IJSGS

ISSN: 2488-9229
FEDERAL UNIVERSITY
GUSAU-NIGERIA

INTERNATIONAL JOURNAL OF SCIENCE FOR GLOBAL SUSTAINABILITY

Antifungal Activities of *Senna Occidentalis* and *Boswellia Dalzieli* Against *Candida* and *Aspergillus Species* in Sokoto State, Nigeria

Hauwa'u Bello Abubakar[1] and Aisha Umar[2]
[1]Microbiology Department, Sokoto State University, Sokoto
[2]Biological Sciences Department, Sokoto State University, Sokoto

Corresponding Authors' Email: aishaumar258@gmail.com

Received on: April, 2022 **Revised and Accepted on:** June, 2022 **Published on:** July 2022

ABSTRACT

Due to the rising costs, accessibility of conventional medication and traditional beliefs, a good number of the populace, especially in the third world tend to rely on traditional herbs as a preferred form of medication. The scientific backing for the wide use of these herbs needs to be established. In this study, the leaves of two plants used as herbs, *Senna occidentalis* and *Boswellia Dalziel*, were extracted using methanol and n-hexane. The antifungal activities of the crude extracts were then tested against *C. Albicans*, *C. pseudotropicalis*, *A. niger*, and *A. flavus* using the agar incorporation method. At 10, 20, and 30 mg/ml concentrations, *Senna occidentalis* and *Boswellia dalzielii* suppressed the growth of *Candida albicans*, *Candida pseudotropicali*s, and *Aspergillus niger*, but had minimal effect on *Aspergillus flavus*. The minimum inhibitory concentration (MIC) for the various species was found to be between 3.75 and 30 mg/ml, whereas the minimum fungicidal concentration (MFC) was found to be between 3.75 mg/ml and 30 mg/ml. The minimum fungicidal concentration (MFC) was 3.75-30 mg/ml, whereas the maximum fungicidal concentration (MFC) was in the range of 3.75-30 mg/ml. The ability of the two herbs, tested, to suppress fungal isolates revealed their wide usage in the treatment of fungal infections and diseases.

Keywords*:* antifungal, *Boswellia dalzieli*, fungicidal, isolates, *Senna occidentalis*,

1.0 INTRODUCTION

Traditional medicine is the oldest technique for treating diseases and infections. Plants are one of the most important and common sources of potentially valuable novel medications, and they have been utilized to treat infection and other illnesses in aboriginal peoples for countries (Duke and Martinez, 1994). Even today many plants are used to cure human ailments and infections in different parts of the world (Venogupal and Venegupal, 1994). In many places of the world, including Nigeria, medicinal herbs are widely used (Kunle, 2000; Agassounon *et al.*, 2001). Although there are a few community-based investigations, controlled clinical trials are scarce.

Plant-based drugs are gaining popularity due to several benefits; including fewer side effects, improved patient tolerance, lower costs, and acceptance due to a long history of use. Herbal medicine, in particular, has provided rational means for the treatment of many diseases that are incurable in other systems of medicine (Abdullah and Lawal, 2010). Herbal medications made from plant extracts are increasingly being used to treat a wide range of medical conditions (Fabricant and Farnsworth, 2001). Many plants, particularly those employed by traditional healers, produce pharmaceutically active compounds with antibacterial, anthelminthic, antifungal, antiviral, anti-inflammatory, anti-oxidant, and anti-diabetic properties (Rabah *et al.*, 2007; Gupta *et al.*, 2007; and Karim *et al.*, 2011). Phytochemicals are bioactive, non-nutrient plant components found in fruits, vegetables, graves, and other plant foods that have been related to lowering the incidence of severe degenerative illness (Liu, 2004). Medicinal plants contain biologically active chemical compounds that have medicinal qualities, such as saponin, tannins, essential oils, flavonoids, and alkaloids (Kayode and Kayode, 2011; Harborne, 1998; Sofowora, 1996). Long before civilization discovered microorganisms, the discovery of these

phytochemicals and their medical benefits piqued people's interest in the plants.

In Sokoto state of Nigeria traditional use of herbs to cure and prevent diseases, which is an age-long practice, is still very popular (Aisha *et al.,* 2019). Plants have been traditionally used to cure ailments such as toothaches, typhoid, skin infections, and urinary tract infections. These herbs are being used without much scientific evidence of their efficacy or effectiveness. This study is therefore aimed at determining the antifungal activities of *Boswellia dalzielii* and *senna occidentalis,* against four fungi species (*C. albican*, *C. pseudotropicali*s, *A. niger*, and *A. flavus*,). These two plants are locally used by traditional herbalists to address diseases of respiratory and urinary infections. The part of the plants that are normally used is the leaves. *C. albican*, *C. pseudotropicalis*, *A. niger*, and *A. flavus*, fungi species are noted to be commonly responsible for respiratory and urinary infections.

