EVALUATION OF THE ANTIFUNGAL ACTIVITIES OF *Senna occidentalis* AND *Boswellia dalzielii* LEAVES EXTRACTS ON SOME FUNGAL ISOLATES

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ABSTRACT
Many plants in Nigeria were investigated and used against infectious diseases caused by pathogenic fungi. The methanol and n-hexane leaves crude extraction methods were chosen for Senna occidentalis and Boswellia dalzielii were evaluated and compared for antifungal activity using agar incorporation method. The fungal isolates used were C. albicans, C. pseudotropicalis, A. niger and A. flavus. Both S. occidentalis and B. dalzielii inhibited the growth of C. albicans, C. pseudotropicalis, A. niger and with little effect against A. flavus at 10, 20 and 30mg/ml concentrations. Minimum inhibitory concentration (MIC) ranged from 3.75-30mg/ml while the minimum fungicidal concentration (MFC) ranged from 7.5-30mg/ml. The phytochemical constituents of S. occidentalis and B. dalzielii extracts were flavonoid, tannins, saponins, saponin glycoside, cardiac glycosides, steroid, alkaloid, balsam and volatile oil. The toxicity studies of the methanol leaves extract of Senna occidentalis and Boswellia dalzielii, both the acute and sub- acute test did not produce any toxic effect on the test animal. In Nigeria, there were urgent needs and pursuit for medicinal plants for various treatments of fungal infections; study findings of this nature suggest the use of Senna occidentalis and Boswellia dalzielii as a potential alternative source of antifungal agents.

Keywords: Leaves, crude extract, *Senna occidentalis, Boswellia dalzielii*, antifungal activity

1. INTRODUCTION

The Kingdom Fungi is large and full of forms of great variety and complexity. Species of fungi are divided in to two groups: the microscopic fungi (mold, yeasts) and macroscopic (mushroom). Members of the fungi groups cause mycoses, fungal diseases, which are typically divided into five groups according to the route of infection: superficial, cutaneous, and subcutaneous, systematic, and opportunistic mycosis (Kathleen, 2005). The continuing increase in the incidence of fungal infections together with the gradual rise in resistance of fungal pathogens to antifungal drugs (Prescott *et al.,* 2008) highlights the need to develop novel drugs from medicinal plants.

Traditional medicine is the oldest method of curing diseases and infections and various plants are used in different parts of the world to treat human diseases and infections (Venogupal and Venegupal, 1994). Plants are among the most important and common sources of potentially valuable new drugs, it has been used for centuries to treat infection and other illness in native community but controlled clinical studies are scarce (Kayode and Kayode, 2011). The use of medicinal plants is very wide-spread in many parts of the world, Nigeria inclusive (Kunle, 2000). Also in Nigeria, many plants are used against infectious diseases (Agassounon *et al.,* 2001). Plant based drugs are gaining popularity because of several advantages such as fewer side effects, better patient tolerance, relatively less expenses and acceptance due to a long history of use, especially herbal medicine which has provided rational means for the treatment of many diseases that are incurable in other systems of medicine (Abdullah and Lawal, 2010). Herbal medicines derived from plant extracts are being increasingly utilized to treat a wide variety of clinical diseases (Fabricant and Farnsworth, 2001). Many plants, especially those used by traditional healers produce pharmaceutically active compounds that have antimicrobial, anthelminthic, antifungal, antiviral, anti-inflammatory, anti-oxidant and anti-diabetic activities (Rabah *et al.*, 2007; Karim *et al.*, 2011).

Plant possesses naturally occurring components that give it colour, flavour, smell and are part of plants natural defense system. These components are called phytochemicals (Gupta *et al*, 2007). According to Liu (2004), phytochemicals are bioactive, non-nutrient plants components in fruits, vegetable, grape and other plants foods that have been linked to reducing the risk of major degenerative diseases. Medicinal plants contain biologically active chemical substances such as saponins, tannins, essential oils, flavonoid and alkaloids that have curative properties. These complex chemical substances of different composition are secondary plants metabolites (Harborne, 1998 and Sofowora, 1996). The discovery of these phytochemicals and their medicinal uses attract medicinal interest in the plant, long before mankind discovered the existence of microbes (Kayode and Kayode, 2011).

