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WHEATGRASS: A COMPREHENSIVE REVIEW ON ITS THERAPEUTIC POTENTIAL

Atul Mer[1]*, Ms. Krupa Vyas[2], Dr. Pragnesh Patani[3]

[1]*Student, Khyati College of Pharmacy, Palodia, Ahmedabad.
[2]Assistant Professor, Khyati College of Pharmacy, Palodia, Ahmedabad
[3]Principal and Professor, Khyati College of Pharmacy, Palodia, Ahmedabad

***Corresponding Author:** Atul Mer
*Student, Khyati College of Pharmacy, Palodia, Ahmedabad. Email: meratul03@gmail.com

Abstract: Wheatgrass is the young grass of *Triticum aestivum Linn.* Due to its extraordinary medicinal properties, it has become a vital part of traditional medicine, especially in Indian culture. It contains various bioactive compounds, including flavonoids, amino acids, chlorophyll, and essential vitamins and minerals, which makes it a nutritional powerhouse. Mostly it is consumed as juice, powder, tablets, etc. In today's scenario, it has become very popular among people because of its beneficial health benefits. The high composition of nutrients in wheatgrass provides multiple pharmacological and therapeutic qualities, mainly including antioxidant, anti-inflammatory, anti-diabetic, detoxification, and anti-aging effects. Clinical trials have demonstrated its multiple therapeutic capabilities as an antioxidant and anti-inflammatory, especially for chronic inflammation, blood purification, general detoxification, and cleanse of the colon. Moreover, it also promotes skin health and boosts biochemical functions as well. With its numerous health benefits, wheatgrass can be an essential addition to skincare routines, offering a natural solution for healthier, more radiant skin and enhanced overall well-being.

Key Words: Wheatgrass, Chlorophyll, Green Blood, Anti-oxidant, Anti-cancer, Anti-diabetic

1. Introduction: Wheatgrass belongs to the family Poaceae. The scientific name of wheatgrass is *Triticum aestivum* Linn. [1]. A study was carried out on a thousand plants in 2010, of which around 356 plants had clinical trials and gave pharmacological activities and medicinal properties. Among them, wheatgrass has been traditionally used in Indian culture for thousands of years and has phenomenal medicinal properties [2]. Globally, about 15-20 species of wheat variety have been acknowledged, of which 8 are reported in India [3].

The use of wheatgrass is widespread in many countries, primarily in the form of juices or tablets as well as health supplements [4]. The consumption of wheatgrass provides protective effects against various chronic and acute diseases [5]. This is a health booster and more effective compared to other synthetic vitamins or supplements because of its natural origin and absolute nutrient composition [6].

It has become more popular in recent times because of its high nutritional content and potential health advantages in general well-being [7]. It is a rich source of chlorophyll, as well as several essential nutrients, including calcium, iron, magnesium, vitamins, B-complex, selenium, and specific amino acids [8]. Also, it is a substantial source of vital nutrients, including an array of vitamins, minerals, enzymes, and amino acids. that plays critical roles in various biochemical processes, contributing to the overall maintenance of physiological health and cellular function [9]. Several enzymes found in

wheatgrass, such as protease, amylase, lipase, cytochrome oxidase, transhydrogenase, and superoxide dismutase, contribute to its beneficial health effects [10].

The primary clinical utility of wheatgrass juice is attributed to its potent antioxidant properties, largely derived from its high concentration of bioflavonoids, such as apigenin, quercetin, and luteolin. These bioactive compounds play a significant role in neutralizing oxidative stress [11]. Wheatgrass therapy is often recommended for managing various chronic conditions, including asthma, thyroid disorders, skin diseases, atherosclerosis, acne, Parkinson's disease, joint pain, menstrual issues, and constipation. It is also believed to aid in controlling hypertension, diabetes, bronchitis, insomnia, eczema, sterility, obesity, and flatulence [12].

Wheatgrass is rich in chlorophyll, a vital phytopigment known for its antibacterial properties. It is associated with various health benefits, including the enhancement of bloodstream health and overall physiological restoration [13]. Additionally, it plays a crucial role in inhibiting the metabolic activation of carcinogens [14]. Also, it is known to contain a high concentration of bioflavonoids, which contribute to its antimicrobial activity [15].

It is rich in both macro and micronutrients, providing essential vitamins and minerals. Additionally, it contains various enzymes that synergistically contribute to enhanced immune function [16]. This plant is believed to have numerous nutritional values. It has mostly shown anti-inflammatory, antioxidant, and anti-aging properties. It is also purported to reduce hair damage, improve digestion, lower blood pressure by enhancing capillary function, support the growth of lactobacilli, and help in the removal of heavy metals from the body [17].

