Nature Finest Neutraceutical – " Wheat Grass juice" : A Literature review

Author

Priyanka Somkuvar (Assistant professor)

Vaidehi P.Thakare (Student)

Abhishek B. Badge (Student)

Shri Sadguru Datta Institute of Pharmacy,Kuhi.

Abstract

Wheatgrass, a young grass of the wheat plant, has been used for over 5000 years and is widely cultivated worldwide. It is consumed as fresh juice or powdered form, with compositions varying based on production processes and growing conditions. Wheatgrass juice is known for its high antioxidant activity and phenolic content, and has been shown to have anti-cancer, anti-ulcer, anti-inflammatory, antioxidant, anti-arthritic, and blood building properties. Wheatgrass therapy is recommended for patients with chronic diseases, including cancer. Wheat grass, a young grass of the wheat plant, is widely cultivated worldwide and consumed as fresh juice or powdered form. It contains bioactive compounds like flavonoids, proteins, alkaloids, terpenoids, saponins, fibers, vitamins, tannins, phenolic compounds, and active enzymes. Wheatgrass juice is rich in chlorophyll, which has similar actions to hemoglobin in human blood. It has traditionally been used as a health tonic for treating diseases like thalassemia, liver disorder, cancer, anemia, osteoporosis, ulcers, and cardiovascular diseases. Wheatgrass juice also helps build red blood cells, stimulates healthy tissue cell growth, and increases hemoglobin retention.Wheatgrass is gaining popularity due to its potential to combat diseases like cancer, thalassemia, and cardiovascular issues. A study developed a juice from fresh wheatgrass, grown in pots and cut into different heights. The juice was analyzed for minerals and antioxidants. Results showed that the 9-10 inch height yielded the most rich nutrients and antioxidants, making it a valuable addition to community health.

Key Word :- wheatgrass ,Triticumaestivum ,chlorophyl, amino acids ,vitamins ,minerals, enzymes.

History

Wheat Grass Juice (WGJ) is an extract from wheat seeds, dating back over 5000 years to ancient Egypt. In the 1930s, Charles Schnabel discovered that wheatgrass could improve hen health by doubling egg production. Schnabel also produced dried and powdered wheatgrass for his family.

Wheat grass products are consumed in Asia and Europe for healthy body growth. Wheat grass juice is nature's finest medicine, rich in vitamins, aminoacids, liver enzymes, and chlorophyll. It contains 98 earth elements, essential enzymes, and 19 aminoacids. Wheat grass contains complete proteins in simple polypeptides, which the body absorbs more efficiently. Scientists and clinicians are conducting extensive studies to evaluate the efficacy and therapeutic potential of wheat grass in treating chronic diseases.

Introduction

The young grass of the wheat is referred to as Freshly juiced or powdered Triticumaestivum, a common wheat plant, is suitable for eating by both humans and animals. Both provide chlorophyll, amino acids, minerals, vitamins, and enzymes. Wheat grass is a common weed that is incredibly rich in vitamins and nutrients for human health. It contains high levels of active enzymes, vitamins, and other nutrients in the form of fresh juice. While wheat grass's amazing health advantages have long been known in the west, they are only now becoming acknowledged in India. Wheat grass juice contains chlorophyll, which fights inflammation, neutralizes infections, and eliminates parasite infections. The three most important effects of wheat grass on the human body are: blood purification, liver detoxification and colon cleansing. wheatgrass juice is the richest source of vitamins A, B, C, E and K, calcium, potassium, iron, magnesium, sodium, sulphur and 17 forms of amino acids. It provides wheat grass the ability to remove toxins from the body and act as a body detoxifier. wheat grass is considered as powerhouse of nutrients and vitamins for the human body.For consumption by humans and animals, wheat grass, the young grass of the common wheat plant, is either freshly juiced or dried into a powder that contains enzymes, minerals, vitamins, and chlorophyll.Due to experiments, wheatgrass eating started in the Western world in the 1930s. carried out by food scientist Charles F. Schnabel, who experimented with different grain and feed and discovered that hens raised on mixes with a lot of wheat grass had developed better, had a 150% better egg, and were healthier. output compared to other hens. Experiments conducted on more animals produced the same outcomes. Animals clearly healthier than those fed other grains when given wheatgrass.3. WGJ, or wheat grass juice is a squeezed extractFew research have been done in this direction to assess the effectiveness of wheat grass (in juice or powder form) in the treatment of long-term illnesses such as cancer6, rheumatoid arthritis7, ulcer8, etc. Within our organization, the International Institute of Our team at the Indian Institute of Herbal Medicine (IIHM) in Lucknow, India, has created organic wheat grass powder. is being studied clinically for a variety of medical ailments, and positive results have been seen. An attempt has been made to present state-of-the-art research from both scientific and clinical investigations in this review. research on the application of *Triticum aestiv*um *Linn.* for improved health knowledge about this medicinal grass's potential for treatment.

