Role of moringa chemical constituents in fortification of food

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Abstract

As it is a rich source of specific macro and micronutrients that are crucial for human nourishment, the Moringaoleifera tree is sometimes referred to as a miracle tree. Depending on the plant variety and source, the elemental composition of the different portions of the moringa tree may change. There are several uses for the leaf, seed, and flower of M. oleifera in cuisine. Initially, we outlined the current state of understanding regarding M. oleifera's usage as a food fortifier in amala (stiff loaf), ogi (maize gruel), bread, cookies, buttermilk, cheese, and the preparation of soups. The industry research research problem was highlighted, and suggestions regarding future M. oleifera food uses as well as the necessity of an experimental setup that is well-organized and quite well were made. A review report in regards to the recently emerging and nutrition packed superfood specifically *moringaoleifera* recounting its various health benefits. It belongs to the group of Moringaceae, indigenous to the subcontinent of India. Frequently used names include moringa, drumstick tree, horseradish tree, etc. One and all part of moringa plant including its leaves, stems, roots, buds etc. is remarkably benefiting in every possible way from anti-ageing to prevention of cancer and diabetes. M. oleifera is associated as a prime source of essential nutrients; full of protein, essential amino acids, minerals and vitamins, anti-nutrients are also present in very negligible amount by many studies. It is a reliable source of nutrients due to presence of flavonoids and phenolic compounds which are bio active compounds. Fortification of processed foods especially of underage groups with M. oleifera will contribute in increasing product's value, organoleptic properties are also increases with

the oxidative stability and product shelf life; it will also contribute to further analytical and consumer studies in the development of products. Brand like 'patanjali' is spreading awareness about this magical plant with medicinal benefits. Working with this superfood will avail majority of the opportunities and growth in food sector and will help in discarding different diseases by means of boosting immunity.

Keyword: *moringaoleifera* (Miracle Tree), superfood, essential nutrients, essential amino acids, fortification.

Introduction

Everyone refers to *MoringaOleifera* as the miraculous plant or the life-giving tree. The Moringa plant acquires its name from its usefulness, especially in terms of nourishment as well as medicinal. It is a shrub that is indigenous to parts of India, Pakistan, Bangladesh, including Afghanistan that are sub-Himalayan.[1]Amongst some of the 13 members of the Moringaceae family, *M. Oleifera* is the one most frequently cultivated due to its outstanding nutritional value and wide range of applications. Nearly every component of just this wonder tree has been discovered to be extremely beneficial. Leaves are utilised as food, tree trunks are used to make gums, flower sap is used to make perfume, as well as ground-up seeds are employed to purify water. To address hunger, particularly among children and newborns, *M.oleifera* leaf has indeed been utilised as an alternate feed ingredient.[2] Moreover, significant quantities of total phenols, proteins, calcium, potassium, magnesium, iron, trace elements, as well as copper have already been identified in the leaves of M. Oleifera.[3]Moreover, *M. oleifera* leaves are an excellent concentration of micronutrients notably sodium ascorbate, tocopherols, and antioxidants.[4,5] Whenever consumed in conjunction with a balanced meal, certain micronutrients are recognized to neutralize free radicals and they could have antiproliferative effects. Together with the leaves, *M. Oleifera's* flowers as well as fruits have also been proven to exhibit significant levels of antioxidants.[6]

The usage of M. Oleifera as a food fortifier is expanding around the world, notably in Africa. As illustration, feasts in African nations including Ghana, Nigeria, Ethiopia, Central Africa, but also Malawi provide both freshly harvested and dried moringa leaves.[7]Several research have demonstrated the possibility for using various *M. oleifera* plant components in culinary preparations, which including stews, neonate meals, amala, a dense dough formed using flour comprising plantains and yams, nettle cookies, bread, dessert.[7–13] There