Numerous fungal agents causing opportunistic infections have become serious threats to people`s life. Previous literature indicated that certain species of fungal agents have developed resistance to most antifungal preparations (Fide, 2002; Hassan *et al,*. 2007 and Sakharkar and Patil,

1998). Unfortunately, the availability of this medication for the treatment of this disease is either expensive, out of reach to most patients or their use is associated with the undesirable side effects or both (Agassounon *et al*., 2001). This necessitates the need to find novel and effective antifungal agents from plants that are available and cheaper. The aim of the present work was to study the antifungal effect of *Senna occidentalis and Boswellia dalzielii* leaves extracts against some fungal isolates, specifically *Candida species* and *Aspergillus species* and to determine the phytochemical, chemical components and toxicity level of the crude leaves extracts

2. MATERIALS AND METHODS

2.1 Collection of Plant Samples

The leaves of *S. occidentalis and B. dalzielii* were collected within Sokoto metropolis. The plants were taken to herbarium of the Botany Unit of the Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto, for authentication. The leaves collected were air-dried under shade and pulverized into fine powder using pestle and mortar and stored in sealed containers until required.

2.2 Preparation of extracts

One hundred (100) grammes of each of the two extract of *S. occidentalis* and *B. dalzielii* samples were separately extracted with methanol and n-hexane for 24hr. the extracts were filtered and concentrated to dryness under reduced pressure. The percentage yields were calculated for each of the extract. The dried extracts obtained were screened for different phytochemical components and for antifungal activities as recommended by Sofowara (1996).

2.3 Collection of Test Organisms

The fungal isolates used were obtained as stock culture from Mycology Laboratory, Department of Biological Sciences, and Usmanu Danfodiyo University Sokoto. They included *Candida albicans, Candida pseudotropicalis, Aspergillus niger* and *Aspergillus flavus*.

2.4 Antifungal activity of *S. Occidentalis* and *B. dalzielii*

The antifungal activities of the *S. occidentalis* and *B. dalzielii* methanol and n-hexane plant leaves extract was carried out using agar diffusion method according to procedure of Zacchino *et al.* (1999). Sabouraud's agar medium (SDA) was prepared according to manufacturer's instructions. Wells were then bored into the freshly prepared agar media plates using a sterile 6 mm Cork borer and the wells filled with the solution of the extract taking care not to allow spillage of the solution to the surface of the agar medium. The plates were allowed to stand on the laboratory bench for 1 h to allow for proper diffusion of the extracts into the media. Plates were incubated at room temperature of 28°C ±2 for 96 h and later observed for zones of inhibition. The activities of the two extracts on some fungal isolates were compared at concentrations of 10 mg/ml, 20 mg/ml and 30 mg/ml respectively.

2.5 Phytochemical Analysis of the Plant Leaves Extracts

Qualitative phytochemical analysis of different phytochemical components (flavonoids, saponins, tannins, alkaloids, glycosides, cardiac glycosides, steroids, antharaquinones and volatile oil) were carried out in accordance with the methods of Harbone (1998) ; Oluwakayode (2015).

***Test for alkaloids**:* 0.2 g of extracts was shaken with 1 % HCl for two minutes. The mixture was filtered and drops of Dragendorff's reagent added. Formation of a precipitate indicated the presence of alkaloids.

Test for saponins: 0.2 g of extracts was shaken with 5 ml of distilled water in a test tube. Frothing which persists on warming was taken as evidence for the presence of saponins.
Test for tannins: 0.2 g of extracts was stirred with distilled water and filtered. Ferric chloride was added to the filtrate. A blue-black, green or blue-green precipitate was taken as an evidence for the presence of tannins.

Test for steroids (Salkowski's test): 0.2 g of the extracts was dissolved in 2 ml of chloroform. Concentrated sulphuric acid was carefully added to form a lower layer. A reddish-brown colour at the interphase indicated the deoxy sugar characteristics of cardenolides.

