



Triticum Aestivum: A Review on Pharmacological Potential and Phytochemical Study

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Abstract

Triticum aestivum, the young grass of the common wheat plant known as Wheatgrass. Its Component includes chlorophyll and flavonoids in good amount. Wheatgrass is called the Green Blood. Chlorophyll is the green pigment of the plant that resembles the structure of the hemoglobin of the red blood cells. Dr. Hans Fischer, a German chemist and a group of associates won a Nobel Prize for this discovery. Like the human blood, chlorophyll carries energy, nutrients and oxygen to the different parts of the plants. It is the blood of the plant.

Chlorophyll in the human body also delivers nutrition and oxygen to the blood and more so, studies have shown that it can stimulate production of healthy red blood cells and prevents anemia and different blood disorders. Wheatgrass demonstrated benefits in cancer prevention and as an adjunct to cancer treatment, as well as benefits to immunological activity and oxidative stress. In clinical trials it has been observed that wheatgrass may induce coadjuvant benefits to chemotherapy and may reduce chemotherapy-related side effects, in addition to aid ulcerative colitis, rheumatoid, hematological diseases, diabetes, obesity, oxidative stress and arthritis,. These trials are not effective and a number of methodological problems emerge. No conflicting circumstance of wheatgrass have been reported, although some forms pose problems of adequacy. The popularity of wheatgrass sustain to grow. Before clinical recommendations for the public the asset seen in the clinical trials need to be proved in larger studies.

Key-words: *Triticum aestivum*, Wheatgrass, chlorophyll, flavonoids, green blood, cancer, immunological, chemotherapy, rheumatoid arthritis, hematological diseases, diabetes, obesity, and oxidative stress

- 1. Introduction:** The world's largest edible grain cereal-grass crop is wheat (*Triticum* species) of the *Gramineae* (*Poaceae*) family. The wheat plant is a perennial grass. A food crop for mankind has been a Wheat from the beginning of agriculture. Scientists have known that at young stage the cereal plant is richer in the levels of vitamins, minerals and proteins as compared to seed kernel, or grain products of the mature cereal plant. A factory of enzyme and actively growth stage of plant is germinated young stage. In the young stage they store large amounts of vitamins and proteins. The nutritional level in the leaves drops

and the fiber content increases rapidly in jointing stage. *Triticum aestivum*, *Triticum durum* and *Triticum dicoccum* are the three important species of Triticum.



Fig. 1: Wheatgrass (*Triticum Aestivum*)

Herbal medicines are an essential and growing part of the international pharmacopeia. Knowledge of their medicinal properties is growing as a result of research and testing, which will make them an increasingly safe alternative or a preferred option to allopathic medicine. Today, there is a renewed interest in traditional medicine and an increasing demand for more drugs from plant sources. This revival of interest in plant-derived drugs is mainly due to the current widespread belief that “green medicine” is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects. Wheatgrass is a food prepared from the cotyledons of the common wheat plant. Wheatgrass differs from wheat malt in that it is served freeze-dried or fresh, while wheat malt is convectively dried. Wheatgrass has been traditionally used, since ancient times, to treat various diseases and disorders. Presently it is often available in juice bars, and some consumers grow and juice wheatgrass in their homes. It is available as fresh produce, tablets, frozen juice and powder. Wheatgrass contains no wheat gluten. Gluten is known to cause adverse health issues ranging from bloating, gas, diarrhea and vomiting to migraine headaches and joint pain in those who suffer from gluten sensitivity and wheat allergy. In this way wheatgrass is having advantage for those who suffer from gluten allergy [1,2]. The use of wheatgrass, and particularly its fresh juice became popular again in the 1970s, when Anne Wigmore wrote ‘*The Wheatgrass Book*’ and it became somewhat of a gospel amongst health supplement fanatics. The book itself is an homage to the applications of wheatgrass.

“Wheatgrass Therapy was supported by 'Dr. Anne Wigmore, Founder director of the Hippocrates Health Institute, Boston, USA. According to Dr. Wigmore, chlorophyll present in wheatgrass act as body cleanser, builder and neutralizer of toxins. A study suggested that Anne Wigmore was also a strong advocate for the consumption of wheatgrass as a part of a Raw Food Diet and professed that wheatgrass, as a part of a raw food diet, would cleanse the body of toxins while providing a proper balance of nutrients as a whole food[3]. She also taught that wheatgrass could be used to treat those with serious disease. Dr.

