clinical medicine, antibacterial agents are often indicated for chemotherapy of infectious diseases that are bacterial in origin. A variety of bacterial species of human and animal origin have developed numerous mechanisms that render bacteria resistant to some, and in certain cases to nearly all antibiotics. Thus, it is important to study the phytochemical and biological mechanisms which made the bacterial pathogens to survive in the presence of these inhibitory agents. The need for new antimicrobials has been increased dramatically. Plants are considered as a major source of new antibiotics due to the presence of phytochemicals. The goal of our research is to evaluate antibacterial efficiency of FKA plant leaf extracts. The leaves of FKA were screened for antibacterial activity and minimum inhibition concentration (MIC). The methanol, n-hexane, and ethyl acetate extracts of these plants were subjected to antibacterial analysis as well as minimum inhibitory concentration (MIC) analysis, using agar well diffusion methods. The crude extracts showed various zones of inhibition against the following microorganisms namely, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*. *Baccilus subtilis*, with different concentration of 25mg/mL, 30mg/ml, 35mg/mL and 40mg/mL respectively, the minimum inhibitory concentrations (MIC) was taken for the tube that shows no turbidity.

Introduction

It is sometimes suggested that the field of medicinal plants have already been exploited to level that further research yield only "academic results". However, it was believed that research have only scratched the surface of this field. Due to the growing recognition of natural products the demand for medicinal plants has been increasing all over the world. They have minimal toxicity, are cost effective and pharmacologically active, and provide an easy remedy for many human ailments as compared to the synthetic drugs which are subject of adulteration and side effects (Shariff et al., 2006) The alarming increase in the rate of infection by antibiotic-resistant

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microorganisms has urged scientists to search for compounds which have potential antimicrobial activity (Ates et al., 2003). The ability to synthesize compounds by secondary metabolism possessing antimicrobial potential makes plants an invaluable source of pharmaceutical and therapeutic Products. The effectiveness of plant extracts on microorganism has been studied worldwide (Duraipandiyan et al., 2006). More phytochemical compounds have been isolated from various parts of the plant, namely phenols, flavonoids, alkaloids, cardiac glycosides, saponins, terpenoids, steroids, and tannins.

Abubakar et al., (2015) worked on phytochemical and antimicrobial screening of methanol root bark extract of *Ficus sycomorus* linn. (moraceae). The author reported that the methanol extract of *Ficus sycomorus* Linn. (Moraceae) revealed the presence of tannins, Saponins, alkaloids, flavonoids, steroids, terpenoids and cardiac glycosides. (*Escherichia coli*, *Pseudomonas aeroginosa*, *Baccilus subtilis* and staphylococcus aureus showing various degree of zone of inhibition.

Festus et al., (2016) worked on antibacterial Activity and phytochemical profile of leaf extracts of *Ficus abutilifolia*. The author reported that the disc diffusion method was used to determine the susceptibility of clinical bacterial isolates to fractions of leaf extract of *Ficus abutilifolia*. with mean zone diameter of inhibition ranging from 9.33±0.58 to 31.67±0.58 mm. Phytochemical assay of leaf extract revealed the presence of tannins, Anthraquinones, Saponins, flavonoids, alkaloids, reducing sugar, cardiac glycosides, carbohydrates and phlobatannins.

The review shows that the plant has the following pharmacological activities: it shows antiviral, antifungal and bactericidal properties (Abdelgaleil et al., 2001, Abdelgaleil and Nakatani, 2003; Ademola et al., 2004). Makut, et al., (2007) report that the *Khaya senegalinesis* , phytochemical screening shoe that Saponins, tannins alkaloids glycosides steroid and flavonoids are presents in the leaves and bark of the plants. The antimicrobial activity test against *Staphylococcus aureus, Staphylococcus feacalis* and *Candida albican* were susceptible to both leaves and bark extracts, were *Escherichia coli* was not, the result of MIC and MBC show that the extracts of Khaya have bactericidal properties against *Staphylococcus aureus* shows the MIC of 7.81mg/ml while the *Escherichia coli* did not show activity. similar report by (Abdullahi et al., 2016) show that the leaf of *Khaya senegalinesis* show the presence of Phytoconstituents such as Saponins flavonoids alkaloids and tannins against bacterial isolates *Escherichia coli* and salmonella typhi but statically there is no significance difference among the test organism with P-value =1>0.05, the MIC on ethanolic stem bark rangs from 12.5gm/mL but the ethanolic leaves extracts ranges from 25gm/ml where *E.coli* and shegella are more sensitives at 25gm/mL.

