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Popular Article

Moringa oleifera (Drumsticks): a nutritional tree for human health

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Abstract

Research on phytomedicines is garnering interest because it is thought that they offer advantages over traditional medications. A versatile herbal plant called *Moringaoleifera* is used all over the world for both culinary and alternative medical applications. The notion of employing *Moringaoleifera* as a nutritional supplement or ingredient in food preparation is supported by the presence of vital amino acids, carotenoids, and other components that have nutraceutical properties. It contains a very diverse range of phenolic compounds, glucosinolates (GL), isothiocyanates (ITC), and nutrients like vitamins and minerals, which is a key aspect in explaining its medical applications.

Keywords: *Moringaoleifera*, Glucosinolates, Isothiocyanates, Nutraceutical

Introduction

Moringa oleifera is a globally cultivated woody edible food as well as a medicinal plant. It is a tree, which originated in the Himalayan region of northwest India, and is a member of the Moringaceae family. Given that it can endure in subtropical and tropical climes, it has colonized many areas **(Castillo-Lopez *et al.*, 2017)**. It is now native to several areas in South America, the caribbean and pacific Islands, Africa, Arabia, and South East Asia. Due to its extraordinary healing powers for a variety of disorders and even certain chronic conditions, it has gained the nickname “the miracle tree” among common people. Phytotherapy is an alternative therapy, which has been exploited to enhance the health of people.Its seeds are rich in oil, proteins, and GL.Leaves, seeds, stems, and roots of the plant are rich in nutrients, consumable, and attributed to antioxidant activity.In this context, the nutritional potential of *Moringaoleifera*is now being examined which

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includes the phytochemical composition that attains the presence of GL. The seeds are characterized by the presence of GL **(Gopalakrishnan*et al.*, 2016)**. It has been described that glucosinolates help to avoid and treat chronic diseases. The therapeutic use of Moringa has been practiced for millennia the world to cure a variety of conditions, including bronchitis, chest congestion, asthma, cholera, catarrh, skin diseases, and anemia.The antioxidant characteristics of leaves have been linked to their ability to treat asthma, dry tumors, hiccups, and hallucinations **(Singh et al., 2012)**. In recent times, the Moringa tree has been frequently utilized in several wellness care products such as moisturizers and conditioners. It has also been reprted to have excellent cosmetic value **(AbdullRazis*et al.*, 2014)**. This article attempts to highlight specific characteristics of glucosinolates and isothiocyanates from *Moringaoleifera*, including their chemical constitution, biological activities, and health-improving benefits. This article mainly focuses on the nutritional content, bioactive compounds, and health-promoting effects of *Moringaoleifera*.

Bioactive components of *Moringaoleifera*

Various concentrations of bioactive molecules can be found all over the plant. Its seeds encompass 19-47% oil, out of which it contains 70% unsaturated fatty acids which are rich in oleic acid. Besides this *M. oleifera* comprises 10-52% proteins and 2.5-20% glucosinolates **(Gopalakrishnan*et al.*, 2016)**.The protein content of the seeds, leaves, and flowers is typically found to be more than 20%, but the lipid is less than 10%. Whereas carbohydrate content is higher than 30% in leaves, flowers, and pods**(Castillo-Lopez *et al.*, 2017)**. In the diets of humans, the wholesome tender pods are an effective source of α-linolenic acid and vitamins. A rich source of calcium, magnesium, iron, and potassium **(Valdez-Solana *et al.*, 2015)**. The antioxidant activity of the plant is credited to the presence of flavonoids, glucosinolates,isothiocyanates,phenolic acids, carotenoids, and tocopherols (**Maizuwo*et al.*, 2017)**. The leaf contains phenolic compounds **(Abdulkadir*et al.*, 2016)**, and stems and flowers contain alkaloids,phenolics,and glucosinolates**(Leone *et al.*, 2015)**.It is reported that flavonoids like kaempferitrin, rhamnatin, kaempferol, and isoquercitrin are also found in the leaves of *Moringa*. Pterygospermin, an antibiotic, and two alkaloids moringine and moringinine are found in its roots **(Nair and Subramanian, 1962)**. The anti-nutritional factors like tannins, saponins, oxalates, and phytates, have also been recognized in its leaves and stems in low quantities. Secondary metabolites like glucosinolates, are found throughout the entire tree and are most abundant in the leaves and seeds **(Maldini*et al.*, 2014)**. The glucosinolates of *Moringa* comprise a benzene ring with two rhamnose moieties attached. It contains four different kinds of glucosinolates having unique and crucial functional components. The key glucosinolate in*M. oleifera* is 4-α-rhamnopyranosyloxy-benzyl glucosinolates, also known as glucomoringin. Glucomoringin has three isomeric glucosinolates and is stored in the vacuoles of the plant. The endogenous enzyme myrosinase converts glucosinolates to isothiocyanates when the tissue of the plant suffers physical damage **(Waterman *et al.*, 2014)**.

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Role of Moringa chemical compounds in various diseases

Moringaoleífera has been considered a natural alternative to traditional medicine for various ailments such as cancer, type 2 diabetes, arthritis, hypertension, and cardiovascular diseases**(Kim *et al.*, 2018)**. Proteins of *M. oleifera* have antimicrobial properties and certainly be used to make food, beverages, and animal feed **(de Medeiros *et al.*, 2018)**.Moringaglucosinolates may also be employed in phytopharmaceutical, nutraceutical, and healthy food products **(Ma *et al.*, 2020)**. Glucosinolates and isothiocyanates are associated with their nutritional value. Via various *in-vitro* and *in-vivo*approaches, numerous researchers have described the hypoglycemic, anti-inflammatory, and anti-oxidant benefits of Moringaglucosinolates and isothiocyanates.GL and ITC derived from *Moringa* tissues (leaves, seeds, fruits, and flowers) can lower inflammation biomarkers such as nitric oxide synthase, IL-1 and IL-6, and NFκB**(Jaja-Chimedza*et al.*, 2017)**.

4RhB-ITC(4-α-rhamnopyranosyloxy-benzyl-ITC) and isomeric form from its leaves increases the NQO1 activity and decreases the iNOS and IL-1β expression and also increases the insulin signaling sensitivity or decreases diabetes-related parameters. In seeds of *M. oleifera* the 4RhB-ITC decreases the IκB degradation, and iNOS expression, and increases the Nrf2 target genes expression, decreasing TNF-α, and IL-1β expression or increasing the glucose tolerance.The fruits of *Moringaoleifera* decrease the IκB- α degradation and vascular permeability. The seeds and leaves of Moringareduce the risk of cancer in both in-vivo and in-vitro by increasing the p53 mRNA, Bax, Bcl-2 expression, cell death, cell cycle perturbations, and phase II enzyme induction **(Lopez-Rodriguez *et al.*, 2020)**.

Conclusion and future prospects

The abundance of nutrients and bioactive substances in several *Moringa* tissues has been found to minimize the risk of life-threatening diseases. The secondary metabolites GL and ITC in different concentrations primarily concoct in seeds and leaves of the tree. However, the majority of in-vivo and in-vitro research so far has been on specific inflammatory illnesses. The health-improving benefits of GL and ITC from the *Moringa* tree are mostly connected to the activation of certain detoxifying enzymes and the lowering of specific inflammatory and cancer markers. The identification of safe doses pertinent to consumption will also be required in order to incorporate these substances as commercial medications.

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