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REVIEW ARTICLE

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All-encompassing and Skyrocketed Wheatgrass (*Triticum aestivum* Linn.), Nature's Passable Medicine: A Powerhouse of Widespread Nourishment

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ABSTRACT

Wheat grass, shoot of *Triticum aestivum* Linn. (Hindi Name- gehun, kanak, Sanskrit name-godhuma) belonging to family-Gramineae consist of fat, carbohydrate, sugar, protein, vitamins viz. thiamine, riboflavin, niacin, pantothenic acid, folate, choline, Vitamin E, Vitamin K, amino acid, enzymes, minerals such that Ca, K, Zn, Na, Mg, B, Mo and choline, chlorophyll which is most important of the therapeutic activity of wheat grass, and some trace element. The fresh juice prepared from Cotyledons of wheat is rich in chlorophyll (pH 7.4) and extensively used for therapeutic purposes. The various enzymes responsible for

its pharmacological actions are protease, amylase, lipase, cytochrome oxidase, trans hydrogenase and super oxide dismutase. The other notable feature of wheatgrass is its high proportion of amino acids such as aspartic acid, glutamic acid, arginine, alanine and serine. Wheat grass juice gets easily assimilated and quickly absorbed in the blood and is often referred to as Green Blood and is used therapeutically for the treatment of various problems and is recommended to the patients suffering from cancer, ulcer, disease related to joints such as gout, osteoarthritis, thalasemia, eczema, diseases related to digestive system, circulatory system, reproductive system, respiratory system, tooth, gum and migraine. An additional enzyme in wheat grass is P4D1. This enzyme stimulates the renewal of nucleic acid and acts as an anti-inflammatory. In the present review attempt have been made to provide detailed information on the importance of wheatgrass their chemical composition, pharmacological activities emphasizing the multitude potential of wheatgrass.

Keywords: Chlorophyll, SOD, GBT, P4D1, Gluten, Amino acids and Anti-inflammatory.

INTRODUCTION

Wheat grass is obtained from the mature sprouts of wheat seeds (*Triticum aestivum* Linn.) belonging to *Gramineae* family, believed to have many therapeutic values viz. anti-inflammatory, antioxidant, anti-carcinogenic, immune-modulatory, laxative, astringent, diuretic, antibacterial, anti-aging and remarkable healing properties. Its use in acidity, colitis, kidney malfunctions, atherosclerosis and swelling has been shown to be beneficial. The name "green blood" of wheatgrass (Fig 1-6) is attributable to its high chlorophyll content which accounts for 70 % of its total chemical constituents. Wheatgrass is a house of Nutrients, Minerals and Vitamins. It contains a plenty of minerals like calcium, phosphorus, magnesium, alkaline earth metals, potassium, zinc, boron, and molybdenum. It's rich source of Vitamins A, C, E and B complex. As wheat grass juice bears a closer resemblance to the "haemoglobin" in our blood, the juice is often called as "green blood" and the therapy using it is called as GBT "green blood therapy" wheat grass juice is complete food. Wheat grass consists of 16 amino acid in which 8 of which are essential (Bodla and Mujoriya, 2011; Thammana et al., 2016). Although the therapeutic activity of wheat grass has approved for four decades before but it was not use before because of the lack of powerful clinical data to support the therapeutic activity. But few experiments have evaluated the efficacy of wheat grass in the form of powder or juice in the treatment of chronic disease like cancer, rheumatoid arthritis, and ulcer, etc. Coeliac is a condition that is caused by an adverse immune system reaction to gliadin, a gluten protein found in wheat. Upon exposure to gliadin, the enzyme tissue transglutaminase modifies the protein, and the immune system cross-reacts with the bowel tissue, causing an inflammatory reaction. That leads to flattening of the lining of the small intestine, which interferes with the absorption of nutrients. The only effective treatment is a lifelong gluten-free diet (Rana et al., 2011).

Wheat grass juice (Fig. 7-12) is very safe and the chance of the side effects is very low or minimum. It may cause nausea and headache if excessive quantities are taken. Throat swelling may occur in hyper sensitive to individual. 100 g of wheatgrass powder is equal to 23 kg of fresh vegetables. Ideally, wheatgrass should be taken about an hour prior to meal. This allows the body to fully metabolize it without competing with other foods, and it may also curb hunger. Wheat grass consumption throughout the world, especially in western countries, has sky rocketed in the recent years. Wheat grass is high in chlorophyll and minerals. A benefit to wheat grass is that it can easily be found in its "live" form. The

enzyme content of fresh wheat grass is impressive. The benefits of these enzymes directly affect the functions of the intestine and bowel. They aid in the assimilation of food and loosen debris in the lower bowel. Wheat grass contains an antioxidant enzyme, SOD (superoxide dismutase) [Fig 13]. Wheat grass in general is an excellent blood purifier as well as an energy booster. Wheat grass contains glycogen, which is quickly translated into energy (Polshettiwar and Khorate, 2016).



