



Bayero Journal of Pure and Applied Sciences, 12(1): 128 - 132
ISSN 2006 – 6996

ANTIMICROBIAL ACTIVITY OF *Moringa oleifera*: A SHORT REVIEW

*** Raubilu, I. A.,¹ Isah, U.¹ and Ahmad, M. A.¹**

1. Department of Microbiology Bayero University Kano, Kano state.

*Corresponding Author: ibrahimalmajir@gmail.com (+2348169806902)

ABSTRACT

***Moringa oleifera* Lam. (Family Moringaceae) is well – known for its various medicinal properties. It grows wild in the tropical and subtropical areas of Asia, Africa and the Middle East. In Nigeria, *Moringa oleifera* trees are planted at a large scale especially in the northern part of the country. It has been widely used in the treatment of certain diseases as a traditional medicinal herb. Antimicrobial activity is the most studied property of *Moringa oleifera*. Many studies have shown that nearly all types of *Moringa oleifera* tissues exhibit antimicrobial activity including antibacterial, antifungal, antiviral and anti parasitic property. This review describes progress on research conducted to understand the antimicrobial activity of *Moringa oleifera* and discusses the potential use of *Moringa oleifera* in the control of pathogenic microbes.**

Key words: Antimicrobial activity; *Moringa oleifera*; pathogenic microbes, control.

INTRODUCTION

During the last decades, the limit of microbial diseases and infections has been exceeded drastically (Wael *et al.*, 2015). A persistent problem in antimicrobial chemotherapy is the increasing occurrence of resistance to antibiotics, which leads to the recalcitrance of antimicrobial treatment (Wael *et al.*, 2015). The continue usage of antibiotics and consequent antibiotic selection pressure is thought to be the most crucial factor contributing to the appearance of several kinds of resistant microbes (Sokovi *et al.*, 2010; Bajpai *et al.*, 2013). Discovery of novel antimicrobial agents/herbal medicine is very crucial for the control of pathogenic microbes, especially for the therapy of infections caused by recalcitrant microbes. Medicinal herbs with antimicrobial activities are considered a potent source of novel antimicrobial function (Wang *et al.*, 2016).

Moringa oleifera is a woody tree mainly distributed in the tropical and subtropical regions of Asia, Africa (including Nigeria) and the Middle East (Leone *et al.*, 2015). *Moringa oleifera* is a highly valued plant, distributed in many countries of the tropics and subtropics. It has an impressive range of medicinal usage with high nutritional contents. Different tissues of this plant contain a profile of important antimicrobial agents (Bukar *et al.*, 2010). Various parts of the plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods have various

antimicrobial activities such as antibacterial activity (Dzotam *et al.*, 2016; Zaffer *et al.*, 2014), antiparasitic activity (Kaur *et al.*, 2014), anti fungal (Zhao *et al.*, 2012), antiviral (Chollom 2012).

Previous studies have shown Antimicrobial activity which has been studied thoroughly in *Moringa oleifera*. However, Crude extracts of different part of *Moringa oleifera* possess different kind of antimicrobial activities. In this paper, the main aim is to review the research progress in understanding and characterizing the antimicrobial activity of *Moringa oleifera* tissues including antibacterial, antifungal, antiviral, and antiparasitic activity, and highlight the potential use of *Moringa oleifera* in the control of pathogenic microbes.

Antibacterial Activities of *Moringa oleifera*

Antibacterial activity of *Moringa oleifera* has been shown in different studies. Using the Disc agar diffusion technique, Bukar *et al.* (2010) evaluated the antibacterial activity of *Moringa oleifera* leaf and seed chloroform and ethanol extracts. One Gram-positive bacterium (*Staphylococcus aureus*) and six Gram-negative bacteria (*Escherichia coli*, *Salmonella typhi*, *Enterobacter aerogenes*, *Salmonella typhimurium*, *Shigella* spp and *Pseudomonas aeruginosa*) were used to test the antibacterial activities of *Moringa oleifera*.