Fig : Wheat grass

Wheat grass juice

Taxonomical detail

Kingdom	Plantae- Plants
Subkingdom	Tracheobionta- Vascular Plants
Superdivision	Spermophyta- Seed Plants
Division	Magnoliophyta- Flowering plants
Class	Liliopsida – Monocotyledons
Subclass	Commelinidae
Order	Cyperales
Family	Poaceae- Grass family
Genus	TriticumL- wheat
Species	T. aestivum

Wheatgrass, a popular alternative medicine, is being researched for its potential as a functional food and preventative dietary supplement for treating minor to serious ailments.

Geographical Source

The levant region of the Near East is where the wheat plant originated. The TriticumAestivum plant is primarily grown in temperate regions with high rainfall, irrigation, warm, humid climates, and chilly climates. It grows virtually exclusively in the Mediterranean region and southwest Asia, where it is endemic worldwide. There are roughly 15–20 species of TriticumAestivum known to exist globally. Only eight wheatgrass species are said to be present in India. The other types of Agropyrontrachycaulam, also known as thin wheatgrass, Elytrigia, Eremopyrum,Pseudoroegneria and Pascopyrum are frequently found in temperate parts of the United Europe and the United States.

Materials:-

Ascorbic acid, aluminium chloride, 2,2′- azobis-3-ethylbenzthiazoline-6-sulfonic acid (ABTS) diammonium salt, β-phycoerythrin, 1,1′-diphenyl-2- picrylhydrazyl (DPPH), ethylene diamine tetra acetic acid (EDTA), ferric chloride, Folin-Ciocalteu reagent, hydrogen peroxide, myoglobin, potassium ferricyanide, potassium phosphate (monobasic and dibasic), sodium carbonate, 1,1,3,3-tetramethoxypropane, 2,4,6-tripyridyls-triazine (TPTZ), 2-thiobarbituric acid and trichloroacetic acid were from Sigma Chemical Co., USA. 2,2′-Azobis (2-amidinopropane) dihydrochloride (AAPH) and Trolox (6-hydroxy 2,5,7,8 tetramethyl chroman 2-carboxylic acid) were from Aldrich Chemical Co., USA. Other chemicals used in the studies were of the highest quality commercially available from local suppliers. The wheatgrass tablets, used in our studies, were purchased from local suppliers in Mumbai and the growth condition of the corresponding wheatgrass is unknown. These tablets constitute 98% of wheatgrass, 1.5% silica and 0.5% vegetable stearates.

Cultivation and Methodology:-

- Wheat grass was cultivated (indoors) in three steps. Soaking (12hrs), Germination (12hrs) and Growth (8-10 days). Proper water was sprinkled daily in the thermocol container in which the wheat grains are kept; 7 inches tall wheat grass was observed

- The cultivated grass was then trimmed and then shade dried for the formulation of wheat grass powder.

- Some of the fresh wheat grass was taken for the preparation of juice. The juice made had to be consumed within 15-20 minutes of preparation.

- Estimation of the proximate components in wheat grass powder and chlorophyll content in fresh wheat grass were estimated by using standard methods.

- Keeping in mind the health of cancer patients, four commonly consumed recipes i.e. Cucumber cooler, Orange blast, Idli and Khaman were standardized and value addition was done by incorporating wheat grass juice and wheat grass powder in 4 variations ranging from10-40 ml and 1-4 g, respectively.

- In cucumber cooler, cucumber juice was substituted by wheat grass juice. In orange blast, apple juice was substituted by wheat grass juice. In Idli and Khaman, semolina was substituted by wheat grass powder.

- 10 semi trained panel members were selected on the basis of sensitivity threshold test and the developed recipes were evaluated by them on a five point rating scales for the attributes like; appearance, colour, taste, after taste and overall acceptability.

Phytochemical constituents

chemical constituents	Observations
Alkaloids	+
Carbohydrates	+
Saponins	+
Gum, Mucilage	+
Protiens	+
Tannins	+
Flavonoids	+
Cardiac glycosides	+

Table 1: list of chemical constituents

Chlorophyll :-Chlorophyll the most important element of wheat grass is contained in the cells called chloroplasts. The chemical formation of wheat grass juice has a striking similarity with the chemical formation of human blood (Chenomorsky , 1988). The only difference is that the central element in **chlorophyll** is **magnesium** and in **haemoglobin it is iron**. Wheat grass is high in oxygen like all green plants that contain chlorophyll. The molecular structure of chlorophyll in wheat grass and haemoglobin in the human body is similar and because of this wheat grass is called "**GREEN BLOOD**" .The pH factor of human blood is 7.4. The pH factor of the wheat grass juice is also 7.4 which may be the reason why WGJ is quickly absorbed in the blood. Chlorophyll present in wheat grass can protect us from carcinogens; it strengthens the cells. It is anti – bacterial and can be used inside and outside the bodies as a healer (Wigmore , 1985). Chlorophyll neutralize toxins in the body and improve blood sugar problems.

