



A SYSTEMATIC REVIEW ON WHEATGRASS

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Abstract

For centuries, plants have been considered primary health care providers for humans. In this view, we have summarized the nutritional values and pharmacological activities of Wheatgrass-"green blood."Wheatgrass is young grass from the shoots of *Triticum aestivum*. It is available in the form of a tablet, powder, and frozen juice for human and animal consumption. It is an abundant source of enzymes, chlorophyll (70%), proteins, amino acids, vitamins, dietary fiber, and minerals. Wheatgrass is a powerhouse of vitamins and nutrients. It is used in the Ayurveda for numerous ailments. In the early days, there was no evidence available to support the uses of wheatgrass. But in recent years, its pharmacological properties have been proven by experiments conducted on human and animal models.

Index Terms-*Triticum aestivum*, Wheat Grass, vitamins, nutrients, and pharmacological properties.

1. INTRODUCTION

Plants have been considered primary health care providers from ancient times. However, identification and isolation of the active constituents from the plant did not obtained much importance until the 19th century. It is reported that greater than half of the synthetic medicines have been obtained from plant origin, and about sixty-four percent of the global population dully uses plant-based medicine for the therapy of various health conditions. According to WHO, about 80 % of the worldwide population relies on herbal medicine. Around fifteen hundred medicinal herbs have been mentioned in the Indian system of medicine, of which five hundred species are extensively used in the preparation of drugs. Herbs are in sync with nature; consequently, they must be safe¹.

In this view, we have concentrated on wheatgrass. Cereals have been considered an abundant source of nutraceuticals because of their high dietary fiber content. Numerous experiments were conducted to identify whole grains pharmacological, nutraceutical, and physiological effects in human and animal models. Among cereals, wheat is the primary source of dietary proteins and carbohydrates; and its bran is a profusely obtainable byproduct, having 14–19% of the wheat grain².

Wheat germinated over a period of six-ten days is commonly referred to as Wheatgrass. Wheatgrass consumption began in the 1930s in Western countries due to experiments conducted by Charles³. During the process of germination, flavonoids, phenolic compounds, minerals, and vitamins are increased in wheat sprouts⁴.Wheatgrass is called the "Green blood" because of its high chlorophyll content, which has various disease curing abilities³. Its uses range from nutraceutical (dietary supplements, drinks, and food) to the treatment of various diseases⁵.Wheatgrass juice is available in powder, frozen juice, and tablet form (Figure 1). Commercially Wheatgrass is sold in the form of gel, cream, liquid herbal supplement, spray, and massage lotion⁶.



Fig. 1 Wheatgrass juice and powder

Wheatgrass taxonomical classification ⁷.

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Liliopsida
Order:	Poales
Family:	Poaceae(Gramineae)
Subfamily:	Pooideae
Tribe:	Triticeae
Genus:	Triticum
Species:	<i>T. aestivum</i>

2. ECOLOGY

Triticum is the genus of the biennial annual grasses, producing different varieties of wheat; indigenous to the Mediterranean region and southwest Asia. It is meticulously grown along with temperate zones of Europe and North America, chiefly in developing countries. *T. aestivum*, common bread wheat, is widely cultivated almost worldwide. In general, about 15-20 species are reported, of which eight have been documented to be found in India. Wheatgrass juice is a famous drink in the United States, Europe, and other developed countries⁸⁻¹⁰.

3. RELIGIOUS HISTORY AND SYNONYMS

Shoot of *Triticum aestivum* Linn. (Sanskrit name- godhuma and Hindi name gehun, gehun, kanak,) is called as a wheat grass. Wheat flour is used to prepare sweet dish-halwa for offering to god and worship and prepare puri and chapattis^{3,10}.

