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EFFECT OF YEMENI SESAME OIL AGAINST SOME PATHOGENIC BACTERIA AND FUNGI

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ABSTRACT: The present study was aimed to evaluate the effectiveness of some sesame oils obtained from different cities of Yemen. Sensitivity testing against some pathogenic bacteria and fungi were studied with four types of sesame oils in the laboratory pouring aqueous extract of the sesame seeds into the wells of the culture media. *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Candida albicans*, *Aspergillus niger* and *Aspregillus flavus* were the microorganisms used and they were identified, confirmed and obtained from the Microbiology laboratory of the Sana'a University, Yemen. The results indicated that *Semsum sanani* and *Semsum dwaini* showed more antifungal activity against *Aspergillus niger* and *Aspergillus flavus*, while *Semsum shahri*, *Semsum hadedi*, did not show any activity against pathogenic bacteria and fungi. This study suggests that the compounds found in the semsum oil can form the basis for the development of novel broad spectrum antimicrobial formulations. These results support the notion that semsum oil may have many pharmaceutical roles.

INTRODUCTION: Concern has been expressed about the rising prevalence of pathogenic microorganisms which are resistant to the newer or modern antibiotics that have been produced in the last three decades worldwide [1, 2]. Coincidentally, the last decade has also witnessed increasing intensive studies on extracts and biologically active compounds isolated from plant species used for natural therapies or herbal medicine [2, 3]. For over thousands of years, natural plants have been seen as a valuable source of medicinal agents with proven potential of treating infectious diseases and with lesser side effects compared to synthetic drug agents.

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However, the problem posed by the high cost, adulteration and increasing side effects of synthetic drugs coupled with their inadequacy in disease treatment found more especially in the developing countries which cannot be over emphasized [4]. Munir *et al*., in Nigeria found that methanolic and ethanolic extracts have broad spectrum antimicrobial effect against all the tested pathogenic micro-organisms except *Streptococcus pneumoniae* and *Staphylo-coccus aureus* respectively, while the aqueous extract exhibited inhibitory activity on *S. aureus, S. pneumoniae* and *Candida albicans* [5]. The result confirmed the folkloric claims of the antimicrobial effectiveness of locally consumed sesame leaf extracts especially against bacteria and common skin infection in many areas of Nigeria.

Kotade *et al*., in India [6] found the effect of *Sesamum indicum* seed oil on experimentally induced excision wound, incision wound, burn

wound and dead space wound models in rats. *Aloe vera* was used as a standard wound healing agent. With the formulation of seeds, oil is prepared in carbopol at 2.5 % and 5 % concentrations and applied to the wounds. In the excision and burn wound models, the treated animals showed significant reduction in period of epithelization and wound contraction (50%).

In the incision wound model a significant increase in the breaking strength was observed. Seeds and oil treatment (250 mg and 500 mg/kg) in dead space wound model produced a significant increase in the breaking strength, dry weight and hydroxyproline content of the granulation tissue. The results suggest that *S. indicum* seeds and oil applied topically or administered orally possess wound healing activity.

Titilade *et al*., in Nigeria found that ethanolic extracts of Sesame leaves have no inhibitory effects on *S. aureus* but strongly effective against *S. pneumoniae* and mildly effective against *C. albicans* [7]. However, the methanolic extract exhibited antimicrobial activity against *S. aureus* and *C. albicans*, but no inhibitory effect on *S. pneumoniae. C. albicans* was mildly inhibited by the aqueous extract. However, there was a strong antimicrobial effect against *S. pneumoniae* and *S. aureus* in the combination of aqueous extracts of two Sesame species. The sesame leaf extracts are equally effective against tested micro-organisms as the standard antibiotics.

Soureshjani *et al*., indicated that sesame oil has an inhibitory property on the growth of *S. aureus* and can kill the bacteria in higher concentration [8]. Tabassam and Vidyasagar found the antimicrobial properties of edible oil including sesame oil against human pathogens causing skin diseases [9]. Syed *et al*., explored natural variation of sesame in the content of antifungal metabolites and their distribution among plant organs [10].