Vitamins

Vitamin A: It enhances the skin luster and provides glow to the outer skin and makes it disease free.

Vitamin B: It aids in digestion. It is helpful in the treatment of digestive disorders, mental depression, insomnia, premature aging and anorexia. Vitamin C: It is helpful for recovering from sickness (including the common cold) and preventing disease such as scurvy. It is a vital substance for healthy gums and teeth and maintenance of bones (Hemilia , 1992).

Vitamin E: It dilates the capillaries and enables free flow of blood. It prevents abortion, diabetes, cancer, heart disorders and dysmenorrhoeal etc. This antioxidant and fertility vitamin is also a protector of theheart (Andrew et al., 2000).

Vitamin K and B-complex vitamins: Wheatgrass is also a source of vitamin B-17, also known as amygdaline, which some studies suggest can help ward off cancer. In addition to these vitamins,

wheatgrass contains 17 amino acids and 92 different minerals the human body uses and needs. The nutrients in wheatgrass are also said to assist in fighting cancer and repairing cellular damage of the lungs.

vitamin A	(beta carotene) 0.2 – 0.5%
vitamin B1	(thiamine): 0.05-0.1%
vitamin B2	(riboflavin): 0.05-0.1%
vitamin B3	(niacin): 0.5-1.0%
vitamin B5	(pantothenic acid): 0.2-0.5%
vitamin B6	(pyridoxine): 0.1-0.2%
vitamin B12	(cobalamin): 0.01-0.05%
vitamin C	(ascorbic acid): 0.5-1.5%
vitamin E	(tocopherol): 0.1-0.3%
vitamin K	phylloquinone): 0.05-0.1%

Table 1.1 Vitamins

Proteins And Amino Acids

Proteins are essential for muscular strength and physical elegance. Plasmas, hormones and antibodies are obtained through proteins. Amino acids aid digestion, blood formation and provide potency to the heart.

Amino Acid & Protiens	Amount (μg/ml)
Arginine	1.0-2.5%
Alanine	1.5-3.0%
Cysteine	0.5-1.5%
Glutamic acid	5.0-10.0%
Glycine	1.0-2.5%
Histidine	0.5-1.5%
Isoleucine	1.0-2.5%
Leucine	2.0-4.0%
Aspartic acid	2.5-5.0%
Lysine	1.5-3.5%

Table 1.2 Amino acids

Enzymes

Enzymes are the digestive element helpful for dyspepsia, digestion, building a healthy body and counteract premature aging.

Amylase	0.1-0.5%
Lipase	0.05-0.2%
Protease	0.1-0.5%
Superoxide dismutase (SOD)	0.01-0.05%

Table 1.3 Enzymes

Minerals

Iron: It is helpful in pregnancy, for excessive sweating, pale complexion, laziness, lethargy, and insomnia. Inorganic iron is often constipating, but the iron salts in wheatgrass have no side effects.

Calcium: Calcium is the prime instigator of vital activity. It strengthens the bones, it restores an alkaline environment in the body for the children and vitality for old. It is helpful in the treatment of diseases like haemorrhage, distension of body, slow movements, coldness and varicose veins etc.

Potassium: Helpful for the radiance and luster of youth, hypertension, dementia, palpitation, tiredness, Suicidalinstincts and depression. Potassium, called the youth mineral by some nutritionists, helps to maintain a smooth mineral balance and balanced body weight.

Zinc: Helpful in the prostate gland disorders and nourishes hair.

Sodium: Sodium regulates the extra cellular fluid volume. It also regulates the acid-base equilibrium and maintains proper water balance in the body.

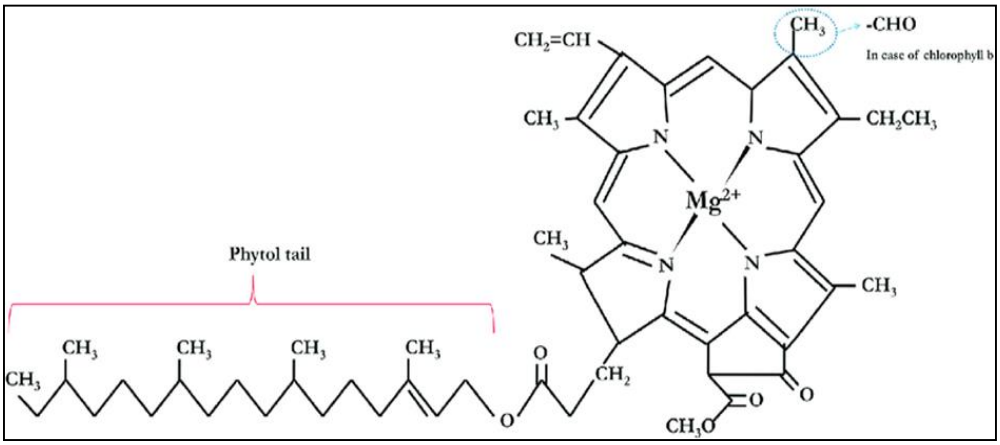
Magnesium: Magnesium is important for good muscle function and for bowel health, as it aids eliminative