4. GENERAL DESCRIPTION

The grass appearance is similar to other grass. The aerial stems of the grass are simple, sunken or succinct, depilated, and 1.2 m tall. Leaves are plane, dense, 1.3 cm obvious, and 20-38 cm long. Spikes are dorsal, elongated, aciculate, compact, planate; rachis is resilient, attached to spikelets; bearing 2-5 flowers, marginally overlapping, rampant; glumes rolled over in upper half, rigid, smooth, truncated; lemmas are spiky or spike less, less than 1.3 cm in length. Palea is unified at maturity; its size is as long as a lemma, and caryopsis is free threshing, squishy or firm, white/ red (hexaploid)¹¹.

5. PHYSICAL CHARACTERISTICS

It has a characteristic odor, dark green/bright green colour, and acrid taste¹¹.

6. CULTIVATION

Wheatgrass can be grown quickly indoors and outdoors. A general technique for indoor sprout generation is to grow on a tray by supplying potting mix. When another leaf emerges, leaves are harvested. These can be cut off to allow the second crop of shoots to form, sometimes, a third cutting is possible, but the sugar content is less this time¹².

7. NUTRITIONAL CONTENT

Wheatgrass is an abundant source of vitamin A, B6, K, E, C, pantothenic acid, thiamin, niacin, riboflavin, minerals like selenium, zinc, manganese, copper¹³⁻¹⁴, molybdenum, calcium, iodine, magnesium, potassium, cobalt, sulfur, sodium, protein, chlorophyll¹⁵, bromine, and iron¹⁶. It has enzymes like superoxide dismutase, lipase, amylase, protease, transhydrogenase, and cytochrome oxidase; amino acids such as serine, tryptophan, histidine, proline, lysine, phenylalanine, threonine, tyrosine, aspartic acid, leucine, asparagines, isoleucine, glutamine, methionine, glycine, arginine, valine, alanine; mucopolysaccharides, gluco-protein¹⁰.

8. BIOACTIVE COMPONENTS

It has bioflavonoids like amygdalin, choline, indole compounds, luteolin, quercetin, and apigenin¹⁰. Various phytoconstituents include glycosides, steroids, terpenoids, tannins, flavonoids, alkaloids⁴, α -dihydroxycarotene, alkyl resorcinols, lignin, fatty oil, phospholipids, glycolipids, polysaccharides-glucans, and saponins, arabinoxylan, starch, total dietary fiber, β -glucan¹⁷⁻¹⁹ and phenolic compounds like butylhydroxyanisole, syringic acid, p-hydroxybenzoic acid, abscisic acid, caffeic acid, benzoic acid, ellagic acid, gallic acid, p-fumaric acid, and ferulic acid. Other components include kumarin, amarines, caryophyllene, squalene, and gamma sitosterol are also present in wheatgrass²⁰.

9. TRADITIONAL USES

The plant is mentioned in the Ayurvedic system of medicine for Kapha and Pitta doshas, acidity, and colitis. It is used as an antibacterial, diuretic, laxative, astringent, antioxidant, immune-modulatory, and antidiabetic agent. Traditionally aqueous wheatgrass extract is used as a health tonic in ayurvedic and folk medicine. Talkhira-preparation from *Triticum Aestivum* helpful in treating menstrual disorders. In folk medicine, practitioners used it to treat constipation, chronic skin disorders, rheumatic pain, gout, and cystitis²¹⁻²⁴.

10. IMPORTANCE OF NUTRITIONAL CONTENT OF WHEATGRASS

Vitamin A: It improves the skin's gleam, makes it disease-free, and provides a blaze to the outer skin. It removes black spots from the skin and dark circles around the eyes and improves eye vision. It also prevents throat, nose, and eye disorders. It helps in hair growth, and it gives protection from harmful pollutants. It is necessary for normal growth and development, reproduction, and good vision.

Vitamin B: It improves digestion. It supports in management of anorexia, premature aging, insomnia, depression, and mental and digestive disorders.