The result of *M. oleifera* leaf ethanol (MLE) extracts show that it had activity against four bacterial isolates. *Enterobacter spp*, *S. aureus*, *P. aeruginosa* and *E. coli* were sensitive while *Shigella spp*, *S. typhi* and *S. typhimurium* were not sensitive at all the concentrations used. *M. oleifera* leaf chloroform (MLC) was active on *E. coli*, *S. typhimurium* and *S. typhi*. Similarly, *Moringa oleifera* seed ethanol (MSE) extract was active against three bacterial isolates (*S. aureus*, *E. coli* and *S. typhi*). *Enterobacter spp*, *Shigella spp*, *P. aeruginosa* and *S. typhimurium* were not sensitive to any of the concentrations tested. *Moringa oleifera* seed chloroform (MSC) extract was active against two bacterial isolates (*E. coli* and *S. typhimurium*). *Enterobacter spp*, *S. aureus*, *Shigella spp*, *P. aeruginosa*, and *S. typhi* were not sensitive to any of concentrations tested.

Similarly, Using agar well diffusion method, Lar *et al.*, 2011 found the antibacterial activity of ethanol and aqueous extracts of dried *Moringa oleifera* seeds using three gram negative organisms, *Escherichia coli*, *Shigella flexneri* and *Salmonella typhi*. The aqueous extract had no effect on the test organisms at the various given concentrations, but there was appreciable antimicrobial activity demonstrated by the ethanolic seed extract with *Escherichia coli* and *Shigella flexneri* being susceptible. *Salmonella typhi* showed no susceptibility to both extracts. The experiments carried out by Bijal and Bhumika (2015) confirmed that the Ethanol, Methanol, Petroleum ether & Aqueous extracts of *Moringa oleifera* leaves showed different inhibition patterns. The result reveals that solvent extracts of the different parts of *Moringa oleifera* (Leaves, Flower, Pulp and Seed) were active against *E. coli* and *S. aureus*. It was suggested that *Moringa oleifera* leaf extracts might be used in the control of many infectious diseases alone or together with other antibiotics (Dzotam *et al.*, 2016).

In addition, Khanitta and Angelika (2015) determine antibacterial activities of three different extracts; i) cold water extract of *Moringa oleifera* seed powder, ii) cold water extract of *MO* residue after oil extraction by Soxhlet method and iii) *Moringa oleifera* seed oil obtained by Soxhlet method were determined using the diffusion technique of Bauer-Kirby (disk method). *MO* seed oil is active against all the tested isolates (*Staphylococcus aureus*, *Bacillus subtilis*, *Salmonella typhimurium*, *Enterobacter aerogenes* and *Pseudomonas aerogonosa*). Similarly, Extracts of *MO* seed

powder and *MO* residue are active against all the above bacterial isolates with the exception of *Staphylococcus aureus*.

The experiments carried out by Patel and Mohan (2018) confirmed that the different tissue extracts of *Moringa oleifera* showed different inhibition patterns against different bacterial strains. The tested organisms are *Bacillus cereus*, *Bacillus subtilis*, *Enterococcus faecalis*, *Micrococcus luteus*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Serratia marcescens*, *Salmonella paratyphi*, *Salmonella typhi*.

In another recent study by Bichi and Shehu 2018 using Agar well diffusion method. The hexane crude extract of *Moringa oleifera* seeds oil exhibited clear antibacterial activity against *E. coli* and the *M. oleifera* seed oil gave average zones of inhibitions of 17.7mm, 14.3mm, 11.3mm, and 9.0mm for the 100%, 75%, 50%, and 25% respectively.

Antifungal Activities of *Moringa oleifera*

Many studies have highlight that different crude extracts from different tissues of *Moringa oleifera* possess antifungal activities against fungi. Bukar *et al.* (2010) evaluated the antifungal activity of *Moringa oleifera* leaf and seed chloroform and ethanol extracts. The result of the study showed that MSC inhibited the growth of *Mucor spp* and *Rhizopus spp* by 100% at 1000 µg/ml while MSE inhibited growth of *Mucor spp* by 75% and *Rhizopus spp* by 50% each at 1000µg/ml concentration. MLC inhibited the growth of *Mucor spp* and *Rhizopus spp* by 25% at 1000 µg/ml while MLE inhibited growth of *Mucor spp* by 50% and *Rhizopus spp* by 100% each at 1000µg/ml concentration. According to this study, it could be observed that MSC proved to be the extract with the best antifungal activity on the test fungi as it prevented completely the growth of both *Mucor spp* and *Rhizopus spp* at 1000µg/ml.