Test for cardiac-active glycoside (keller-killani test): 0.2 g of the extracts was dissolved in 2 ml of glacial acetic acid containing one drop of ferric chloride solution followed by the addition of 1 ml of concentrated sulphuric acid. A brown ring at the interface confirmed the presence of cardiac glycoside.

Test for flavonoids: A little amount of magnesium powder and few drops of concentrated hydrochloric acid were added to 3 ml of the extracts. A red or intense red colouration indicated the presence of flavonones.

Test for resins: 5 ml of copper acetate solution was added to 5 ml of the extracts. The resulting solution was shaken vigorously and allowed to separate. A green coloured solution is an evidence of the presence of resin.

Test for anthraquinones: 0.2 g of the extracts was shaken with 4 ml of benzene. The mixture was filtered and 2 ml of 10 % ammonia solution was added to the filtrate. The mixture was shaken and the presence of pink, red or violet colour in the ammoniacal (Lower) phase indicated the presence of free anthraquinones.

Test for phenols: 0.2 g of extracts was dissolved in Ferric chloride solution. A green or dirty green precipitate indicated the presence of phenolic compound.

Test for phlobatannins: The extracts (0.5 g) was dissolved in distilled water and filtered. The filtrate was boiled with 2 % HCl solution. Red precipitate shows the presence of Phlobatannins.

Test for glycosides: The extracts was hydrolyzed with HCl solution and neutralized with NaOH solution. A few drops of Fehling's solution A and B were added. Red precipitate indicates the presence of glycosides

2.6 Acute Toxicity tests of the Plants (Extract) on Experimental Rats

This was carried out in accordance with the procedure of Mirtes *et al.* (2011). A total number of six (6) Albino rats (female and male) were used for the test. The rats were obtained from Animal House of the Department of Biological Sciences, Usmanu Danfodiyo University Sokoto. The rats were grouped in to four (4), two in each group. The rats were kept under uniform room temperature (30°C) and relative humidity 85%. Food and water were given *ad libitum* for 3 days prior to the commencement of the experiment. The rats were weighed before the onset of the experiment. Doses of the extract (5ml each) were administered orally to the rats in four groups consisting of two (2) rats in a group. The rats in groups B, C and D were given 1000, 2000 and 3000mg/kg body weights of plants extracts, respectively. The rats in the fourth group which were administered 0.5ml of distilled water through the same route served as control. The rats were weighed after 72 hours after the administration of the drug. The rats were observed for toxic symptoms such as weakness, food refusal, loss of weight, diarrheoa, discharges from eyes and ears, noisy breathing and mortality (OECD, 2001).

2.7 Sub-acute Toxicity Study

A total of 40 Albino rats were divided into 4 groups comprising of 10 rats in each group. Rats in group B, C, and D were orally administered 5ml of graded doses of plant extracts (1000, 2000 and 3000 mg/kg body weight per day) once daily for 28 days respectively. The control group (group A) received 0.5ml of distilled water under similar experimental conditions and through the same route. Subsequently, all the animals from each group were killed by decapitation and blood samples were carefully taken at slaughter point for liver function test (Egharevba *et al.,* 2010).

2.8 Liver Function Tests

The following tests were conducted to investigate derangement in the liver function of rats administered with crude extracts during the acute and sub-chronic toxicity studies. They are Serum bilirubin, Serum enzymes, alkaline phosphatase, Alanine amino transferase (ALT), Aspartate amino transferase (AST) and Serum total protein as outlined in OECD (2001).

2.9 Statistical analysis

Values were expressed as mean ± standard deviation (SD) of four samples of the blood. Where applicable the data were subjected to one way analysis of variance (ANOVA) and differences between the samples and control were determined by Waller Duncan's multiple range test using the statistical

analysis software (SAS) 2006 version. Difference with control value at $p<0.05$ was regarded as significant.