Calcium	0.5-1.5%
Copper	0.01-0.05%
Iron	0.05-0.2%
Magnesium	0.2-0.5%
Manganese	0.01-0.05%
Phosphorus	0.5-1.5%
Potassium	1.0-2.5%
Sodium	0.1-0.5%
Zinc	0.01-0.05%

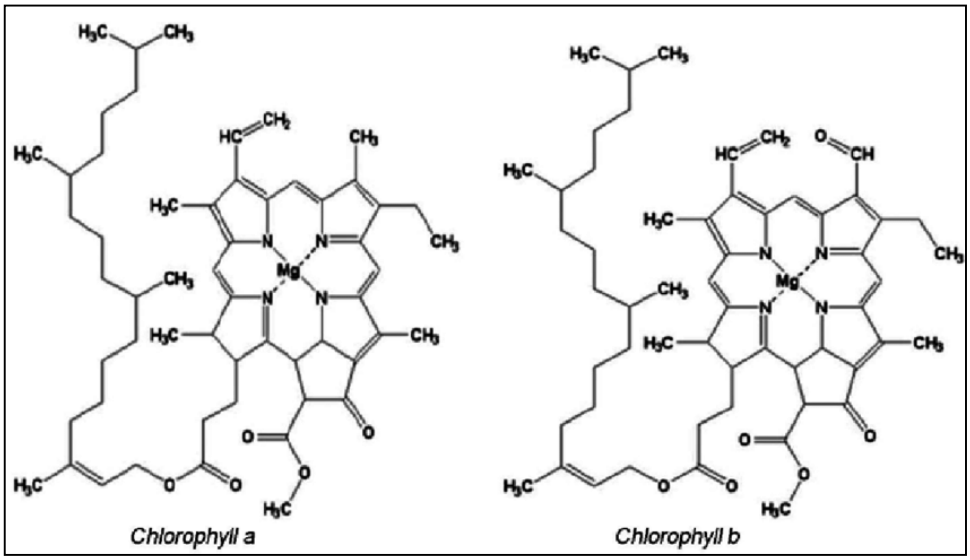
Table 1.4 Minerals

Chemical structures :-

Chlorophyll



Chemical structure of chlorophyll



Chemical structure of chlorophyll a and chlorophyll b

Health benefits of WGJ :-

The various health benefit and pharmacological effects on wheat grass juice are as follows :-

1. Anti- Oxidant Activity

2. Deficiency of haemoglobin

3. Reduces skin Toxicity in X-ray

4. Treatment of Migraine

5. Thalassemia

6. Anti-ulcer Activity

7 . Breast cancer

8 . Reduce Eczema symptoms

9. Myelodysplastic syndrome (Preleukemia)

10. Disease connected with the Reproductive Organs

11. Gout, Acute and Chronic

12. Gangrene

13. Fractures

Mechanism of Action of wheat grass juice

Cancer:-Cancer is a disorder when certain body cells proliferate out of control and invade other bodily areas.

Wheatgrass juice has been studied for its potential pharmacological actions in cancer prevention.The extract of wheat grass when applied to known chemical mutagens, decreased their cancer causing ability by up to 99 percentwhich suggests that wheat grass may have cancer preventing property

Anti-Cancer Properties:

1. Inhibits cancer cell proliferation and induces apoptosis (cell death).

2. Prevents cancer cell migration and invasion.

Health benefits :

Wheatgrass juice has been studied for its potential health benefits in cancer prevention and

treatment. Here are some of the key benefits:

Cancer Prevention:

1. Antioxidant activity: Neutralizes free radicals, reducing oxidative stress and DNA damage.
2. Anti-inflammatory effects: May reduce chronic inflammation, a known cancer risk factor.
3. Immune system support: Enhances immune function, helping to detect and eliminate cancer cells.
4. Anti-angiogenic effects: Inhibits tumor blood vessel formation, slowing cancer growth.

Mechanism:

- Anti-Proliferative Effects:

1. Inhibition of cancer cell growth and division
2. Induction of apoptosis (programmed cell death)
3. Cell cycle arrest

- Antioxidant and Anti-Inflammatory Effects:

1. Neutralization of free radicals
2. Reduction of oxidative stress
3. Inhibition of pro-inflammatory cytokines

Cancer Treatment:

1. Chemotherapy adjunct: May enhance chemotherapy effectiveness and reduce side effects.
2. Radiation protection: Antioxidants in wheatgrass juice may mitigate radiation damage.
3. Tumor growth inhibition: Wheatgrass juice's anti-proliferative and pro-apoptotic effects may slow tumor growth.
4. Improved quality of life: Alleviates symptoms like fatigue, nausea, and vomiting.

