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Chemical Composition and Antimicrobial Activities of *Picralima nitida* Stem Bark Extracts

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ABSTRACT

Picralima nitida has varied applications in West African traditional medicine. The stem bark of the plant was successively extracted with n-hexane and chloroform using cold extraction techniques. The phytochemical analysis and antimicrobial activity of *P. nitida* extracts were determined using established methods. Chemical composition of the n-hexane extract was determined by GC-MS. The phytochemical screening of the n-hexane and chloroform extract revealed the presence of alkaloids, phenols, glycosides, eugenols, terpenoids, reducing sugars and proteins. The GC-MS of the n-hexane extract of *P. nitida* stem bark revealed the presence of 54 compounds, representing 100% of the total identified components. The major components detected were found to be dodecanoic acid (lauric acid)(18.34%), 9 octadecanoic acid (Stearic acid) (7.49%) , n-hexadecanoic acid (palmitic acid) (5.95%) while among the minor component were phytol (1.73%) and 5cholesten-3-Beta, 2,6-dioic-16-one (0.36%). The result of the antimicrobial activity revealed that the n-hexane extract exhibited the highest inhibitory activity against *Escherichia coli* while the chloroform extract exhibited the highest inhibitory activity against *Staphylococcus aureus.* The activity of the extracts against the fungi isolates were found to insignificant at all test concentrations. The MIC value for of n-hexane was found to be 150 and125mg/ml for *S. aureus and E. coli* respectively while that of chloroform extract was found to be 125 and 125mg/ml for *S. aureus and E. coli* respectively. This study has shown that the n-hexane extract was more active against the Gram negative bacteria while the chloroform extract was more active against the Gram-positive bacteria .This investigation therefore revealed that the stem bark extracts possess some antimicrobial properties and could be a promising source of novel drugs.

Keywords: Antimicrobial activity, GC-MS, *Picralima nitida*, Phytochemicals

INTRODUCTION

Medicinal plants refer to a variety of plants with medicinal properties. They are a rich source of compounds that drugs could be formulated from (Rasool, 2012; Ogbeide *et al.*, 2018). It could also be referred to as plants in which one or more of its parts (fruit, seed, leaf, stem or root), are made up of active chemical compounds that has therapeutic functions or which acts as precursors for drugs synthesis (Sofowora 2008; Evans, 2008).

However, identifying more new and effective drugs from medicinal plants could be achieved by isolating and investigating bioactive compounds from medicinal plants. The rising antibiotics resistance of bacterial pathogen has been found to be suppressed by emergence of these compounds present in medicinal plants (Rossiter, 2017). Naturally occurring, biologically active compounds which occur in plants are known to be phytochemicals (Scalbert., 2005). Some of the major phytochemicals from plants are; glycosides, Terpenoids, tannins, alkaloids, saponins, flavonoids, steroids, phenols, etc.

Picralima nitida is a specie of genus *Picralima*. It belongs to the hunterieae tribe of the Apocynaceae family. The plant is called by different local names in Nigeria such as Osu (Edo), Osi-Igwe (Igbo), and Abere (Yoruba) (Duwiejua., 2002). Botanically, is a tree that can reach up to 4-3.5m in height. It flowers are white (about 3 cm long) and they have ovoid fruits which become yellowish when mature. It has wide leaves of 3-10 cm and oblong with length of 6-20 cm including laterals that are tough and tiny. is extensively distributed across West-Central Africa. The wood is hard with pale yellow and a cylindrical shape. The diameter of the trunk ranges from 5 to 60 meters (Okonta and Aguwa, 2007). Different ailment such as fever, hypertension, jaundice, gastrointestinal disorders, and malaria has cured or managed by traditional physician using various parts of the plant (Falodun, 2006). Crude herbal extract use as a remedy for various kinds of human

diseases have been prepared from various parts of the plant (Duwiejua, 2002). The existence of flavonoids, alkaloids, saponins, terpenoids, steroids, tannins and glycosides in the plant has been discovered by the screening of possible phytochemicals present in the plant (Nkere and Iroegbu,2005; Mabeku., 2008; Obasi., 2012; Ubulom., 2012; Kouitcheu., 2013).This was supported by the Isolation of several alkaloids from the seeds of the plant, as well as polyphenols from other parts of the plant (Ansa-Asamoah,1990; Menzies, 1998; Tan., 2002).

