Int.J.Curr.Microbiol.App.Sci (2022) *11*(02): 361-369

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 02 (2022)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2022.1102.041

White and Black Sesame Seed Oil and their Natural Active Compounds Presenting Antifungal Properties

Abd Elmaboud Breima Saaeed Dehiash[1] and Taha Mohammed Sharief Mohammed[2*]

[1]Department of Biology, [2]Department of Horticulture, University of Zalingei, Zalingei, Central Darfur, Sudan

**Corresponding author*

Keywords

Sesame (*Sesamum indicum* L.), antimicrobial activity, folk remedy

Article Info

Received:
01 January 2022
Accepted:
05 February 2022
Available Online:
10 February 2022

A B S T R A C T

In the present study, we evaluated the antimicrobial activity of white and black sesame seed oil against a range of fungal pathogens including that responsible for animal and plant infection. Sensitivity testing against some pathogenic fungi were studied with white and black sesame seed oils in the laboratory pouring aqueous extract of the sesame seeds into the culture media. *Trichophyton mentagrophytes*, *Trichophyton verrucosum, Microsporum canis, Microsporum gypseum,* and *Aspergillus* spp. were the microorganisms used and they were identified, confirmed and obtained from the Biology laboratory of the University of Zalingei, Sudan. The result showed that sesame oil has strong antifungal activity against opportunistic fungal pathogens such as *Trichophyton mentagrophytes, Trichophyton verrucosum, Microsporum canis, Microsporum gypseum*, and *Aspergillus* spp. The oil extracted from white sesame seed was found to give better than black sesame seed oil on the studied fungi. This article focuses on natural products used as antifungal properties, their effects on the minimum inhibitory concentration value, as well as their environmental value. The study suggested that both white and black sesame seeds are potential sources of functional food to prevent chronic diseases.

Introduction

Sesame (*Sesamum indicum* L.) belongs to the family Pedaliaceae is considered one of the most ancient oilseed crops known to mankind, it is also known as Benne seed in Africa and sim-sim in East Africa (Goshu *et al.*, 2020). Grown in numerous countries with a rich diversity reported in wild species in the African continent. Sesame seeds have a considerable adaptation, with a large number of populations growing under different environmental conditions. The Ayurvedic has been used sesame oil in their medical system. Sesame seeds have antioxidant and antitumor potential. Due to the abundant amount of protein the oil cake is used for livestock feed (Burni and Muhammad, 2020). Sesame oil has natural

antioxidants such as sesamin, sesamolin, and sesamol known as the most stable vegetable oils having a long shelf life. Sesame seed oil is rich in Omega 6 fatty acids but lacks Omega 3 fatty acids. So there is a need to produce more Omega 3 fatty acids like alpha-linolenic acids with the help of various desaturase enzyme pathways for improvement of the quality of sesame oil as healthy oil (Pusadkar *et al.,* 2015). Besides these metabolites, the white sesame showed the presence of phlorotannins, coumarins, leucoanthocyanins, whereas black sesame showed anthraquinones and emodins (Neeta *et al.,* 2015). In addition to other uses of the oil, like cooking as well as for medicinal purposes such as the treatment of ulcers and burns, the oil extract is used in making soap and skin moisturizers (Warra, 2012). In ethnobotanical studies conducted in New York City, Dominican interview participants reported using or knowing about the use of this edible food plant as a remedy for the following health conditions or effects on Asthma, Bronchitis, Common cold, Cough, Expectorant and Flu (Yukes and Balick, 2011).

The use of sesame oil in the cosmeceutical and pharmaceutical industries is based on its content in several phytochemical agents that improve the quality and health of the skin (Khatoon *et al.*, 2019 and Naser *et al.,* 2019).

For pharmaceutical applications, sesame oil is used as a solvent for intramuscular injections and has nutritive, demulcent, and emollient properties, and is a laxative. Sesame oil was used to cure toothaches and gum diseases in the 4th century. It is also used for the treatment of blurred vision, dizziness, and headaches (Mn *et al.,* 2012).