2.0 MATERIALS AND METHODS

2.1 Collection of Plants Samples

The leaves of *Senna occidentalis, and Boswellia dalzieli,* were collected within the Sokoto metropolis (Latitude: 13.059^0N: and Longitude: 5.236^0 E). The plants were taken to the herbarium of the Botany Unit of the Department of Biological Science, Usmanu Danfodiyo University Sokoto for authentication. The voucher specimens of the plants were retained in the Departmental Herbarium with the voucher number UDUH/ANS/0023, and UDUH/ANS/0069. The leaves collected were air-dried and pulverized into a fine powder using a pestle and mortar then stored in sealed containers until required.

2.2 Extraction Procedure

The extraction of the crude extracts from the plants was carried out by following the procedure described by Abdullahi and Lawal (2010).

2.3 Determination of Antifungal Activity

The plant (leaves) crude extracts were tested for antifungal activity using the Agar incorporation method as described by Zacchino *et al*. (1999). Observations and readings for the zone of inhibition were done and the result was recorded (Janky *et al.,* 2011).

2.4 Determination of Minimum Inhibitory Concentration (MIC)

The Minimum inhibitory concentration (MIC) was determined as the least concentration that shows an inhibitory effect on any of the test organisms using the tube method (Atlas, 1998). The tube that fails to show evidence of growth (turbidity) just after the one that shows growth was recorded as MIC (Wokoma *et al.,* 2008*).*

2.5 Determination of Minimum Fungicidal Concentration (MFC)

The minimum fungicidal concentration was determined by culturing the content of the tube that showed no visible growth in the MIC. A loopful of the mixture contained in the tubes was sub-cultured on a freshly prepared sabouraud dextrose agar plate and incubated at ambient temperature for 7 days. The minimum fungicidal concentration was recorded as the concentration of the extracts that did not permit any visible colony growth on the agar medium after the period of re-incubation (Wokoma *et al.,* 2008*).*

3.0 RESULTS

3.1 Results of the Antifungal Activities of the Leaves Extracts

The results of the antifungal activities of the plant leave investigated are presented in tables 1 and 2. Table 1 shows the results of antifungal activity of methanolic crude leaves extracts of *Senna occidentals* and *Boswellia dalzielii* against *Candida Albicans, Candida pseudotropicalis, Aspergillus niger* and *Aspergillus flavus* at concentrations of 10, 20, and 30 mg/ml. The crude leaves extract of *Senna occidentalis* and *Boswellia dalzielii* was active on *C. albican, A. niger, and C. pseudotropicalis* with little effect against *A. flavus* at a concentration of 20 and 30 respectively. The result of antifungal activity of n-hexane crude extracts of *Senna occidentalis and Boswelliadalzielii* tested at various concentrations of 10, 20 and 30 mg/ml is presented in Table 2. *Senna occidentalis* and *Boswellia dalzielii* crude extracts showed high activity on *C. pseudotropicalis, and C.albican,* with little activity against *A. niger* and *A. flavus* at a concentration of 20 and 30mg/ml.

Table 1: Antifungal Activity of Methanol Crude Leave Extracts of Plants against Fungi

Plants used	Conc. in mg/ml	Mean radial growth (mm)/species of fungi				
		C. albicans	*C. pseudotropicaalis*	*A. niger*	*A. flavus*	Total mean
S. occidentalis	10	13.0	3.3	7.3	1.0	6.15
	20	14.7	9.0	8.3	2.7	8.68
	30	17.7	12.3	13.0	4.0	11.75
B. dalzielii	10	9.0	7.3	1.3	2.3	4.98
	20	10.3	7.3	3.7	2.7	6.00
	30	11.7	11.0	3.7	3.3	7.43
Itraconazole	10	12.5	13.0	20.0	20.0	16.38

Key: Itraconazole = positive control *S. occidentalis= Senna occidentalis*
B. dalzielii = Boswellia dalzielii

Table 2: Antifungal Activity of N-Hexane Crude Leave Extracts of Plants against Fungi

Plants used	Conc. in mg/ml	Mean radial growth (mm)/species of fungi				
		C. albicans	*C. pseudotropicaalis*	*A. niger*	*A. flavus*	Total mean
S. occidentalis	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	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
Itraconazole	10	13.0	13.5	20.0	20.0	16.6

Key: Itraconazole = positive control *S. occidentalis= Senna occidentalis*
***B. dalzielii = Boswellia dalzielii* Values < 2mm shows no zone of inhibition**

3.2 Results of the Minimum Inhibitory Concentration of the Leaves Extracts

The results of the minimum inhibitory concentrations of the two extracts are presented in tables 3 and 4. Table 3 showed the minimum inhibitory concentration of *Senna occidentalis* and *Boswellia dalzielii* methanol crude leaves extract. The methanol crude extract of both plants had the activity against *C. albican and C. pseudotropicalis,* at 7.5mg/ml concentration, *A. niger* and *A. flavus* at 15mg/ml concentration.