is a lot of interest in using this nutritionally plant to fortify foods. This offers a structured approach by summarising the current understanding of *M. Oleifera's* function as a food fortifier. The level of awareness is then presented with the intention of making recommendations for potential uses in foods also aboutthevarietyof health benefits of *moringaoleifera*andorange juice and how it will assist in humanwelfare,ifmoringaextractisusedinfortificationoforangejuicetocreateacandy. An affordable choice with excellent profitability as well as accessibility is to fortify moringa with orange juice to create a sweet. Citrus fruits like oranges have health benefits because they include vitamins like vitamin B1 (thiamine), vitamin A, vitamin E, vitamin D, vitamin B6, folate, and vitamin B6. Given the presence of calcium, zinc, copper, potassium, phosphorus, magnesium, and other minerals, orange juice has very similar health advantages to those of moringaoleifera. Together, orange juice &moringa are used to cure a variety of illnesses, including cardiovascular problems, cancers, but instead skin conditions. The vitamin supplements A and B12, folate, zinc, as well as iodine are the micronutrients that are most frequently deficient in the world. Because moringa extracellular matrix all of these elements, it is also referred to as a superfood. According to the World Health Organization (WHO), supplementing, variety, as well as stabilization are the three main methods for increasing nutritional absorption. Regrettably, *M. oleifera* has drawn investigators' attention to its use as a nutritional supplement to create effective food compositions, in addition to enhance nutritional properties but also health impacts. [14–16]

MORINGAOLEIFERA

"Drumstick tree" also can be golden rain tree, Cassia fistula, is also known by this name.Native towards the Indian subcontinent, *Moringaoleifera* is indeed an incredibly quickly, water shortages tree in the Moraceae family.Notable brands for this plant encompass moringa, horseradish tree (from either the flavour of both the roots, which would be similar to horseradish), drumstick tree (from of the tall, thin, trapezoidal seed pods), as well as ben oil tree but rather benzolive tree.For some of its juvenile seedlings as well as leaves, which are used as appetizers and for conventional herbal remedies, it is commonly farmed. Moreover, it purifies water. Despite *M. oleifera* is classified as an introduced species across several nations, these have "been not documented penetrating undamaged habitat or eliminating native flora" and as a result "should be considered at presently as a widely farmed

species with limited invasive propensity."A fast-expanding evergreen tree, M. oleifera might attain a height of 10 to 12 metres (33 to 39 feet) with a trunk circumference of 45 centimetres (18 inches). A thick blanket of wood surrounds the whitish-grey bark. Bark on young seedlings is hairy and purple or greenish-white in colour. The tree has a fluffy covering with opponents leaves and an unstructured crown of sagging, frail limbs.During the first six months afterwards growing, flowering starts. Only once each year, in spring and early summer, does blossoming take place in locations with a cold climate (northern hemisphere between April and June, southern hemisphere between October and December). Flowering can take place twice or even all year long in climates with more regular season temperature as well as consistent precipitation.

This herb can be consumed in a wide variety of ways since it can be preserved for long periods of time and because all of the different portions of the moringa tree are edible and rich in nutrients. Fresh moringa leaves can indeed be kept since they retain their nutritious value for an extended period of time and can be eaten as a salad or grilled. Because there is little moisture in moringa leaves, which is a key factor in preventing pathogenic but rather antifungal growth, the foliage has quite a prolonged shelf life. The majority of moringa tree cultivation occurs in semi - arid regions, tropical, including subtropical regions, which correspond to USDA hardiness zones 9 and 10 inside the United States. Although it can survive a variety of soil types, it likes moderate to mildly alkaline (pH 6.3 to 7.0), well-drained, gritty or silt loam soil. Moringa is especially well suited for dry areas since it can be grown utilizing rainwater rather than spending money on high-priced irrigated agriculture procedures (Table .1)

Variable	**Frequencies/ Specifications**
Temperature	effective growth in tropical or subtropical climates
Elevation	0 – 2000 m
Kind of Soil	fine sand, gritty, even silt loam
Precipitation	If precipitation is less than 800 mm,

	irrigated of 250–3000 mm is required for leaflet formation.
Ionic strength of Soil	pH 5 – 9

Emerging economies are more reliant on their traditional medicinal plants since they offer a variety of health advantages, have less adverse effects than conventional medical medications, and are long-term beneficial. When used correctly and in sufficient quantities, it does wonders for the system, slowing the progression of illnesses and even curing deadly ailments such as cancer and diabetes.

What Makes Moringa Extract Special?