Also, in research by Kubmarawa, et al., (2008) report that the Khaya senegalensis has medicinal properties for the effective management of several ailments including diarrhea. All fractions were subjected to phytochemical screening and antimicrobial activity against gram-positive and gram-negative bacteria using the disc-diffusion method. The extracts contained saponins, tannins, phenols but no flavanoids, glycosides and resin. These findings support the claim for its treatment of bacterial infection.

Yerima et al., (2012) reported that the *Azadirachta indica* leaf extracts of aqueous leaf extract shows antibacterial activity against test bacterial isolates tested at all concentration from the results obtained in this study it can be seen that the neem extracts had varying inhibition potential on the test bacteria.

Several studies had been performed to investigate the antimicrobial activity of Neem leaf extract and their results were almost similar to our results. Recent studies have shown that Neem possesses anti-inflammatory, anti-arthritic, antipyretic, hypoglycemic, antigastric ulcer, antibacterial, antifungal, and antitumor activities (Sharma et al., 2014). It possesses a wide spectrum of antibacterial action against Gram-positive and Gram-negative microorganisms (Banna et al., 2014).

Itelima et al., (2016) reported in their studies both plant extracts had antimicrobial effects against the test organisms. Thus, the mean diameter zones of inhibition ranged from 0.03mm-40.00mm and 0.50mm-21.00mm for different extract at the highest concentration of 50mg/ml. The finding of this study supports the use of neem leaf in the treatment of various microbial infections by alternative systems of medicine. The present aims of the current research is to evaluate the antibacterial activity of FKA plant leaves extracts against these bacterial isolates namely: staphylococcus aureus, Pseudomonas aeruginosa, *Baccilus subtilis* and *Escherichia coli* which are gram positive and gram negative bacteria.

Materials and Methods

Sample collection

Samples of *Ficus sycomorus* (Linn) Leaves were collected from river side in Maru local Government area of Zamfara state the samples leaves were washed using tap water. They were air dried and

pounded into a paste using pestle and mortar. The paste of the leaves extracts was allowed to dry in the sun for five days. It was then ground into powder and stored in a tied container for feature use. The taxonomy of the plant was authenticated, at Usmanu Danfodiyo university sokoto teaching hospital herbarium school of pharmacognocy and ethno medicine.

Preparation of plant extracts

The collected plant samples were dried and crushed to powder form. 150 g of powdered FKA plant sample were macerated with 500 ml of methanol, N. Hexane, and ethyl acetate separately. The after 48hr its then filtered and concentrated at 40°C for 48 hr. After the incubation period was over, the mixture was filtered and centrifuged at 10,000 rpm at 4°C. The extracts were concentrated to dryness in rotary evaporator (IKA-RV 10 Control) and were stored at 4°C until further used.

Qualitative Phytochemicals (wet) test

The prepared plants extract of all the 9 crude extracts of the plants was used to test various Phytoconstituents present in them different chemical and reagents are used for major constituents was adopted by using standard qualitative methods as described based on the article reviewed (Alamzed et al., 2013, Taulukar and Chaudhary, 2010). The phytochemical screening of the ethyl acetate, methanol and n-Hexane extracts of the leaf of FKA was carried out for the presence alkaloids, cardiac glucosides, flavonoids phenols, saponins, tannins, terpenes and steroids using standard phytochemical methods. The phytochemical screening of the FKA extracts of the plant was carried out in order to detect the chemical constituents (bioactive agents) responsible for their antibacterial and therapeutic activities.

Tests for Alkaloid

To 2ml of the extract, 1ml of Mayers reagents was added, the presences pale yellow precipitate (ppt) indicates the presence of alkaloids (Taulukar and Chaudhary, 2010)

Tests for Cardiac Glycoside

To 5millilitres of the plant extract was treated with to 2.mililter of glacial acetic acid with one drop of FeCl3 solution a violet ring may appear or greenish ring from just which indicates the presence of the cardiac glycoside (Alamzed et al., 2013).

