



Biological Activities of Derived Bioactive Components from Moringa Species: An Overview

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ABSTRACT

Moringa which is called miracle tree, contains numerous bioactive substances and almost all of its sections are considered as good sources of pharmaceutical compounds; mainly its leaves whose antioxidant properties is a score in curing cancer. *Moringa* and its plant parts exhibit some medical properties such as anti-inflammatory, antioxidant, tissue protective, analgesic, antiulcer, antihypertensive due to the presence of a broad spectrum of components like poly phenols, phenolic acids, flavonoids, Glucosinolates and alkaloids. The aim of this review was to present an overview on *Moringa* and its benefits to human body.

Keywords: Moringa, bioactive compounds, medical properties, health

HOW TO CITE THIS ARTICLE: Privalo Oleg*, Glebova Ilona, Glinushkin Alexey, Sycheva Irina, Savchenko Ivan, Kosolapov Vladimir, Biological activities of derived bioactive components from moringa species: an overview, Entomol Appl Sci Lett, 2018, 5 (1): 82-87.

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Received: 03/12/2017

Accepted: 05/03/2018

[4-5] due to its bioactive substances. *Moringa* is an evergreen tree with 8-12 m in height [6, 7].

INTRODUCTION

In general, herbal plants have been used for years as supplements and additionally to treat illnesses [1-3]. From antiquity era, herbal medicines have been used to treat illnesses and *Moringa* species as well. *Moringa oleifera*, which belongs to Moringaceae and referred as Drumstick, horseradish or benzolive tree, is cultivated throughout the world (but indigenous in Afghanistan, Bangladesh, Pakistan and India

Almost all parts of *Moringa* tree has extraordinary advantages to human body; its seeds have hypotensive affection, acts as chelating in case of arsenic toxicity [8], *Moringa* leaves could be eaten freshly, cooked or stored for a long time with no cooling process [9-13]. In recent decades, people are mostly informed and aware of this fact that natural products have the least risk to body, and therefore, considering traditional plants as treating agents associated with their using even in food formulations are taking remarkably consideration these days as

green revolution [14]. Some of the chemical compounds of Moringa are methionine, cysteine, benzyl glucosinolate, moringyne, mono palmitic,

and di-oleic triglycerides [15-17]. Table 1 shows some bioactive substances of Moringa.

Table 1 . Some of Moringa bioactive compounds and their properties [18].

Chemical Constituents	Properties	Plant Part
Flavonoids: Quercetin, kaempferol	Inhibit production of tumor necrosis factor, inhibit mutations and prevent carcinogenesis	Flowers
γ -tocopherol	Inhibit lipid peroxidation, metabolize peroxides, prevent atherosclerosis	Whole plant
Oleic acid	Prevent cardiovascular diseases	Seeds
Terpenoids	Hypoglycemic and anti-hyperglycemic activity	Whole plant
4-(α -L-rhamnosyloxy)benzyl isothiocyanate	Antitumor promoter, antimicrobial	Seeds
B-sitosterol-3-O- β -D-glucopyranoside	Antitumor promoter	Seeds
Glucomoringin	Anticolon carcinogenic activity	Leaves
Benzyl isothiocyanate	Anticancer activity	Leaves
Glucosinolates	Chemo preventive activity, by inducing apoptosis	Leaves
Niazimicin	Anticancer activity	Leaves
Pterygospermin	Hyperthyroidism, Crohn's disease, antiherpes simplex virus arthritis, rheumatism, gout, cramp, epilepsy	Seed
Morphine, moriginine	antiulcer and anti-inflammatory agent	Root bark

Natural antioxidant

Presence of natural antioxidant of plant foods would involve scavenging the free radicals, and thus, afford a healthy body [19, 20]. The main technique to extract and accomplish to bioactive substances from herbal medicines is solvent extraction (methanol, ethanol, hot water and buffers) [21, 22]. Moringa is renowned as miracle tree as it contains primary and secondary metabolites with biological effects to cure diverse diseases, nourish human body and livestock, and manage water issues. Several parts of this plant have been used as vegetables for a long time [23]. Moringa leaf is a good source of vitamins, calcium, iron, beta-carotene, and phenolic acid [26]. The protein amount of Moringa leaves is more than egg and milk [6]. The pod of Moringa is a good source of fiber

[24], and its oil has been using as a remedy of skin diseases [25].