Wigmore assert that wheatgrass is a safe and effective treatment for ailments such as high blood pressure, some cancers, obesity, diabetes, gastritis, ulcers, anemia, asthma and eczema.

Kingdom	Plantae (Plants)
Subkingdom	Tracheobionta (Vascular plants)
Superdivision	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Liliopsida – Monocotyledons
Subclass	Commelinidae
Order	Cyperales
Family	Poaceae – Grass family
Genus	Triticum L. – wheat
Species	<i>Triticum aestivum</i>

Table1. Taxonomical details of Wheatgrass:[4]

2. Nutritional Content:

Scientific studies on nutritional analysis of wheatgrass and the chemical analyses undertaken reveal that wheatgrass is rich in chlorophyll, potassium, and a very good source of dietary fiber. It has antioxidants like β -carotene (provitamin A), vitamin C (Ascorbic Acid), Vitamin E (α -Tocopherol), Vitamin K, Thiamin, Riboflavin, Niacin, Vitamin B₆, Pantothenic Acid, minerals like Iron, Zinc, Copper, Manganese and Selenium, zinc, chromium, and anti-anemic factors like vitamin B₁₂, iron, folic acid, pyridoxine and many other minerals, amino acids and enzymes, which have medicinal values and are beneficial for health. The USDA National Nutrient Database reports that wheatgrass contains no vitamin B₁₂. Because vitamin B₁₂ is not made by plants, any of this vitamin would have to be produced by bacteria found in the preparation [5].

Main Ingredients		Content %	
Carbohydrates	23.5	Fat	3.7
Moisture	0	Protein	46.7
		Ash (Minerals)	26.1
Mineral & trace minerals mgs/gm			
Boron	.0055	Calcium	4.9
Chloride	.49	Chromium	.0012
Cobalt	<0.0005	Copper	.027
Fluoride	.0065	Germanium	<.011
Iodine	<0.0005	Iron	.051
Magnesium	4.4	Manganese	.026
Molybdenum	<0.0005	Nickel	<0.0005
Phosphorous	29	Potassium	2.8
Selenium	<0.0005	Sodium	.11
Silicon	.16	Titanium	<0.0005
Tin	<0.0005	Zinc	.066
Vanadium	<0.0005		
Vitamins mg/g			
Biotin	.00011	Choline	.0011
Cyanocobalamin (B12)	.00001	Folic Acid	.0012
Inositol	<0.011	Niacin (B3)	.09
Panotothenic Acid	.0196	Pyridoxine HCL B6	.0065
Riboflavin	.0031	Thiamin (B1)	.0098
Vitamin A (Retinol)	501 IU/Gm	Vitamin C	.185
Vitamin D	<0.1 IU/Gm	Vitamin E	.02 IU/Gm
Others mg/g			
Cholesterol	<0.01	Chlorophyll	1.2
		Sugars	48
Essential Amino Acids mg/g			
Isoleucine	15.8	Leucine	31.5
Lysine	22.6	Methionine	3.5
Phenylalanine	19.8	Proline	17.1
Threonine	14.8	Valine	22.1
Non-Essential Amino Acids mg/g			
Alanine	24.8	Arginine	22.1
Aspartic Acid	46.9	Glutamine	77.4
Glycine	20.4	Histidine	7.4
Serine	15.9	Tyrosine	6.9