Sesame belongs to the family- Pedaliaceae and genus-Sesamum [11]. The genus consists of about 36 species and 19 of which are indigenous to Africa [12, 13]. Sesame plant is believed to have originated from Africa [14]. Sesame is reputed in folk medicine in Africa and Asia. All parts of the plant are useful. However, in the South-Western Nigeria, decoction of the leaves is used for the treatment of bruised or erupted skins, cataract and eye pains. Warm water leaf infusion is used to gargle inflamed membranes of the mouth. The decoction of both leaves and roots have been found to be effective against chicken pox and measles (anti-viral) and used as hair shampoo for *Taenia capitis* (antifungal properties) [15]. Sesame seed oil, known to man since the dawn of civilization has been used as a healing oil and is locally consumed as a staple food in Nigeria, especially in South-West and Middle Belt areas, where it is richly cultivated by local subsistence farmers [16].

Thus, the use of sesame leaves and oil as food sources may account for the high fecundity among the adult male population in these areas [17]. Among oil crops, sesame is one of the highest in oil content. Generally, the oil content in sesame ranges from 34 to 63 % [18, 19]. Genetic and environmental factors influence the oil content and fatty acid compositions in sesame [20]. Late maturing cultivars are reported to have higher oil content than early cultivars and the indeterminate cultivars accumulated more oil than determinate ones [18]. Sesame contains high levels of antioxidants such as sesamol, sesamin, sesamolin and sesaminol. Therefore, sesame oil is called the queen of the vegetable oils because of its antioxidants [21].

The sesame oil consists of mainly four fatty acids (palmitic-C16:0, stearic-C18:0, oleic-C18:1 and linoleic-C18:2), while other fatty acids appear in very small amounts. Even though different fatty acid compositions of sesame oil have been reported; the major fatty acids were being oleic and linoleic acids [22]. Were *et al*., reported [19] variation in the quantities of palmitic, stearic, oleic and linoleic acids, with palmitic and stearic acids ranging from 7.2 to 9.6 % and 3.7 to 5.6 %, respectively, while high levels of oleic acid and linoleic acid ranged from 31.6 to 41.9% and 42.9 to 53.9% respectively. Due to the fact that sesame seeds are rich in PUFAs, as well as vitamin and minerals such as calcium, magnesium and phosphorus, its oil has health benefits. Therefore, sesame oil has been used as medicine or for pharmaceutical purposes [23]. Sesame oil contains Vitamin E and several important antioxidants such as sesaminol and sesamolinol that are believed to promote the integrity of body-tissues in the presence of oxidizing compounds [24].

Cooney *et al*., found [25] that intake of food made from sesame seed, which contain gamma-tocopherol, significantly elevated its levels in the serum. Gamma-tocopherol has been shown to positively influence Vitamin E activity that is believed to prevent cancer and heart disease [25]. Sesame oil is used as a pharmaceutical aid [26] and as such used to remedy gum disease, treat toothaches, relieve anxiety or insomnia, or used as an anti-bacterial mouthwash by Chinese and Indians in the past [24, 27]. Sesame oil has found use in several non-food applications such as in paints, cosmetics, solvents and soap [26]. In Africa, sesame flowers have been used to prepare perfumes [24]. Hasan *et al*., reported [28] that chlorosesamone extracted from roots of sesame has anti-fungal properties and were used as a fungicide. The primary aim of this present study was to determine the effect of Yemeni *Sesamum indicum* extract against some pathogenic bacteria and fungi identified bygone.

MATERIAL AND METHODS:

Sample Collection: The samples of sesame oil collected for the study were: 1. *Semsum sanani* 2. *Semsums hehri* 3. *Semsum dwaini* 4. *Semsum hadedi*. These were extracted by different farmers of Yemen from the locally grown sesame seeds.

Microorganisms: *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Candida albicans*, *Aspergillus niger* and *Aspregillus flavus*, were the microorganisms used and they were identified, confirmed and obtained from the Microbiology laboratory of the Sana'a University, Yemen.

Culture Media and Inoculum Preparation: Sabouraud dextrose agar (SDA) and Nutrient Agar (NA) were used as the media for the culturing of fungal and bacterial strains. Loop full of all the bacterial cultures were inoculated in the nutrient agar at 37 °C for 72 hours and fungal cultures were inoculated in SDA at 25 °C for 220 hours [29].