Vitamin C: It is a natural source of antibiotics. It is abundant in citrus fruits, like oranges, limes, and lemons. However, the vitamin C content is more in Wheatgrass than in orange. It is a potent antioxidant; it is used to treat the common cold to cancer. It is majorly beneficial in scurvy for healthy teeth, gums, and bones; helpful to heal wounds and sores.

Vitamin E: Its deficiency results in sterility, infections, and muscle degradation and slows the process of wound healing. It is very rich in antioxidants. It is vital during pregnancy for the prevention of abortions, helpful in protecting the heart, to get rid of impotence, and treat dysmenorrheal, cancer, and diabetes.

Vitamin B-complex and vitamin K: These vitamins assist the body to fight against cancer and repair cellular damage in the lungs. Vitamin K is essential for the blood clotting process. B complex vitamins counteract premature aging, anemia, and metabolism of the body.

MSM: It is a sulfur-containing component found in all living organisms but destroyed in processed food. MSM helps to absorb vitamins; increases oxygen content in the body, aids in detoxifying the body, reduces allergies, and reduces inflammation.

Amino acids and Proteins: Proteins are building blocks of the body, essential for physical elegance and muscular strength. Antibodies, hormones, and plasmas are obtained via proteins. Amino acids help to strengthen the heart, digestion, and in blood formation.

Enzymes: These aids in dyspepsia. These improve digestion, prevent premature aging, and build a healthy body.

Minerals:

- **Zinc:** Helpful for healthy hair and beneficial in disorders associated with the prostate gland.
- **Calcium:** It maintains the blood pH; it is essential for strong teeth and bones. It helps to treat diseases like slow movements, coldness, swelling of the body, varicose veins, bleeding, etc. It also regulates the rhythm of the heart.
- **Iron:** It is a vital element of life. Iron deficiency causes anemia. It is an essential mineral in pregnancy and helps to prevent insomnia, lethargy, laziness, pale complexion, and excessive sweating.
- **Magnesium:** It is crucial for proper bowel movement and muscle function. It helps in the detoxification of the body.
- **Sodium:** It regulates the ECF volume and the acid-base balance. It maintains water and electrolyte balance in the body.

- **Potassium:** It is essential in treating depression, malaise, palpitation, dementia, and hypertension. It is considered as the youth mineral. It maintains mineral balance in the body and body weight. It promotes beauty, maintains firm skin, and improves muscle tone.

Other substances and nutrients: These supply nutrition to the tendons. These are helpful in preventing disorders related to the cold, tooth, mental incapacity, dysentery, hydrocele, menstruation, jaundice, and evacuation of bowels²⁵.

11. PHARMACOLOGICAL PROPERTIES

Wheatgrass is effective in managing chronic ailments for which modern systems have lost their hopes²⁶. Wheatgrass is beneficial in treating breast cancer and some other types of cancers¹ and protective against diabetic neuropathy. It helps the body to heal from many ailments²⁷. In breast cancer patients, wheatgrass improves hematological toxicity associated with chemotherapy²⁸⁻²⁹. Its aqueous extract is curative in vascular dementia-induced damage; this is due to protecting mechanism of wheatgrass on the myelin sheath and preventing astrocytic activation¹⁸. It is effective in treating chronic ailments like thyroid, hypertension, constipation, TB, menstrual disorders, foul smell, joint pains, Parkinson's disease, atherosclerosis, acne, pimples, bronchitis, eczema, asthma, flatulence, insomnia, tooth decay, liver ailments, and psoriasis and sterility. Wheatgrass is supportive in dealing with bladder stones and heart problems^{30, 31-34}. It has a healing effect on RBC membrane damage³⁵.

