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Comprehensive Review Article on Nutraceuticals and Herbal Medicines

Anil Veljya Pawara[1,*], Mrunal D. Pendharkar[2], Neha P. Patil[2], Krutadnya P. Patil[2], Sunil P. Pawar[3]

Abstract

Ayurveda is a roughly 5000-year-old medical system that is mainly practiced in India. It emphasizes the body, mind, and spirit in illness prevention and treatment and incorporates herbal treatments and diet. Ayurveda is one of the traditional medical systems in India. Ayurveda is based on the idea of avoiding needless pain and leading a long, healthy life. Ayurveda employs natural remedies to eradicate the disease's underlying cause by reestablishing equilibrium while simultaneously fostering a healthy lifestyle to stop imbalance from happening again. Polyherbal formulations are those that contain two or more herbs. Nutraceuticals are essential food components with both medicinal and nutritional qualities. Active ingredients, such as dietary fibers, collagen hydrolysate, and carotenoids, aid in the healing process. Herbal and nutraceutical formulations are the most well-known worldwide. There are less adverse effects with Hal formulations. Herbal formulations have gained popularity in recent years. Nowadays, more people prefer herbal remedies. Plant extracted powders are usually used as supplements because they are rich in minerals, vitamins, and other nutrients. Herbal extracts are usually used as powders and capsules, but formulators find it challenging to formulate these products due to their high dosage, harsh taste, very poor flowability, and low compressibility.

Keywords: Therapeutic properties, disease prevention, dietary supplements, probiotics, Prebiotics, and functional foods

INTRODUCTION

Over two thousand years ago, Hippocrates wrote, "Let food be your medicine, and let medicine be your food." This illustrates how closely linked our diets are to our health. In more recent years, there has been renewed interest in how nutraceuticals may help contribute to health promotion and disease prevention all over the world.

***Author for Correspondence**
Anil Veljya Pawara
E-mail: paradkeanil318@gmail.com

[1]Student, B. Pharm., Department of Pharmaceutical Analysis, P. S. G. V. O. Mandals College of Pharmacy Shahada, Nandurbar, Maharashtra, India
[2]Assistant Professor, Department of Pharmaceutical Analysis, P. S. G. V. O. Mandals College of Pharmacy, Shahada, Nandurbar, Maharashtra, India
[3]Principal, Department of Pharmaceutical Analysis, P. S. G. V. O. Mandals College of Pharmacy, Shahada, Nandurbar, Maharashtra, India

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Nutraceuticals were first referred to by Dr. Stephen De Felice, the chairman of the Foundation for Innovative Health, in 1989 as a combination of nutrition and pharmaceuticals. While there is no official regulatory definition for nutraceuticals, they are typically defined as nutritional products that are marketed as having the potential for preventing or treating disease. Nutraceuticals refer to any food or food-derived material that has medical or health benefits beyond basic nutrition. Nutraceuticals include whole diets, dietary supplements, isolated nutrients, genetically modified or designer foods, herbal products, and processed foods such as cereals, soups, and beverages. As of December 2005, there are more than 470 nutraceutical and functional food products available to consumers with scientifically validated health benefits.

Nutraceuticals provide nutrition and health advantages and are derived from food sources. These goods include vitamins, genetically modified foods, herbal products, and dietary supplements [1]. They are abundant in bioactive compounds that have physiological benefits and aid in illness prevention and treatment. Herbal nutraceuticals are foods made from plants and/or their oils, roots, seeds, berries, or flowers that promote health and fight both acute and long-term illnesses brought on by poor eating habits. The use of herbs for food and medicine was highly valued in many ancient societies [2].

Guidelines for the Assessment of Herbal Medicines have also been released by WHO (WHO, 1996). To support national regulatory bodies, scientific associations, and manufacturers in evaluating paperwork, submissions, and dossiers pertaining to such goods, these guidelines established the fundamental standards for the assessment of the quality, safety, and efficacy of herbal medicines [3].

Herbal medication is defined as one that is safe for daily human use and is used to treat or prevent illness. Herbal medicines are essential to human health care in an Asian nation. Patients with chronic illnesses, including cancer, diabetes, and asthma, are more likely to take herbal medicines. Different dose forms of herbal medicinal formulations are used in modern science and technology in human healthcare. Herbal formulations are dose forms that contain one or more specific herbs or progressive herbs in predetermined amounts to offer particular nutritional, cosmetic, and supplemental benefits. Herbs are mostly employed in medicine, but they are also utilized in cuisine, tea, perfumes, natural dyes, and pest control. A significant source to produce pharmaceuticals is medicinal plants. Ayurveda, Yoga, Unani, Siddha, and homeopathy are the recognized traditional medical systems that have been practiced in India for centuries [4, 5].

