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A preliminary evaluation of the antibacterial effects of *Commiphora molmol* and *Boswellia papyrifera* oleo-gum resins vapor

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Abstract

This study was conducted to evaluate the effects of the vapor of the resins of two aromatic medicinal plants, *Commiphora molmol* and *Boswellia papyrifera* on the growth of some reference bacteria and clinical isolates, as antibacterial material. Resins were subjected to successive solvent extraction using petroleum ether, ethyl acetate, methanol and water. The method employed in this study was Micro-atmosphere assay. The study showed that the vapor of the methanolic extracts of these resins suppressed -to some degree- the bacterial growth, this may be due to its antibacterial activity confirming its positive application in inhalation therapy to treat bronchitis and sinusitis in traditional medicine.

Keywords: *Commiphora molmol*, *Boswellia papyrifera*, antibacterial activity, resin's vapor.

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1. Introduction

Recently, the continued emergence of bacterial strains resistant to antibacterial drugs is a serious threat to human lives, these pathogens that are resistant to multiple drugs have been emerged around the globe [1]. Plants are the largest pharmaceutical stores ever known on Earth, being able to produce endless bioactive compounds [2]. Plants of medicinal benefits are major sources for antimicrobial drugs [3]. This has led to the screening of medicinal plants for their antimicrobial activities. Our studies showed that *Commiphora molmol* and *Boswellia papyrifera* have antibacterial activities [4]. Among all families of the plant kingdom, members of the *Bruseraceae* have been used for centuries in traditional medicine. *Commiphora molmol* is originally found in Northern Africa, Arabian Peninsula and Northern Somalia [5]. *Boswellia papyrifera* is originally found in East Africa (Sudan, Eritrea and Ethiopia) [6]. The oleo-gum resins of *C. molmol* and *B. papyrifera* are known to have considerable amounts of volatile oils, and both are applied as incense in traditional medicine beside other medicinal applications [5, 1]. It is observed in traditional medicine in Sudan that, *B. papyrifera* resin is employing as incense, and its smoke is applied for the treatment of the upper respiratory infections and inflammations. Similar application present in the Arabian Peninsula, the smoke of *C. molmol* resin is employed against respiratory inflammations (personal communication). Our previous investigations showed that these resins have antibacterial activity and the phytochemical analysis showed the presence of phenolic compounds, alkaloids and saponins in the methanol extracts of *C. molmol* and *B. papyrifera* [4,7].

The aim of this study is to investigate the antibacterial effects of the vapor of these resins, based on its application in folk medicine.

2. Materials and Methods

2.1. Plant materials

The oleo-gum resin of *B. papyrifera* (Figure 1) was purchased from traditional medicine shops from Khartoum town, Sudan and the oleo-gum resin of *C. molmol* (Figure 2) was purchased from traditional medicine shops from Al-Rass town, Saudi Arabia. Both plants and their resins have been authenticated prior of purchasing. Resins of *C. molmol* and *B. papyrifera* were crushed into powder using sterile mortar and pestle and kept in dark bottles until used.

2.2. Bacterial strains

The bacterial reference strains and clinical isolates were supplied from Department of Microbiology, Medicinal and Aromatic Plants Research Institute, National Center for Research, Khartoum, Sudan and/or the School of Bioscience and Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Malaysia. Namely, *Stapylococcus aureus* (ATCC 25923); *Proteus vulgaris* (ATCC 6380); *Pseudomonas aeruginosa* (ATCC 27853); *Bacillus subtilis* (NCTC 8236). Seven strains of methicillin resistant *Staphylococcus aureus* (MRSA-1, MRSA-2,

Figure 1. The crude oleo-gum resin of *Boswellia papyrifera*

Figure 2. The crude oleo-gum resin of *Commiphora molmo*

MRSA-3, MRSA-4, MRSA-5, MRSA-6 and MRSA-N32064) and *Klebsiella pneumoniae* (Clinically isolated from patients).

2.3. Preparation of the extracts

The powder of oleo-gum resins of *C. molmol* and *B. papyrifera* were subjected to successive solvent extraction [8,9]. The extraction process was performed using the following solvents in increasing order of polarity: petroleum ether, ethyl acetate, methanol and de-ionized distilled water, respectively. Then, the solvents were evaporated under reduced pressure and the residues (Extracts) were reconstituted by adding the same solvent to extract to give 500 mg/ml. According to our previous study, this was the highest dose showed antibacterial activity [4].