Application of wheatgrass juice for iron deficiency anemia treatment is one very useful and simple remedy as it raises hemoglobin count in blood. They have immense benefits, such as promoting red blood cell production, acting as a blood builder in thalassemia major, and also being given with other components of the diet for its adjuvant therapy in haemolytic anemia [18]. Recently, the utilization of wheatgrass as a potential antidiabetic agent has gained popularity [19]. Its bioactive compounds provide antioxidant, anti-inflammatory, and immune-boosting benefits that help to reduce symptoms and improve the overall quality of life during cancer treatment [20].

Wheatgrass provides its beneficial effects on reactive oxygen species due to its rich content of antioxidants, including vitamins, flavonoids, phenolic compounds, and chlorophyll [21]. Additionally, the polyphenols present in wheatgrass have been shown to mitigate the effects of reactive oxygen species (ROS), thereby reducing oxidative stress and limiting the risk of developing cancer-related diseases. This antioxidant action supports wheatgrass's potential role in cancer prevention and overall cellular protection [22].

It is recommended that wheatgrass should be consumed probably one hour before a meal. This provides the time to the body so that it can fully metabolize the nutrients in the wheatgrass without any interference from other foods, gives optimal absorption, and increases the effectiveness [23].

2. Wheatgrass in Ayurveda and folk

Wheatgrass in Ayurveda: The wheatgrass plant is used in the Ayurvedic medicinal system for the treatment of various conditions, such as acidity, colitis, kidney dysfunction, inflammatory wounds, and imbalances of *Kapha* and Pitta [24].

It provides a wide range of medicinal properties and therapeutic actions according to traditional medicinal classifications. *Jeevniya,* it boosts immunity; *Britney,* it provides nourishment to the body; *Balya,* it strengthens the body; *Shukrapada,* it promotes reproductive health; and *Pittadahkrit,* it induces the digestive fire that helps in proper digestion [25].

Wheatgrass exhibits potent antioxidant properties and has been widely used in traditional medicine as a health tonic. [26]. In the rural and remote areas, it is widely consumed as juice as traditional folk medicine because of its rich nutrient profile. It is commonly employed to treat conditions such as the common cold, coughs, bronchitis, fevers, throat and mouth infections, oral health, and several inflammations [25].

3. Nutrient Contents

"Green blood" is a term that applies to the wheatgrass due to its high chlorophyll, which accounts for about 70% of all other chemical components [27]. Additionally, it is abundant in essential nutrients, including a wide range of minerals, vitamins, amino acids, proteins, chlorophyll, and enzymes, all of which contribute to its therapeutic value and support overall physiological function [28]. Phytochemical screening of wheatgrass indicates the presence of carbohydrates, phenols, flavonoids, terpenoids, tannins, alkaloids, glucosides, proteins, steroids, saponins, and fixed oils [29].

Young shoots of wheatgrass are freshly juiced or dried into powder for animal and human consumption. Both forms provide chlorophyll, minerals K, Ca, Fe, Mg, Na, and S, vital vitamins such as A, B, C, and E, enzymes, and various amino acids [30].

3.1 Total Chlorophyll

Wheatgrass contains approximately 70% chlorophyll, which is significant for its antimicrobial and detoxifying properties; furthermore, it plays a vital role in strengthening cellular structures, promoting a healthy liver, general detoxification, and chemically neutralizing the environmental pollutants that can cause further complications [24]. The chlorophyll content in wheatgrass has been shown to inhibit the metabolic activation of carcinogens and reduce oxidative DNA damage [25]. It helps in neutralizing toxins present in the body. Furthermore, chlorophyll improves blood sugar control and offers potential health impacts for individuals with higher blood sugar levels [31]. Because of its high chlorophyll content, it can be utilized for general body detoxification and reduce blood pressure [32].

Wheatgrass and other chlorophyll-rich plants are considered safe and effective treatments for a range of conditions, including high blood pressure, preventing cancers, reducing obesity, diabetes, gastritis, ulcers, pancreatic and liver issues, fatigue, anemia, asthma, eczema, haemorrhoids, skin problems, halitosis, and constipation [33]. Additionally, it offers protective effects against a variety of health conditions, including atherosclerosis, osteoporosis, cataracts, neurodegenerative diseases, mutagenesis, and oxidative stress [34].