Source – EPA, USDA

Table 2. Major Ingredients of Sweet Wheat Grass Powder

	Wt.	Protein	Fiber	Calcium	Vit. A	Iron	Selenium	Magnesium	Potassium
Vegetable	gr.	gr.	gr.	mg.	IU	mg.	mcg.	Mg.	mg.
Dehydrated Wheatgrass	100	25	17	515	66,080	57.1	99.7	197.5	1,425
Beets (raw)	100	1.7	0.8	17	22	0.7	-	23.3	339
Bib Lettuce (raw)	100	1.3	0.5	35	964	2.1	-	9	264
Broccoli (raw)	100	3.6	1.5	103	2,500	1.1	-	24	380
Cabbage (raw)	100	0.9	0.8	34	90	0.3	1.5	13	163
Cauliflower	100	2.7	1	25	60	1.1	0.7	24	295
Celery, raw	100	0.9	0.6	39	266	0.3	-	21.6	39
Collards (raw)	100	3.6	0.9	401	6,500	1	-	57	401
Corn (cooked)	100	3.2	0.7	163	396	3	-	20	163
Cucumber (raw)	100	0.9	0.6	25	245	1.1	0.1	11.2	158
Eggplant (raw)	100	1.2	0.9	12	10	0.7	-	16	214
Green Pepper (raw)	100	1.3	1.4	9	425	0.8	0.6	18	213
Kale (raw)	100	4.2	1.3	179	8,900	0.5	-	37	318
Mushrooms (raw)	100	2.7	0.8	6	5	0.8	12	10.8	406
Okra (raw)	100	2.4	1	249	520	0.6	-	41	-
Onions (raw)	100	1.5	0.6	27	41	0.5	1.5	11.8	155
Peas (raw)	100	6.3	2	26	632	1.9	-	34.5	311
Potato (raw)	100	2.2	0.8	7	5	0.6	-	-	409
Radish (raw)	100	1	0.7	28	5	1	4.2	14	290
Spinach (raw)	100	3.5	0.6	97	8,109	3.2	-	80	471
Sweet Potato (baked)	100	1.6	1.2	31	3,400	0.7	-	-	233
Tomato (raw)	100	1.1	0.5	10	905	0.6	0.5	14.1	245
Turnips (raw)	100	1	0.8	38	5	0.5	0.6	18.8	261

Source: *Nutrition Almanac* and Published scientific papers on cereal grass [6]

Table 3. Comparative Nutritional contents in other vegetables

3. Health Benefits:

Wheat grass is believed to have many unexplained natural healing qualities. Many of the phytonutrients contained in cereal grasses have yet to be identified and it is not completely known how they provide such great benefits to our health. Wheat Grass is one of the most alkaline green leafy vegetables known and part of the cereal grass family, which includes barley grass, oat grass and rye grass. Wheat grass is a potent, convenient and affordable way to get your daily quota of 5 to 9 servings of fruits and vegetables. Each serving wheat grass is packed full of vitamins, minerals, enzymes, amino acids, phytonutrients and carotenoids to promote optimal health. Proponents of wheatgrass make many claims for its health properties, ranging from promotion of general well-being to cancer prevention. However, according to the American Cancer Society, "available scientific evidence does not support the idea that wheatgrass or the wheatgrass diet can cure or prevent disease". Some of earlier studies showed some evidence that wheatgrass might help with the symptoms of ulcerative colitis and the side-effects of breast cancer chemotherapy.

3a. Modern Medicines from Medicinal Plants:

Natural products play an important role in the field of new drugs research and development, but it was not until the 19th century that man began to isolate the active principles of medicinal plants and the landmark discovery of quinine from Cinchona bark was made by the French scientists Caventou and Pelletier.

Prior to World War II, A series of natural products were isolated from higher plants became clinical agents and a number of them are still in use today [7].

S. No.	Name of the plants	Drugs	Clinical application
1.	<i>Rauwolfia serpentina</i>	Serpentine	Hypertension and lowering of blood pressure
2.	<i>Catharanthus roseus</i>	Vinblastine	Hodgkins, choriocarcinoma, non – hodgkias, Leukemia in children, testicular and neck cancer
3.	<i>Phodophyllum emodi</i>	Phophyllotoxin	Testicular, small cell lung cancer and lymphomas
4.	<i>Papaver somniferum</i>	Codeine, Morphin	Headaches, arthritis and sleep
5.	<i>Ephedra sinica</i>	Ephedrine	Respiratory ailments
6.	<i>Cinchona spp</i>	Quinine	Fevers
7.	<i>Cephaelis spp</i>	Emetine	To induce vomiting and cure dysentery
8.	<i>Digitalis leaves</i>	Digoxin	Heart therapy

Table 4. Plant derived drugs and their clinical applications

The major source of drugs were Natural products from centuries, and about 50% of the pharmaceuticals in use today are derived from natural products. Quinine, theophylline, penicillin G, morphine, paclitaxel, digoxin, vincristine, doxorubicin, cyclosporine, and vitamin A all share two important characteristics: they are cornerstones of modern pharmaceutical care, and they are all natural products [8].