Test for Flavonoids Shinodas test

To the extract of the plants sample 4mililetrs was taken and 1.5mililters of 50% methanol solution, a small magnesium chunk was warmed, 5-6 drops of concentrated HCl was added, red color was observed indicates Flavonoid (Taulukar and Chaudhary, 2010)

Test for Saponins

The pulverized powdered plant 2 gram was weighed and boil in 20milliters of distilled water, 10 milliliters filtrate 5millliter of distilled water was quivered Vigorously, the appearance of frothing indicates the presences of Saponins (Alamzed et al., 2013).

Tests for Tannins/polyphonols

To dilute extract 3-4drops of 10% FeCl3 was added, A blue colour was observed for gallic tannins, and the presence of catechol tannins turned the solution green (Taulukar and Chaudhary, 2010).

Test for Terpenoids

A 0.2g of each sample was mixed with 2 milliliters of chloroform, 3 milliliters of conc. H2SO4, reddish brown colouration indicates the presences of terpenoids (Alamezd, et al., 2013).

Quantitative phytochemical screening of the *Ficus sycomorus* leave s extracts of different solvent s used for the extraction of the secondary metabolites.

Determination of Total Flavonoid

Procedure: 0.5g of the plant sample extracts was weight and placed in 250 ml conical flask, 100ml of dilute hydrochloric acid was added and boil in water bath for 35 mints, after it was filter while hot to recover the extracts. The filtrate was treated with ethyl acetate in drop wise twice. The precipitate recovered was filtrated and weight which give the percentage of the flavonoids presents.

$$\frac{W3 - W1}{W2} \times 100 = \%flavonoid\ presents$$

Where W1 is the weight of the empty filter paper
W2 is the weight of the extract = 0.5g for each sample
W3 is the weight of empty filter paper + the flavonoids precipitate

Determination of Total Alkaloids (Harborne J, 1973)

Five gram (5 g) of the sample was weighted and transferred into a 250 ml beaker. About 200 ml of 10% acetic acid in ethanol & cover the beaker with

aluminum foil and allow to stand for 4 hours. The extract was filter & concentrated on a water bath to one-quarter of the original volume, a drop wise of concentrated ammonium hydroxide was added to the extract until the precipitation was complete. The whole solution was allowed to settle, and the precipitates were collected and wash with dilute ammonium hydroxide and then filter. The residue is the alkaloid, which was dried and weighed.

$$\frac{W3 - W1}{W2} \times 100 = \% \, alkaloids \;\; presents$$

Where W1 is the weight of the empty filter paper
W2 is the weight of the extract = 0.5g for each sample
W3 is the weight of empty filter paper + the alkaloids precipitate

Antibacterial Assay of *Ficus sycomorus* leaves extracts of three solvents

Microorganism's collection

The chemical isolates were collected from the stock organisms from the department of pharmaceutics and pharmaceutical microbiology of teaching hospital, Usmanu Danfodiyo University. The microorganism used are *Escherichia coli*, *Staphylococcus aureus, Pseudomonas aeruginosa* and *Baccilus subtilis.*

Preparation and sterilization of materials

All glass wear used were washed and dried in a hot air oven at 40OC for 35 minutes.

Preparation of the culture media

The antimicrobial activity was carried out using nutrient Agar which was prepared according to the manufacturer's recommendation. 14g of nutrient agar was dissolved in 500ml of distilled water. The nutrient agar prepared was distributed in 19ml portioned each and was sterilized in an autoclave at 121oC for 15minuties. The seeded agar plates were prepared by pouring 19cm3 of the molten nutrient agar into sterile petri-dish which 0.1cm3 of the test microorganism was inoculated.

Preparation of stock solution of the extract

The preparation of stock solution was carried out by using 0.2g of each extract which was carefully weighed and transferred into the sterilized test-tube. 2cm3 of DMSO was added to each of the test-tube containing the extract and was dissolved completely to get the stock.

Response of the test organisms.

The zone of inhibition was then taken after the incubation period using a graduated ruler and then recorded.