The fatty acid analysis revealed that the seeds are composed of both saturated, monounsaturated, and polyunsaturated fatty acids. The two varieties of sesame seeds had a comparable composition of fatty acids. Among the nine fatty acids identified, 82% of the total fatty acids were composed of unsaturated fatty acids, which makes sesame seed is nutritionally important. The predominant polyunsaturated fatty acids components in the sesame seed varieties were linoleic acid (C18:2), which was ranging from 42.5 to 44.3% of the total fatty acid followed by the monounsaturated fatty acid, oleic acid (C18:1) which ranged from 37.2 to 38.9% of the total fatty acid. Both black and white sesame seed samples were rich in omega-6 fatty acid (linoleic acid) as compared to some other oil seeds. The saturated fatty acids constituted < 18% of the total fatty acids, of which palmitic acid (C16:0) constituted (9.3–11.2%) followed by stearic acid (C18:0) (5.78–6.52%) of the total fatty acids (Agidew *et al.,* 2021). White and black sesame seeds have the potential to be developed as sources of natural antioxidants (Ruslan *et al.,* 2018).

The antibacterial activity of seeds against Staphylococcus and Streptococcus as well as common skin fungi, such as athlete's foot fungus has also been well recognized. The oil is also known to maintain high-density lipoprotein cholesterol (HDL) and lower low-density lipoprotein cholesterol (Anilakumar *et al.,* 2010).

Oral powdered (*Sesamum indicum* L.) with palm was used for treating retention of placenta in cattle as ergometric alkaloid present in the mix helps in the contraction of the uterus has been explained. Safflower and olive oil also inhibited the growth of both forms of *C. albicans* but to a lesser extent than sesame oil. The ability to inhibit the growth of the mycelial form correlated with sesame oil concentration (Ogawa *et al.,* 2014).

Materials and Methods

Chemicals of analytical grade purity and distilled water were used in the preparation of reagents. All glassware was washed with the detergent solution and rinsed with water before drying in the oven.

Oil Extraction (Cold-press extraction)

The cold press extraction of sesame seed oil was done using the local extraction method as described by Kate *et al.,* (2014) with slight modifications. The

process involved using 500g of a dried sesame seed, milling, mixing, kneading, a sprinkling of warm water intermittently, and pressing to remove the oil without using any chemicals. The oil allowed settling (water and dirt settle below and the oil float at the top) for about two days before it decanted into a container. The oil was filtered through filter paper (Whatman No. 1), then centrifuged at 3000 rpm (2,431 x g) for 3 min to separate the water and residues from the oil. The oil was then stored in amber bottles/plastic at 4°C until analyzed.

Sampling and Sample Preparation

Samples of white and black sesame seeds were collected from Zalingei, Central Darfur State, Sudan. The samples dried atroom temperature overnight for two days.

Preparation of fungicides

Black and White sesame seed oil and Griseofulvin were used against *Trichophyton mentagrophytes, Trichophyton verrucosum, Microsporum canis, Microsporum gypseum,* and *Aspergillus* spp. Used in media and smeared plates.

Isolation

A total of 50 hair samples and skin scraping of clinically infected goat and sheep (25 of each) were collected randomly localities of Zalingei area by removal of dull broking hairs and skin scraping from a margin of a lesion using sterile forceps and keeping these specimens in dark papers was describe by Monica Chesbrough (2005).

For processing fungi associated with animal hair, the hair-baiting technique and dilution plate method was used. The samples were cultured on the sabouraud dextrose agar for growth and further identification of the isolates. Identification dermatophyte isolates and tested with the different oils in media to see the in vitro effect of oils on the isolate's ability to grow in presence of sesame oil and Griseofulvin in vitro was tested.

Results and Discussion

The result is presented in Table 1. Showed that the qualitative phytochemical analysis of the oil extract indicates that anthraquinones and tannins are present in small concentrations. Alkaloids, flavonoids, saponins, and phenols are present in moderately high concentrations. Terpenoids and steroids are present in a very high concentration while phlorotannins and cardiac glycosides are absent. These results agreed with Sani *et al.,* (2013). Mekky *et al.,* (2021) analyzed sesame seed and found different metabolites and phenolic acids, lignins, flavonoids, nitrogenous compounds, and organic acids. (Naser *et al.,* 2019).