Most of the major anticancer drugs are derived from plants or microorganisms. Important examples include bleomycin, doxorubicin, daunorubicin, vincristine, vinblastine, mitomycin, streptozocin, and most recently, paclitaxel, ironotecan.

3b. The Medicinal Properties and Value of *Triticum aestivum* (Wheatgrass Juice):

The extract known as wheatgrass derived from the plant *Triticum aestivum L.* The use of wheatgrass has a long history and is widely used as a health food supplement. The themes reviewed highlight the far reaching branches of study and application surrounding this broad subject. At first inspection the majority of information available is in the form of anecdotal literature, usually published by a company selling a wheatgrass product. This has been largely bypassed as it does not present validated scientific literature, which is at the centre of developments regarding wheatgrass and medicine. Wheatgrass juice (WGJ) is the pressed young shoots of the plant *Triticum aestivum*, a member of the Phocaea family. Wheatgrass juice is a rich source of Vitamins A, C, E and B complex, including B₁₂. It contains a

multitude of minerals like calcium, phosphorus, magnesium, alkaline earth metals, potassium, zinc, boron, and molybdenum. The various enzymes responsible for its pharmacological actions are protease, amylase, lipase, cytochrome oxidase, transhydrogenase and super oxide dismutase (SOD). The other notable feature of wheatgrass is its high proportion of amino acids such as aspartic acid, glutamic acid, arginine, alanine and serine. It also has a high content of bioflavonoids like apigenin, quercetin and luteolin. All of these enzymes contribute to its antioxidant activity. Due to high chlorophyll content as 70% of its total chemical constituents the name of wheatgrass is attributed “green blood”[9]. Wheatgrass juice is a rich source of Vitamins A, C, E and B complex. It contains a plethora of minerals like calcium, phosphorus, magnesium, alkaline earth metals, potassium, zinc, boron, and molybdenum [10]. The various enzymes responsible for its pharmacological actions are protease, amylase, lipase, cytochrome oxidase, transhydrogenase, super oxide dismutase (SOD). The other notable feature of wheatgrass is its high proportion of amino acids such as aspartic acid, glutamic acid, arginine, alanine and serine. The major clinical utility of wheatgrass juice is due to its antioxidant action which is derived from its high content of bioflavonoids like apigenin, quercetin and luteolin[11,12]. Other compounds present, which make this grass therapeutically effective, are the indole compounds, choline and laetrile (amygdalin).

4. Chlorophyll as green blood:

Porphyrin heads of the structure of chlorophyll and hemoglobin demonstrated analogy between them [1,11]. (Figure 2, 3) The structure of both the compounds chlorophyll and hemoglobin illustrates a similarity in having a tetra pyrrole ring structure, the only difference between the two being the nature of the central metal atom – magnesium (Mg) in chlorophyll and iron (Fe) in hemoglobin. The therapeutic effects shown by chlorophyll in conditions involving deficiency of hemoglobin.