It is helpful in the fight against malnutrition because it is rich in proteins, vitamins, plus iron. In various places of the world, the moringa plant provides a significant source of food. It is simple and inexpensive to grow, while drying it keeps a large portion of its nutritious content. It appears to work as an antioxidant to help shield cells from harm.Several more vital nutritional substances can be found in moringa. The leaves contain 15 times additional potassium than bananas and seven times the amount of vitamin C than oranges. Moreover, it contains iron, calcium, protein, as well as amino acids, all of which aid in muscle growth and healing.The moringa tree, known colloquially as the life-sustaining tree, is a significant source of pharmaceutical chemicals for the cosmetics industry. The plant possesses potent antioxidant, antibacterial, soothing, astringent, as well as anti-inflammatory qualities because it contains a wide range of bioactive chemicals.[17]*Moringoleifera* concentrate attributes which make the vale of composition good and it can further use in application (Table.2)

Table.2 Features of a moringa uproot

Quality	**Relevance**
Shade	Deep brown
Constitute	Vulnerable Fluid

Delectable	Flavor of Foliage
onder Meer	15.895
ionic strength	6.18
water dosage	8.24
porosity	20

Handling of Moringa

As plants are treated, they typically lose their nutritional value. When the nutritional contents of raw, hatched, as well as aged moringa seed flour were examined, it was discovered that the uncooked seed flour had elevated amounts of phytonutrients while the fermented whereas started growing seed flour had the highest levels of amino acids.[18,19]The metabolic processes involved in germinating but also metabolic activity involved in fermentation may have led to this. Nevertheless, an investigation looked at the impact of steaming, simmering, as well as softening to examine how well the nutrients in moringa leaves were retained. Oddly enough, boiling was the most efficient approach because it significantly diminished the concentrations of cyanide, oxalate, and phytate.Computation can be carried out to maximise the consumption of the essential vitamins from either the seeds and foliage because the accumulation of phytic acid and perhaps other anti-nutrients can lower the accessibility of some nutrients.[20,21] Yang et al.,2006 demonstrated that the bioavailability of iron as well as antioxidants concentration was improved by simmering.[22] As a result, diseases related to deficiency can be treated with processing moringaoleifera seed flour.Yet, several studies have demonstrated that because to the mild bitterness of moringa, youngsters do not consume it.[23]Kiranawati et al.,2014 created moringa noodles using the three processes of scalding, simmering, as well as stir - frying.[24] The effects among these noodles on the mammary glands were investigated on rats. Surprisingly, the rat mammary glands responded better towards the sautéed noodles, increasing milk output. So, because oil used only for sautéing was high in sterols, the results on the noodles' lactogogum levels were strengthened. Moreover, *M. oleifera* has been used in confectionery.

In accordance with study conducted, 20% moringa integration in cocoa powder was the best amount when compared to other moringa fortification proportions used in chocolate.

Corresponding to this, adding moringa to halawatahinia improved the food's nutritional content. These investigations have demonstrated the possibility of creating chocolate plus halawatahinia that are loaded with protein and micronutrients.

M. Oleifera's nutritional quality/ value

Numerous additional cultures as well as civilizations nowadays are appreciating moringa as science continues to support its health benefits. As many dietary items can be fortified, it is currently protecting youngsters from malnutrition and serving as a rescuer. Knowing that the moringa tree alone has this many elements in it is truly surprising; no additional plant, when compared to many other trees and plants, has this many different types and amounts of nutrients in them. Moringa seeds contain a variety of bioactive substances, including alkaloids, gluco-isothiocyanates, sinolates, oil, proteins, thiocarbamates, and carbohydrates, in addition to other plant parts. The *M. Oleifera* tree is a shrub abundant in several nutrients, including mineral deposits, fibers, as well as vitamins that are crucial to human diet.[25,26] Several research studies have been conducted that demonstrate how much more protein-rich *M. Oleifera* leaves are than other leaves used for food. Depending on the variety and source, *M. Oleifera* leaves may have varying nutrient quality.