Sesame seeds possess significant antioxidant activity. They also contain significant amounts of phenolic, flavonoids, nutrients, and minerals. This suggests that dietary uptake of sesame seeds could be potentially protective against diverse diseases (Elikem *et al.,* 2020).

Oil extracted from white and black sesame seed showed promising activity against the test fungi. This indicates their broad range of activity. This is consistent with the earlier reports that many plant products contain fungi toxic constituents that have the potential to control plant diseases (Toba *et al.,* 2016).

Experimental results in figure 1 showed that the sesame seed is a good source rich in protein, minerals, and oil. *Sesamum indicum* L. seed oil is of unsaturated type and contains mainly the fatty acids highly amount of palmitic acid, stearic acid, oleic and linoleic. The oil is classified in the oleic-linoleic acid group. High unsaponifiable matters content guarantees the use the oils in the cosmetics industry. The oil extracts exhibited good physicochemical properties and could be useful for industrial applications (Nzikou and Silou, 2009).

The fatty acid analysis revealed that the seeds are composed of both saturated, monounsaturated, and polyunsaturated fatty acids. The two varieties of

sesame seeds (white and black sesame) had a comparable composition of fatty acids. Among the nine fatty acids identified, 82% of the total fatty acids were composed of unsaturated fatty acids, which makes sesame seed is nutritionally important (Agidew *et al.,* 2021). Data present in figure 2 guaranteed that *trichophyton* spp is the most microorganism causing domestic animal diseases followed by *Microsporum* spp and *Aspergillus*. Antimicrobial activities have been found in sesame oil possess to reduce the effect of diseases.

This activity is claimed to be due to the linoleic and oleic acids content (35-50% of each) present in the oil (Olaleye *et al.,* 2018). It is concluded that the sesame seed extracts possess high antioxidant activity and that the white variety elicits better antioxidant activity than the black one (Vishwanath *et al.,* 2012).

Data present in figure 3 revealed that *Trichophyton mentagrophytes* isolate was found to be resistant to both Griseofulvin and sesame oil. *Trichophyton verrucosum* has a sensitive response to antifungal Griseofulvin giving the highest zone of inhibition. Other observations showed sensitivity to both white and black sesame oils to a lesser degree. The white sesame seed oil showed a greater effect of inhibition than black sesame oil.

Antifungal Griseofulvin gave the highest zone of inhibition to both *Microsporum canis* and *Microsporum gypseum* followed by white sesame seed oil-smeared then black sesame seed oil for *Microsporum canis*.

Antifungal Griseofulvin gave the highest zone of inhibition to *Aspergillus* spp than white and black, but white sesame seed oil was more effective than black sesame seed oil.

Scientists studied the sensitivity of *Microsporum canis* isolated from dogs towards antifungals and found that the diameter of inhibition zone was measured, then compared with the standard, to determine whether they were sensitive, intermediate, or resistant (Sakan *et al.,* 2020). The result of the qualitative phytochemical analysis revealed that the oil contains alkaloids, saponins, flavonoids, tannins, steroids, terpenoids, anthraquinone, and phenols. Cardiac glycosides and phlorotannins are absent (Sani *et al.,* 2013). The antioxidant (ORAC values) and anti-proliferation activities of six varieties of black and white sesame seeds were both associated with contents of bound phenolic (Zhou *et al.,* 2016). The antioxidant activity is attributed to the presence of phenolic compounds, which increase the shelf life and nutraceutical value of sesame seed oil (Harfi *et al.,* 2019).

The metabolic extracts showed antibacterial effect against all the tested microorganisms except *Streptococcus pneumonia* and *Candida albicans*. The ethanoic extract had no inhibitory effects against *Staphylococcus aureus* but had both antibacterial and antifungal activity (Laj *et al.,* 2007).

The results indicated that Semsumsanani and Semsumdwaini showed more antifungal activity against *Aspergillus niger* and *Aspergillus flavus*. The 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 (Shantaram, 2019).