Agar Well Diffusion Method: The extracts obtained from the *Sesamum indicum* were used for studying their antimicrobial activity. A loop full of bacterial strains and fungal strains was inoculated in 30 ml of NA and SDA separately in a conical flask and incubated for 72 hours and 220 hours respectively to get active strain using agar well diffusion method [29]. SDA was poured into petri dishes. After solidification, 0.25 ml of test strains were inoculated in the media separately. Care was taken to ensure proper homogenization. The experiment was performed under strict aseptic conditions. After the medium was solidified, wells were made in the plates with sterile borer (5mm). The extract compound (50ml) which was introduced in to the well plates were incubated at 37 °C and 20 °C for 72 and 220 h respectively. All samples were tested in triplicates. Microbial growth was determined by measuring the diameter of zone of inhibition [30].

Measurement of Zone of Inhibition: Zones of inhibition were measured from the edge of the disk to the edge of the growth by ruler and recorded the zone measurements in the **Table** [31].

RESULTS: In the present study, the antibacterial activity of the sesame oil was evaluated against four bacterial spp. and three fungi spp. In the first stage, sesame oils were applied on each bacterial and fungi species. *Semsum sanani* and *Semsum-dwaini* have more activities on the organisms than sesame oil *Semsum shahri* and *Semsum hadedi*. The *Semsum sanani* and *Semsum dwaini* oil have more activity against *A. niger* and *A. flavus* (**Table 1**, **2** and **Fig. 1**, **2**) while *Semsum shahri* and *Semsum hadedi*, did not show any activity in these organisms (**Table 3** and **Fig. 3**, **4**).

TABLE 1: THE ANTIMICROBIAL ACTIVITY OF SEMSUM SANANI OIL AGAINST BACTERIA AND FUNGI

S. no.	Micro-Organisms	Sensitivity	Mean zone of Inhibition in cm
1.	*S. aureus*	-	-
2.	*S. typhi*	-	-
3.	*Bacillus* sp.	-	-
4.	*E. coli*	-	-
5.	*C. albicans*	-	-
6.	*A. flavus*	+	2.2
7.	*A. niger*	+	1.14

(+) Susceptibility (-) Absence of susceptibility

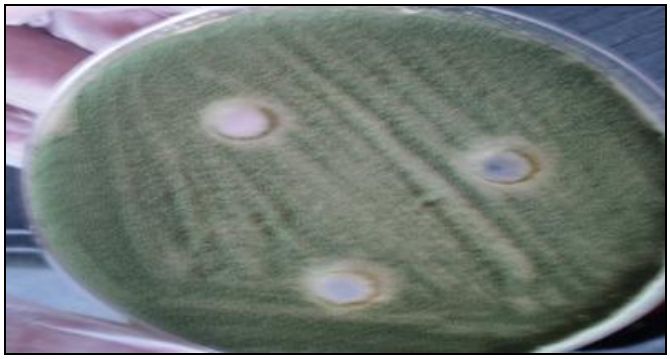

FIG. 1: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM SANANI* OIL AGAINST *A. FLAVUS*

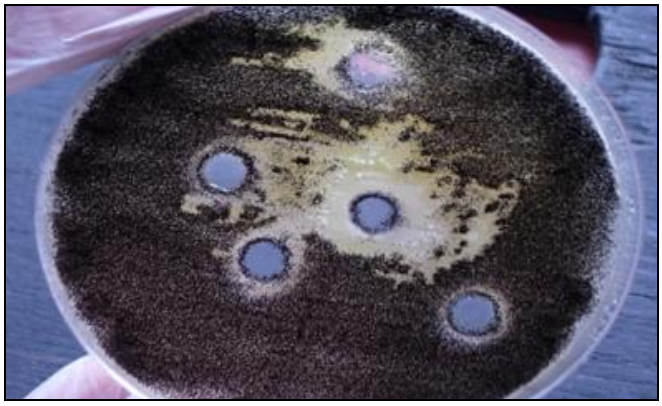

FIG. 2: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM SANANI* OIL AGAINST *A. NIGER*

TABLE 2: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM DWAINI* OIL AGAINST BACTERIA AND FUNGI

S. no.	Micro-organisms	Sensitivity	Mean zone of Inhibition in cm
1	*S. aureus*	-	-
2	*S .typhi*	-	-
3	*Bacillus* sp.	-	-
4	*E. coli*	-	-
5	*A. albicans*	-	-
6	*A. flavus*	+	0.2
7	*A.niger*	+	0.24