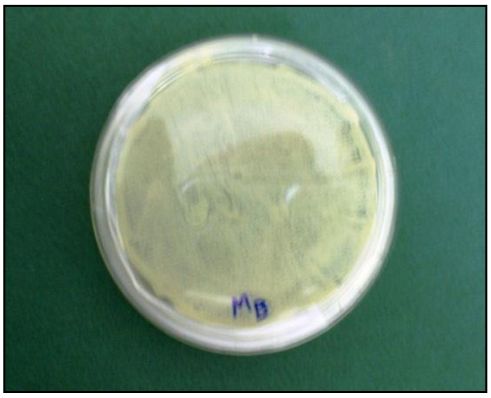
2.4. Antibacterial testing of vapor

The micro-atmosphere method was used in this investigation [7]. Previously, Mueller-Hinton agar was prepared according to the manufacture instructions; it was autoclaved and poured in sterile plates. Subsequently, bacterial suspension was adjusted to 0.5 McFarland to prepare a suspension containing about 5×10^7 CFU ml^{-1}. A sterile cotton swab was dipped into this suspension and spread over the Mueller-Hinton agar plate, left for up to 15 minutes to set, turned upside down and on the inner surface of the plate's cover 100 µl of the previously prepared extract (500 mg/ml) were loaded. Carefully, without changing the plate position, plates were closed, sealed and incubated overnight at 37^{o}C. observed for any growth suppression compared to the positive control. For another plate, followed all the above mentioned steps but without adding the extract to serve as positive control. Experiment was repeated twice.

3. Results and discussion

Little is known about the antibacterial activity of vapor and smoke of medicinal plants as no standard method used to measure this activity of vapor. However, there are many prescriptions of application in folk medicine using the vapor of some medicinal and aromatic plants in curing some aliments. The evaluation of vapor activity by the inverted Petri-dish technique was first reported by Kienholz in 1955 and it is still used without development till now [10]. However, this technique needs more development to measure the activity quantitatively. As is apparent from Table 1 and Figure 3, the resin's vapor of *C. molmol* and *B. papyrifera* extracts may had a potential to suppress the growth of some microorganisms. The results were described according to the density of the growth which may be an indicator for susceptibility of these microorganisms toward the extract's vapor. These resins were already found to have antibacterial activity [4]. The results of this study confirm the application of vapor of the oleo-gum resins of these plants in folk medicine against the upper thorax infections like cough and cold which may be due to bacterial infections [6], although not every infection there is bacterial. More studies on this vapor and resins are required to investigate any possible antiviral activity. It is evident from Table (1) that, 83.3% of the standard bacteria and clinical isolates showed some degree of growth suppression due to the vapor of methanol extract of *C. molmol*.

Negative Control
No bacterial growth
(Media only)



Positive Control
Dense growth
(Bacteria only)

Weak growth suppression
(Bacteria + extract)

Moderate growth suppression
(Bacteria + extract)

Figure 3. Representative photos of the micro-atmosphere assay showing the suppressant effect of the methanol extract's vapor

Table 1. The effect of plant extracts vapors on selected microorganisms according to micro-atmosphere assay

Extract*	Bacteria*											
	MRSA1	**MRSA2**	**MRSA3**	**MRSA4**	**MRSA5**	**MRSA6**	**MRSA N32064**	***S. a.***	***B. s.***	***Pr. v.***	***Ps. a.***	***K. p.***
Petroleum ether (A)	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum ether (B)	-	-	-	-	-	-	-	-	-	-	-	-
Ethyle acetate (A)	±	-	±	±	±	-	±	-	±	±	±	-
Ethyle acetate (B)	±	-	+	+	±	±	±	-	±	±	-	±
Methanol (A)	+	-	+	-	±	+	±	+	±	+	±	±
Methanol (B)	-	+	+	±	+	+	±	±	+	±	±	±
Water (A)	-	-	-	-	-	-	-	-	-	-	-	-
Water (B)	-	-	-	-	-	-	-	-	-	-	-	-

* A= *C. molmol*, B= *B. papyrifera*, MRSA= Methicillin resistant Staphylococcus aureus , *S. a. = Staphylococcus aureus* ATCC 25923, *B. s. = Bacillus subtilis* NCTC 8236, *Pr. v. = Proteus vulgaris* ATCC 6380, *Ps. a. = Pseudomonas aeruginosa* ATCC 27853 and *K. p. = Klebsiella pneumoniae* isolates . Results: (-) = No growth suppression observed, (±) = Weak growth suppression, (+) =Moderate growth suppression