Figure 1 – 6. Wheatgrass and Its products.



Figure 7 – 12. Wheatgrass Juice.

Chemical structures of various phytoconstituents.

<p>1</p>	<p>2</p>	<p>3</p>
<p>4</p>	<p>5</p>	<p>6</p>
<p>7</p>	<p>8</p>	<p>9</p>
<p>10</p>	<p>11</p>	<p>12</p>

Mucopolysaccharides found in the carbohydrate structure of wheat grass, are found to strengthen bodily tissue (heart and arteries) and lower cholesterol. This is especially a benefit to wheat grass is that it can easily be found in its "live" form. The enzyme content of fresh wheat grass is impressive. The benefits of these enzymes directly affect the functions of the intestine and bowel. They aid in the assimilation of food and loosen debris in the lower bowel (Shirude, 2011).

Pharmacokinetics, Phytochemistry and Pharmacology of WGJ

The carbohydrates, protein and lipid in wheatgrass are digested, absorbed, and metabolized by normal physiological process. Wheat grass juice is extracted from the cotyledons of the common wheat plant *Triticum aestivum*. It has been used therapeutically from years all around the world because of its healing properties (Padalia et al., 2010; Roshan et al., 2016; Lam and Brush, 1950).

The juice from wheat grass is high in chlorophyll, active enzymes, vitamins and other important nutrients like Iron.

The chlorophyll (Fig. 15) present in wheat grass and haemoglobin has similar structures except for the central moieties. The compounds in chlorophyll and magnesium depict a striking similarity in having a tetra pyrrole ring structure, the only difference between the two being the nature of the central metal atom Mg in chlorophyll and Fe in haemoglobin (Fig. 16). Also the pH of wheat grass juice is 7.4 which equals same as that of blood. Therefore it is absorbed quickly in the blood and is often referred to as Green Blood (Gahan et al., 1943; Chernomorsky and Segelman, 1988). This juice is extensively used therapeutically for the management of diseases like Anemia, Thalassemia, Inflammatory Bowel diseases, etc. Nutritional deficiency anaemia refers to a decrease in the concentration of haemoglobin in the blood due to poor dietary habits that causes deficiency of iron, proteins, vitamins like vitamin C, vitamin B₁₂ along with folic acid. Deficiency of the above nutrients can affect the production of red blood cells. The major clinical utility of wheat grass juice is due to its antioxidant action which is derived from its high content of bioflavonoid. Other compounds present, which make this grass therapeutically effective is choline. Being highly anti-bacterial, consuming wheatgrass will help to alkalize and detoxify the lymph and blood cells, helping the body to rebuild and transport toxins out of the body quickly and effectively. The analogy between chlorophyll and haemoglobin can be demonstrated with respect to the structure of their porphyrin heads. The structure of both Wheat grass consumption throughout the world, especially in western countries, has skyrocketed in the recent years. Wheat grass is high in chlorophyll and minerals. A benefit to wheat grass is that it can easily be found in its "live" form (Mancinelli et al., 1998; Calzuola et al., 2004; Yang et al., 2001; Peryt et al., 1992; Lai et al., 1978).

Nutritional Value Concerning to Wheatgrass per 100g	
Energy	1368Kcal
Carbohydrate	71.8Kcal
Dietary fiber	12.2g
Fat	1.54g
Protein	12.63g

Wheat grass contains glycogen, which is quickly translated into energy. An additional enzyme in wheat grass is P4D1. This enzyme stimulates the renewal of nucleic acid (RNA/DNA) [Fig 17/18] and acts as an anti-inflammatory. This is especially beneficial for those suffering from arthritis and other inflammatory diseases. The other notable feature of wheat grass is its high proportion of amino acids like arginine, serine, lysine, aspartic acid, glycine, alanine, methionine, leucine, tryptophane, phenylalanine, and valine (Mancinelli et al., 1998; Calzuola et al., 2004; Yang et al., 2001; Peryt et al., 1992; Lai et al., 1978).