These findings show that the leaves have a protein concentration of 28%, which is comparable to Brazilian reportsas well as South Africa (30%), respectively.[26,27] Significant variances have also been discovered in the leaf' calcium, iron, even potassium levels.[25] Yang et al.2006 working investigated four different Moringa cultivars, it was discovered that M. oleifera had the most iron, -carotene, sodium ascorbate (Vitamin C), plus -tocopherol (Vitamin E). There has been discovered that *M. Oleifera's* fresh leaves are a significant source of the carotenoids notably trans-lutein (about 37 mg/100 g) and genderfluid (about 18 mg/100 g).[22]Current findings demonstrated that *M.oleifera* iron supplementation is superior to standard iron supplements for treating iron insufficiency and controlling the activation of iron-responsive pathways.[28] Furthermore, using only a rat model, it was discovered that the relative absorption of folate from *M. Oleifera* leaves was quite high (about 82%), indicating that the plant's leaves may be a source of nutritional folate.[29] It's also crucial to note that *M. Oleifera's* leaves, flowers, and delicate pods are possible sources of poly unsaturated fatty acids, which could provide some advantageous benefits in products made from *M. Oleifera*.[6]

Several of the nutritious advantages *of M. Oleifera* described above imply that even these plants can operate as an element inside the food as well as related sectors. Moringa fresh and dry leaf weights in comparison to conventional foods per 100 gm (Table.3).[30]

Nutritional	**Common Basic food**	**Moringa (Fresh Leaves)**	**Moringa (Dried Leaves)**
Vitamin A	1.8 mg Carrots	6.8 mg	18.9 mg
Calcium	120 mg Milk	440 mg	2003 mg
Potassium	88 mg Banana	259 mg	1324 mg
Protein	3.1 mg Yogurt	6.7 mg	27.1 mg
Vitamin C	30 mg Oranges	220 mg	17.3 mg

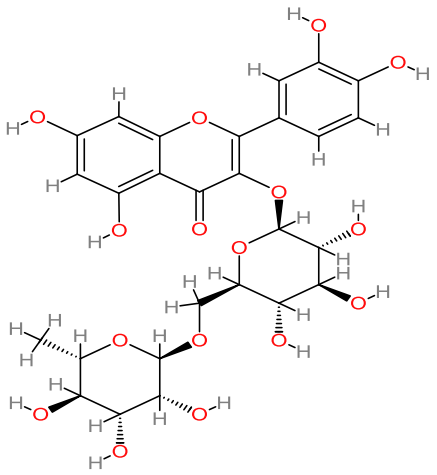
The moringa tree is a rich source of nutrients, including vitamins, fibre, as well as carbohydrates, which can be crucial for human dietary patterns. Several studies have revealed that Moringaoleifera leaves contain more protein than some other plants used for food.[25] Every component of the moringa tree, including its nuts, seeds, leaves, flowers, tannins, including roots, is linked to the availability of one or more advantages.[31] It has a variety of uses, including fresh, cooked, and long-term storage of dried powder devoid losing nutritional quality.

Moringa Leaf Qualities

The foliage of the Moringa plant, which are said to be the healthiest portion of the plant, can be used dried, diced, or ground into sauces, soups, teas, even extracts. Hence, the benefits of moringa are believed to be obtained by regularly consuming its leaves, which have been extremely rich in vitamins and minerals vital to the body's health and welfare, in compliance with medical guidance. The leaves of the Moringa plant have a distinctive flavour that is mildly spicy and pleasant, even when they are raw. They are rich in vitamins A and C and have three times the potassium of bananas. They also encompass 25% of their poundage in proteins, that contains more than eggs and twice as much as cow's milk.

So, the qualities of Moringa and its leaves are ideal to strengthen as well as replenish the nourishment of persons who suffer from these vitamin and mineral shortages, as well as for individuals who need to have an excess of these substances, such as pregnant women, the elderly, or individuals who convalescing. Moringa leaves are a great item to add to meals to flavour them and make them even more healthy. They may be eaten raw and uncooked.