Determination of Minimum Inhibition Concentration (MIC)

Minimum inhibition concentration was determined using dilution method.(Williams and Wilkins, 2007) the nutrient broth was prepared according to the manufacturer instruction and 5ml of the nutrient broth was dispensed into separate test-tube well labeled according the concentration 25, 30, 35, and 40mg/ml then 1ml of the extract was transferred into the test-tube of different concentration containing the nutrient broth from these concentrations, 2ml of each concentration was transferred to its corresponding test-tube serially. It was allowed to stand for 30 minutes before incubation. After incubation, the lowest concentration which showed no turbidity in the test-tube was recorded as the MIC.

Results and Discussion

The result obtained from the extraction of the secondary metabolites using the cold maceration methods with little modification among the three solvents of varying of polarity, method which the FME, FEE and FHE yielded 12.23, 10.72 and 7.28 g respectively. This corresponds to 8.12, 7.14 and 4.85 % respectively. From Table 1, Also the percentage yield of the extract obtained from the extraction of the AME, AEE and AHE are 12.04 g 10.57 g, and 6.62g respectively which correspond to the percentage yield as recorded in table 1 Moreover, KME, KEE and KHE, the yield obtained are 13.21g 11.94g, and 6.35g, respectively as presented in table 4.1 the highest percentage was obtain from KME with 8.81%, then AME with 8.12%, then AHE 8.02% followed by KEE with percentage of 7.96% then KHE 7.23% the least is AME 4.41% as presented in table 1

Table 2 preliminary phytochemical screening of the constituents of active metabolites in FME indicates that Saponins, alkaloids tannins are present while steroid flavonoids and cardiac glycosides are absent. In the FEE contains the following Phytoconstituents steroids, flavonoids, and Tannins, while Saponins alkaloids are found absent from the ethyl acetate extract. Also, in the FHE contains alkaloids, flavonoids and tannins while glycoside, steroids and Saponins are not detected from the FHE. This was agreed with the findings from Abubakar et al., (2015), and the research by Festus et al., (2016), similar research by Makut et al., (2008)

Table 1. percentage yield of extraction *Ficus sycomorus, Khaya senegalensis* and *Azadirachta indica* leaves.

S/No.	Extracts	Weight (g)	Percentage Yield (%$_{w/w}$)
1.	FME	12.23	8.12
2.	FEE	10.72	7.14
3.	FHE	7.28	4.85
4.	KME	13.21	8.81
5.	KEE	11.94	7.96
6	KHE	6.35	4.23
7.	AME	12.04	8.02
8.	AEE	10.57	7.05
9.	AHE	6.62	4.41

Key: FME = *Ficus sycomorus* Methanol extract, FEE= *Ficus sycomorus* ethyl acetate extract, KME *Khaya senegalinesis* methanol extract KHE *Khaya senegalinesis* Hexane extract, KEE *Khaya senegalinesis* ethyl acetate extract, AME *Azadirachta indica* methanol extract, AEE *Azadirachta indica* ethyl acetate extract AHE *Azadirachta indica* Hexane extract.

Table 2. Phytochemical test (Wet) of *Ficus sycomorus, Khaya senegalensis* and *Azadirachta indica* leaves (FKA).

	Metabolites Tested							
Plant Extracts Type	**Alkaloids**		**C Gl**	**Flavonoid**	**Saponins**	**Steroids**	**Tannins**	**Terpenoids**
	M	D						
F sycomorous(F)								
FHE	+	+	-	+	-	-	+	-
FEE	+	-	+	+	-	+	+	+
FME	-	+	+	-	+	-	+	-
K. senegalensis(K)								
KHX	+	+	-	+	+	-	+	-
KEE	-	+	+	+	-	-	+	-
KME	+	+	-	-	-	+	+	+
A. indica (A)								
AHX	+	+	-	-	+	-	-	-
AEE	+	+	-	-	-	+	-	-
AME	-	+	-	+	+	+	+	+

Key = + presents - =absent, FME = *Ficus sycomorus* Methanol extract, FEE= *Ficus sycomorus* ethyl acetate extract, KME *Khaya senegalinesis* methanol extract KHE *Khaya senegalinesis* Hexane extract, KEE *Khaya senegalinesis* ethyl acetate extract, AME *Azadirachta indica* methanol extract, AEE *Azadirachta indica* ethyl acetate extract AHE *Azadirachta indica* Hexane extract. D= Dragendoff's M= Mayers

Table 3. Quantitative phytochemical evaluation of active metabolites in FKA plant leaves extracts.