Quantity of Amino acids in WGJ µg/ ml	
Aspartic acid	510.3
Threonine	105.8
Serine	201.8
Asparagine	3039.6
Glutamine	200.6
Proline	33.6
Glycine	20.6
Alanine	166.4
Valine	272.1
Methionine	14.0
Isoleucine	145.1
Leucine	101.0
Tyrosine	121.8
Phenylalanine	200.9
Lycine	174.5
Histidine	232.2
Tryptophan	160.1
Arginine	252.9

Quantity of minerals and Vitamins in Wheatgrass per 100ml WGJ	
Minerals	57
K (Potassium)	57
P (Phosphorus)	8.2
Ca (Calcium)	2.4
S (Sulphur)	2,37
Mg (Magnesium)	1.7
Na (Sodium)	1.42
Al (Aluminium)	0.31
Zn (Zinc)	0.02
Cu (Copper)	0.007

Wheatgrass has been shown to have potential anti-inflammatory and anti-aging properties. Wheatgrass is promoted to treat a number of conditions including the common cold, cough, bronchitis, fever, infections, inflamed mouth and throat, and skin disorders like hemorrhoids, psoriasis, ivy, eczema, burns and thalassemia. The extract of wheatgrass has shown significant improvement in rectal bleeding and abdominal pain associated with ulcerative colitis, a type of inflammatory bowel disease. Flavonoids, anti-

inflammatory agents- apigenin (fig. 19) and agropyrene (Fig.20) contained in wheatgrass, play a role in alleviating symptoms. Another flavonoid present in wheatgrass is Indole (Fig.21), which helps in synthesis of enzymes and deactivating carcinogens in the liver. Other benefits of wheatgrass are: removal of toxins from the body, improvement of blood sugar balance, prevention of tooth decay, and maintenance of healthy hair, aiding digestion, and reducing high blood pressure levels. Chlorophyll present in wheatgrass can protect us from carcinogens; it strengthens the cells, detoxifies the liver and blood stream, and chemically neutralizes the polluting elements (Reynolds, 2005; Pannu and Kapoor, 2014; Chauhan, 2014; Rajesh and Ramesh, 2012).

Wheat germ oil is rich in and essential fatty acids. Wheat bran oil is also high in Tocopherols, 68 % of which is Epsilon-Tocopherols. α -Tocopherol (Fig.22), Sitosterol, ergosterol (Fig. 23) and campesterol, phosphatidic acid (Fig.24) and glyceroinositophosphatidic acids, phytoglycolipid, serine, etc., are also reported. Leaf protein isolate contains methionine, tryptophane, histidine, arginine and total lysine. Wheatgrass has the ability to increase the amount of oxygen in the blood, making it a great way to stimulate circulation. Instead of reaching for antacids to relieve heartburn or indigestion, introduce wheatgrass into your daily regimen. Wheatgrass contains several elements that can boost digestion, including a great deal of fiber, and B complex vitamins, which boost the function of the muscles of the digestive system. Thiamine helps convert carbs into energy, and riboflavin keeps the mucosal lining of your digestive tract healthy; wheatgrass contains both. Wheatgrass is effective in treating arthritis (Rimple et al., 2016; Shirude, 2009; Mathur et al., 2017).

Chlorophyll is thought to fight inflammation, which is associated with joint pain and may be the reason wheatgrass is so helpful in these cases. Not only does chlorophyll boost the immune system, it also helps to increase oxygen supply in your body's cells and tissues, contributing to cell regeneration, which heals the body and reduces fatigue symptoms. Wheatgrass improves lipid levels. As wheatgrass supports immunity and reduces inflammation, it can also be an excellent tool for reducing congestion. Some tout the benefits of snorting wheatgrass juice through the nose to clear the sinuses by pulling toxins and breaking up mucus--which we don't recommend. Fortunately, you can just as easily reap these benefits by drinking wheatgrass. Wheatgrass' antibacterial benefits and its ability to reduce chronic inflammation combine to make wheatgrass an excellent tool to reduce acne and occasional breakouts. Wheatgrass's anti-cancer benefits stem from its blood oxygenating ability; cancer thrives in a low-oxygen environment, so wheatgrass may contribute to cancer prevention in this way. Wheatgrass extract proved successful in topically treating acute radiation-induced skin reactions. Wheatgrass was shown to be a powerful anti-hyperglycemic agent. Wheatgrass could be beneficial for those suffering from diabetes or other hyperglycemic issues (Bhikaji et al., 2015; Wigmore, 2011; Meyerowitz, 1999).