In this work, attempts were made to qualitatively screen the presence of phytochemicals present in both extracts, and GC-MS analysis was employed to identify some of the individual phytochemicals present in the *n*-hexane extracts of the stem bark of *P. nitida*. The extracts were further tested against some microbial isolates to assess their activity.

MATERIALS AND METHODS

Collection of Plant Sample

The *P. nitida* was obtained from Ikpoba Hill Market, Ikpoba Okah Local Government Area of Edo State. The plant was identified in the Department of Plant Biology and Biotechnology, University of Benin, Benin City, Edo State with a voucher number UBH-P424 deposited.

Plant extraction The stem bark of P. nitida was air-dried at room temperature (30±0.5 °C). The cold method of extraction was used in the extraction of the active components from the plant material using n - hexane and chloroform. The sample was pulverised to fine powder using a grinder according to the method of Wokocha and Okereke, (2005). After which, 500 g of the dry stem powder of P. nitida was weighed, poured into a glass container and mixed with 1 L of n-Hexane which was left for 72 hours with shaking, then filtered using a funnel and sieved of very tiny mesh. Another 500 mL of n-Hexane was added and left for another 48hours which was followed by filtration. It was repeated again with another 500 mL making it 3 batch extraction. The same process was repeated for chloroform extract. Then the percentage yield was calculated. The filtrates were freeze dried, and the resulting extracts were stored at 4 °C.

$$Yield\ of\ extract\ (\%) = \frac{A}{B} \times 100\%$$

A= amount of extract recovered from solvent
B= total amount of plant material

Gas Chromatography-Mass Spectroscopy (GC-MS) Analysis of the n-Hexane Extract of Stem bark.

The GC-MS analysis of n-hexane extract of stem bark was carried out using an Agilent 7890 GC system equipped with an Agilent 5977A mass selective detector system (Agilent Technologies, Shimadzu, Japan). The instrument with a Zebron-5MS (cross-linked 5% – phenyl methyl polysiloxane) column (HP-5 fused silica 30 m × 0.320 mm × 0.250 µm film thickness) was operated at injection temperature (250°C), ion source temperature (280°C), and pressure (144.4 kpa). The carrier gas used was GC-grade helium (99.999% purity) at a flow rate of 36.262 cm/s, and about 1 µL sample injections were used. The oven temperature was initially started from 60°C (held for 4 min) and then ramped to 300°C at 4°C/min**.**

Phytochemical Screening

Chemical tests for the screening and identification of phyto-constituents in of the n-hexane and chloroform extracts of *stem bark* were carried out using the standard procedures as described by Sofowora (1993) and Trease and Evans (2002).

Bacterial Isolates

The pathogenic isolates obtained from the Department of Medical Microbiology, University of Benin Teaching Hospital (UBTH), Benin City, Edo State, were comprised of Staphylococcus, Aspergillus flavus, and Candida albicans.

Antibacterial Assay

The extracts were spot-checked for antibacterial activity using the agar well diffusion technique (Okeke., 2001). Standardized inoculum (5x105cfu/ml) of each test bacterium was spread on to sterile Muller Hinton agar (MHA) plates to achieve a confluent growth. The plates were allowed to dry and a sterile cork borer of diameter 5.00 mm was used to bore wells in the agar plates. The extracts were reconstituted in 20% dimethylsulphoxide (DMSO) and diluted with sterile water to a concentration of 100 mg/ml. Subsequently, a 10 µl volume of the extracts were introduced in triplicate wells into the MHA cultures. The plates were allowed to stand for 1h or more for diffusion to take place and then incubated at 37°C for 24h. The zone of inhibition was recorded to the nearest mm.