Table 4 showed the MIC of *Senna occidentalis* and *Boswellia dalzielii* n-hexane crude leaves extract, both plant's extracts showed effect against *C. albican and C. pseudotropicalis*, at 7.5mg/ml concentration, but no MIC against *A. niger* and *A. flavus*.

Table 3: Minimum Inhibitory Concentration of *S. Occidentalis* and *Boswellia dalzielii* Methanol Crude Leaves Extract against Fungal Species

Plants	Organisms	Concentration of extracts mg/ml								MIC value mg/ml
		30	15	7.5	3.75	1.875	0.9375	0.46875	0.234375	
	C.A	-	-	-	+	+	+	+	+	7.5
	C.P	-	-	-	+	+	+	+	+	7.5
	AN	-	-	+	+	+	+	+	+	15
	AF	-	-	+	+	+	+	+	+	15
	CA	-	-	-	+	+	+	+	+	7.5
	C.P	-	-	-	-	+	+	+	+	3.75
	AN	-	+	+	+	+	+	+	+	15
	AF	-	-	+	+	+	+	+	+	15

Key:bbbS.O= *Senna occidentalis* B.D= *Boswellia dalzielii* CA= *Candida albican*
CP=*Candidapseudotropicalis* AN=*Aspergillus niger AF= Aspergillus flavus*

Table 4: Minimum Inhibitory Concentration of *S. occidentalis* and *Boswellia dalzielii* N- hexane Crude Leaves Extract against Fungal Species

Plant used	Organisms	Concentration of extracts mg/ml								MIC,value mg/ml
		30	15	7.5	3.75	1.875	0.9375	0.46875	0.234375	
SO	CA	-	-	-	+	+	+	+	+	7.5
	CP	-	-	-	+	+	+	+	+	7.5
	AN	+	+	+	+	+	+	+	+	-
	AF	+	+	+	+	+	+	+	+	-
BD	CA	-	-	-	-	+	+	+	+	7.5
	CP	-	-	-	-	+	+	+	+	7.5
	A N	+	+	+	+	+	+	+	+	-
	AF	-	-	+	+	+	+	+	+	-

SO= *Senna occidentalis CP= Candida pseudotropicalis* AN=*Aspergillus niger*
BD= *Boswellia dalzielii AF= Aspergillus flavus CA= Candida albican*

3.3 Results of the Minimum Fungicidal Concentration of the Crude Leaves Extract against Fungal Isolates

The results of the minimum fungicidal concentration of *S. occidentals* and *B. dalzielii* crude leave extract against fungal isolates are presented in tables 5 and 6. As shown in Table 5, the n-hexane extract of *Senna occidentalis* showed MFC against *C. albican* and *C. pseudotropicalis* at 7.5mg/ml concentration. *Boswellia Sdalzielii* has MFC against *A. flavus* at 15mg/ml concentration and *C. albican* and *C. pseudotropicalis* at 7.5 mg/ml concentration, but no MFC against *A. niger.* From table 6, the methanol extract of both plants showed MFC against the tested organism at7.5 and 15mg/ml concentration except *A. niger* which has MFC at 30 mg/ml concentration.

TABLE 5: Minimum Fungicidal Concentration of *S. occidentals* and *B. dalzielii* N- hexane Crude Leave extract against Fungal Isolates

Plants used	Organism	Concentration of extract mg/ml				MFC value (mm)
		30	15	7.5	3.75	
S0	CA	-	-	-	+	7.5
	CP	-	-	-	+	7.5
	AN	-	-	-	+	7.5
	AF	-	-	-	+	-
BD	AC	+	+	+	+	-
	CP	-	-	-	+	7.5
	AN	+	+	+	+	-
	AF	-	-	+	+	15

SO= *Senna occidentalis* CP= *Candida pseudotropicalis* AN=*Aspergillus niger*
CA= *Candida albican* AF= *Aspergillus flavus* BD= *Boswellia* dalzielii