Common Aliments Cure

Wheat protein, which comprises up to eight per cent of the grain, has a special benefit as it has eight of the essential amino acids in delicately balanced proportions. A complete internal rejuvenation takes place when Wheat protein is metabolized into health-building amino acids. These amino acids build a resilient muscle that comes back to its original form after stretching and bending, healthy skin and hair and clearer eyesight and nourish the heart and lungs, tendons and ligaments, brain, nervous system and glandular network. The B-complex vitamins, especially thiamine,

riboflavin and niacin offered by natural brown Wheat promote youthful energy and nourishment to the skin and blood vessels. An abundance of minerals in natural brown Wheat helps to nourish the hormonal system, heal wounds and regulate blood pressure. Wheat also offers iron to enrich the bloodstream and phosphorus and potassium to maintain internal water balance along with other nutrients. Wheat, thus helps restore internal harmony. Wheat is valuable in the prevention and cure of pyorrhea. It takes time to eat wheat and as it is generally taken with other foods, it compels the chewing of other foods also. This not only provides the needed exercise for the teeth and gums but also a great aid to digestion. Wheatgrass juice acts as an excellent mouth wash for sore throats and pyorrhea. It also prevents tooth decay and tooth aches. Therefore, it is beneficial to chew wheat grass which draws out toxins from the gums and thus checks bacterial growth (Marwaha et al., 2004; De et al., 2006; Ashok, 2011).

The bran of wheat, which is generally discarded in milling of the flour, is more wholesome and nourishing than the flour itself. It is an excellent laxative. The laxative effects of bran are much superior to those fruits or green vegetables as cellulose of the latter is more easily broken down by bacteria while passing through the intestine. The bran is highly beneficial in the prevention and treatment of constipation due to its concentration of cellulose, which forms a bulk-mass in the intestines and helps easy evacuation due to increased peristalsis. It has been scientifically proved that chlorophyll arrests growth and development of harmful bacteria. Wheat grass therapy can be effectively used for skin diseases and ulcerated wounds as by retarding bacterial action, it promotes cell activity and normal re-growth by drinking wheatgrass juice regularly, an unfavorable environment is created for bacterial growth (Dubey et al., 2012; Ferruzzia and Blakesleeb, 2012; Kakkar et al., 2012). Poultrice of wheatgrass juice can be applied on the infected area, as it is an able sterilizer. Externally, wheat flour is useful as a dusting powder over inflamed surface as in burns, scalds and various itching and burning eruptions, Whole wheat flour, mixed with vinegar, boiled and applied outwardly removes freckles. Wheat grass juice used as an enema helps detoxify the walls of the colon and is very helpful in mucous and ulcerative colitis, chronic constipation and bleeding piles. The chlorophyll content present in wheat enhances heart and lung functions. Capillary activity also increases while toxemia or blood poisoning is reduced. Due to increased Iron content in the blood and hemoglobin, lungs function better. Oxygenation improves and the effect of carbon dioxide is minimized. It is for this reason that wheatgrass juice is prescribed for circulatory disorders (Kapil, 2012; Randle and Wagner, 1939; Kulkarni et al., 2006).

DISCUSSION AND CONCLUSION

A wide range of health benefits have been attributed to wheatgrass. This review concluded that the wheat grass juice (WGJ) has higher degree of curative index and which is useful for various pharmacological activities such as anticancer, antibacterial, antimicrobial, antidibetic, antilukemic, antioxidant, antiulcer etc.

The isolation of properties in wheatgrass is becoming more prevalent. Superoxide dismutase is gaining interest as an antioxidant as is apigenin, both of which are present in wheatgrass. There is evidence to suggest that it is the combination of these properties which make wheatgrass activity potentially useful as a medical treatment. The name "green blood" is because of the structural homology of chlorophyll with

hemoglobin indicates the role of chlorophyll as a blood builder in various clinical conditions involving hemoglobin deficiency.

The chlorophyll present in wheatgrass helps in combating inflammation and eases joint pain, which is linked with curing arthritis. It helps in detoxifying the liver by ridding it of excess toxins such as heavy metals. Wheatgrass contains a compound known as P4D1, which increases fertility levels in the human body. The chlorophyll present in wheatgrass helps increase the red blood cell count and normalizes blood pressure. Wheatgrass is an incredible source of vitamin A, C, phenolic compounds, antioxidants, minerals and most importantly, chlorophyll. It's great for your heart, your brain, skin and your entire body. It is a nutritionally complete source of food which has shown to sustain and promote growth and development. Wheatgrass consists of all essential amino acids, making it a complete protein source. Wheatgrass contains selenium, which facilitates the healthy functioning of the thyroid gland. The chlorophyll present in wheatgrass contains enzymes, amino acid chains and antioxidants which helps in repairing damaged DNA and decomposing the superoxide radicals in the body and slows down the ageing process. This results in a better health overall (Lam and Brush, 1950; Singh and Thalwal, 2013).