Chemical constituents of moringa



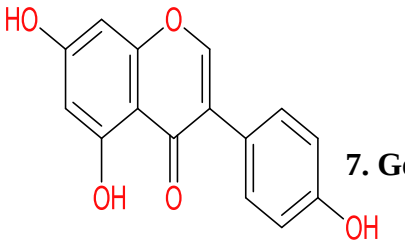
1. Rutin

2. Quercetin

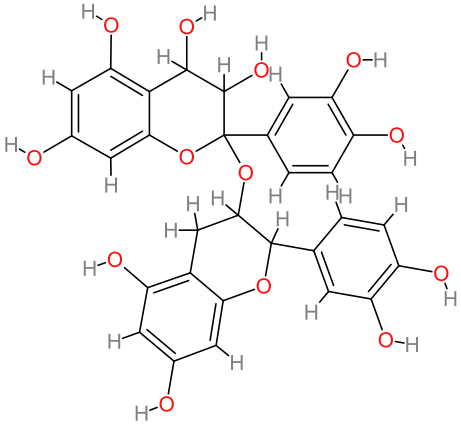
4. Kaempferol

3. Isoquercetin

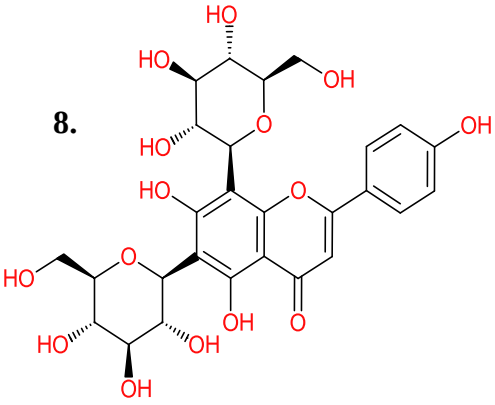
5. Myricetin



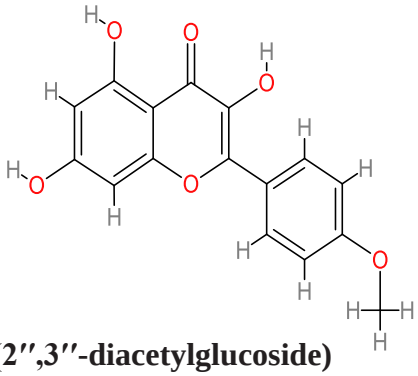
6. Luteolin



7. Genistein



8. Procyanidins



9. Vicenin-2

10. Kaempferide 3-*O*-(2″,3″-diacetylglucoside)

Supplements with moringa: features and advantages

The benefits of moringa expand beyond just eating the leaves; they can also be obtained as a supplemental and even in powder form.

The powdery sections of the moringa tree, particularly the leaves and seeds, are exceptionally full of health-promoting qualities. They are known in particularly for:

- Anti-inflammatory property: owing to the presence of polyphenolic compounds as well as flavone. While seeds of the moringa plant have been demonstrated to be effective in reducing irritation, the entirety of the plant's parts, including the leaves, roots, pods, and leaves, are known to have analgesic effects. Regardless of the fact that the methanol extracts are mostly beneficial to animals, research has discovered that the benefits of the ethanol extracts of the moringa plant are identical.In addition to killing pathogens like bacteria, fungus, viruses, and parasites, moringa can help reduce systemic inflammation, which is a factor in conditions such ulcerative colitis, asthma, and metabolic disorders.
- Antimicrobial property: Moringa compounds with flower root bark, stem bark, as well as leaves also have anti-bacterial as well as antimutagenic qualities.
- Anti-oxidant quality: probably attributable to the abundant phytonutrients in the food.Although they scavenging free radicals that trigger peroxidation, tissue destruction, and inflammatory, antioxidants are well-liked. Flavonoids, polyphenol, and ascorbic acid are antioxidant found in Moringaoleifera's leaves, blossoms, as well as seeds.
- Anti-hyperglycemic properties: perhaps as a result of the plant's naturally occurring substances.

The goal of food fortification

Food fortification is the process of enhancing the nutritional quality of dietary staples by adding important nutrients, such as vitamins and minerals, to them. The majority of time, fortification can quickly and affordably enhance a citizenry's condition in terms of elements. Foods that are to be fortified must be ingested appropriately by a sizable fraction of the citizenry's specific individuals.Moreover, the fortificant must be widely obtainable, well-absorbed, but also easily available into the food without significantly altering its sensory characteristics. Many methods of food fortification exist, including market-driven, customized, including mass fortifying. Whichever the goal of fortification, it is important to remember that perhaps the food being fortified (also known as the food vehicle) as well as the fortificant must get along. Also, the fortifier must be chosen to ensure that it does not

compromise the food's sensory qualities in order to increase its nutritional worth. This is crucial since how users are initially drawn in can have a significant impact on whether they continue to purchase a certain food product.