Determination of minimum inhibitory concentration (MIC)

The MIC value was determined for chloroform and n-hexane extracts of the stem bark of by a modified agar well diffusion technique (Okeke *et al*., 2001). A two-fold serial dilution of the extracts was prepared by first reconstituting in 20% DMSO then diluting in sterile distilled water to achieve a decreasing concentration range of 100 to 6.25 mg/ml. A 100µlvolume of each dilution was introduced in triplicate wells into Muller Hinton agar (MHA) plates already seeded with the standardized inoculum (5×10^5) of the test bacterial cells. All test plates were incubated at 37°C for 24 h. The least concentration of each extract showing a clear zone of inhibition was taken as the MIC

And Minimum Bactericidal concentration (MBC) was also determined for the two extracts to show the minimum concentrations at which the bacterial was completely inhibited by the extract.

RESULT AND DISCUSSION

The yield of the extracts is shown in Table 1. The chloroform extract gave the highest yield of (4.3 %,) while the n-hexane extract recorded a yield (of 2.3%) was recorded from the stem bark of *P. nitida*. The higher yield of the chloroform extracts compared with the n-hexane extract, suggest higher proportion of plant components soluble in medium polar solvent. That is, chloroform is a better extraction solvent in terms of yield than n-hexane.

Table 1- Percentage yield of extracts

Extracts	Yield (%)
n-hexane extracts	2.3
Chloroform extracts	4.3

Chemical Composition of the extracts of *P. nitida* Stem Bark

The GC-MS chromatograph of the n-hexane extract of *P. nitida* stem bark. shown in Figure 1. revealed the presence of 54 compounds, representing 100% of the total identified components. The major components detected from the n-Hexane extract of *P. nitida* were dodecanoic acid (lauric acid)18.34%) a saturated fatty acid, 9octadecanoic acid (Stearic acid) (7.49%), a saturated fatty acid, n-hexadecanoic acid (palmitic acid) (5.95%) while among the minor component were phytol (1.73%) a terpenoid and 5cholesten-3-Beta, 2,6-dioic-16-one (0.36%) Cholesterol derivative (Table 3). Dodecanoic acid (Lauric acid) as found in the plant is a medium-chain triglyceride (MCT) widely acknowledged as a “healthier” saturated fat. Lauric acid (LA) has been known to be rapidly absorbed by the body because of its ability to hydrolyze completely into fatty acids and glycerol by pancreatic lipase.

Hence, being an MCT itself, lauric acid's specific chemical structure also allows the body to absorb them as a whole which makes them more easily digestible (Marie, 2015). LA is also used as a source of direct energy because the body processes them as carbohydrates (Marie, 2015) found in abundance from natural resources.9-octadecanoic acid (Stearic acid) is also known as a potent anti-inflammatory lipid and antiviral agent. This fatty acid has profound and diverse effects on liver metabolism (Philippe and Vincent, 2010; Deniz *et al*., 2018).n-Hexadecanoic acid (Palmitic acid) has useful in the production of soaps, cosmetics, and industrial mold release agents. Because it is inexpensive and adds texture and "mouth feel" to processed foods (convenience food), palmitic acid and its sodium salt find wide use in foodstuffs (US SAOs, 2009). Medical authorities have recommended an intake of a limited amount of palmitic acid in your diet since it can be used by the cells as fuel to generate energy and it is also a key component of cell membranes, lung secretions, and some signaling molecules, which regulate cellular activities (St. John, 2019).