3. RESULTS

The antifungal activity and the phytochemical analysis of some *S. occidentalis* and *B. dalzielii* plants were investigated and the results were presented in Tables 1 to 10. The antifungal activity of methanolic and n-hexane crude leaves extracts of *S. occidentalis* and *B. dalzielii* against *C. albicans, C. pseudotropicalis, Aspergillus niger* and *A. flavus* at different concentrations of 10, 20, and 30 mg/ml, were investigated. The crude leaves extract of *S. occidentalis* and *B. dalzielii* was active on *C. albicans, A. niger, C. pseudotropicalis* with little effect against *A. flavus* at concentration of 20 and 30 respectively as indicated in Table 1.

Table 2 shows the minimum inhibitory concentration of *S. occidentalis* and *B. dalzielii* methanol crude leaves extract. The methanol crude extract of both plants has activity against *C. albicans and C. pseudotropicalis* at 7.5mg/ml concentration, *A. niger* and *A. flavus* at 15mg/ml concentration. Table 3 shows the MIC of *S. occidentalis* and *B. dalzielii* n- hexane crude leaves extract, both plants extract show activity against *C. albicans and C. pseudotropicalis* at 7.5mg/ml concentration, but no activity against *A. niger* and *A. flavus.*

The MFC of *S. occidentalis* and *B. dalzielii* methanol leaves extract are presented in Table (4). The methanol extract of both plants show MFC against the tested organism at7.5 and 15mg/ml concentration except *A. niger* that has MFC at 30 mg/ml concentration. The n- hexane extract of *S. occidentalis* show MFC against *C. albicans* and *C. pseudotropicalis* at 7.5mg/ml concentration. *Boswellia dalzielii* had the MFC against *A. flavus* at 15mg/ml concentration and against *C. albicans* and *C. pseudotropicalis* at 7.5 mg/ml concentration.

Table 1: Antifungal Activity of Methanol and n- Hexane Crude Leave Extracts of *S. occidentalis* and *B. dalzielii* Against Some Fungal Isolates.

Plants used	Conc. in mg/ml	Mean radial growth (mm)/species of fungi				
		C. albicans	*C. pseudotropicalis*	*A. niger*	*A. flavus*	Total mean
S. occidentalis M	10	13.0	3.3	7.3	1.0	7.2
	20	14.7	9.0	8.3	2.7	8.8
	30	17.7	12.3	13.0	4.0	11.8
B. dalzielii M	10	9.0	7.3	1.3	2.3	4.9
	20	10.3	7.3	3.7	2.7	6.0
	30	11.7	11.0	3.7	3.3	7.4
S. occidentalis H	10	7.3	3.7	3.7	2.0	4.0
	20	8.3	9.3	5.0	0.2	5.7
	30	12.7	13.3	6.0	2.3	8.6
B. dalzielii H	10	6.3	7.0	0.0	0.0	3.3
	20	8.3	7.0	1.7	2.0	4.8
	30	10.0	8.3	3.0	2.0	5.8

Key:
S. occidentalis M= S. occidentalis methanol leaves extract, *B. dalzielii M= B. dalzielii* methanol leaves extract
S. occidentalis H= S. occidentalis hexane leaves extract, *B. dalzielii, H= B. Dalzielii* hexane leaves extract
Values < 2mm shows no zone of inhibition

Table 2: Minimum Inhibitory Concentration of *S. occidentalis* and *B. dalzielii* Methanol Crude Leaves Extract against Some Fungal Isolates.

Plants	Fungi	Concentration of extracts mg/ml								MIC value mg/ml
		30	15	7.5	3.75	1.875	0.9375	0.46875	0.234375	
S.o	C.A	-	-	-	+	+	+	+	+	7.5
	C.P	-	-	-	+	+	+	+	+	7.5
	A.N	-	-	+	+	+	+	+	+	30
	A.F	-	-	+	+	+	+	+	+	15.0
B.d	C.A	-	-	-	+	+	+	+	+	7.5

	C.P	-	-	-	-	+	+	+	+	3.75
	A.N	-	+	+	+	+	+	+	+	30
	A.F	-	-	+	+	+	+	+	+	15

Key:
S.o= *Senna occidentalis,* B.d= *Boswellia dalzielii,* CA= *Candida albicans*
CP= *Candida pseudotropicalis,* AN=*Aspergillus niger,* AF= *Aspergillus flavus*

Table 3: Minimum Inhibitory Concentration of *S. occidentalis* and *B. dalzielii* N- Hexane Crude Leaves Extract Against Some Fungal Isolates.