Specific Cancer Benefits:

1. Breast Cancer: Reduced chemotherapy-induced side effects, improved hematological parameters.
2. Leukemia: Reduced transfusion requirements, improved platelet count.
3. Lung Cancer: Improved cough and dyspnea, reduced chemotherapy-induced anemia.
4. Colon Cancer: Reduced diarrhea and abdominal pain, improved bowel function.

NOTE :- *There is no scientific evidence that wheat grass prevents or treats cancer. A small study showed that wheat grass juice reduced fever and infection in patients receiving*

chemotherapy, but some patients also had nausea from ingesting wheat grass. Larger studies are needed

Anemia:-Lack of sufficient hemoglobin or healthy red blood cells to supply oxygen to the body's tissues is known as anemia. The molecule called hemoglobin, which is present in red blood cells, transports oxygen from the lungs to every other organ in the body.

Freshly extracted wheatgrass juice might reduce overall disease activity and the severity of rectal bleeding in people with this condition Anemia.

Mechanisms:

1. Erythropoiesis stimulation: Wheatgrass juice's antioxidants and growth factors may stimulate erythropoietin production, enhancing red blood cell production.

2. Iron mobilization: Wheatgrass juice's vitamin C and other compounds may enhance iron absorption and mobilization.

3. Antioxidant activity: Wheatgrass juice's antioxidants (e.g., vitamin C, E, beta-carotene) may reduce oxidative stress, protecting red blood cells from damage.

4. Inflammation reduction: Wheatgrass juice's anti-inflammatory compounds (e.g., flavonoids, phenolic acids) may alleviate chronic inflammation, which contributes to anemia.

Treatment Approaches:

1. Adjuvant therapy: Wheatgrass juice may enhance conventional anemia treatment.

2. Alternative therapy: Wheatgrass juice may be used as a standalone treatment for mild anemia.

3. Supportive care: Wheatgrass juice may alleviate anemia-related symptoms.

Anemia-Specific Treatment Protocols:

1. Iron-deficiency anemia: 1-2 ounces (30-60 mL) wheatgrass juice per day for 3-6 months.

2. Vitamin deficiency anemia: 1-2 teaspoons (5-10 mL) wheatgrass juice per day for 1-3 months.

3. Cancer-related anemia: 1-2 ounces (30-60 mL) wheatgrass juice per day for 3-6 months.

Health Benefits of WGJ in anemia :-

1. Improved hemoglobin levels

2. Increased red blood cell count

3. Reduced transfusion requirements

4. Enhanced quality of life

5. Alleviated fatigue and weakness

Antiulcer activity :- Ben-Arye et al. (2002) found that the use of wheat grass juice as a single or adjuvant treatment of active distal Ulcerative colitis (UC) is very effective and safe in a randomized, double blind, placebo controlled study on WGJ. Young barley leaves' green liquid and its constituent fractions that include water-soluble substances In stressed rats, chemical compounds containing proteins shown anti-ulcer properties. The results of the clinical research indicate that wherever it is wanted to stimulate tissue healing, chlorophyll might be the most effective chemical currently available Research is being conducted to assess WGJ as a potential treatment for ulcerative colitis because it is high in bioflavonoids, which are thought to have antioxidant and anti-inflammatory qualities. Apigenin, one of these bioflavonoids, has been demonstrated to prevent transactivation caused by tumour necrosis factor (TNF).

Chlorophyll ointment and aqueous solution are particularly successful in treating skin ulcers, according to studies on the use of chlorophyll in encouraging tissue growth . Additionally, it has been demonstrated that derivatives of chlorophyll have anti-inflammatory, wound-healing, and odor-reducing properties. diminishing capacities. With its bacteriostatic qualities, chlorophyllin promotes the healing of wounds and creation of erythrocytes and hemoglobin in anemic animals.

Mechanism:

1. Inhibition of NF-κB: Reduces inflammation and oxidative stress.

2. Modulation of COX-2: Reduces inflammation.

3. Inhibition of H. pylori: Anti-bacterial effects against Helicobacter pylori.

4. Enhanced gastric mucosal blood flow: Improves mucosal oxygenation.

What are the side effects?

- Nausea, difficulties in swallowing the juice due to strong grass-like taste.
- Contamination by microbials is possible as wheat grass sprouts are grown for 7–10 days before the leaves are harvested.
- Allergic reaction
- Digestion discomfort

Pharmacokinetics:-

Absorption:

1. Rapid absorption: Wheatgrass juice's bioactive compounds are absorbed within 20-30 minutes.

2. High bioavailability: Chlorophyll, flavonoids, and other compounds are readily absorbed due to their water-soluble nature.