Hippocrates correctly said, “Let food be your medicine, and medicine be your food,” some 2000 years ago. The realization that “nutraceuticals” are essential for improving health has led to an increase in interest worldwide.

BARLEY GRASS

Scientific Categorization

- *Kingdom:* Plantae.
- *Order:* Poales.
- Poaceae family.
- Poaceae family.
- Hordeum is the genius.
- *Species (Binomial name): Hordeum vulgare*

One of the first cultivated grains, Barley (*Hordeum vulgare*) is a major cereal grain grown in temperate climates worldwide. Around 9000 BC, it was tamed in the Fertile Crescent, giving it nonstuttering spikelets and making harvesting much simpler. Its use had expanded throughout Eurasia by the year 2000 BC. Barley prefers relatively low temperatures and well-drained soil, but it is not as winter-hardy as wheat or rye [6–8].

An annual grass that grows in many different regions, Barley is more nutritious if harvested early. Instead of the grain, Barley grass is the leaf of the Barley plant.

DESCRIPTION

In 2012, the Barley genome was sequenced by the UK Barley Sequencing Consortium and the International Barley Genome Sequencing Consortium. With 14 chromosomes**,** it is a diploid species that self-pollinates. Clusters of spikelets grouped in a distinctive herringbone pattern make up its blooms. The ears appear tufted because each spikelet has a long, thin awn that can reach a length of 160 mm (6.3 in). Barley is an annual bunchgrass that grows to a height of two to four feet during the cool-season (Ball et al., 1996). Its internodes and nodes are hairless, and its hollow, jointed stems feature smooth, tapering leaf surfaces and borders that emerge on the stem above ground (Brown, 1979).

Seeds are carried on a spike inflorescence that is ¾ to 4 inches (2–10 cm) long, with flower clusters organized in groups of three long bristles (known to as awns). In certain kinds, awns are lacking, but when they are present, they can grow up to 6 inches in length (Radford et al., 1968) [9–11].

Barley can be confused with other tiny grains prior to flowering. By observing the leaf collar when it is separated from the stem, it can be differentiated from wheat, rye, and oats. Auricles are two overlapping appendages that grip the stem of a Barley plant's leaf collar (Ball et al., 1996). Based on how the seedheads are arranged in the spike, Barley can be divided into two groups: six-rowed and two-rowed. Only the middle spikelet develops a kernel from above; the other two spikelets are sterile [12, 13].

MORPHOLOGY OF PLANTS

The annual grass can reach a height of 60 to 120 cm. It has adventitious and seminal root systems. The deepest roots are usually of seminal origin, while the higher soil layers are usually packed with the adventitious roots that emerge later, depending on the temperature and the structure, texture, and condition of the soil. A "rhizomatous stem" is created when the grain is planted deeply, and when it reaches the surface, it releases leaves. The "rhizome" may have adventitious roots and be one or more internodes in length (Briggs, 1978).

A mature Barley plant has a central stem and two to five branch stems called tillers; each fertile tiller and the main stem's apex carry a spike; at or close to the soil's surface, the section of the stem that carries the leaf bases swells to form the crown, from which the adventitious roots and tillers grow (Gomez-Macpherson, 2001). The nodes that bear the leaves are spaced apart by hollow, cylindrical internodes that make up the upright stems [14–16].

The linear, 5–15 mm broad Barley leaves are generated on opposing sides of the stem and are composed of the sheath, blade, auricles, and ligule. Barley differs from other cereals in that the ligule and auricles are smooth, completely encircle the stem, and may be anthocyanin-pigmented (Gomez-Macpherson, 2001).

CLASSIFICATION OF TAXONOMY

Scientific Categorization

- *Kingdom:* Plantae.
- *Order:* Poales.
- Poaceae family.
- *Species (Binomial name): Hordeum vulgare*.

Uses

A crucial component in the creation of beer and whisky is Barley, which is turned into malt [17]. German and English beers traditionally employ two-row Barley. Although both types are currently widely utilized, six-row Barley was historically employed in US brews. Barley is the main ingredient in Scottish and Irish whisky, which is distilled from green beer [18, 19]. Barley is the most suitable grain for malting, which uses around 25% of American Barley [20]. As a result, Barley's malting enzyme level is frequently used to evaluate it [11]. A robust beer from the English brewing tradition is called Barley wine. The same named alcoholic beverage was created in the 18th century by boiling Barley in water and combining it with sugar, white wine, borage, and lemon.