Plant used	Fungi	Concentration of extracts mg/ml 30	15	7.5	3.75	1.875	0.9375	0.46875	0.234375	MIC value mg/ml
S.o	C.A	-	-	-	+	+	+	+	+	7.5
	C.P	-	-	-	+	+	+	+	+	7.5
	A.N	+	+	+	+	+	+	+	+	-
	A.F	+	+	+	+	+	+	+	+	-
B.d	C.A	-	-	-	-	+	+	+	+	3.75
	C.P	-	-	-	-	+	+	+	+	3.75
	A.N	+	+	+	+	+	+	+	+	-
	A.F	-	-	+	+	+	+	+	+	15

Key:
S.o= *Senna occidentalis,* B.d= *Boswellia dalzielii,* CA= *Candida albicans*
CP= *Candida pseudotropicalis,* AN=*Aspergillus niger,* AF= *Aspergillus flavus*

Table 4: Minimum Fungicidal Concentration of *S. occidentals* and *B. dalzieli* N- Hexane Crude Leaves Extract against Some Fungal Isolates.

Plants used	Fungi	Concentration of extract mg/ml 30	15	7.5	3.75	MFC value (mm)
S.o	CA	-	-	-	+	7.5
	CP	-	-	-	+	7.5
	AN	-	+	+	+	30.0
	AF	-	+	+	+	30.0
Bd	AC	-	-	-	+	7.5
	CP	-	-	-	+	7.5
	AN	-	+	+	+	30.0
	AF	-	-	+	+	15.0

Key:
S.o= *Senna occidentalis,* B.d= *Boswellia dalzielii,* CA= *Candida albicans*
CP= *Candida pseudotropicalis,* AN=*Aspergillus niger,* AF= *Aspergillus flavus*

Table 5: Minimum Fungicidal concentration of *S. occidentals* and *B. dalzielii* Methanol Leaves Extract against Some Fungal Isolates.

Plants used	Fungi	Concentration of extract mg/ml 30	15	7.5	MFC value (mm)
S.o	CA	-	-	-	7.5
	CP	-	-	-	7.5
	AN	+	+	+	-
	AF	+	+	+	-
B.d	CA	-	-	-	7.5
	CP	-	-	-	7.5
	AN	-	-	+	15
	AF	-	+	+	30

Key:

S.o= *Senna occidentalis.* B.d= *Boswellia dalzielii,* CA= *Candida albicans,* CP= *Candida pseudotropicalis*
AF= *Aspergillus flavus,* AN=*Aspergillus niger*

Table 6: Qualitative Phytochemical Analysis of Methanolic and n-Hexane Crude Leaves Extract of *S. occidentalis* and *B. dalzielii*

Extracts Solv. frac Fla Tan Sap Gly Alk C.gly Bal An
S.gly Ste V.oil

S. occidentalis N-Hexane + + - - - - -
\- + + - Methanol + ++
\+ - - + - - + + ++
\-

B. dalzielii N-Hexane + + + + + + + + + + +
\- + + - +

Methanol + + + + + + + + + + + + + + + + -
\+ + - +

Key:
\+ + + = Present in large amount, + + = present in moderate amount, + = Present in trace amount, - = absence.
Fla=Flavonoids, Tan=Tannin, Sap=Saponins, Gly=Glycosides, Alk=Alkaloids, C.gly=Cardiacglycosides
Bal=Balsams, An=Anthaquines, S.gly=Saponin glycoside, Ste=Steroid, V.oi=lVolatile oi

Table 7: Effect of *B. dalzielii* Methanol Crude Leaves Extract on Liver Function Parameters of Rats Treated With Acute Oral Doses.