Similar results mentioned that the antibacterial efficacy of sesame seed powder used as local drug delivery as chip, gel at a particular concentration, which will help to prevent further progression of periodontal pocket after scaling and root planning such as reduction of periodontal pocket (Aditya *et al.,* 2019).

A series of molecules with antifungal activity against different strains of fungus have been found in plants, which are of great importance to humans and plants (Arif *et al.,* 2011).

Table.1 Qualitative phytochemical analysis of extracts of white and black sesame seeds

Compound	White Sesame		Black Sesame	
	ME	WE	ME	WE
Fixed Oils	+	+	+	-
Volatile Oils	+	+	+	+
Alkaloids	-	+	+	-
Glycosides	-	-	-	-
Phenols	+	+	+	+
Tannins	+	+	+	+
Terpenoids	+	+	+	+
Saponins	+	+	+	+
Steroids	+	-	+	-
Flavonoids	+	+	+	+

ME: Methanol Extract; WE: Water Extract

Fig.1 Sesame seed oil fatty acid constituents

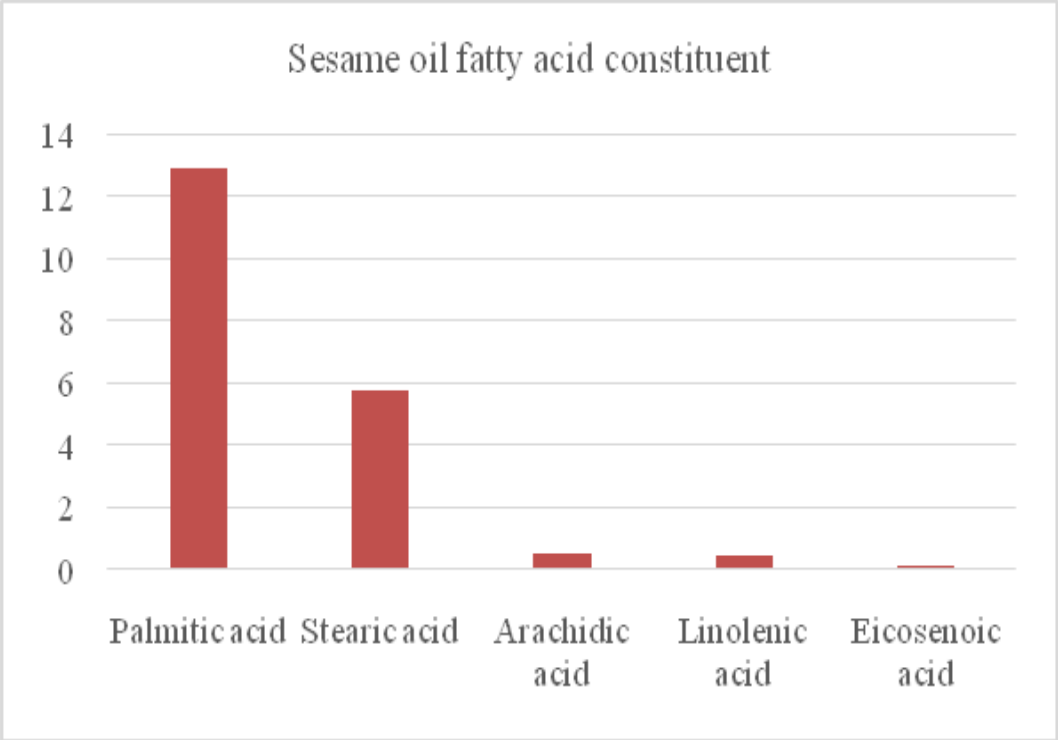


Fig.2 Fungi Isolated from goat and sheep

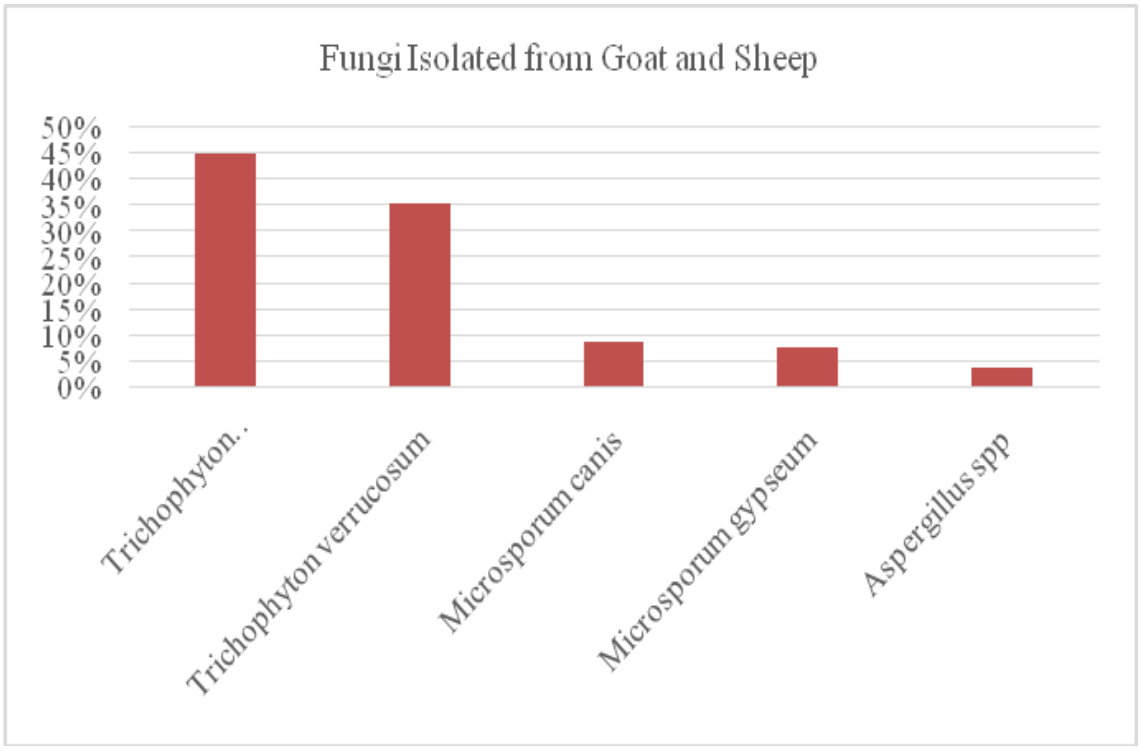
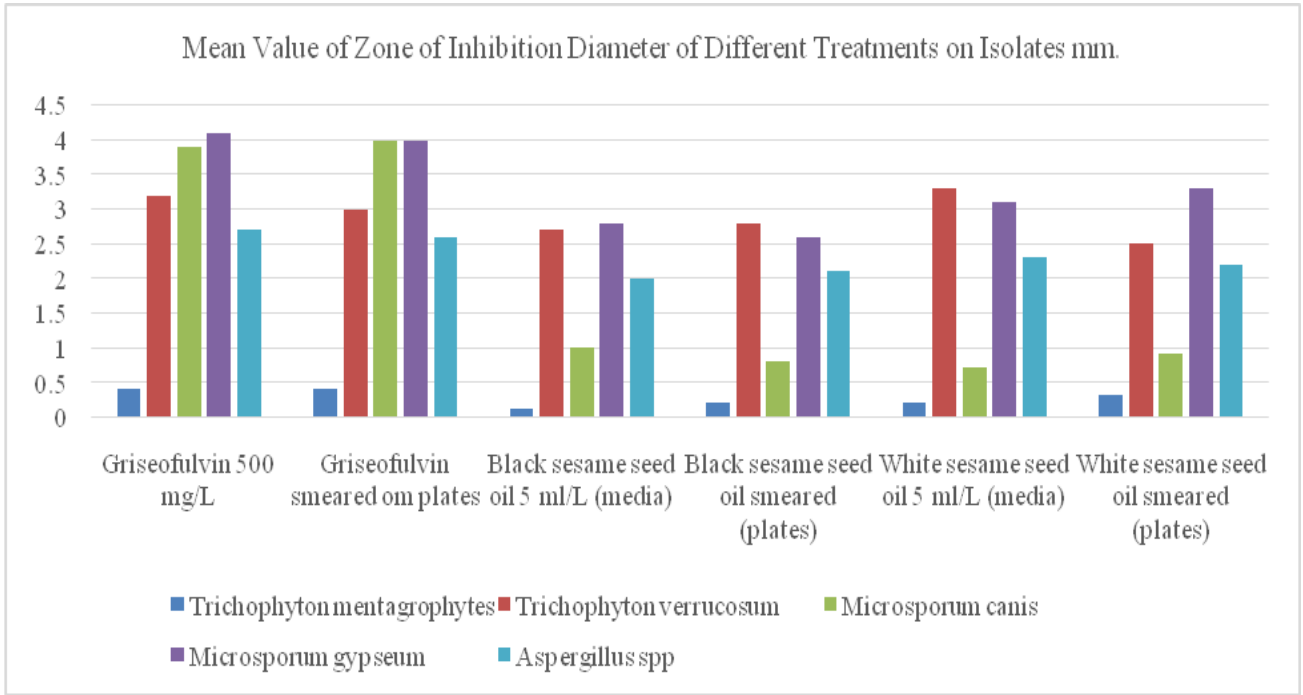