Table 6: Minimum Fungicidal Concentration of *S. occidentals* and *B. dalzielii* Methanol Leaves Extract against Fungal Isolates

Plants used	Organism	Concentration of extract mg/ml			MFC value (mm)
		30	15	7.5	
5.0	CA	-	-	-	7.5
	CP	-	-	-	7.5
	AN	+	+	+	15
	AF	+	+	+	30
BD	CA	-	-	-	7.5
	CP	-	-	-	7.5
	AN	-	-	+	30
	AF	-	+	+	15

SO= *Senna occidentalis* BD= *Boswellia dalzielii* CA= *Candida albican* CP=*Candida pseudotropicalis* AN=*Aspergillus niger* AF= *Aspergillus flavus*

4.0 DISCUSSION

The antifungal activity of methanol and n-hexane leaves extracts of *Senna occidentalis* and *Boswellia dalzielii*, was determined. They both showed high activities against all the fungal tests. As the concentration increased, the methanol extracts of the extracts had a great effect on the examined organisms. The maximum antifungal activity against the total tested organism was recorded at a dosage of 30 mg/ml. *Senna occidentalis* had the greatest mean antifungal activity of 11.75 against the species examined.

The findings of this study agree with those of Jain *et al.*, (1998), who found that methanolic and aqueous extracts of *Senna occidentalis* leaves were most efficient against *Candida albicans* and *Aspergillus fumigatus*. It also supports the findings of Odeja et al (2014), who found that the methanol, hexane, and ethyl acetate extracts of Senna occidentalis were most effective against *Candida albicans*, *Aspergillus niger*, and Egharevba *et al.*, (2010), who discovered that the leaves extract of *Senna occidentalis* has high antifungal activity against Candida species, Microsporum species, and Trichophyton species.

With a mean radial growth of 7.0, *Boswellia dalzielii* also exhibits promising antifungal efficacy against the examined species. This study's findings are similar to those of Adelakun *et al.*, (2001), who found that a methanol extract of *Boswellia dalzielii* had antibacterial and antifungal properties. Plants containing flavonoid, triterpenoid, and other phenolic chemicals have been discovered to exhibit antibacterial activities (Rojas *et al.*, 1992). Gbile, 1986, discovered that alkaloids are one of the elements of *Senna occidentalis* and *Boswellia dalzielii*, which supports the presence of alkaloids in these plant extracts. The antimicrobial activity of *Senna occidentalis* and *Boswellia dalzielii* crude leaf extracts could be related to the inhibition of fungus growth.

The results of a MIC investigation using methanol extracts of *Senna occidentalis* and *Boswellia*

dalzielii vary depending on the species of fungus investigated. *C. albican* and *C. pseudotropicalis* had the most potent actions. Higher concentrations of antifungal ingredients in the same extract showed considerably greater growth suppression in both fungicidal and fungi static, as found by Camarda *et al.,* (2007).

Methanol and n-hexane extracts of *Senna occidentalis* and *Boswellia dalzielii* were found to be fungicidal against all of the species tested using the minimal fungicidal concentration (MFC). Because the plant extract had a fungicidal effect on these organisms, patronizing these plants for local treatment owing to infection caused by this organism seems justified. The plants' fungicidal properties are extremely valuable because, when used as a medicinal extract and provided for therapy, there would be no recurrence of the illness. The findings of these investigations support the therapeutic use of the plants studied. As a result, individuals with candidiasis and Aspergillosis can use it alone or in combination for therapeutic purposes.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Senna occidentalis and *Boswellia dalzielii* were portent and demonstrated high antifungal activity against the investigated organisms based on the results obtained for antifungal activity of the two plants. The examined plants are extremely active against the tested species according to both MIC and MFC with *Senna occidentalis* being more effective with higher zone of inhibition on the growth of the fungi species. The ability of these plants to suppress fungal isolates in tests indicates their promise in the treatment of fungal infections and diseases.

5.2 Recommendation

Given the high potential of these plants (*Senna occidentalis and Boswellia dalzielii*) as useful plants in Sokoto, further antifungal screening is recommended using other fungal isolates not included in this research. Further study on the safety of the use of these plant extracts is also suggested.

REFERENCES

Abdullahi, S. K and Lawal, G. H. (2010) Phytochemical and Microbial Screening of *Parkinsonia culeate L*. leaves Int. j. Drug Dev. And Res., Jan-March 2010,2 (1):1-7.

Adelakun, E.A., Finbar E.A.V., Agina S.E. and Makinde A.A. (2001): Antimicrobial activity of Boswelliadalzielii stem bark; Fitoterapia **72(7),** 822-824.