Distribution:

1. Systemic circulation: Wheatgrass juice's bioactive compounds enter the bloodstream, distributing throughout the body.

2. Tissue uptake: Chlorophyll and other compounds accumulate in tissues, including liver, kidney, and bone marrow.

Metabolism:

1. Hepatic metabolism: Chlorophyll is metabolized in the liver, forming water-soluble compounds.

2. Enzymatic degradation: Flavonoids and other polyphenols are broken down by enzymes in the gut and liver.

Excretion:

1. Renal excretion: Water-soluble compounds are excreted in urine.

2. Fecal excretion: Unabsorbed compounds are eliminated in feces.

Pharmacokinetic Parameters:

1. Half-life (t1/2): 2-4 hours (chlorophyll), 4-6 hours (flavonoids)

2. Volume of distribution (Vd): 1.5-2.5 L/kg (chlorophyll)

3. Clearance (Cl): 10-20 mL/min/kg (chlorophyll)

Future Scope:-

Use every four or three hours. keeps up treatment for hyperuricemia. can accelerate the anti-inflammatory impact of hyperuricemics and reduce the duration of an episode. Apply consistently each day to help stop more attacks.

The possible health benefits of wheatgrass juice, including its impact on a number of chronic conditions, have been investigated. Nevertheless, there is no particular information regarding the impact of wheatgrass juice on gout in the context that is given. The articles mostly address additional facets of gout and wheatgrass juice individually. In summary, wheatgrass juice is said to offer a number of health advantages, although the context given lacks details regarding how it affects gout. To determine whether wheatgrass juice has any potential benefits for gout patients, more research is required. Further research into the benefits of wheatgrass juice on uric acid levels and gout symptoms appears to be a viable avenue, based on studies conducted on alternative natural therapies for gout.

Boost your immune system
In patients undergoing chemotherapy, a short research found that wheat grass juice decreased fever and infection; nonetheless, some patients experienced nausea as a result of consuming wheat grass. We need larger research.

lower the amount of serum iron
According to a tiny research, people with myelodysplastic syndrome may benefit from using wheat grass juice as a chelator to lower their iron levels.

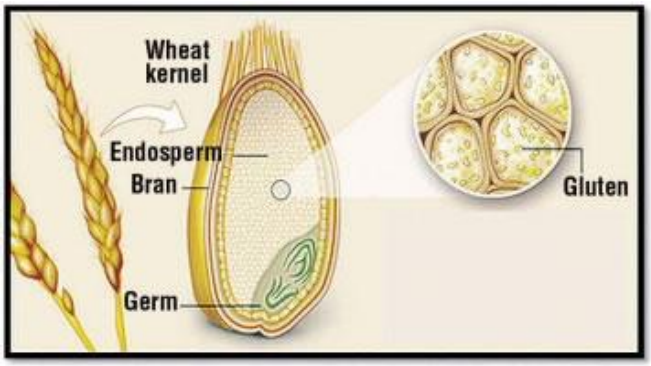
Colitis in ulcerative patients
Wheat grass has been proven in one small research to alleviate the symptoms of chronic colon inflammation.

Gangrene is a dangerous illness that has to be treated right away. Wheatgrass juice can be used as a supplemental therapy under a doctor's supervision, but it shouldn't be used in place of traditional medical care.

Precautions :-

People who are *pregnant or nursing*, *young children*, and people with *weakened immune systems* should probably avoid wheatgrass**.**

Wheatgrass is made from the fresh sprouts of the wheat plant. Even so, they do not contain **"Gluten"**. Gluten is made in the seed kernels of the wheat plant, not in the green parts of the grass.



Conclusion :- To sum up, wheatgrass appears to be a very promising herbal medication, but further study is required to confirm its potential for treating a range of illnesses. A potential allergic response is the only potentially dangerous ingredient in wheatgrass juice. It is known that wheatgrass can reduce weariness, strengthen, enhance sleep, naturally control blood sugar and blood pressure, aid in weight reduction, maintain healthy skin, teeth, eyes, muscles, and joints, enhance digestion and excretion, and enhance the performance of our heart, lungs, and reproductive functions, treat skin wounds and ulcers, delay cellular aging, and enhance mental function and helps with cramping in the muscles and arthritis. It has been demonstrated to be advantageous in a number of ailments include the common cold, eczema, constipation, kidney edema, diabetes, cancer, and anemia. So, Therefore, to maximize its effects, it should be incorporated into regular food consumption.

Refrences

1. ***Ashok SA Phytochemical and Pharmalogical Screening of Wheatgrass Juice (Triticum aestivum L.) International Journal of Pharmaceutical Sciences Review and Research, 2011; 9: 159-164***

2. ***Dubey PK, Bais N, Kakkar A, Netam R, Dubey S, Verma DR Studies on antimicrobial and anthelmintic potential of wheatgrass. Journal of global pharma technology, 2012; 11(4): 08-11***

3. ***Ferruzzia MG, Blakesleeb J Digestion, absorption, and cancer preventative activity of dietary chlorophyll derivatives. Nutrition Research, 2007; 27: 1-12***

4. ***Gomez, Hartman and Dryden "Influence of Wheat Grass Juice Extract on Rats (as research).The Journal of Dairy Science, 1941; 24: 507.***