Fig.3 Mean Value of Zone of Inhibition Diameter of Different Treatments on Isolates mm.



Another related result showed that there is an important effect of sesame oil synergistically with CIP on the Enterobacteriaceae resistant to this antibiotic and causing urinary tract infection and diarrhea and did not show the same effect when adding sesame oil or antibiotics separately (Malhan *et al.,* 2019).

The antibacterial, Anti-inflammatory, Anti-diabetic and anti-fungal actives have been reported in Sesame seed. The contribution of Sesame is countable in the food and health industry because of its richness in unsaturated fatty acids, sulfur-containing amino acids (Deep *et al.,* 2019).

Different scientists studied antifungal properties extracted from sesame leaves; limited data are available on antifungal activities of stem and root extracts. Sesame leaves extracts were found to have inhibitory effects on *Streptococcus pneumonia*, *Candida albicans, Staphylococcus aureus*, and symbiotic fungus of leafcutter ants (Syed *et al.,* 2015).

MICs calculated were lesser than that obtained for Griseofulvin and this result not agreed with (Bokhari, 2009). The ability to inhibit the growth of the mycelial form correlated with sesame oil concentration. Roasting influenced growth inhibition ability and high-roasted sesame oil most effectively inhibited the yeast form (Ogawa *et al.,* 2014). A variety of oral and topical antifungal agents is available and drugs such as griseofulvin (Gri), terbinafine (TER), itraconazole (IT), and fluconazole (FLZ) are used to cure severe infections in humans and animals (Aneke *et al.,* 2018).

Similar observation found with clove oil was found to possess strong antifungal activity against opportunistic fungal pathogens such as *Candida albicans*, *Cryptococcus neoformans*, and *Aspergillus fumigatus*, etc (Bisht and Owais, 2005). It is clear that clove oil shows powerful antifungal activity, and it can be used as an easily accessible source of natural antioxidants and in pharmaceutical applications (Chaieb *et al.,* 2007).

Phyto-medicines are a major component of a traditional system of healing in developing countries, which have been an integral part of their history and culture. Besides widespread use of botanicals as medicinal products in developing countries, such products are becoming part of the integrative healthcare system of industrialized nations, known as a complementary and alternative system of medicines.

References

Aditya V, Babitha G A, Prakash S, Timmasetty J. Evaluation of Antibacterial Efficacy of Sesame Seed on Periodontal Pathogens : An *In Vitro* Study. Published online 2019:3-6.