S/N	Extracts	Alkaloid	Flavonoids	Saponins
1.	FME	2.81±0.01	4.52±0.03	5.35±2.2
2.	FEE	4.13±0.01	3.40±0.02	0.60±005
3.	FHE	1.62±0.02	7.93±0.05	5.32±0.08
4.	KME	1.77±0.01	6.93±0.02	11.80±0.02
5.	KEE	4.02±0.01	10.33±0.01	3.49±0.02
6.	KHE	2.21±0.01	4.35±0.01	9.61±0.03
7.	AME	5.02±0.02	7.23±003	8.16±002
8.	AEE	4.78±0.07	4.78±0.07	3.80±0.05
9.	AHE	4.09±0.02	3.65±0.02	6.31±002

Key: All the values are represented in Mean ±SE, FME = *Ficus sycomorus* Methanol extract, FEE= *Ficus sycomorus* ethyl acetate extract, KME *Khaya senegalinesis* methanol extract KHE *Khaya senegalinesis* Hexane extract, KEE *Khaya senegalinesis* ethyl acetate extract, AME *Azadirachta indica* methanol extract, AEE *Azadirachta indica* ethyl acetate extract AHE *Azadirachta indica* Hexane extract.

(2016) it clearly show that the plant possess the active secondary metabolites which are responsible for antibacterial activity (Italema et al., 2010).

Table 2 present the data obtained from the screening of active constituents in KME indicates, the presence of alkaloids steroids, and Tannins while cardiac glycoside flavonoids and Saponins are absents. The KEE indicate the presence of tannins, and cardiac glycosides while alkaloids, steroids and flavonoids are not detected from the extracts. The KHE which is less polar than KEE indicates the presence of alkaloids, flavonoids and Tannins while steroids and cardiac glycoside are absents. These have agreements with finding of Kubmarawa et al., (2008) and similar research by Festus et al., (2016).

In general comparison of the secondary metabolites screened from FKA medicinal plants some of them possess this Phytoconstituents which are the active ingredients for the therapeutics activities are found in some while other not detected. The methanol extracts of all the plants extracts Saponins is present only in the *Azadirachta indica* and *Ficus sycomorus* leaves but it's absent in the *Khaya senegalinesis* of the methanol extract. Also, alkaloids are presents in all three-plant extract of crude methanol. Steroids are found in the *Khaya senegalinesis* and *Azadirachta indica* and absent in the *Ficus sycomorus* leaves extract, as presented in the table 2

Our present study revealed good antibacterial effect of plant extracts towards a panel of microorganisms under study. This may be due to the rich diversity of phytochemicals such as flavonoids, Saponins, alkaloids, phenols and tannins present in the plant extracts in higher amounts as well as the type of solvent used to completely extract these bioactive compounds present within the plant. From table 3 the Results of quantitative evaluation indicate highest Saponins content in KME, which comply to the statement that methanol, is undoubtedly considered the best solvent for extraction of phenolic compounds due to better solubility and polarity of the solvent (Roby et al., 2013). The statistical analysis using the one way Anova indicate that the P-value (0.005) which is less than tabulated value (0.05) for the three solvent used for the extraction of the active Phytoconstituents the result is presented in Mean ± SE, with the P-value is 0.05 which indicates that there is no significant difference between the sample extracts in alkaloids and flavonoids in *Ficus sycomorus*, *Khaya senegalinesis* and *Azadirachta indica* extracts, but the *Ficus sycomorus* Saponins have the p- value (0.99) which greater than the tabulated P-value this mean that there is significance difference between the means in KME and KHE leaf extracts with the mean of 5.35±2.2 and the p- value =0.99.

The plant there show that is no significant difference between the three mean of the results, further comparison using the turkey pair wise test show that two solvent are significantly the same with P-value (0.99) which is greater than the tabulated value P-value(0.05) it signify that there no significant difference between the two solvent of extraction. Similar to the study conducted by (Roby et al., 2013), our study also displayed similar results in case of KME in comparison to AME and FME. Statistically using the same method of analysis show that the result obtained from Anova and turkey pair wise test there is no significant difference between the three solvent used for the extraction with p-value (0.00) which less than the tabulated value (0.05).