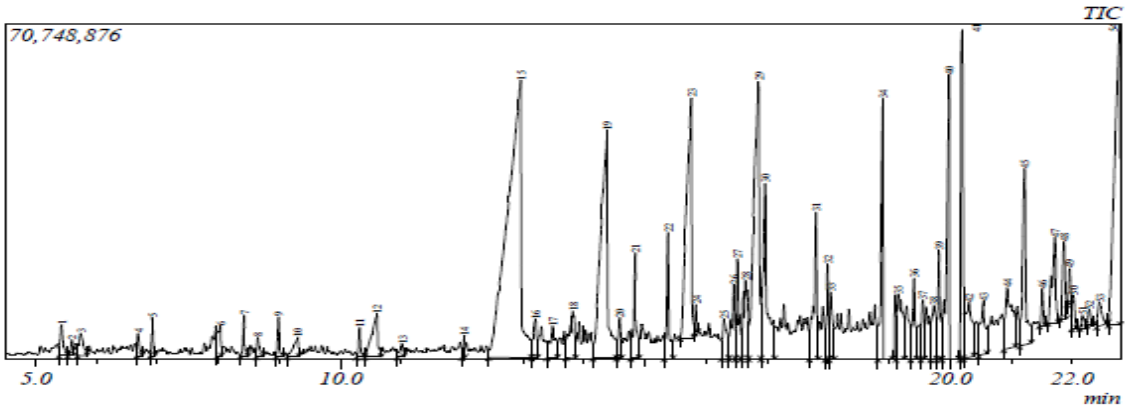

Figure 1:GC-MS chromagraph of n-hexane extract of *P. nitida* stem bark

Alkaloids, proteins, phenols, terpenoids, reducing sugar, glycosides, flavonoid, saponin, and eugenols were found in both the n-hexane and chloroform stem bark extracts of *P. nitida* (Table 2). The n-hexane extract was found to be devoid of flavonoid and tannin, whilst the chloroform extract was found to be devoid of saponin and tannin. Saponins are well-known for their anti-inflammatory and hemolysis activities in erythrocytes (George *et al*., 2002). Flavonoids have antiallergic, antibacterial, antithrombotic, anti-inflammatory, antimutagenic, antioxidant, antineoplastic, and antiviral effects, according to Ojoku *et al* (2010). For millennia, alkaloids have been connected with medical purposes, and cytotoxicity is one of their most prevalent

biological features (Okwu and Okwu, 2007). Antimicrobial, antidiarrheal, and anthelmintic activities are all found in alkaloids, phenols, and tannins. Tannins were always thought to be anti-nutritional, but researchers have since discovered that their beneficial characteristics are dependent on their dose and chemical composition. The presence of tannins in plants may also indicate that it is an efficient astringent, or one that assists in wound healing and anti-parasitic activity (Okwu and Okwu, 2007).