An alternative Barley wine was made in the 19th century using Greek techniques [3]. Barley has been boiled in water to create nonalcoholic beverages such roasted Barley tea and Barley water [21]. Caffè d'orzo, or Barley coffee, is a coffee replacement made from roasted Barley in Italy [22]. Barley is an annual cool-season grass that produces grain for human and animal use. It can be cultivated in many different places because of its summer and winter variations. After rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.), and maize (*Zea maize* L.), it is ranked fourth in the world for grain output (Carena, 2009). Barley is mostly utilized in the US to make high-protein drinks like beer (Table 1).

Table 1. Barley grass formulation for tablets.

Quantity of ingredients per pill	Each tablet's quantity
Barley Grass Powder	400–500 mg
MCC (binder)	50–30 mg
Starch (breaks down)	20–30 mg
PVP (binder)	10–20 mg
Magnesium Stearate	2–5 mg

Rich in vitamins, minerals, and antioxidants that may help protect against chronic diseases, reduce inflammation, and support overall vitality, Barley grass is a nutrient-dense functional food with many potential health benefits, including boosting the immune system, improving digestion, and providing energy. Although promising, some potential side effects, such as digestive discomfort, exist, and further research, are needed for specific claims.

FLAXSEED

Scientific Categorization

- *Kingdom:* Plantae.
- Malpighiales is the order.
- Linaceae family.
- Linum is the genus.
- *L. usitatissimum* is the species

In 2022, 75% of the flax produced worldwide came from France. Grown as a food and fiber crop in temperate portions of the world, flax, often known as common flax or linseed, is a flowering plant (*Linum usitatissimum*) in the Linaceae family. On the other hand, the plants known as "flax" in New Zealand are members of the Phormium genus. From the wild species *Linum bienne*, sometimes called pale flax, the plant species appears to have been domesticated just once and is only known as a cultivated plant [23].

Signs and Osteoporosis [15]

Due to the presence of several biologically active compounds and elements, such as linolenic acid, linoleic acid, lignans, cyclic peptides, polysaccharides, alkaloids, cyanogenic glycosides, and cadmium, flaxseed and flaxseed oil, are thought to have potential health benefits [13]. Because of its many applications, it enjoys a favorable status among oilseeds. Because of its exceptionally high levels of phytoestrogens, dietary fiber, high-quality protein, and alpha-linolenic acid (ALA), it has become a compelling nutritious food.

Over the past twenty years, flaxseed has become increasingly popular. The focus of nutritionists and academics studying diet and illness is on the possible health advantages linked to a few of its physiologically active ingredients – ALA, lignan, dietary fiber, and Secoisolariciresinol diglycoside (SDG) [24]. There are detectable amounts of lignans in *L. usitatissimum* roots and flavones [4]. The reason flax is becoming more popular is Due to its ability to lower the incidence of cardiovascular illnesses, Risk of cancer, especially prostate and breast cancer symptoms, laxative effects, anti-inflammatory properties, and gland cancer [25].

Due to consumers' increasing desire for foods with exceptional health advantages, functional foods are currently popular. It is now a desirable part of diets intended for specific health advantages because of their exceptional nutritional profile and potential health benefits.

Linum usitatissimum, often known as flax or linseed, is a flowering plant that belongs to the Linaceae family. In regions of the world with temperate climates, it is grown as a crop for food and fiber [26]. In addition to the flax plant itself, the word "flax" can also refer to its unspun fibers. It appears to have

been domesticated just once cytogenetically from the wild *Linum Bienne*, also called pale flax, and is only known as a farmed plant. However, the plants known as "flax" in New Zealand are actually members of the genus Phormium [3, 4].

Among the several chemical components of flax seed are linamarin, a cyanogen etic glycoside, fixed oil (30–40%), mucilage (6–10%), protein (linin and colinin) at 25%, and a trace amount of the enzyme lipase. Carbohydrates come in four different forms: mucus, cellulose, raffinose, and sucrose. Both linamarin and Phaseolunatin are cyanohydrins of glucose or acetone [27].