5. ***Kakkar A, Dubey PK, Dubey S, Khare P, Bias N, Netam R Studies on synergistic antimicrobial potential of aloe-wheatgrass extract combination. Asian Journal of Pharmacy and Life Science, 2012; 2(2).***

6. ***Kapil S (2012) The Elixir Of Life, Wheatgrass Juice. Popular Book Depot.***

7. ***AOAC. (2005) Handbook of analysis and quality control for fruit and vegetable products; Tata McGraw Hill Education PVT.LTD. second edition; eighteenth reprint.***

8. ***Fahey, J.W. Stephenson, K.K. Dinkova-Kostova, A.T. Egner, P.A. Kensler, T.W. and Talalay, P., Chlorophyll, chlorophyllin and related tetrapyrroles are significant inducers of mammalian phase 2 cytoprotective genes, 26: 1247-1255 (2005)***

9. ***Mackowiak, C.L. Amacher, M.C., soil sulfur amendments suppress selenium uptake by alfalfa and western wheatgrass. Journal of Environ Qual. 2; 37(3): 772-9 (2008).***

10. ***Mujoriya Rajesh, Sardar patel & Balaghat, A study on wheat grass and it Nutritional value, (2011).***

11. ***Krygier, K. Sosulski, F. and Hodge, L., Free esterifies, and insoluble bound phenol acids Extraction and purification procedure. Journal Agriculture and Food Chemistry, 30: 330-334 (1982) .***

12. *Kulkarni, S. Tilak, J. Acharya, R. Rajurkar, N. Devasagayam, T. and Reddy, A., 25% more antioxidants in Supershots than fresh wheatgrass juice Evaluation of the antioxidant activity of wheatgrass (Triticum aestivum L.) as a function of growth under different conditions 20: 218-227 (2006)*

13. *S. Premkumari, S. Haripriya. Effect of Supplementation of Wheat Germ, Wheat Bran, Wheat Grass to subjects with Specific Health Issues. UGC Minor Research Project, 2007; 3: 33-439.*

14. *Premkumari, S. Haripriya. Effect of Supplementation of Wheat Germ, Wheat Bran, Wheat Grass to subjects with Specific Health Issues. UGC Minor Research Project, 2007; 33-439, 26-27.*

15. *SteveMeyerowitz. Wheatgrass Nature‟s Finest Medicine. Sproutman. The Cultural Significance of Grass. U S A. Seventh Edition, 9.*

16. *Premkumari, S. Haripriya. Effect of Supplementation of Wheat Germ, Wheat Bran, Wheat Grass to subjects with Specific Health Issues. UGC Minor Research Project, 2007; 3: 33-439.*

17. *Kellner, Jordan, Wilson, et Al. Missouri, 1915. From The Cause and Cure of Famine and Hidden Hunger, By Charles F. Schnabel, 1936.*

18. *Second Annual Report of the Department of Agriculture State of New Hampshire, by Morse, F. W, 1890.*

19. *Hattarki Sanjeevini A, Bogar Chetna; Triticum Aestivum (wheatgrass); a powerhouse plant - A review; Dental Journal of Advance Studies, 2017; 5(1): 26.*

20. *Suriyavathana M, Roopavathi I, Vijayan Vinu; Phytochemical Characterization of Triticum Aestivum (Wheat Grass); Journal of Pharmacognosy and Phytochemistry, 2016; 5(1): 284*

21. *Thakur Nandita, Dhaliwal Singh Harcharan, Sharma Vivek; Chemical Composition, Minerals and Vitamins Analysis of Lyophilized Wheatgrass Juice Powder; International Journal on Emerging Technologies, 2019; 10(4): 137-144.*

22. *Millat Md. Shalahuddin, Amin Mohammad Nurul, Uddin Mohammad Sarowar, Phytochemical Screening and Antimicrobial Potential Analysis of Methanolic Extracts of Ten Days Mature Triticum Aestivum Linn. (Whole Plants), Discovery Phytomedicine, 2019; 6(1): 16-19*

23. *Alzoreky N, Nakahara K. 2001. Antioxidant activity of some edible Yemeni plant leaves by ferrylmyoglobin/ABTS·+ assay. Food Sci Technol Res 7: 141–144*

24. *Aquino R, Morelli S, Lauro MR, Abdo S, Saija A, Tomaino A. 2001. Phenolic constituents and antioxidant activity of an extract of Anthurium versicolor leaves. J Nat Prod 64: 1019– 1023*

25. *Aquino R, Morelli S, Lauro MR, Abdo S, Saija A, Tomaino A. 2001. Phenolic constituents and antioxidant activity of an extract of Anthurium versicolor leaves. J Nat Prod 64: 1019– 1023*

26. *Calzuola I, Valeria M, Gianfranceschi GL. 2004. Synthesis of antioxidants in wheat sprouts. J Agric Food Chem 52: 5201– 5206.*

27. *Chouhan, S.K. and Mogra, R. (2014). Development and quality evaluation of wheatgrass powder. Food Sci. Res. J., 5(1): 26-29.*