The zone of inhibition for n-hexane and chloroform extracts of *P. nitida* stem bark against two human pathogenic bacterial isolates (*Staphylococcus aureus and E. coli*), and two fungal isolates (*A. flavus* and *C. albicans*) as presented in Table 3. It was observed that the n-hexane extract showed a very poor activity against *S. aureus* at the highest concentration of 100mg/ml with 4.00 mm zone of inhibition, but showed better activity against *E. coli* at that same concentration with a 12.00 mm zone of inhibition. It was also observed from the table that the chloroform extract was found to have moderate effect on the two tested bacterial isolates at a high concentration (100mg/ml) with 7.00 and 11.00mm zone of inhibition for respectively. Hence, as the concentration decreased, the antibacterial activity of the extracts decreased, this showed that the antibacterial effect of the extracts was concentration-dependent. The fungal isolates, on the other hand, were shown to be less effective, with a very minimal activity at 100 mg/ml with inhibitory zones of 3.00 and 2.00 mm, respectively, for . But no activity at lower doses. The chloroform extract, however, was substantially more potent against Gram-positive bacterial (*S. aureus*) with a zone of 7.00 mm than the n-hexane extract at a concentration of 100 mg/ml, which had a clearance zone of 4.00 mm, this implies that the Gram-positive bacteria were more vulnerable to the chloroform extract than Gram-negative bacteria, meaning that Gram-positive bacteria (*S.* aureus) are more susceptible to the chloroform extract of *P. nitida* stem bark than Gram-negative bacteria (*E. coli*). The n-hexane extract was moderately active against *E. coli*, with a zone of inhibition of 12.00 mm, which was slightly higher compared to the chloroform extracts, which had a clearance zone of 11.00 mm, Gram-negative bacteria (*E. coli*) were found to be more sensitive to the n-hexane extract than the chloroform extract, as indicated by this result. This might be related to the presence of saponin in n-hexane extract by phytochemical screening. This finding is in agreement with Ifijen *et al.* (2020) that shows that saponins can decrease the microbiological activity of *Streptococcus pneumoniae, Escherichia coli, Neisseria gonorrheae, and Staphylococcus aureus.* This might explain why this plant could be considered as antimicrobial agent. For chloroform extract, *S. aureus* and *E. coli* had MIC values of 125 mg/ml and 125 mg/ml respectively, whereas for n-hexane extract, S. aureus and E. coli had MIC values of 150 and 125 mg/ml, respectively (Table 4). MBC values for both S. aureus and E. coli in chloroform extract were likewise determined to be 150mg/ml respectively, while that of n-hexane gave 175mg/ml and 150mg/ml respectively for *S. aureus* and *E. coli* (Table 5). The MIC and MBC values for fungal isolates were not determined since the two strains of fungi were still able to thrive when exposed to the extract at 100 – 150 mg/ml. The standard antibiotics normally used in treatment of diseases caused by these pathogenic isolates gave the following result when tested with the isolates; Ciprofloxacin showed a zone of inhibition of 16.00 mm diameter against Gram-positive bacteria (*S. aureus*) and inactive Gram-negative (*E. coli*), while Zinacef exhibited an activity against Gram-negative bacteria (*E. coli*) and inactive against the Gram – positive bacterial (*S. aureus*) with a zone of inhibition of 15.00mm. The capacity of the *P. nitida* stem bark extracts to suppress the growth of these tested human pathogens potently adds to the case for its use in herbal medicine to treat disorders including diarrhea, typhoid fever, gonorrhea, syphilis, fever, tiredness, and skin infections.

Table 2: Phytochemical screening of the Stem bark Extracts of *P. nitida*

Phytochemicals	Inference	
	n-Hexane extract	Chloroform extract
Alkaloids	+	+
Saponins	+	-
Tannins	-	-
Phenols	+	+
Flavonoids	-	+
Terpenoids	+	+
Reducing sugar	+	+
Proteins	+	+
Glycosides	+	+
Eugenols	+	+