Our study showed KEE contain the highest flavonoids contents in addition to highest Flavonoids contents, which is in accordance with the findings of (Mahboubi, et al ., 2015) who reported the methanol extract to have maximum phenolic and Flavonoid levels, and displaying more pronounced antibacterial potential compared to other solvent extracted samples, as presented table 3.

All these plant extract samples showed promising antibacterial activity compared to other extracts FEE, AEE, AHE, FME which their presence was not detected. It can be said that high content of Saponins present in plant extracts could be considered as the basis for its antimicrobial property as claimed previously that Saponins rich plants have profound antimicrobial activity (Ohadoma, 2014). Generally all the three plant show that there no significance difference between the three solvent used in phytochemical analysis which reveal different class of metabolites which Saponins was among them which clearly show that only in FME to FHE with P-value (0.99) which is greater than the P-value tabulate (0.05), but all other are significantly different. The statistical analysis using the ANOVA show that there is No significant different between the three solvent used in extraction of the metabolites with P-value (0.00) which is less than the tabulated value P-value (0.05).

The results obtained revealed a notable antibacterial activity of the compounds of FME, FEE, FHE, KME KEE KHE AME, AHE and AEE. The antibacterial evaluation of FKA plants leaves AEE show greater zone of inhibition diameter 14.00±3.54 then, KME and FEE 11.75±3.99 and 11.75±3.51 respectively. From these it showed that FEE 11.50±4.01 and the lowest value was obtained from the FHE and KHE with 0.00±0.00 each

Table 4. Average means of zones of inhibition of FKA plant leaves extract on the test organism.

Plants extract	Ps	Bs	Ec	Sa
FME	7.25±1.25	3.0±1.78	8.75±3.50	10.75±2.81
FEE	8.75±3.75	4.50±2.63	11.50±4.01	11.75±3.51
FHE	0.00±0.00	4.25±2.46	6.00±2.16	3.00±1.78
AME	12.00±4.20	8.75±3.42	0.00±0.00	0.75±0.75
AEE	7.75±2.90	11.00±3.03	8.25±3.82	14.00±3.54
AHE	7.25±3.35	6.00±4.24	9.25±2.78	5.50±3.20
KME	11.00±2.42	11.75±3.99	5.75±3.79	5.50±2.40
KEE	7.50±2.72	9.75±3.28	4.25±2.53	7.50±3.86
KHE	0.00±0.00	4.25±1.05	8.00±3.34	10.50±2.72

Ps= *Pseudomonas aeruginosa*, Bs =*Baccilus subtilis*, Ec= *Escherichia coli*, and SA= *Staphylococcus aureus*.

Table 5. Minimum Inhibitory Concentration (MIC) of FKA.

Conc. (mg/ml)	40	20	10	5	2.5	1.25	0.625	0.313	0.156
AME PS	-	-	+	+	+	+	+	+	+
AEE SA	-	-	-	+	+	+	+	+	+
KME SA	-	-	+	+	+	+	+	+	+
KEE BS	-	-	-	-	-	+	+	+	+
FME	-	-	+	+	+	+	+	+	+
FEE SA	-	-	-	+	+	+	+	+	+

Key: FEE EC = *Ficus sycomorus* ethyl acetate extracts *Escherichia coli*, AEE SA = *Azadirachta indica* ethyl acetate extracts *Staphylococcu aureus*, AMEE= *Azadirachta indica* methanol extracts of *Pseudomonas aeruginosa*, KME SA= *Khaya senegalinesis* methanol extracts of *Staphylococcus aureus*, FME SA = *Ficus sycomorus* methanol extracts of *Staphylococcus aureus*, KEE *Khaya senegalinesis* ethyl acetate extracts *Baccilus subtilis*.