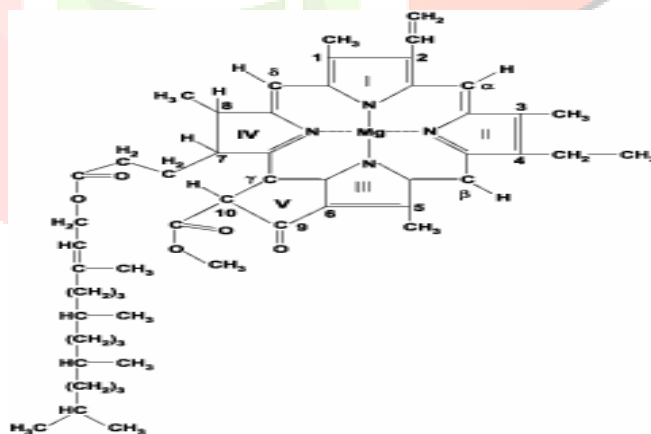


Fig. 2: Structure of Chlorophyll Molecule

Hemoglobin and its congeners are protein bodies which act as the oxygen carrier in higher animals by binding two electrons attached to the oxygen molecule, whereas chlorophyll is the active metabolic agent in plants which assimilates carbon from the carbon dioxide of the atmosphere by producing two electrons which are then transmitted through electron transport chain. The structural similarity between the two compounds is stipulated to be the reason behind the limited use of chlorophyll as a blood substitute in conditions like chronic anemia, tissue hypoxia, thalassemia and other hemolytic disorders etc.

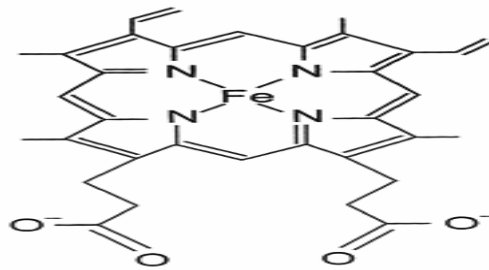


Fig. 3: Structure of Tetra Pyrrole Head of Hemoglobin

Wheatgrass consist of chlorophyll and flavonoids in good amount. The green pigment Chlorophyll of wheatgrass resembles the structure of the hemoglobin of the red blood cells it is called the Green Blood. Similar to the human blood, chlorophyll carries energy, nutrients and oxygen to the different parts of the plants. It is the blood of the plant

Interestingly, chlorophyll in the human body also delivers nutrition and oxygen to the blood and more so, studies have shown that it can stimulate production of healthy red blood cells and prevents anemia and different blood disorders.