+ = indicate the presence of the compound, - = indicates the absence of compound

Table 3: GC-MS Analysis result of n-hexane extract of *P. nitida* stem bark

Peak No	Retention Time (Rt)	Name of Compound	Area Percentage (%)	Molecular mass	Molecular formula
1.	5.432	Mesitylene	0.48	120	C_9H_{12}
2.	5.593	Undecane	0.21	156	$C_{11}H_{24}$
3.	5.738	2-benzoyl-8-octanelactam	0.49	245	$C_{15}H_{19}NO_2$
4.	6.681	Nonanal	0.26	142	$C_9H_{18}O$
5.	6.914	Dodecane	0.34	170	$C_{12}H_{26}$
6.	8.030	Octanoic acid	0.44	144	$C_8H_{16}O_2$
7.	8.416	Dodecane	0.37	170	$C_{12}H_{26}$
8.	8.643	Octane, 1,1'-oxybis-	0.25	242	$C_{16}H_{34}O$
9.	8.981	2-Tridecenal,(E)-	0.35	196	$C_{13}H_{24}O$
10.	9.297	Nonanoic acid	0.45	158	$C_9H_{18}O_2$
11.	10.313	2-Undecenal	0.28	168	$C_{11}H_{20}O$
12.	10.600	n-decanoic acid	1.31	172	$C_{11}H_{20}O_2$
13.	11.013	1,3,2,dioxaborolane,2-ethyl-4-(oxiranyl propyl)-	0.21	184	$C_9H_{17}BO_3$
14.	12.032	2-methyltetracosane	0.21	352	$C_{25}H_{52}$
15.	12.955	Dodecanoic acid	18.34	200	$C_{12}H_{24}O_2$
16	13.200	6,9,12-Octadecatrienoic acid,phenylmethyl	0.67	368	$C_{25}H_{36}O_2$
17.	13.47	Decan 1-chloroacetate,1,2,4a,5,8a-tetramethyl-1,2,3,4,4a7	0.89	176	$C_{10}H_{21}Cl$
18.	13.816	Acetate, (2,4a,5,8a-tetramethyl-1,2,3,4,4a,7,8,8a	1.18	250	$C_{16}H_{26}O_2$
19.	14.371	Tetradecanoic acid	7.90	228	$C_{14}H_{28}0_2$
20.	14.580	Octadecanoic acid, (2-phenyl-1,3-dioxolan-4-yl)methyl ester, cis-	0.54	446	$C_{28}H_{46}0_4$
21.	14.833	2-Pentadecanoic,6,10,14-trimethyl-	1.37	268	$C_{18}H_{36}O$
22.	15.372	Hexadecanoic acid, methylester	1.42	270	$C_{17}H_{34}O_2$
23.	15.754	n-hexadecanoic acid	5.95	256	$C_{16}H_{32}O_2$
24.	15.832	Hexadecanoic acid, ethyl ester	0.16	284	$C_{18}H_{36}0_2$
25.	16.291	Octadecanoic acid	0.91	284	$C_{18}H_{36}O_2$
26.	16.451	2(3H)-furanone,5-dodecyldihydro-	1.16	254	$C_{16}H_{30}O_2$
27	16.512	9-Octandecanoic acid,methylester,(E)-	1.20	296	$C_{19}H_{36}O2$
28	16.647	Phytol(2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-,)	1.73	296	$C_{20}H_{40}O$
29.	16.859	9-octadecanoic acid,(E)-	7.49	282	$C_{18}H_{34}0_2$
30.	16.970	Octadecanoic acid	3.78	284	$C_{18}H_{36}O_2$
31.	17.799	Octacosane	2.14	394	$C_{28}H_{58}$
32.	17.995	4,8,12,16-Tetramethylheptadecan-4-olide.	0.99	324	$C_{21}H_{40}O_2$
33.	18.042	9-Octadecanoic, (z)-	1.01	266	$C_{18}H_{34}O$
34.	18.900	Eiocosane	2.45	282	$C_{20}H_{42}$
35.	19.734	Cyclopentadecanone,2-hydroxyl-	1.81	240	$C_{15}H_{25}O_2$
36.	19.407	2-Methylhexacosane	1.16	380	$C_{27}H_{56}$
37.	19.554	4,8-Methanoazulen-9-ol,decahydro-2,2,4,8-tetramethyl-	0.71	222	$C_{15}H_{26}O$
38.	19.735	Acetic acid,10-chloroddecylester	1.18	234	$C_{12}H_{23}ClO_2$
39.	19.820	Azulene,1,2,3,5,6,7,8,8a-octahydro-1,4din	1.34	204	$C_{15}H_{24}$
40.	19.992	Tetrapentacontane	3.88	758	$C_{54}H_{110}$
41.	20.192	2-Isopropenyl-4a,8-dimethyl-1,2,3,4,4a,5,6	3.20	204	$C_{15}H_{24}$
42.	20.316	9,10-Secocholesta-5,7,10(19)-triene-1,3-diol	1.91	488	$C_{30}H_{52}O_3Si$