3.2 Proteins and amino acids

Wheatgrass protein is one of the main components in plant proteins and contains a variety of necessary amino acids such as aspartic acid, alanine, glutamic acid, arginine, and serin [4]. The amino acid composition of wheatgrass contains 17~20 amino acids, a vital component in various biological processes, including all eight essential ones [21]. Proteins are essential for maintaining muscular strength and physical vitality, and they serve as the building blocks for the synthesis of plasma, hormones, and antibodies. Amino acids, the fundamental components of proteins, play a crucial role in digestion and blood formation and contribute to the overall function and strength of the cardiovascular system [35].

3.3 Enzymes

Wheatgrass mainly contains amylase, protease, cytochrome oxidase, lipases, transhydrogenase, and superoxide dismutase [30]. Enzymes are crucial digestive agents that facilitate the breakdown of food, aiding in the management of dyspepsia and enhancing overall digestion. They contribute to the development of a healthy body and may also play a role in mitigating the effects of premature aging [35].

3.4 Minerals

Wheatgrass juice is rich in different minerals such as calcium, potassium, magnesium, alkaline earth metals, potassium, zinc, boron, and molybdenum. It provides significant amounts of important mineral nutrients, such as iron, phosphorus, magnesium, manganese, copper, and zinc, making it a vital source of these micronutrients [25].

Iron is a very important element for various biological functions, primarily because of its role in hemoglobin and RBC production. Iron salts found in wheatgrass are very effective in the metabolic process without any notable adverse effects [31]. Magnesium plays a pivotal role in various

physiological functions, including nerve function, muscle regulation, blood pressure control, and the management of blood sugar levels. Zinc helps in improving cellular growth, immune function, wound healing, and other cellular division [7]. Calcium plays a critical role in building and maintaining strong bones and teeth, regulating heartbeat, and acting as a buffer to maintain blood homeostasis. Potassium is essential for maintaining a balanced mineral equilibrium and body weight. It also contributes to muscle tone, skin firmness, and overall physiological well-being [30].

3.5 Vitamins

Wheatgrass juice is considered a vital source for various important vitamins such as Vitamin A, Vitamin C, and Vitamin E.

Vitamin A found in wheatgrass plays an important role in maintaining healthy skin by improving skin luster and providing a healthy glow, improving the health of the eyes, nose, and throat, and significantly promoting overall cellular function. Additionally, it provides protection against various environmental pollutants that can significantly affect skin and hair health [30]. It also helps in the reduction of black spots and blemishes and improves visual acuity [31].

Vitamin C is an effective antioxidant that plays a significant role in supporting recovery from various conditions of illness, including the common cold, and in preventing diseases such as scurvy [30]. It is essential for the maintenance of healthy gums, teeth, and bones. Additionally, vitamin C is important for overall health and vitality, contributing to the healing of sores and wounds. It also possesses natural antibiotic properties, enhancing the body's defence mechanisms against various infections [31].

Vitamin E is a fat-soluble antioxidant that plays a significant role in dilating capillaries and promoting proper blood circulation. It also contributes to decreasing the diabetic effects, preventing cancer, and reducing cardiovascular disorders. Sufficient amounts of vitamin E are necessary to prevent muscle degeneration and sterility, reduce infection, and promote wound healing [36].

4. Therapeutic Potential

4.1 Wheatgrass and general well-being

The consumption of plants and phytochemicals derived from them has been a longstanding tradition worldwide. A diet rich in nutritious plant-based foods enhances the phototherapeutic properties of these substances, which contribute to protective effects against the onset of various diseases [37].

Wheatgrass is rich in various essential nutrients, including a wide range of minerals, vitamins, amino acids, proteins, carbohydrates, chlorophyll, and enzymes, all of which are beneficial to health [28]. Wheatgrass therapy is recommended for individuals with chronic conditions such as asthma, thyroid disorders, skin diseases, atherosclerosis, acne, Parkinson's disease, joint pain, menstrual disorders, tuberculosis, constipation, hypertension, diabetes, bronchitis, insomnia, eczema, sterility, obesity, and flatulence [12].

The general procedure for administering a wheatgrass juice involves first giving with lukewarm or neem water, further followed by a 20-minute wait. Then, 90 to 120 ml of wheatgrass juice is administered and retained for 15 minutes. This treatment is beneficial for disorders of the colon, including mucous and ulcerative colitis, chronic constipation, and bleeding piles [38].