It might not always be considered fortification but rather enhancement when M. Oleifera is used to enhance the nutritional content of staple foods in various regions of the world, including Africa. As stated earlier, fortification, which is occasionally used simultaneously with enhancement, entails the inclusion of particular micronutrients to standard foods in order to enhance the total nutritional value of the targeted population. Fortification will be used in this review to refer to the increase in nutrient quality of common foods that contain M. Oleifera.Mass fortifying is applied to food that is routinely ingested on a frequent basis by the general population, focused fortification is typically applied to the targeting foods or the particular food, and brand fortification is applied by the producer for the trade or on-demand. Fortification is carried out to aid citizens with limited food budgets in assembling their nutritional level, which is why the food products are intended to be made readily and affordably attainable to consumers. Because that consumers primarily purchase items that appeal to their senses, it is important to keep in mind that a food material cannot be strengthened without sacrificing its sensory properties.

Moringa as food fortificant: The moringa beans are a good choice whenever one wishes to achieve an appealing flavour because they are rather crunchy as well as slightly sweet, but on the other hand, they have poor nutritional content. Yet, since moringa leaves have an abrasive flavour and taste like grass, they can be used to have great nutritional superiority while balancing the flavour. The presence of significant amounts of polyphenols as well as micronutrients in moringa makes it a promising herbal for health advantages and a fantastic fortifier.[32]

[Moringa is a multipurpose tree and its each and every part has their use in human welfare and socio-cultural aspects. Their use and benefits are explained here under.]

Usage frequently

The Moringa tree has a variety of uses in daily life, it can be mentioned. The succeeding utilises of parts of the plant are just a few, but certainly not all of them: shack crop growth

(bio-mass manufacturing), mammal pastureland (leaves and allowed to treat seed cake), bio - gas (ends up leaving), disinfectant (crushed leaves), blue dye (wood), barbwire (living trees), fertiliser (seed-cakes), foliar nutrient (leave juice), green manure (leaves), gum (tree trunk), honey as well as beverage clarifier (powdered seed), syrup (flower neck) (bark and gum).

Potential Contributor of Food and Fiber

The possibility of the Moringa tree has expanded as a viable source of fodder and nourishment due to its easy supply of fodder, strong growth as well as scavenging habit, and adaptation in climatic changes challenging areas. A reliable reference of ration for animals is moringa. When it's dry out, the excellent nutritional composition but also bio-mass synthesis is very important as cattle feed. [33]

Therapeutic usage

Several medical applications that have traditionally been accepted as belonging to the Ayurveda and Unani systems of medicine. Mostly in indigenous system of medicine, almost every part of the plant—root, bark, gum, leaf, fruit (pods), flowers, seeds, and seed oil—has been used to treat a variety of illnesses, including skin conditions, inflammation, anaemia, breathing problems, bronchitis, diarrhoea, headache, joint pain, rheumatism, gout, vomiting and diarrhea, heart problems, fevers, gastrointestinal issues, wounds, diabetes, conjunctivitis (Sanjay &Dwivedi., 2021; Kumar et al.,2021). The marvel plant known as moringa has a wide variety of medical applications. Distinctive curative qualities of the moringa plant include its anti-fibrotic, anti-inflammatory, anti-microbial, and anti-cancer characteristics.[34]

Industry Implementation

Oil known as Ben oil is extracted from moringa seeds. Oleic acid, tocopherols, and sterols are abundant in this oil. It's also able to survive microbial spoilage caused by oxidation. The oil can be utilized as a counterpart for olive oil in cookery, as well as in scents and lubricants.[1,35] By neutralising the electrical impulses of dispersed material in water to generate flocs that make particulates filterable, pharmacological coagulants such aluminium sulphate (Alum), ferric sulphate, and polymers dissolve large particles in polluted water. Coagulants and flocculants *M. oleifera* seed contains electrostatic protein that can clear muddy water.As alternative chelating agents like alum, activated charcoal, as well as ferric chloride are expensive and scarce, this characteristic of *M. oleifera* seeds is drawing a lot of attention.[36]