Agidew M G, Dubale A A, Atlabachew M, Abebe W. Fatty acid composition, total phenolic contents and antioxidant activity of white and black sesame seed varieties from different localities of Ethiopia. *Chem Biol Technol Agric*. Published online 2021:1-10. doi:10.1186/s40538-021-00215-w

Agidew M G, Dubale A A, Atlabachew M, Abebe W. Fatty acid composition, total phenolic contents and antioxidant activity of white and black sesame seed varieties from different localities of Ethiopia. *Chem Biol Technol Agric*. Published online 2021:1-11. doi:10.1186/s40538-021-00215-w

Aneke C I, Otranto D, Cafarchia C. Therapy and Antifungal Susceptibility Profile of *Microsporum canis*. Published online 2018. doi:10.3390/jof4030107

Anilakumar, Kandangath Raghavan, Farhath Khanum, and Amarinder Singh Bawa. 2010. "Nutritional , Medicinal and Industrial Uses of Sesame (Sesamum Indicum L .) Seeds - An Overview" 75 (4): 159–68.

Arif T, Mandal T, Chandra B, Viswavidyalaya K, Dabur R. 9. Natural products : Anti-fungal agents derived from plants. 2011;(January).

Bisht D, Owais M. Antimicrobial activity of clove oil and its potential in the treatment of vaginal candidiasis. 2005; 13(December):555-561.

doi:10.1080/10611860500422958

Burni T, Muhammad A. *In vitro* shoots multiplication from nodal explants of Sesame (*Sesamum indicum* L.). 2020;9(1):303-308.

Chaieb K, Zmantar T, Ksouri R, Hajlaoui H, Mahdouani K. Antioxidant properties of the essential oil of *Eugenia caryophyllata* and its antifungal activity against a large number of clinical Candida species Antioxidant properties of the essential oil of *Eugenia caryophyllata* and its antifungal activity against a. 2007; (October):1-5. doi:10.1111/j.1439-0507.2007.01391.x

Deep A, Sharma M, Kumar V. 2019. Enlightening Food Application and Mega Health Benefits of *Sesamum indicum* L. *Int J Curr Microbiol Appl Sci*. 8(01): 2224-2232. doi:10.20546/ijcmas.2019.801.232

Elikem E, Korley N, Ken E, Okraku C, Agyemang A, Hunkpe G. Antioxidant, phytochemical and physicochemical properties of a sesame seed (*Sesamum indicum* L). *Sci African*. 2020;8(March):e00349. doi:10.1016/j.sciaf.2020.e00349

Goshu H, Mulatu A, Alemu T. Antifungal Activity Evaluation of Trichoderma Species against Fusarium Wilt and Alternaria Leaf Blight of Sesame (*Sesame indicum* L.) Under in vitro conditions. *Asian J Biol Sci*. 2020;13(2):139-151. doi:10.3923/ajbs.2020.139.151

Harfi M El, Nabloussi A, Rizki H, Ennahli S, Hanine H. Proximate Composition and Fatty Acid Composition, Phytochemical Content of Sesame (*Sesamum indicum* L.) Seeds Landrace from Morocco. *Adv Crop Sci Technol*. 2019;7(3).

Kate A.E., U.C.Lohani, J.P. Pandey N.C.Shahi, A. Sarkar. 2014. Traditional and mechanical method of the oil extraction from wild apricot kernel: a comparative study. RJCES Vol 2 [2] April 2014.

Khatoon R, Abbasi H, Aslam M, Chaudhary S S. A comprehensive review on Tukhme Kunjud (*Sesamum indicum* Linn.) with special reference to the Unani System of Medicine. 2019;9(3):1-7.

Laj S, Bankole M A, Ahmed T, *et al.*, Antibacterial and Antifungal Activities of Essential Oils of Crude Extracts of Sesame Radiatum against Some Common Pathogenic Micro-Organisms. 2007;6(2):165-170.

Malhan A B, Najeeb L M, Buniya H K. The synergistic effect for sesame oil-ciprofloxacin on the sensitivity of some Enterobacteriaceae species. 2019;11(12):6-9.