Three important classics that include thorough descriptions of more than 700 herbs are the Atharvaveda (c. 1200 BC), Charak Samhita, and Sushrut Samhita (c. 1000–500 BC). Some hints of old wisdom can be found in a scholarly account of Charaka and Sushruta legacy in modern parlance, which is best approached with commentary from the perspective of modern science and medicine. More than 200 herbs, minerals, and lipids for skin care are described in Ayurvedic literature.

The writings of Hippocrates, Qantes, and Dioscorides, as well as medieval books on medicinal herbs in Asia and Europe, all refer to the therapeutic use of linseed. Historians incorporated flax's healing properties into ancient history after Ayurveda. This seed has been consumed by humans from ancient times, according to records [28–30].

There are two types of flax seeds: brown and yellow (golden). Most of these basic kinds have comparable levels of short-chain omega-3 fatty acids and comparable nutritional characteristics. Brown flaxseeds and yellow flaxseeds, known as solin (brand name "Linola"), have comparable oil profiles and are both extremely high in omega-3s, particularly alpha-linolenic acid (ALA).

AN EXPLANATION

L. usitatissimum, the cultivated flax, is like other species in the genus Linum, some of which have blue blossoms, while others have white, yellow, or red flowers [31, 32]. Some of these species are perennials, but *L. usitatissimum* is an annual.

The fruit is a dry, spherical capsule with a diameter of 5 to 9 mm with many glossy brown seeds that are 4 to 7 mm long and resemble apple pips. Depending on the species, the five petals of the 15–25 mm in diameter flowers might be red, blue, yellow, or white.

Flax is an herbaceous annual that grows to an average height of 0.9 to 1.2 meters (3 to 4 feet) when planted densely for fiber. It has slender stalks that are 2.5 to 4 mm (about 0.10 to 0.15 inch) in diameter, with branches concentrated at the top. Plants grown for seeds are shorter and have many branches; the leaves are small and lance-shaped and alternate on the stalk; the flowers are borne on stems that grow from the tips of the branches and have five petals, which are small, dry capsules with five lobes [33].

Although the plant can grow in a wide range of soil types and temperatures, it thrives in temperate climates and well-drained sandy loam. In most places, flax is only planted on the same land once every six years to prevent soil exhaustion. The best fiber is produced during cool, moist growth seasons.

The flax plant (*Linum usitatissimum* L.) produces linseeds. Flax is grown for its oil or fiber, depending on the variety; linseeds are usually derived from flax kinds intended for oil production. Linseeds, which are high in oil and protein, are beneficial to cattle, particularly because they contain omega-3 and polyunsaturated fatty acids [34].

MORPHOLOGY

The flax plant (*Linum usitatissimum* L.) produces linseeds. Flax is grown for its oil or fiber, depending on the variety; linseeds are usually derived from flax kinds intended for oil production. Linseeds, which are high in oil and protein, are beneficial to cattle, particularly because they contain omega-3 and polyunsaturated fatty acids [7–9].

The yield of flax straw and fibers is highest in the yellow maturity stage; individual flax fibers are isolated within the plant but are arranged in bundles that are completely and firmly enclosed by the holding tissue. Flax fibers are found inside the plant as individually separated filaments of varying lengths that vary depending on the height of the leaf on the stem of the plant. Because the plant's roots are made of absorbent tissue, it can store all the water that its tiny rootlets, which extend in all directions and at various depths, collect [35].

Because of their smooth, glossy surfaces, stems may bend in any direction and glide over one another with ease [12, 13, 14]. The testa contains little pits on its surface and is smooth, shiny, and reddish-brown. The seeds measure 4–6 mm in length and 2–3 mm in width. They are oval, flattened, and elongated. The seed has a spherical end and an obliquely pointed end where the hilum and micropyle are situated in a little depression. The embryo is surrounded by the narrow endosperm, which has raphe along one of its borders. It consists of two thicks, flattened, plano-convex cotyledons and a radicle. The seeds taste mucilaginous and greasy, although they do not smell. Flax is an annual, tall herb that branches corymbosly above the main stem. It is self-fertile, hermaphrodite, and pollinated by insects [36].

- *Leaves:* They are linear, lanceolate, and 3.8 cm long [37, 38, 9]. They are greyish green in color and have a smooth margin [16].
- *Flower:* The inflorescence is a loose terminal raceme or cyme that blooms from June to July [2, 12]. It is often blue [20, 21], though it can also be bluish violet or white [20].
- *Fruits:* The fruit can have up to ten seeds and is a capsule made up of five carpels [12].
- *Seeds:* The seeds are small, capsular, oval, lenticular, 4–6 mm long, brown to golden in color, and have a smooth, glossy surface.
- *Use:* Traditionally used as a source of linen fiber, flaxseed oil is used to make paints, varnishes, inks, and linoleum due to its quick polymerization properties [22]. The flaxseed oil retains heat, relieving the affected area [23]. It is also used to make chutney and sprinkle on salads [10].