The flowers have hypocholesterolemic properties therefore it is consumed as a tea [26]. Moringa is a rich source of many bioactive compounds, such as phenolic compounds, alkaloids, phytosterols, terpenoids and tannins.

Medicinal value of Moringa plants

The medicinal value of different part of Moringa tree is recognized as a folk drug to cure several specific diseases such as rheumatism, poisonous bites, etc [27]. This plant includes many components which act biologically and functionally in human body [28, 29], and additionally most of them have investigated for their beneficial roles [30]. Tables 2 and 3 summarize the medicinal benefits of each plant part using and their biological properties.

Table 2 . Medicinal properties of each part of Moringa Plants.

Plant section	Function	Ref
seeds	treat arthritis, rheumatism, gout, sexually transmitted diseases and boils and antimicrobial activities	[31]
Roasted seeds	epilepsy, skin infections	[31]

Natural polysaccharides	antitumor, anticancer, antioxidant and anti-inflammatory	[32, 33]
stem bark	Abortifacient, antifertility activity	[34, 35]
Moringa leaves	high content of essential amino acids, proteins, minerals and vitamins	[36]
Moringa oleifera pods	Phenolics, flavonoids, saponins	[37]
leaves	macro- and micronutrients and highly nutritious for pregnant women	[22, 23]
Fresh leaf juice	inhibits the growth of human pathogens	[38]
Fruits or pods	antimicrobial and antifungal activities	[39]
roots	antispasmodic and antimicrobial activity	[40]

Table 3 . Biological properties of Moringa.

antioxidant	[41-44]
antibacterial	[45]
antifungal, anti-inflammatory and diuretic activities	[46]
Antitumor	[47, 48]
anti-carcinogenic	[49]
anti-inflammatory, antispasmodic, diuretic	[46]
antinociceptive	[50]
antiulcer, antibacterial, antifungal	[51, 52]
wound healing ability	[53]
hepatoprotective activities	[54]
Moringa seed oil, Ben oil	[55]
analgesic	[56]
hepatoprotective activity against liver damage	[57]
Antioxidant and hepatoprotective	[58]
anti-malaria, and anti-diabetes	[59]
anti-hypertention	[60]

Pharmacological properties

Primarily, herbal medicines have been used to cure malaria for years such as artemisinin, quinine, [61]. In the study of ethanol leaf extract of Moringa oleifera, scientists found that it has antimalarial affections and acts as protective agent against plasmodium infection as well [62].

Antioxidant effect

Antioxidants are compounds with ability of scavenging free radicals, the reason to produce many chronic diseases in human body. Mostly, phenolic components are responsible for antioxidant activities such as flavonoids, tannins and alkaloids [63]. Antioxidant properties of

Moringa leaves have been studied in 2 stages of mature and tender leaves [64].

Antimicrobial effects

Like other medicinal plants, Moringa oleifera is also studied to see its antimicrobial components [6, 65]. Some scholars found that extraction of Moringa could attenuate growth of Pseudomonas aeruginosa, Candida albicans, Bascillus subtilis, Staphylococcus aureus, Escherichia coli, and Salmonella typhi [63]. In addition, being a good source of flavonoids and poly phenol compounds, and presence of some chemical substances like benzyl isothiocynate, and benzyl glucosinolate are other reasons to make it have antimicrobial and fungicidal effects [6, 63, 66]. Other studies depicted that presence of antimicrobial peptides (AMPs) play role in lethality of Legionella, Streptococcus, and Staphylococcus species [67].

Nutritional aspect

Regarding high amounts of nutrients in Moringa oleifera, being a good source to solve malnutrition issues, its application could be triggered for nursing mothers. While Moringa flowers and leaves are being used to feed livestock, recent studies revealed this fact that nutritionally they are richer than fruits and vegetables; for instance, vitamin C amount is 7 times more, or Calcium is 4 times more than milk [68].

CONCLUSION

Moringa oleifera is being recognized to have plentiful applications, throughout of the world widespread along with easy cultivation, makes this plant to have brilliant potent in line with economical, nutritional and health benefits. Additionally, it would be considered as a good alternative of nourishing while preventing from incidence of many diseases. We need to develop

some strategies in order to explore and utilize full benefits of this miracle tree.

FUNDING

This work was partly supported by the Russian Foundation Basic Research (RFBR) under the project 15-29-05893.

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