Mekky R H, Abdel-Sattar E, Segura-Carretero A, Contreras M D M. Metabolic profiling of the oil of sesame of the Egyptian cultivar 'Giza 32' employing lc-ms and tandem ms-based untargeted method. *Foods*. 2021;10(2). doi:10.3390/foods10020298

Mn N P, Kr S, Prasad D S, Vijay N, Kothari R, S N S. Journal of Nutrition & Food Sciences A Review on Nutritional and Nutraceutical Properties of Sesame. 2012;2(2). doi:10.4172/2155-9600.1000127

Monica Chesbrough. 2005. District Laboratory Practices in Tropical Counters 2nd Edition Cambridge University Press

Naser A, Jaradat N, Malkieh N, *et al.*, Impact of Sesame Oil Source : A Quality Assessment for Cosmeceutical and Pharmaceutical Use. 2019;(2159):189-196.

Neeta M P, Mukta N, Bilwa K. Original Research Article Comparative Qualitative Phytochemical analysis of *Sesamum indicum* L. 2015;2(2):172-181.

Nzikou J M, Silou T. Chemical Composition on the Seeds and Oil of Sesame (*Sesamum indicum* L.) Grown in Congo-Brazzaville Chemical Composition on the Seeds and Oil of Sesame (*Sesamum indicum* L.) Grown in Congo-Brazzaville. 2009;(January).

Ogawa T, Nishio J, Okada S. Effect of Edible Sesame Oil on Growth of Clinical Isolates of *Candida albicans*. 2014;16(3):335-343. doi:10.1177/1099800413501539

Olaleye O O, E R, Eke M O, Aondo T O. Extraction, Physicochemical and Phytochemical Characterization of Oil from Sesame Seed. 2018;1(4):1-12.

doi:10.9734/AFSJ/2018/40444

Pusadkar P, Eswaran K, Bonde S, Phule M, Vidyapeeth K, Mohite N. Sesame (*Sesamum indicum* L.) Importance and its High-Quality Seed Oil : A Sesame (*Sesamum indicum* L.) Importance and its High-Quality Seed Oil : A Review. 2015;(June 2016).

Ruslan K, Happyniar S, Fidrianny I. Antioxidant potential of two varieties of *Sesamum indicum* L. collected from Indonesia. *J Taibah Univ Med Sci*. Published online 2018. doi:10.1016/j.jtumed.2018.02.004

Sakan G Y I, Indarjulianto S, Nururrozi A, Raharjo S. Sensitivity of *Microsporum canis* Isolated from Dogs. 2020;14(December):108-111.

Sani I, Sule F, Warra A A, Bello F. Phytochemicals and Mineral Elements Composition of White *Sesamum indicum* L. Seed Oil. 2013;(January).

Shantaram M. Effect of Yemeni Sesame Oil against Some Pathogenic Bacteria and Fungi. 2019; (May 2018). doi:10.13040/IJPSR.0975-8232.9(6).1000-06

Syed R N, Laurentin H, Splivallo R, Karlovsky P. Antifungal properties of extracts of sesame (*Sesamum indicum*). *Int J Agric Biol*. 2015;17(3):575-581. doi:10.17957/IJAB/17.3.14.612

Toba S, Adebayo E, Nwogbo O. Effects of Botanical Extracts on Fungal Load of Sesame (*Sesamum indicum* L.) Seeds. 2016;5(2):804-809.

Vishwanath H S, Anilakumar K R, Harsha S N, Khanum F, Bawa A S. Academic Sciences. 2012;5(3).

Warra A. Sesame (*Sesamum indicum* L.) Seed Oil Methods of Extraction and its Prospects in Cosmetic Industry: A Review. *Bayero J Pure Appl Sci*. 2012;4(2). doi:10.4314/bajopas.v4i2.33

Yukes J E, Balick M J. Dominican Medicinal Plants : Published online 2011.

Zhou L, Lin X, Abbasi A M, Zheng B. Phytochemical Contents and Antioxidant and Antiproliferative Activities of Selected Black and White Sesame Seeds. 2016;2016.

How to cite this article:

Abd Elmaboud Breima Saaeed Dehiash and Taha Mohammed Sharief Mohammed. 2022. White and Black Sesame Seed Oil and their Natural Active Compounds Presenting Antifungal Properties. *Int.J.Curr.Microbiol.App.Sci.* 11(02): 361-369. doi: https://doi.org/10.20546/ijcmas.2022.1102.041