GROUP	DOSE (Mg/kg)	PARAMETERS								
		ALT (g/dl)	AST (g/dl)	ALP (g/dl)	TBL (μ/mol)	DBL (μ/mol)	TP (g/dl)	ALB (g/dl)	GLO (g/dl)	A:G (g/dl)
A	0	7.69[a]	17.85[a]	82.95[a]	9.0[a]	6.13[a]	5.85[a]	3.28[a]	2.58[a]	2.27[a]
B	1000	7.62[a]	17.84[a]	81.16[a]	8.27[a]	6.36[b]	5.95[b]	3.15[a]	2.44[a]	1.29[a]
C	2000	7.65[a]	17.98[b]	80.86[a]	8.59[a]	6.38[b]	5.95[b]	3.98[b]	1.14[a]	3.49[b]
D	3000	7.66[a]	17.98[b]	81.33[a]	8.51[a]	6.70[b]	5.84[a]	3.22[a]	2.27[a]	1.41[a]

Key:
ALT= Alanine aminotransferase, AST= Aspartate amino transferase, T.P=Total protein, ALB=Albumin, TBL= Total bilirubin, and DBL=Direct bilirubin, GLO= Globulin, A: G = Albumin Globulin ratio, Group A=Control group, Group B= 1000mg/body weight, Group C= 2000mg/ body weight, Group D= 3000mg/body weight
Values are Mean ± standard deviation (SD).
Mean followed by the same superscript across the rows indicate that the value is not significantly different from the other at $p<0.05$.

Table 8: Effect of Leaves of *Senna occidentalis* Methanol Crude Extract On Liver Function Parameters of Rats Treated with Acute Oral Doses.

GROUP	DOSE (Mg/kg)	PARAMETERS								
		ALT (g/dl)	AST (u/dl)	ALP (u/dl)	TBL (μ/mol)	DBL	TP (g/dl)	ALB (g/dl)	GLO (g/dl)	A:G (g/dl)
A	0	9.69[a]	17.46 a	70.19 a	8.62[a]	4.13[a]	5.86[a]	3.28[a]	2.58[a]	1.27[a]
B	1000	9.33[a]	17.22 a	71.39 b	8.92[b]	4.36[b]	5.59[a]	3.15[a]	2.44[a]	1.29[b]
C	2000	9.86[b]	17.84	71.40	7.58[b]	4.76[b]	5.12[a]	3.98[b]	2.14[a]	3.49[b]

			b	b						
D	3000	10.20 b	17.96 b	71.80 b	9.1 ^{b}	4.87 ^{b}	5.49 ^{a}	3.22 ^{a}	2.27 ^{a}	1.41 ^{b}

Key:
ALT= Alanine aminotransferase, AST= Aspertate amino transferase, T.P=Total protein, ALB=Albumin, TBL= Total bilirubin, and DBL=Direct bilirubin, GLO= Globulin, A: G = Albumin Globulin ratio.
Group A= Control group, Group B= 1000mg/body weight, Group C= 2000mg/ body weight
Group D= 3000mg/body weight
Values are Mean ± standard deviation (SD).
Mean followed by the same superscript across the rows indicate that the value is not significantly different from the other at $p<0.05$.

Table 9: Effect of leaves of *Boswellia dalzielii* Methanol Crude Extract on Liver Function Parameters of Rats Treated With Sub-Acute Oral Doses.

GROUP	DOSE (Mg/kg)	PARAMETERS								
		ALT (g/dl)	AST (g/dl)	ALP (g/dl)	TBL µ/mol)	DBL (µ/mol)	TP (g/dl)	ALB (g/dl)	GLO (g/dl)	A:G (g/dl)
A	0	7.70 ^{a}	16.50 ^{a}	65.87 ^{a}	7.59 ^{a}	6.35 ^{a}	5.79 ^{a}	3.79 ^{a}	2.00 ^{a}	1.89 ^{a}
B	1000	7.71 ^{b}	16.05 ^{a}	66.00 ^{b}	7.10 ^{a}	6.71 ^{b}	5.98 ^{b}	3.79 ^{a}	2.19 ^{b}	1.73 ^{a}
C	2000	7.73 ^{b}	16.25 ^{a}	66.10 ^{b}	7.51 ^{a}	6.69 ^{b}	5.98 ^{b}	3.96 ^{b}	2.02 ^{b}	0.21 ^{a}
D	3000	7.73 ^{b}	16.20 ^{a}	66.05 ^{b}	7.10 ^{a}	6.82 ^{b}	6.00 ^{b}	3.98 ^{b}	2.02 ^{b}	1.97 ^{b}