4.2 Anti-oxidant Potential

Wheatgrass is endowed with a diverse array of phytochemical compounds, including vitamins, terpenoids, phenolics, lignin, tannins, flavonoids, quinones, alkaloids, and various other metabolites. These compounds exhibit significant antioxidant properties [39]. These compounds play an important role in reducing oxidative stress and preventing cellular integrity [7].

Wheatgrass extract has demonstrated significant antioxidant activity by inhibiting oxidative DNA damage and suppressing superoxide radicals. This effect is largely attributed to the presence of redox enzymes, including catalase, which play a crucial role in neutralizing reactive oxygen species (ROS). These antioxidant properties help protect against various diseases in humans by mitigating oxidative stress and its associated cellular damage [4].

4.3 Hepatoprotective and Detoxify

The vitality of the liver is important for the overall well-being of an individual because it is the primary organ responsible for detoxification. The liver's role in filtering toxins and waste products from the blood is significant for maintaining the systemic health and homeostasis [4]. Wheatgrass contains three key compounds, choline, magnesium, and potassium, that play a significant role in maintaining a healthy liver and promoting vitality. Choline helps to prevent the accumulation of fat in the liver, while magnesium helps in the removal of excess fat. Potassium acts as a stimulant and invigorator, supporting overall liver function. Additionally, chlorophyll in wheatgrass plays a significant role in liver purification [2].

4.4 Anti-hyperlipidaemic Property and Cardio Protective Potential

Chlorophyll, present in elevated levels in wheatgrass, has been shown to contribute to the enhancement of cardiac function [38]. Wheatgrass facilitates lower blood pressure by improving capillary function and promoting the growth of lactobacilli. Furthermore, wheatgrass juice promotes vasodilatory effects, expanding blood vessels and facilitating more efficient blood flow [2]. Additionally, it provides a significant amount of potassium, a mineral that is important for regulating fluid and mineral balance within body cells. Potassium helps in maintaining normal blood pressure and supporting various essential physiological functions [30].

Wheatgrass juice also has vasodilatory effects, which involve the expansion of blood vessels. This effect enhances nutrient delivery to endothelial cells and facilitates the effective removal of metabolic waste products, thereby improving overall blood circulation within the veins [23]. Wheatgrass has been shown to contribute to reductions in total cholesterol and triglyceride levels while simultaneously increasing levels of high-density lipoprotein (HDL) cholesterol, commonly referred to as "good" cholesterol. This effect supports improved lipid profiles and cardiovascular health [25].

4.5 Antidiabetic Activity

Diabetes is a metabolic disorder characterized by the decreasing regulation of insulin, resulting in increased blood glucose levels. This condition can arise from a variety of factors, including an imbalanced diet, which disrupts normal glucose metabolism and insulin function [4]. The fiber content in wheatgrass aids in stabilizing glucose metabolism and improving overall glycemic control [30]. Supplementation with wheatgrass powder has demonstrated significant improvements in managing diabetes and lowering blood sugar levels, primarily due to its natural fiber content. The fiber in wheatgrass aids in enhancing glycemic control and regulating blood glucose levels, contributing to its therapeutic efficacy in diabetes management [40].

4.6 Anaemia

Anemia is a condition that can occur due to several reasons, involving complex interactions between nutritional deficiencies, infectious diseases, and other contributing factors [27]. Regular administration of chlorophyll derivatives has been associated with a notable increase in red blood cell count and hemoglobin concentration within a few days. Additionally, chlorophyll enhances the formation of blood cells, particularly in anemic animal models, suggesting its potential as a therapeutic agent in treating anemia [2]. Chlorophyll has been shown to increase the hemoglobin index in the human body, making it a promising therapeutic option for the treatment of anemia [3].

4.7 Anti-Ulcer Activity

Wheatgrass juice provides a notable therapeutic benefit for patients with ulcerative colitis. It is both effective and safe as a primary or adjunctive treatment for active distal ulcerative colitis [12]. The efficacy of wheatgrass juice in the treatment of ulcerative colitis is linked to its high content of bioflavonoids [30]. Studies on the use of chlorophyll in stimulating tissue growth have demonstrated that chlorophyll-based ointments and aqueous solutions are effective in the treatment of skin ulcers [41].

4.8 Healthy Skin

Reactive oxygen species (ROS) and reactive nitrogen species (RNS) are physiological metabolic byproducts. An imbalance between ROS/RNS production and the antioxidant defence system leads to oxidative stress. This condition causes damage to lipids, proteins, and DNA, disrupts cell signalling pathways, and alters cytokine release, which can contribute to the development of various diseases, including skin aging [42].