Using Agar well diffusion method, Pinal *et al.*, (2014) showed the Antifungal activity of *Moringa oleifera* leaf extracts against several fungi namely *Saccharomyces cerevisiae*, *Candida albicans* and *Candida tropicalis*. The ethanol and aqueous leaf extract result showed activity against *Saccharomyces cerevisiae* and *Candida tropicalis* but no activity was observed in *Candida albicans*. The largest zone of inhibition was produced by water and ethanol extract of *Moringa oleifera* against *Saccharomyces cerevisiae*.

The antifungal activity of aqueous and ethanol extracts of *M. oleifera* Lam. leaf was investigated using the agar well diffusion method against selected clinical fungal pathogens namely; *Candida albicans*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus* and *Cryptococcus neoformans* (Isitua *et al.*, 2016). The result indicated that, the crude extracts of *M. oleifera* showed susceptibility of all the fungal strains to both the ethanol and water extracts.

In a recent study by Aondo *et al.*, (2018), mycelia growth of *Aspergillus flavus* was found to be inhibited by the extract of *Moringa oleifera* (Bark seed and Leaf) Crude extracts. This antifungal property of *Moringa oleifera* can prevent culture media contaminations by some saprophytic fungi. The result showed ethyl acetate, Methanolic, ethanolic and water extract of *Moringa oleifera* leaves, seeds, bark were found to be effective against the fungi.

According to the experiment carried out by Patel and Mohan (2018) confirmed that the different tissue extracts of *Moringa oleifera* showed different inhibition patterns against different fungal strains. The tested fungal isolates include *Aspergillus niger*, *Aspergillus paracitic*, *Candida Albicans*, *Aspergillus flavus*, *Trichoderma harzanium*, *Alternata burnsi*, *Fusarium oxysporum*.

Anti parasitic Activity of *Moringa oleifera*

Leishmania is a genus of trypanosomes that are responsible for Leishmaniasis disease (Wang *et al.*, 2016). Kaur *et al.*, (2014) showed that 70% ethanolic extract of *Moringa oleifera* roots exhibit antileishmanial activity with IC50 values of 83 µg/ml and the methanolic extract of leaves showed antileishmanial activity with IC50 values of 47.5 µg/ml

Harvie and Delfin (2017) demonstrate the anthelmintic activity of *M. oleifera* seed ethanolic (MSEE) and aqueous (MSAE) extracts against the eggs and larvae of *Haemonchus contortus*. The result showed that with the exception of the larvicidal activity of MSAE, the rest of the *M. oleifera* seed extracts displayed its anthelmintic activity in a dose-dependent manner.

In another experiment carried out by Hegazi *et al.*, (2018), they showed ovicidal effects of the different *M. oleifera* extract on the *Fasciola gigantica* Eggs. The result of *M. oleifera* alcoholic and aqueous extracts, as well as nitroxynil, showed an ovicidal effect on *Fasciola* non-embryonated and developed eggs. LC50 was higher in non-embryonated eggs than developed eggs for methanolic and ethanolic extracts. Water extract exhibited a different effect as LC50 of aqueous extract on developed was higher than that of non-embryonated eggs.

In many developing countries including Nigeria, irrigation water is widely used in urban farming, which can get polluted by the helminth parasite and their eggs. Sengupta *et al.*, 2012 showed that *Moringa oleifera* seed extracts could reduce helminth eggs and turbidity in irrigation water. It is well known that *Moringa oleifera* seeds have been widely used in water purification for a long time in underdeveloped countries.

Antiviral Activity of *Moringa oleifera*

Foot and mouth disease (FMD) is terribly disease caused by a virus named picornavirus (Ishrat *et al.*, 2015). In a research by Ishrat *et al.* (2015) on Antiviral assay of *Moringa oleifera* alcoholic leaves extracts at eight concentrations (1 µg/ml, 6 µg/ml, 12 µg/ml, 25 µg/ml, 50 µg/ml, 100 µg/ml, 200 µg/ml and 400 µg/ml respectively) had revealed cell survival percentages in the range of 14% to 74%. The results had indicated that first six concentrations up to 100 µg /ml had antiviral activity against FMDV as cell survival was found above 50% whereas 200 µg/ml and 400 µg/ml did not resulted in antiviral activity.