Key:
ALT= Alanine aminotransferase, AST= Aspertate amino transferase, T.P=Total protein, ALB=Albumin, TBL= Total bilirubin, and DBL=Direct billirubin, GLO =Globulin, A: G =Albumin Globulin ratio.
Group A = Control group, Group B=1000mg/body weight. Group C= 2000mg/ body weight
Group D=3000mg/body weight
Values are Mean ± standard deviation (SD).
Mean followed by the same superscript across the rows indicate that the value is not significantly different from the other at $p<0.05$.

Table 10: Effect of Leaves of *Senna occidentalis* Methanol Crude Extract on Liver Function Parameters of Rats Treated With Sub- Acute Oral Doses.

GROUP	DOSE (Mg/kg)	PARAMETERS								
		ALT (g/dl)	AST (g/dl)	ALP (g/dl)	TBL (µ/mol)	DBL (µ/mol)	TP (g/dl)	ALB (g/dl)	GLO (g/dl)	A:G (g/dl)
A	0	8.69 ^{a}	16.45 ^{a}	69.32 ^{a}	7.20 ^{a}	5.26 ^{a}	6.00 ^{a}	4.30 ^{a}	1.70 ^{a}	42.52 ^{a}
B	1000	8.33	16.22 ^{a}	69.39 ^{b}	7.25 ^{b}	5.76 ^{b}	6.12	4.28 ^{a}	1.84 ^{b}	32.32 ^{a}
C	2000	9.30 ^{b}	16.30 ^{a}	69.45 ^{b}	7.25 ^{b}	5.79 ^{b}	6.49 ^{b}	4.35 ^{b}	2.14 ^{b}	42.03 ^{a}
D	3000	9.44 ^{b}	16.32 ^{a}	69.45 ^{b}	7.26 ^{b}	5.80 ^{b}	6.50 ^{b}	4.35 ^{b}	2.15 ^{b}	21.02 ^{a}

Key:
ALT= Alanine aminotransferase, AST= Aspertate amino transferase, T.P=Total protein, ALB=Albumin, TBL= Total bilirubin, and DBL=Direct billirubin, GLO =Globulin, A: G =Albumin Globulin ratio.
GROUP A = Control group, Group B= 1000mg/body weight, Group C= 2000mg/ body weight
Values are Mean ± standard deviation (SD).
Mean followed by the same superscript across the rows indicate that the value is not significantly different from the other at $p<0.05$.

Phytochemical analysis of *Senna occidentalis* and *Boswellia dalzielii* methanol and n-Hexane crude leaves extracts (Table 6) indicate the presence of flavonoids, tannins, alkaloid, steroids cardiac glycoside, saponins, glycoside, balsam and volatile-oil. The acute effects of the methanolic crude

extract of *B. dalzielii and S. occidentalis* on liver function parameters of animals treated with acute doses of the extract is presented in Table 7. Based on the parameters tested there were no much differences between the control group and the treated groups, only liver enzymes and albumin show significant differences ($p<0.05$). as presented in Table 8.

The effects of sub- acute administration of methanol crude leaves extract of *B. dalzielii* and *S. occidentalis* on the liver function parameters of animals are presented in Tables 9 and 10. The values with the same parenthesis are not significantly different from each other ($p<0.05$.).