43.	20.542	2-methylhexacosane	1.17	380	$C_{27}H_{56}$
44.	20.935	Betulin	2.03	442	$C_{30}H_{50}O_2$
45.	21.224	Tetratetracontane	2.77	618	$C_{44}H_{90}$
46.	21.515	Thunbergo	0.36	290	$C_{20}H_{34}O$
47.	21.721	5h-3,5a-epoxynaphth (2,1-c) oxepin, dodecahydro-3,8,8,11a-tetramethyl-	1.69	278	$C_{18}H_{30}O_2$
48.	21.870	d-Norandrostane(5,alpha, 14-alpha)	0.97	246	$C_{18}H_{30}$
49.	21.962	Hexadecanoic acid ,(3-bromoprop-2-ynyl)	0.30	372	$C_{19}H_{33}BrO_2$
50.	22.284	5-Cholesten-3-beta,26-diol-16-one diacetate.	0.36	500	$C_{31}H_{48}0_5$
51.	22.176	1-Heptatriacotanol	0.19	536	$C_{37}H_{76}O$
52.	22.284	Stigmasta-4,7,22-trien-3-alpha-ol	0.16	410	$C_{29}H_{46}O$
53.	22.450	Stigmasta-5,22-trien-3-ol,acetate, (3, beta)-	0.44	454	$C_{31}H_{50}O_2$
54.	22.780	Butanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-	7.41	418	$C_{24}H_{34}O_6$
		Total	**100**		

Table 3: Zone of Inhibitions of Various Concentration of Chloroform Extract of *P. nitida* Stem Bark in (mm) Diameter

Test isolates	**Control**	**Concentration of n-hexane extract in mg/ml**					**Concentration of chloroform extract in mg/ml**					**CPXZ**	
	0	**6.25**	**12.50**	**25**	**50**	**100**	**6.25**	**12.50**	**25**	**50**	**100**	**10 µg**	**20 µg**
****S. aureus***	0.00	0.00	0.00	0.00	2.00	4.00	0.00	0.00	2.00	4.67	7.00	16.00	–
****E. coli***	0.00	0.00	0.00	8.67	10.00	12.00	0.00	2.00	4.00	7.00	11.00	–	15.00
+A. flavus	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	3.00	NA	NA
+C. albicans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	NA	NA

*+ = fungi isolates, * = Bacteria isolates*

CPX = Ciprofloxacin, Z = Zinacef, NA = Not applicable i.e. there was no activity of drug on the isolates. The control showed no zone of inhibition since no extract was introduced to the plates.

Table 4: Minimum Inhibitory concentration (MIC) value of the extracts of *P. nitida* stem bark on the test isolates

Test isolates	(MIC) in mg/ml	
	n-Hexane extract	Chloroform extract
**S. aureus*	150	125
**E. coli*	125	125
+A. flavus	ND	ND
+C. albicans	ND	ND

ND = not determined

Table 5: Minimum Bactericidal concentration (MBC) value of the extracts of *P. nitida* Stem bark on the test isolates

Test isolates	(MBC) in mg/ml	
	n-Hexane extract	Chloroform extract
**S. aureus*	175	150
**E. coli*	150	150
+A. flavus	ND	ND
+C. albicans	ND	ND

ND = not determine

CONCLUSION

The phytochemicals present in the stem bark of *Picralima nitida* could be associated with the activities of the extracts against microorganisms capable of causing the different ailment. *S. aureus* was more susceptible to chloroform extract while the *E. coli* was found to be more susceptible to n-hexane extract of the stem bark of *P. nitida*. The fungi isolates were found to be less susceptible to both extracts, suggesting that the extract was more active against bacterial isolates than the fungi isolates used for this research. Hence, the inhibition of these isolates is of great importance to the health care system since it is cheap, it may be used as an alternative to orthodox antibiotics in the treatment of infections.

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