1. The antibacterial and antimicrobial property of wheatgrass boosts oral hygiene and reduces the risk of cavities and gum inflammation. Wheatgrass help in keeping common diseases such as flu, cough and cold, and other infections at bay. Wheatgrass is used to treat skin diseases such as eczema, psoriasis, acne, skin wounds by regenerating the skin cells. It also helps in converting carbohydrates into much-needed energy. Wheatgrass is widely believed to be a remedy for dandruff and reverses greying hair. Wheatgrass is proven to be an effective anti-hyperglycaemic agent, which makes it beneficial for those suffering from diabetes. Being chock full of vitamins, minerals and other nutrients, it reduces the craving for other foods to compensate for the intake of such nutrients. By reducing such cravings, it helps in preventing overeating. By clearing out the harmful, toxic substances, the body can focus its energy better on other forms of physical activity and in performing day-to-day activities. By balancing the iron levels in the blood, wheatgrass helps in fighting depression and improve mental health. Wheatgrass has been proven to reduce bowel inflammation and ease movement. By compensating for any lack of vitamins and minerals, it helps in tiding over the menstrual cycle better. In view of the above benefits, it is recommended to consume wheatgrass juice every morning, for a healthy day ahead. It can contribute towards the overall well-being of the people. Health experts vouch for the immense beneficial effects of wheatgrass, but at the same time caution that it should be treated as an addition to our everyday diet, and not as a supplement or replacement. Widespread data from a number of studies has made known the multitude effects of Wheatgrass is known to help diminish fatigue, improve sleep, increase strength, naturally regulate blood pressure and blood sugar, support weight loss, improve digestion and elimination, support healthy skin, teeth, eyes, muscles and joints, improve the function of our heart-lungs and reproductive organs, heal ulcers and skin sores, slow cellular aging, improve mental function, and is beneficial in arthritis and muscle cramping, thalassemia, hemolytic anemia, cancer, asthma, allergy, inflammatory bowel disease and detoxification. Thus, it should be made part of daily dietary intake in order to explore its utmost benefits. The structural homology of chlorophyll with hemoglobin indicates the role of chlorophyll as a blood builder in various clinical conditions involving hemoglobin deficiency - thus the name "green blood". To conclude wheatgrass seems to be very promising herbal drug and extensive research work is

needed in order to explore its therapeutic application in various diseases (Kulka et al., 2006; Lam and Brush, 1950; Singh and Thalwal, 2013; Wakeham, 2013).

Consumption of freshly squeezed wheatgrass juice resembles living food which has bio-electricity. This high vibration vitality is actually the life power inside the living juice. This asset of life-power vitality can conceivably unleash effective recharging vibrations and more prominent availability to one's inward being. These intense supplements can likewise prevent DNA destruction and shield the humans from the continuous impacts of pre-adult maturing and cell breakdown. Late research demonstrates that exclusive living foods and juices can reestablish the electrical charge between the vessels and the cell dividers which supports the resistant framework. Wheatgrass juice is especially high in chlorophyll along with some other constituents. Wheatgrass washes down and manufactures the blood because of its high substance of chlorophyll. Chlorophyll, the life blood of plants is the main result of light and in this manner contains more mending properties than some other component. Drinking wheatgrass juice resembles drinking fluid daylight. Chlorophyll conveys elevated amounts of oxygen (in addition to other things) which is particularly intense in helping the body to reestablish irregularities. The chlorophyll which has more oxygen conveys more oxygen to the blood. Red Blood cells numbers will increase and blood oxygen levels raises rapidly with the drinking of wheatgrass squeezed juice and utilizing wheatgrass juice. Wheatgrass found to break down scars formed in the lungs also serves to remove various drug deposits from the body, filters the blood and organs and counteracts acids and poisons in the body. It builds the compound level in our cells, supporting in the revival of the body and the digestion system of supplements. Researches found that insertion of wheatgrass chlorophyll packs into the sinuses clears the congestion. It also helps to cure chronic sinusitis. Wheatgrass is one of green substances that are esteemed by wellbeing of people as an incredible source of nutritious supplements. Wheatgrass is known as complete nourishment. Researches should focus on this exceptionally encouraging natural medication, endeavors are expected to direct broad studies on the wheat grass both in test models and human subjects to create wheat grass treatment with no side effects in prevention, cure and treatment of many harmful health conditions for which the current medical sciences did not discover any fine solution.

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