Mohamed *et al.*, (2017) tested the Antiviral Potential of Leaf Extracts from *Moringa oleifera*. The result from this study indicated that antiviral assay of *M. oleifera* aqueous extract at concentration of 200 µg/ml revealed inhibition percentage of 43.2% and 21.4% for herpes simplex virus type 1 and 2, respectively. These are evidences that moringa oleifera can be used singly or incorporation with viral drugs in the treatment of viral disease.

Potential Use and Future Applications

Moringa oleifera has been broadly used in food and treatment to certain microbial infections and diseases through traditional medicine. Various studies have shown that Crude extracts from *Moringa oleifera* exhibit antimicrobial activity against various pathogenic bacteria, fungi, viruses and parasites that affect man and his environment. It can be used in medicinal treatments to control the infection of pathogenic microbes. In agriculture, *Moringa oleifera* can improve the control of phytopathogenic fungi that cause disease and affect the production of economic crops. In marine aquaculture, *Moringa oleifera* also shows a promising future in the control of infectious diseases. For Future application, it is important to promote the isolation and identification of certain bioactive molecules with potential antimicrobial activity from *Moringa oleifera*. Also, evaluate the safety and toxicity of antimicrobial agents form *Moringa oleifera* before implementing the use of these compounds.

The detailed antimicrobial molecular mechanism of compounds to *Moringa oleifera* is of crucial value. In brief, this review provides valuable information on *Moringa oleifera* antimicrobial activity and its potential applications.

CONCLUSION

In conclusion, nearly all parts of *Moringa oleifera* (the leaves, bark, root, flower, seed, flowers,

fruits) have been reported with antimicrobial activities against different microorganisms. Antimicrobial reported effects include antibacterial, antifungal, antiviral, antiparasitic and wound healing potentials. Hence the need to isolate bioactive compounds for novel herbal medicine.

REFERENCE

- Aondo T. O., Odiaka N. I., Akese T. M., and Olaleye O. O. (2018). Phytochemical and Antifungal Efficacy of Different Parts of *Moringa oleifera* Plant Extracts. *Asian Journal of Biotechnology and Bioresource Technology*. 3(2): 1-8, 2018 ISSN:2457-0125
- Bajpai, V.K., Shukla, S., and Sharma, A. (2013). Essential oils as antimicrobial agents. *Natural Prod.*, Pp. 3975–3988.
- Bichi, M. H and Shehu, U. H. (2018). Antimicrobial properties of *Moringa oleifera* seed oil. *International Journal of Research In Earth & Environmental Sciences*. 13(1) ISSN 2311-2484.
- Bijal, A., and Bhumika D. (2015). Antibacterial Activity and Phytochemical Screening of Different Parts of *Moringa oleifera* Against Selected Gram Positive and Gram Negative Bacteria. *Journal of Pharmaceutical, Chemical and Biological Sciences*. 3(3):421-425
- Bukar, A., Uba, A. and Oyeyi, T.I. (2010): Antimicrobial profile of moringa oleifera lam. extracts against some food – borne microorganisms. *Bayero Journal of Pure and Applied Sciences*, 3(1): 43 – 48.
- Chollom S. C., Agada G. O. A., Gotep J. G., Mwankon S. E.1, (2012). Investigation of aqueous extract of *Moringa oleifera* lam seed for antiviral activity against newcastle disease virus *in ovo*. *Journal of Medicinal Plants Research* 6(22). 3870-3875.
- Dzotam J.K., Touani F.K., and Kuete V. (2016). Antibacterial and antibiotic-modifying activities of three food plants (*Xanthosoma mafaffa* Lam., *Moringa oleifera* (L.) Schott and *Passiflora edulis* Sims) against multidrug-resistant (MDR) Gram-negative bacteria. *BMC complementary and alternative medicine* 16(1).
- Harvie P.P., and Delfin E. C. (2017). Anthelmintic activity of *Moringa oleifera* seed aqueous and ethanolic extracts against *Haemonchus contortus* eggs and third stage larvae. *International Journal of Veterinary Science and Medicine*. 5. 30-34
- Hegazi A.G, Abdel Megeed K.N, Hassan S.E, Abdelaziz M.M, Toaleb N.I, El Shanawany E.E, and Aboelsoued D. (2018). Comparative ovicidal activity of *Moringa oleifera* leaf extracts on *Fasciola gigantica* eggs. *Veterinary World*, 11(2): 215-220
- Ishrat Y., Afshan S., Tahira A., Sehrish B., Sarah J., and Muhammad A. (2015). Screening Antiviral Activity of *Moringa oleifera* L. Leaves against Foot and Mouth Disease Virus. *Global Veterinaria*. 15 (4): 409-413,
- Isitua, C. C., Ibeh, I., and Olayinka, J. N. (2016). In Vitro Antifungal Activity of *Moringa Oleifera* Lam Leaf on Some Selected Clinical Fungal Strains. *Indian Journal of Applied Research* 6 (8) ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50
- Kaur A, Kaur PK, Singh S, and Singh IP (2014) Antileishmanial compounds from *Moringa oleifera* Lam. *Z Naturforsch C* 69: 110-116
- Khanitta R., and Angelika P. (2015): Antimicrobial activities of *Moringa oleifera* seed and seed oil residue and oxidative stability of its cold pressed oil compared with extra virgin olive oil. *Songklanakarin Journal of Science and Technology*. 37 (5): 587-594.
- Lar, P.M., Lojile, E. E., Dashe, E., and Oluoma J. N. (2011). Antibacterial activity of *Moringa oleifera* seed extracts on some gram negative bacterial isolates. *African journal of natural sciences*. 14: 57 - 62
- Leone A., Spada A., Battezzati A., Schiraldi A., and Aristil J. (2015). Cultivation, genetic, ethnopharmacology, phytochemistry and pharmacology of *Moringa oleifera* leaves: An overview. *International journal of molecular sciences* 16: 12791-12835.
- Mohamed A. N., Ahmed G. A., and Dina M. B. (2017). Antiviral Potential of Leaf Extracts from *Moringa oleifera* and