Furthermore, 91.6% of the standard bacteria and clinical isolates showed some degree of growth suppression towards the vapor of methanol extract of *B. papyrifera*. Surprisingly, literature regarding the antimicrobial activity of the vapor of medicinal and aromatic plants is scantly. However, the findings of this study concerning the effect of vapor of the two plants understudy is consistent with [11] who was reported that, among the 14 essential oils from different medicinal plants used in traditional medicine, *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Streptococcus pyogenes* and *Staphylococcus aureus* showed susceptibility for the vapor of most essential oils. The antibacterial action of the essential oils was more effective when at high vapor concentration for a short term. Thus, one may take into consideration that the antibacterial potency to the vapor of *C. molmol* and *B. papyrifera* resins are attributed to its aromatic constituents. The author believes that the smoke may have some advantages on the vapor by releasing more aromatic compounds. Anyhow, the application of the plant's smoke in traditional medicine in Sudan is well known. Smoke of the wood of *Acacia seyal* and the bark and wood of *Combretum hartmannianum* are used for treatment of arthritis rheumatism and rheumatic fever in Sudan [12]. Further studies regarding this issue are recommended. This is the first study to demonstrate that the vapor of *C. molmol* and *B. papyrifera* resins could suppress the normal growth of bacteria.

4. Conclusion

There are numerous applications of vapor and smoke of some medicinal and aromatic plants in folk and traditional medicine. They requires intensive study to investigate its bioactive principles which may lead to discover new therapeutics. In this investigation, the methanolic extracts of oleo-gum resins of *C. molmol* (Myrrh) and *B. papyrifera* (Frankincense) which were previously reported having antibacterial activity, were found to have some degree of growth suppressant effects against some bacteria studied. These findings require more advanced investigations.

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References

[1] C.T. Walsh. (2003). Where will new antibiotics come from? Nature Reviews Microbiology. 1: 65–70.

[2] E.M. Abdallah. (2011). Plants: An alternative source for antimicrobials. Journal of Applied Pharmacology Science. 1(6) 16-20.

[3] A. Sofowora. (1986). Medicinal plant and traditional medicine in Africa II. John Wiley Chiechester. pp. 178.

[4] E.M. Abdallah, A.S. Khalid and N. Ibrahim. (2009). Antibacterial activity of oleo-gum resins of *Commiphora molmol* and *Boswellia papyrifera* against methicillin resistant *Staphylococcus aureus* (MRSA). Science Research Essay. 4 (4) 351-356.

[5] L.O. Hanus, T. Rezanka, V.M. Dembitsky and A. Moussaieff. (2005). Myrrh-Commiphora chemistry, Biomedical Papers. 149(1) 3-28.

[6] J.H. Langenheim. (2003). Plants resins: Chemistry, Evolution, Ecology, and Ethnobotany. Timber Press, Portland, Oregon, USA.

[7] E.M. Abdallah. (2009). Antibacterial activity and toxicological studies on the oleo-gum resins of *Commiphora molmol* and *Boswellia papyrifera*. Ph.D thesis, Faculty of Science and Technology, Al Neelain University, Sudan.

[8] I. Darout, A. Cristy, N. Shaug and F. Egeberg. (2000). Identification and quantification of some potentially antimicrobial anionic components in Miswake extract. International Journal of Pharmacology. 32:11-14.

[9] N. Jothivel, S.P. Ponnusamy, M. Appachi, S. Singaravel, D. Rasilingam, K. Deivasigamani and S. Thangavel. (2007). Anti-diabetic activity of methanol leaf extract of *Costus pictus* D. Don in alloxan-induced diabetic rats. Journal of Health Science. 53(6) 655-663.

[10] S. Gocho. (1991). Antibacterial action of aroma compounds in vapor state. Journal of Antibacterial and Antifungal Agents. 19: 329-334.

[11] S. Inouye, T. Takizawa and H. Yamaguchi. (2001). Antimicrobial activity of essential oils and their major constituents against respiratory tract pathogens by gaseous contact. Journal Antimicrobial and Chemotherapy. 47 (5) 565-730.

[12] G.E.B. El Ghazali., M.S. El Tohami., A.A.B. El Egami., W.S. Abdalla and M.G. Mohammed. (1997). Medicinal plants of the Sudan, Part IV, National center for research, Omdurman Islamic Univ. printing and publishing house. Sudan.