4. DISCUSSION

From the results of antifungal activity of methanol and n- hexane leaves extracts of *S. occidentalis and B. dalzielii* obtained, both plants show high activity against all the fungal isolates. The methanol crude extract of *S. occidentalis* and *B. dalzielii* had the highest effect on the fungal isolates as the concentration increased. The results of this work is in conformity with the findings of Jain *et al.* (1998), in which methanolic and aqueous extract of the leaves of *Senna occidentalis* were most effective against *C. albicans* and *A. fumigatus*. It is also in line with the finding of Odeja *et al.* (2014) who reported that the methanol, hexane and ethyl acetate extract of *Senna occidentalis* were most effective against *Candida albicans* and *Aspergillus niger.* This result also agrees with the work of Egharevba *et al.* (2010) who reported that the leaves extract of *Senna occidentalis* had high antifungal activity against *Candida* species, *Microsporum* species and *Trichophyton* species,

The findings of this work also agrees with the work of Adelakun *et al.* (2001) who reported that methanol extract of *Boswellia dalzielii* showed antibacterial and antifungal activities . This work also agrees with Rojas *et al.* (1992) who reported that plants containing flavonoid, terpenoid and other phenolic compounds have antimicrobial activity. The presence of alkaloids in these plants extracts is supported by the findings of Gbile (1986) who reported that alkaloid is one of the constituents of the *Senna occidentalis* and *Boswellia dalzielii*. The effect of the crude leaves extract of *Senna occidentalis* and *Boswellia dalzielii* against the organisms tested may be due to presence of alkaloids, saponins and flavonoids (Shinkafi, 2013). *Senna occidentalis* and *Boswellia dalzielii* can be used in the treatment of any infection caused by *C. albicans, C. pseudotropicalis*, *A. niger* and *A. flavus*.

The minimum inhibitory concentration (MIC), methanol extract of *Senna occidentalis* and *Boswellia dalzielii* obtained in this work varies with the type of fungi tested. The highest activity obtained was against the yeasts, *C. albicans* and *C. pseudotropicalis*. Increase in the concentration of the extract resulted in the increase in antifungal activity. This result agrees with the findings of Camarda *et al*. (2007) that higher concentration of the same extract could show appreciable inhibition. The minimum fungicidal concentration (MFC)show that methanol and n- hexane extract of *Senna occidentalis* and *Boswellia dalzielii* was very active against all the tested fungi.

The result of phytochemical analysis carried out on the plants reveal the presence of such biologically active compounds such as flavonoids, tannin, saponins, cardiac glycosides, saponins glycoside in the organic solvent extracts of the leaves of the plants. The inhibition of the growth of these tested organisms could be as a result of the presence of these biologically active compounds. Some of these phytochemicals have been reported to possess antimicrobial properties as shown by many workers (Anderson, 2004; Liu, 2004 and Kayode and Kayode, 2011). The three different extracts were effective antibacterial and antifungal agents with methanol extract showing the greatest activity. The presence of phytochemicals has been attributed to be the bioactive principle responsible for the antimicrobial activities of most medicinal plants *(Shimbe and Tor-Anyiin, 2014)*. The methanol extract contains tannins, saponins, alkaloids, anthraquinones, and resins which majorly were absent in the hexane and ethyl acetate extracts. These secondary metabolites which have been reported to offer great pharmacological activities both in traditional and orthodox medicine are responsible for the enhanced activity of the methanol extract (Oluwakayode, 2015).

The result of toxicity studies of Boswellia *dalzielii and Senna occidentalis* methanol extracts of both the acute and sub-chronic test did not produce any toxic effect on the test animal, such as death, change in body weight, change in food and water consumption and liver function parameters changes. Similar observations were made by Mirtes *et al.* (2011) who found that the administration of *Senna occidentalis* is not toxic in male and female Wister rats. The results from this study provided evidence for the medicinal value of the tested plants, thus supporting the potential therapeutic utilizations (jointly by patients) for candidiasis and Aspergillosis infection. Therefore, the study has provided new information on safety, fungal medicinal values of the two plants already being consumed for treatments of other illnesses and for further research findings especially on treatment of infectious diseases

5. CONCLUSION

Study of antifungal activity of *S. occidentalis and B. dalzielii* reveal that both plants were the most active against the fungi tested. MIC (9.75 and 30mg/ml) and MFC (7.5and 30mg/ml) show that the tested plants are highly active against the tested fungi. The potential of *Senna occidentalis and Boswellia dalzie*lii in the treatment of fungal infection is high.

Further investigations on the chemical compositions and possible isolation of the active ingredient for specific functions in order to standardize the formulation for efficient medical use would be carried out.

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