28. *Desai, T.R. and Goyal, R.K.(2005). Investigation into the mechanism of action and effects of triticum aestivum (wheat) grass*

29. *Goraghani, H., Heidary, G. and Sardo, M. (2013). Effects of salinity and drought stresses on desert wheatgrass. J. Rangeland Sci., 4 : 14-22*

30. *Jain, B. and Jain, N. (2014). Product development from green food Triticum aestivum. Indian J. Ancient Medicine & Yoga, 7(1) : 24-27.*

31. *Khan, N. and Shrivastava, S. (2005). Nutritive value of wheatgrass powder and effect of its supplementation on hemoglobin status of females. M.Sc. Thesis, Department of Foods and Nutrition G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (India).*

32. *Kumar, N.S., Murali, M., Nair, A.M. and Nair, A.S. (2016). Green blood therapy of wheat grass – Nature's Finest Medicine – A Literature Review, IOSR J. Pharmacy & Biological Sci.., 11 : 57-64.*

33. *Kumari, S., Singhal, A., Singh, R.R., Kumar, S. and Rajendran. N. (2012). Wheatgrass: An alternative household nutritional food security. Internat. Res. Pharmacy, 3(7): 246-250.*

34. *Goraghani, H., Heidary, G. and Sardo, M. (2013). Effects of salinity and drought stresses on desert wheatgrass. J. Rangeland Sci., 4 : 14-22.*

35. *Informa Health Care. http://informahealthcare.com/doi/abs/10.1080/003655202 317316088, 01 Jan, 2014.*

36. *Edwin E, Sheeja E. Color Atlas of Medicinal Plants. Edn 1, New Delhi CBS publisher and distributor; 45, 247, 2006.*

37. *Health benefits of wheatgrass juice. [http://www.knowledgebasecript.com/demo/export.php?ID=970&type=PDF.*

38. *Fahey JW, Stephenson KK, Dinkova-Kostova AT, Egner PA, Kensler TW, Talalay P. Chlorophyll, chlorophyllin and related tetrapyrroles are significant inducers of mammalian phase 2 cytoprotective genes. Carcinogenesis 2005; 26(7):1247-1255.*

39. *Susan PP, Gordon DG, Douglas VF, George HD, Iku-ta T, Witkowska HE et al. A Short-Term Trial of Butyrate to Stimulate Fetal-Globin-Gene Expression in the ί-Globin Disorders. The New England Journal of Medicine 1993; 328:81-86.*

40. *Lee SH, Jew SS,Chang PS, Hong IJ,Hwang ES, Kim KS. Free radical bscavenging effect and antioxidant activities of barley leaves. Food Science and Biotechnology 2003; 12 268-273.*

41. *N.Singh, et al., "Therapeutic Potential of Organic Triticum aestivum Linn.(Wheat Grass) in Prevention and Treatment of Chronic Diseases: An Overview", International Journal of Pharmaceutical Sciences and Drug Research 2012; 4(1) P.No. 10-14.*

42. *Wheatgrass (Online). Available from: URL: http://en.wikipedia.org/wiki/wheatgrass [5]. Meyerowitz S. "Nutrition in grass" Wheat grass Nature‟s Finest Medicine: The complete Guide to using grass foods and juices to revitalize your health 6 th Great Barrington (Massachusetts) Sproutman Publication; 1992.p53 .*

43. *M. Rajesh, B.Ramesh, "A study on wheat grass and its Nutritional value", Food Science and Quality Management, Volume No. 2, 2011, P.No.1-8*

44. *P.Sweti, et.al ., "Multitude potential of Wheat grass juice (Green blood) An Overview", Chronicles of young Scientists, Volume no.2 (2010), P.no.23-28phase 2 cytoprotective genes. Carcinogenesis 2005; 26(7):1247-1255.*

45. *K.Ravi, "wheat grass therapy", Phama Tutor, P.no.1-5.*

46. *Hemila H. Vitamin C and the common cold. British Journal of Nutrition. 1992; 67: 3-16 [11]. Andrew F, Sarah L, Weiss S, Britton J. Dietary vitamin E, IgE concentrations, and atopy. The Lancet, 2000; 9241(356): 1573-1574.*

47. *Chernomorsky S, Segelman A. Review Article: Biological activities of chlorophyll derivatives. 1988; 85(8):669-673.*

48. *Wigmore A. The wheatgrass Book, New York Avery Publishing Group, 1985.*
49. *Sean M. Wheatgrass, healthy for the body and the bank account. Australia‟s National Rural Affairs Weekly- Landline. 13- 10-2002, Retrieved 2006-1006.*
50. *Falcioni G, Fedeli D, Tiano L, Calzuola I, Mancinalli L, Gianfranceschi G. Antioxidant activity of wheat sprouts extract in vitro: Inhibition of DNA oxidative damage. Journal of Food Science 2002; 67(8):2918-2922.*