It is also claimed to remove heavy metals from the body, support lactobacilli's growth, reduce high blood pressure, improve digestion, and reduce hair from gray³⁶⁻³⁸. It has antioxidant and antihyperglycemic properties³⁹⁻⁴⁰. It acts as a supportive agent in cancer treatment and boosts immunological responses. It has synergistic benefits in chemotherapy and may ease adverse effects associated with the chemotherapy, and be helpful in oxidative stress, ulcerative colitis, and rheumatoid arthritis⁴¹⁻⁴². It has free radical scavenging activity⁴³. It reduced the blood transfusion demands in Myelodysplastic and Thalassemia major^{22, 44-45}. It is helpful for the management of diabetes mellitus and for curing acute diarrhea^{19, 46}. It exhibits antiobesity activity, with VLDL, LDL, total cholesterol, and triglycerides lowering capacity¹⁷.

It has a wound-healing impact in surgery as it contains syndecan4 and tissue transglutaminase proteins⁴⁷. Wheatgrass has immunostimulatory and protective actions against coccidiosis in broiler chicken². Isoorientin and luteolin are components present in wheatgrass that exhibit an anti-adipogenic effect by inhibiting the activation of the adipogenic transcription factor, SREBP, and activating insig 1 and 2⁴⁸. It has a neuroprotective effect on brain ischemia by inhibiting neutrophil or microglia-related inflammation⁴⁹. It is effective for treating sore throat and tonsillitis⁵⁰ and stimulates metabolism, and restores blood alkalinity³. It helps alleviate anemia by building blood in HIV patients⁵¹. It has antimutagenic, bacteriostatic/ bactericidal and antifungal effects^{19, 52-53}. The components like polysaccharides and arabinoxylans present in wheatgrass have antitussive activity.

The chlorophyll present in the Wheatgrass has anti-aging, antibacterial, immune-modulatory, anti-carcinogenic, and anti-inflammatory properties controls neurodegenerative diseases, and improve microflora of the digestive tract^{3, 54}. The chlorophyll also has the capacity to neutralize strep infections, ease varicose veins, abolish impetigo, treat chronic sinusitis, cure leg ulcers, surmount chronic inner-ear infection and inflammation and other scabby eruptions, and effectively treat uterine cervix inflammation and parasitic vaginal infections, heal rectal sores, beneficial in typhoid fever, and advanced pyorrhea, migraine, gout, gangrene, osteomyelitis, osteoarthritis, fractures, jaundice, hydrocele, common cold, clots, high blood pressure, internal bleeding²⁵. Mainly winter wheat grass is used in ice cream as an anti-freezing protein⁵⁵. It is an adjuvant in anemia and liver ailments⁵⁶ and acts as an internal rejuvenator²⁵. It is one of the components in Salavana upanaha churna used to manage spastic cerebral palsy in children⁵⁷.

12. CONTRAINDICATION

Wheatgrass-containing supplements are contraindicated in nursing mothers, pregnant women, and individuals who are allergic to any component of wheatgrass⁵⁴. It quickly develops tolerability⁴¹.

13. CONCLUSION

Many ayurvedic vaidyas have used Wheatgrass (*Triticum aestivum* L.) for ages. Wheatgrass has been curative in many diseases such as cancer, GI ailments, thalassemia, hepatic disorders, asthma, detoxification, allergy, IB, obesity, diabetes, skin, eye, ear infections, anemia, etc... Wheatgrass is rich in phytoconstituents like alkaloids, flavonoids, phenolic compounds, saponins, terpenoids, tannins, glycosides, steroids, chlorophyll, vitamins, enzymes, and minerals. Bioactive compounds present in wheatgrass have become an interesting and critical subject of research. These are the plant's secondary metabolites. They act as phytochemical regulators or chemical messengers that can arrest the cell cycle. Wheatgrass juice is commonly devoid of harmful substances with a probable allergic reaction exemption. So, it is recommended that daily consumption of 30 ml of wheatgrass juice helps stay healthy. Because of its extensive uses, wheatgrass seems to be a very promising herbal medicine, and yet, so far, very limited research work has been done on the activity of wheatgrass. Still, extensive research is required to explore its biological application in diverse ailments.

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