Table 6. Minimum bactericidal concentration (MBC) of Bioactive recorded FKA plant extract against the bacterial isolates

Conc. (mg/ml)	40	20	10	5	2.5	1.25	0.625	0.313	0.156
AME PS	-	-	+	+	+	+	+	+	+
AEE SA	-	-	-	+	+	+	+	+	+
KME SA	-	-	+	+	+	+	+	+	+
KEE BS	-	-	-	-	-	+	+	+	+
FME	-	-	+	+	+	+	+	+	+
FEE SA	-	-	-	+	+	+	+	+	+

KEY: Me A= methanol *Azadirachta indica* extract *Pseudomonas aeruginosa*, Eth A. S.a Ethyl acetate *Azadirachta indica* extracts *Staphylococcus aureus*, Me K Ps= methanol *Khaya senegalinesis* extract *Pseudomonas aeruginosa* Eth K Bs ethyl acetate extract *Baccilus subtilis* ; Me F Sa= methanol extract *Ficus sycomorus* extract *Staphylococcus aureus* Eth F Ec= ethyl acetate extracts *Escherichia coli*

respectively. AEE has greater activity among the three-plant tested on bacterial isolates which indicates that some are active/ resistant while other are not resistant.

Generally from table 4 the various readings recorded for the whole three plant at various levels of concentration on different solvent AEE show greater activity of 14 mm exhibited by staphylococcus aureus then AME of the same plant but different extract exhibits response to the test organism with the zone diameter of 12 mm equally *Ficus sycomorus* and Khaya senegalensis show the same zone of inhibition but different extract as recorded from KME of *Baccilus subtilis* in and FEE in staphylococcus aureus they have the same zone diameter of inhibition 12 mm also FME staphylococcus aureus and FEE have the same zone of 11 mm in comparison with AEE *Baccilus subtilis* and KME have the same zone diameter equally with FEE with zone diameter of 11 mm while other show moderate activity of zone diameter of inhibition at various levels of concentration of for different test organism. In a nutshell *Azadirachta indica* show greater activity among the plant as medicinal plant used in treatment of different ailments affecting both human and animal. All the result that are obtained are compared to the literature reviewed which revealed that the result has agree with the literature that both the FKA medicinal plants have antibacterial activities against the gram positive and gram-negative bacterial isolates.

From the different result obtained in table 5 MIC of FKA shows that *Azadirachta indica* has the highest MIC obtained at the concentration 1.25 mg/ml against staphylococcus aureus, the *Khaya senegalinesis* extracts of methanol against pseudomonas aeruginosa at the concentration of 5 mg/ml, followed by the methanol extracts of

Azadirachta indica , *Ficus sycomorus* and ethyl acetate extracts of *Khaya senegalinesis* which show the same MIC at the same concentration 10 mg/ml against different bacterial isolates *Pseudomonas A., staphylococcus A.,* and *Baccilus S*., respectively. While the ethyl acetate extracts of *Ficus sycomorus* show lower MIC at the concentration of 20 mg/ml against *Escherichia coli*.

Ttable 6 the minimum bacterial concentration of the various extract of the plants against different bacteria indicates that ethyl acetate of both the Azadirachta and *Khaya senegalinesis* extracts show greater MBC at the concentration of 2.5 mg/ml against different bacterial isolates for two plants Azadirachta and *Khaya senegalinesis* staphylococcus and *Baccilus subtilis* respectively. Methanol extracts of the *Azadirachta indica* against staphylococcus aureus show MBC at concentration of 10 mg/ml. Also, *Ficus sycomorus* methanol extract shows similar MBC at the same concentration 10 mg/ml, ethyl acetate have similar MBC as compared with the methanol extracts both *Khaya senegalinesis* and *Azadirachta indica*.

Conclusion

Currently, there is resurgence in the use of natural products, especially medicinal plants in prevention, treatment and management of several diseases. Natural products are perceived by the consuming public as safer alternatives to conventional therapies, especially in the face of known numerous adverse effects associated with the latter. It is on record that more than 80% of the world population depends on medicinal plants as alternative to conventional drugs in the healthcare sector. Recommendations: We are now recommending that further research should be encouraged to further investigated to elucidates the structure of the metabolites that are responsible for the antibacterial activity of the plants for further processing of drugs.

Contribution of authors

N, Muhammad: funding acquisition, formal analysis, writing original draft, review & editing. M. Lawal: funding acquisition, formal analysis, writing original draft, review & editing. S.R. Saidu: conceptualization, formal analysis, writing original draft, writing review & editing. Zayyanu I. and Abubakar I: conceptualization, formal analysis, writing original draft, review & editing.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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