- Rosemary (*Rosmarinus officinalis* Lam.). *Egypt. J. Microbiol.* 52, pp. 129 - 139
- Pinal, P., Nivedita, P., Dhara, P., Sharav D., and Dhananjay, M. (2014). Phytochemical analysis and antifungal activity of *Moringa oleifera*. *International Journal of Pharmacy and Pharmaceutical Sciences.* 6 (5). ISSN- 0975-1491.
- Pramanik B. K., Pramanik S. K., and Suja F. (2016) Removal of arsenic and iron removal from drinking water using coagulation and biological treatment. *Journal of Water Health.* 14: 90-96.
- Sengupta ME, Keraita B, Olsen A, Boateng O. K, Thamsborg S. M.(2012). Use of *Moringa oleifera* seed extracts to reduce helminth egg numbers and turbidity in irrigation water. *Water Res* 46: 3646-3656.
- Sokovi, M., Glamočlija, J., Marin, P. D., Brki, D., Van Griensven, L. J. L. D. (2010). Antibacterial effects of the essential oils of commonly consumed medicinal herbs using an in vitro model. *Molecules*, 15: 7532–7546
- Thilza, I. B., Sanni S., Isah, Z.A., Sanni, F.S., Talle, M., and Joseph, M.B. (2010); *In vitro* Antimicrobial activity of water extract of *Moringa oleifera* leaf stalk on bacteria normally implicated in eye diseases; *Academia arena* 2010; 2(6), pp80-82; ISSN 1553-992X
- Wael M. A. E., and Walaa S. M. A. (2015). Effect of *Moringa oleifera* Seed Oil on Antimicrobial Activity of some Antibiotics against some Pathogenic Gram Negative Bacteria: *International Journal of Current Microbiology and Applied Sciences.* 4(5): 140-151
- Wang L., Chen X., Wu A. (2016). Mini Review on Antimicrobial Activity and Bioactive Compounds of *Moringa oleifera*. *Journal of Medicinal Chemistry (Los Angeles)* 6: 578-582.
- Zaffer M., Ahmad S., Sharma R., Mahajan S., Gupta A. (2014). Antibacterial activity of bark extracts of *Moringa oleifera* Lam. against some selected bacteria. *Pak Journal Pharm Sci* 27: 1857-1862.
- Zhao J., Zhang Y., Wang L., Wang J., and Zhang C. (2012) Bioactive secondary metabolites from *Nigrospora* sp. LLGLM003, an endophytic fungus of the medicinal plant *Moringa oleifera* Lam. *World Journal of Microbiology and Biotechnology* 28: 2107-2112.