The moringaseedcakes can be employed as soil amendment but rather fertiliser, although the seeds can be utilised in cosmetology and as a feedstock for biodiesel production. Moringa blossoms are used to manufacture a tea that has hypolipidemic qualities. Once sautéed, moringa blooms are rumoured to taste like mushroom.[8]Growers use the moringa flowers because they are great resources of nectar. The bark extract will be used medicinally to treat dyspepsia, eye conditions, and heart problems.[37]It is proposed that this modification can be made towards other munchies as well after taking into account the opinions of various such fortifications. The addition of moringa to the snacks can increase their nutritional content. The majority of snacks are composed of cornmeal, and studies have shown that adding a small amount of moringa to maize flour can increase the snack's nutritional content in terms of protein, calories, as well as elements. While introducing commercialized moringa to the marketplace, more research on moringa as a fortified Indian snack is necessary.

Epilogue and potential outcomes

In India, the study of *M. oleifera* has not yet attained prominence. The wondrous tree's resources must be used for a number of things; thus, this is crucial. Remarkable anti-diabetic and anti-cancer activities are possessed by *M. oleifera*. To even further demonstrate these qualities of moringa, quintuple studies are less common.The *M. Oleifera* plant is undoubtedly a magical potion with a wealth of applications in the food industry that have yet to be completely realised. In numerous food purposes, such as fortifying amala (stiff dough), ogi (maize gruel), bread, biscuits, yoghurt, cheese, and in producing soups, the usage of *M. Oleifera* leaf powder, *M. Oleifera* seed powder, and *M. Oleifera* flower powder was studied.[9] To support their conclusions, several of the studies that were summarised in this publication require additional research. For particular, lower set back stiffness readings for hard dough made from plantain flour were found to indicate that *M. Oleifera* leaf powder reduced the likelihood for depolymerization. The investigation, unfortunately, could not demonstrate how the preparation of the tough dough actually effected oxidative degradation. Moreover, research studies must to be such that factors like mixing duration and speed are thoroughly described in academic journals. An intriguing technique to enhance people's nutritious well-being and health, particularly in areas of extreme poverty or food shortages, is the addition of *Moringaoleifera* to the food business. This plant contributes a significant amount to the essential worth of products. Also, the idea that a food item offers more than merely quality plus significance is appealing to people who enjoy eating healthily.[38]Longitudinal

investigations must also assess the phytoconstituents but also nutritious absorption of products supplemented with *M. oleifera*. The nutritional content of meals fortified with *M. oleifera* was found to have improved in several of the trials analyzed, however none of the investigations examined the bioavailability as well as in vivo or perhaps in vitro analysis of these components.

Although *Moringaoleifera* L. is an Indian native, it is a common tree in Florida, South Africa, Asia, the Caribbean, Florida, and the Pacific Islands. It is referred to as a "wonder tree" since it is a drought-tolerant, expanding rapidly, multifaceted, environmentally friendly tree that is also one of the most helpful in the world because of its curative and nutritional qualities. The moringa tree has a lot of vitamins, mineral deposits, fibre, as well as proteins. It is a particularly nutrient-dense plant with leaf nutritional quality competitive with that of dairy and cheese, more vitamin A than carrots, more vitamin C than oranges, and much more potassium over bananas.or just a nation like Nepal, facing the gravest challenges like climate change and global warming, it is just and proper to look into any potential solutions that have not yet been considered. As a result, because of its resilience and capacity to adapt to a wide range of environmental changes, moringa might be a useful resource. Furthermore, the wood's ability to absorb and store atmospheric carbon dioxide contributes to the reduction of global warming. With one-fourth of the population living in extreme poverty and being extremely susceptible to climate change, Nepal has a lot of potential for moringa plantations to enhance their standard of living. Little studies on the cultivation of moringa have been conducted in Nepal up to this point. If rapid implementation of systematic and academic study as well as promotion of the Moringa is done at diverse agro-climatic zones of Nepal, risks including agricultural production, illiteracy, environmental degradation, and deteriorating livelihoods quality might be overcome.

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