The most popular usage of flaxseed is as a laxative.

During menopause, flaxseed is also utilized to treat breast pain and hot flashes.

Arthritis is one of the disorders for which flaxseed oil is utilized.

Flaxseed and flaxseed oil have been used to prevent cancer and cure high cholesterol. Its binomial name, *usitatissimum*, contains a particular epithet that meaning "most useful." Flax is cultivated for its seeds, which can be ground into food or processed into linseed oil, which is found in many wood-finishing goods and as a nutritional supplement. Additionally, linen is made from flax fibers. In addition to being naturally straight and smooth, flax fibers extracted from the plant's stem are two to three times stronger than cotton fibers. Both North America and Europe used flax to make rag-based paper until the 19th century [39].

In addition to its various anti-cancer properties, flaxseeds also function as a lubricant, reduce the risk of constipation, and are an exceptional source of fiber. By controlling blood sugar levels, flaxseeds can help to relieve the symptoms of diabetes [40].

According to one study, schoolchildren who took no more than a teaspoon of flax oil daily experienced fewer and milder respiratory tract diseases than those who did not. This suggests that flax oil also boosts immunity.

Omega-3 fatty acids at extremely high concentrations lower LDL (bad) cholesterol levels; flax is beneficial for your heart and circulatory system; fish oils and algae also include essential fatty acids [41–43].

A wise mother should think about incorporating a spoonful of flax oil into her regular diet during pregnancy and nursing because flax contains lipids that are precursors to brain development Table 2. This is especially important during various stages of life when an infant's brain develops the fastest such as during pregnancy and early childhood. Flax is beneficial to your skin.

For my patients with eczema, dry skin, or particularly sensitive skin to the sun, I have used flax oil as a dietary supplement [44–47].

Thermogenesis is the process by which essential fatty acids, especially gamma-linolenic acid, cause specialized fat cells throughout the body (known as brown fat) to go into high gear and burn extra fat. Flax fat has slimming properties. Essential fatty acid-rich lipids, like flax, increase the body's metabolic rate, helping to burn extra, harmful fats. When you eat the right kind of fat, your body has a higher chance of storing the right amount of fat [48–50].

Table 2. Formulation components and their functions in a flaxseed oil-based soft gel capsule.

Components	Function	Amount
Cold-pressed flaxseed oil	The active component (the source of ALA)	500–1000 mg
Vitamin E α-tocopherol	Antioxidant (avoids oxidation)	0.1–0.2%
Gelatin	Capsule shell of the substance	QS
Sorbitol with Glycerin	Plasticizer shell	QS
Purified water Solvent shell Q.S.	Solvent shell	QS
Option: Omega-6/Omega-9 oil	To balance fatty acid ratio	QS

CONCLUSION

Flaxseed is a well-known nutraceutical, and an oilseed crop rich in bioactive components. Fat, proteins, dietary fiber, lignans, vitamins, and minerals are all abundant in it. The nutritional, functional, probiotic, and Phytomedicinal properties of flaxseed are snatching the consideration of sensible consumers and nourishment producers, on a high note. Flaxseed and its inferred items can be utilized for a wide run of techno-functional purposes within the food industry, besides their recently found part within the control of all intestinal microbiome and defense against various maladies. The utilization of flaxseed increases the probiotic microbes within the gut and also produces metabolites that play a vital role in lipid and glucose metabolism and homeostasis pathways. Flaxseed oil contains an expansive sum of polyunsaturated fatty acids, which are prone to rancidity during the subsequent storage and handling stages. Hence, it is essential to find mechanisms Finding ways to reduce their oxidation and increase their shelf life is, therefore, crucial. To increase the bioavailability of flaxseed components in microcapsules or emulsion forms, appropriate emulsifiers must be identified.

Flaxseed oil is wealthy in linoleic and α-linoleic acids; it is critical to follow the metabolic pathways which lead to the change of these fatty acids into fundamental fatty, eicosapentaenoic and docosahexaenoic acids that are required for normal human body development and working. Finally, more in vitro, in vivo, and dietary interventional studies ought to be conducted to assess the efficacy and productivity of flaxseed items on the intestine micro-biome, human health, and protection against different maladies.

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