Agassouno, D.T.M., DE Souza, K. T Anani, K. Koumaglo, F. Toukourou and M. Gbeassor,(2001). Evaluation of cytotoxic, antibacterial and antifungal activities of six medicinal plants. *Pharm*. *Trad. Afr*.**, 11**:93-105.

Aisha Umar, Bashir L. Alaero, Lawal G. Hassan, Kasimu Shehu and M. S. Rabia (2019). Phytochemical study and antifungal activity of stem extracts of Phyllanthus niruri. *Caliphate journal of science and technology* 12-18.

Camarda, L.Dayton, T. Di Stefano, V. Pitonzo, R. Schillaci, D.(2007). Chemical composition and antimicrobial activity of some oelegum resin essential oils from *Boswellia spp. (Burseraceae*). *Ann Chim*; **97** :837-844.

Duke, J. A. and Martinez, R.V. (1994). *Handbook of Ethano botanicals.* Boca Raton (Peru): CRC press.

Egharevba, H. O. Odigwe A. C. Abdullahi M. S. Okwute S. K. and J. I (2010). Phytochemical analysis and broad-spectrum antimicrobial activity of Cassia occidentalis L. (whole plant). *New York science research journal* **3**(10):74-81.

Enriz (1999). Invitro Evaluation of antifungal properties of phenyl prostanoids and related compounds acting against dermatophytes *J Nat. Prod.*, **62**:1353-1355.

Fabricant, DS, and Farnsworth, NR. (2001). The value of plants used in traditional medicine for drug discovery." *Environ. Health Perspect*. **109** Suppl 1(Suppl 1):69- 75.

Gupta M, Mazumdar, Kokand Gomathi, P. (2007). Antioxidant and antimicrobial properties of *galega Purpurca* root, *Asian Journal of plant Science.* **6:**533-537.

Harborne, JB (1998). Phytochemical methods. Aguide to modern techniques of plant analysis.

London. New York Chapman & Hall, Pp 200-280.

Jain, SC, Sharma,RA, Jain, R, and Mittal C.(1998). Antimicrobial screening of *Cassia occidentalis* L invivo. and in vitro. *Phytotherapy Res*; 12: 200-204.**37[1];** 26- *29clin infect dis*. 2008; 46[3]; 327-60.534752.

Janky Kumar, K. Sivasankari, k. and Sekar, T. (2011). Screening of antimicrobial activities of indigenous herbs cassia occidentalism. Elixir, *APPL. Botany* **39** (2011) 4588.

Karim, A. Sohail, MN. Munir S.and Satter, S. (2011) Pharmacology and phytochemistry of Pakistani herbs and herbal drugs used for the treatment of diabetes. *Int J. Pharmacol*.**, 7:**419-439.

Kayode, A. A. and Kayode, O. T (2011). Some medicinal value of Telfair occidentalis, A review. *American Journal of biochemistry and molecular biology* **1**:30-38. Doi: 10/39.23/ajbmb 2011.30.38.

Kunle, O.O(2000). The production of pharmaceuticals from medicinal plants and their products. *Nigerian Journal of Natural Products and medicine* .4:9.

Liu, R. H (2004). Potential synergy of Phytochemicals in cancer prevention: mechanism of action *Journal of Nutrition* **134**:34795-34855.

Odeja O.O. Obi G. Ogwuche C. E. Elemike E. E. (2014). Phytochemical Screening, Antioxidant *Senna occidentalis (L) Leaves. International Journal of herbal medicine* **2**(4):26-30.

Rabah F. L., Ali, S. Muhmoud, C. Bengraa and Hacene, H. (2007). Screening, isolation and characterization of a novel antimicrobial producing actinomycete, strain RAF10. *Biotechnology*, **6**:489-496.

Sofowara, A. (1996). Medicinal plant and traditional medicine in Africa 2nd Edition, Spectrum Book Ltd, Ibadan, Nigeria, PP 112.

Venogupal, P.V and Venegupal,T.V.(1994). Antidermatophytic activity of neem (Azadirachta indica) leaves in vitro: *Indian Machol*; 26:141-143.

Wokoma, EC. Essein ,IE. and Agwa, OK. (2008). The in-vitro antifungal activity of garlic (Allium ssatium) and onion (Allium cepa) extracts against dermatophytes and yeast. *The Nig. J. of Microbiol*. **Vol 21**:21489.

Zacchino AS, Lopes NS, Pezzenati DG, Furlan LR, San tecchia BC, Munoz L, Giannini MF, Rodriguez MA,