Chlorophyll has been scientifically demonstrated to inhibit the growth and development of harmful microorganisms. Regular consumption of wheatgrass juice may contribute to the prevention of skin infections [43]. Additionally, wheatgrass is rich in antioxidants, vitamins, and minerals that support skin rejuvenation and repair [25].

Consumption of wheatgrass has been associated with various dermatological benefits. It is also reported to help prevent the formation of dark circles around the eyes [24]. It is an effective skin cleanser, known for treating acne and pimple problems as well as reducing the appearance of acne scars [44]. Wheatgrass has been used in the treatment of various skin lesions, burns, and ulcers, where it acts as a wound healing agent by stimulating granulation tissue formation and epithelialization [45].

4.9 Cancer Prevention

Environmental factors are critical contributors to the multistage process of cancer development. Among these factors, nutritional interventions have been identified as playing a significant role in cancer prevention [2]. Wheatgrass is a rich source of chlorophyll, antioxidants, enzymes, including superoxide dismutase (SOD), and cytochrome oxidase, all of which exhibit significant potential in neutralizing reactive oxygen species (ROS). These compounds facilitate the conversion of ROS into hydrogen peroxide and oxygen, thereby reducing oxidative stress [24].

Additionally, wheatgrass plays a role in inhibiting the metabolic activation of carcinogens, contributing to its potential in cancer prevention [4]. A functional drink containing fucoidan along with other natural substances, such as vegetable juice, mulberry, and wheatgrass, has been shown to effectively prevent the potential development of oral cancer in a dose- and time-dependent manner [46]. Clinical studies on human breast cancer have demonstrated that chlorophyllin, a synthetic derivative of chlorophyll, has potential to prevent the risk of cancer [47]. Additionally, it contains trace elements such as selenium and laetrile, both of which are known for their anticarcinogenic properties [48].

4.10 Blood Developer in Thalassemia

It has been reported that the intake of chlorophyll derivatives increases the RBCs and hemoglobin concentrations [25]. Additionally, it reduces the overall volume of blood transfused, thereby contributing to more efficient management of this condition [2]. Patients undergoing this therapy have demonstrated a notable extension in the interval between blood transfusions, with the duration increasing to approximately 25-30 days. This improvement suggests a potential enhancement in the management of thalassemia through the therapeutic effects of the treatment [35]. Studies have shown that treatment with wheatgrass tablets helps maintain serum ferritin levels and increases HbF levels in thalassaemic children undergoing chronic blood transfusions [49]. Marwaha et al. conducted a pilot study to scientifically evaluate the effects of wheatgrass juice therapy in patients with transfusion-dependent beta-thalassemia. The study observed that consumption of wheatgrass juice had a beneficial impact on transfusion requirements in 50% of the patients [50].

4.11 Oral Health

Wheatgrass, well known for its natural antibiotic and anti-microbial properties, has been identified as effective in combating a range of oral health issues. It can kill various germs and pathogens that are responsible for tooth decay, periodontal disease, gum disease, cold sores, yeast infections, canker sores, and bad breath. This makes wheatgrass a valuable component in the maintenance of oral health and hygiene [40]. Incorporating a small amount of wheatgrass juice into the diet has been shown to

help detoxify the gums and serve as an effective gargle for treating sore throats [24]. Additionally, wheatgrass helps in preventing tooth decay and alleviating toothaches [43].

5. Conclusions: Plant-based foods, including wheatgrass, are widely integrated into Indian diets for their therapeutic benefits. Wheatgrass is recognized for its extensive range of health benefits, including reducing fatigue, improving sleep, regulating blood pressure and blood sugar, supporting weight loss, and enhancing digestive and elimination processes. It also contributes to the health of skin, teeth, eyes, muscles, and joints and supports cardiovascular, respiratory, and reproductive functions. Additionally, wheatgrass has shown promise in managing conditions such as anemia, diabetes, cancer, eczema, constipation, kidney swelling, and the common cold. Wheatgrass juice is generally free from harmful substances, except for potential allergic reactions, and offers a multitude of health benefits. Its inclusion in the daily diet could significantly enhance overall well-being. Given its wide-ranging benefits and growing demand for natural wellness products, wheatgrass holds significant potential for future applications in the health, nutrition, and skincare industries. Its continued research and development could further enhance its integration into modern health practices, making it a valuable component in holistic health management.

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