(+) Susceptibility (-) Absence of susceptibility

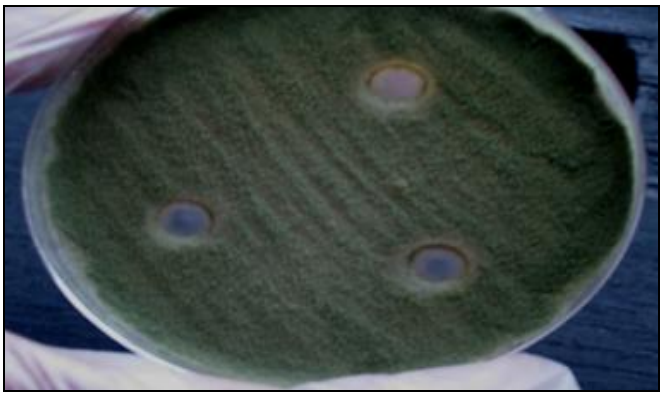

FIG. 3: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM DWAINI* OIL AGAINST *A. FLAVUS*

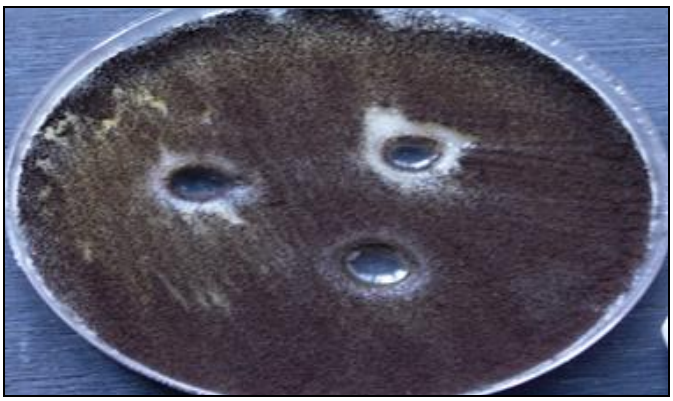

FIG. 4: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM DWAINI* OIL AGAINST *A. NIGER*

TABLE 3: THE ANTIMICROBIAL ACTIVITY OF *SEMSUM SHEHRI* AND *SEMSUM HADEDI* OIL AGAINST BACTERIA AND FUNGI

S. no.	Micro-organisms	Sensitivity
1	*S. aureus*	-
2	*S .typhi*	-
3	*Bacillus* sp.	-
4	*E. coli*	-
5	*A. albicans*	-
6	*A. flavus*	-
	A.niger	-

(-) Absence of susceptibility

DISCUSSION: The overuse of antibiotics in the treatment of infectious diseases and the appearance of 'multi-drug resistant' bacterial strains (resistant to two or more antibiotics), has driven research towards the study of antimicrobial agents from essential oils [32 - 38]. Our results showed that sesame oil *sanani* and *dwaini* have more activity on the organisms than sesame oil *shahri* and *hadedi* as shown in **Table 1** and **2**.

The sesame *sanani* oil and *dwaini* oil have more activity against *A. niger* and *A. flavus*. These results do not agree with Anand *et al.,*[39] who found antibacterial activity of sesame oil against bacteria. *S. mutans* and *Lactobacillus acidophilus* were found to be moderate to sensitive to the sesame oil. It was also observed that sesame oil is being used for oil pulling for maintaining oral hygiene, inhibiting the growth of various bacteria [40]. Annussek [27] also found sesame *sanani* and *dwaini* oil showing activity while *shahri* and *hadedi*, did not show any activity in these organisms.

Similar results were reported by Oloma [41] who observed that the above said oils did not show any activity against *S. aureus* and *Klebsiella* sp. and his results also revealed that sesame oil *sanani* and *dwaini* were active against *A. niger* and *A. flavus*, but other oils, did not show any activities in these organisms.

CONCLUSION: The present study signifies the antifungal role of the Yemeni sesame oils *viz*. *Semsum sanani* and *Semsum dwaini*, especially on *Aspergillus niger* and *Aspergillus flavus*. Compounds found in the sesame oil can form the source for the improvement of novel broad spectrum antimicrobial formulations. These results support the belief that sesame oil may have many pharmaceutical roles.

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CONFLICT OF INTEREST: None declared

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