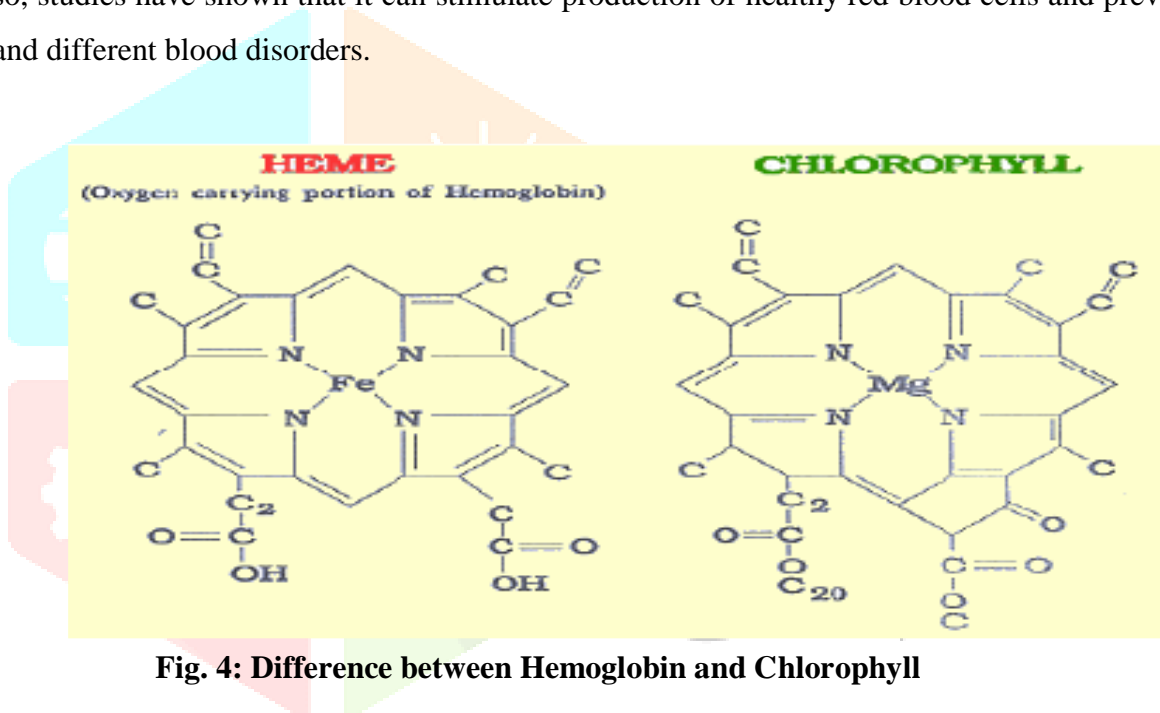


Fig. 4: Difference between Hemoglobin and Chlorophyll

Nutrients	per 100gm	Minerals	per 100gm	Vitamins	per 100gm
Proteins	36.29 g	Sodium (Na)	82.50 mg	Vitamin A	12.59 mg
Carbohydrates	49.23 g	Potassium(K)	2954.2 mg	Vitamin B ₁₂	1.08 µg
Calories	340.57 (Kcal)	Iron (Fe)	234.51 mg	Vitamin C	185.62 mg
Fat	1.25 g	Zinc (Zn)	1653 mg	Vitamin E	9.245 g
Fiber	9.15 g	Phosphorous (P)	410.25 mg	Vitamin B ₁₇	2.62 µg
Chlorophyll	6.15 g	Calcium (Ca)	436.25 mg	Folic Acid	21.95 µg

Table 5 Constituents of Wheatgrass powder [12, 13]

4a. Curative and Prophylactic Elements- Chlorophyll:

The wheat grass juice is a major source of the curative, prophylactic and alkaline elements,. It also addendum carbohydrates, proteins and fat. It has been observed that the frosted substances found in it are considered to be an effective element and the only restorative for curing cancer. The green pigment chlorophyll is most important element of the wheat grass is contained in the cells called chloroplasts. Chloroplasts produce nutritious elements with the help of sunshine and chlorophyll. Dr. Brusher calls it as “Concentrated Solar Energy.’ Due to structural similarity of chlorophyll with hemoglobin, the chemical formation of the wheat grass juice and human blood is also same. The quick absorption of wheatgrass juice by blood is due to similarity of pH factor of the human blood with wheat grass juice that is 7.4[14].

Hemoglobin present in human blood obstructs their regeneration or reproduction. The physicians successfully tried this therapy on a number of diseases such as T.B., heart diseases skin diseases, brain hemorrhage, varicose veins, ulcer, and inflammation of the intestine, arteriosclerosis and osteomyelitis and have found it quite effective.

Internal Rejuvenation: Wheat protein, 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.

5. Diseases and Their Treatment:

Wheat grass therapy is endorsed for treatment of chronic diseases like Asthma, Atherosclerosis, Parkinson's disease, Joint pains, TB, Constipation, Hypertension, Diabetes, Bronchitis, Insomnia, Eczema, Sterility, Hemorrhage, Obesity and Flatulence[8]. It is also benefitted in the treatment of cancer. Wheat grass can be directly taken by chewing or in the form of juice. For better results it can be taken in the form of juice. This is the last alternative when all other therapies fail to cure.

5a Diseases related to Blood and the Circulatory System:

Blood and the Circulatory System related diseases are anemia, high blood pressure, atherosclerosis, internal hemorrhage, clotting and the like. In the cases of anemia regular intake of the wheat grass juice works wonders no other therapy has such quick cure [13].

Deficiency of Hemoglobin -Wheat grass juice is termed as a substitute for natural red blood cells. The wheat Grass possesses all the compositions that Hemoglobin possesses. It is also known as “Green Blood” because of its close structural similarity to Hemoglobin. Wheat Grass contains many nutritious and prophylactic ingredients.

Effect of Uric Acid In Blood - The high uric acid level in the blood caused complications such as swelling of the body, digestion trouble, insomnia, etc. Grime’s Nature Cure Center treated the patient with that of Wheatgrass therapy. The center got amazed at the excellent results. Within one month patient problems were gone and he became perfectly normal.

5b Diseases related to the Respiratory System

Wheat grass juice therapy useful to cure common cold, asthma, bronchitis and all the related disease. Common cold generally disappears in a couple of days only. Asthma is a dreadfully stubborn disease responding to almost no given therapy. But wheat grass juice taken twice a day creates wonders in this case also [15].

5c Diseases related to the Digestive System

Digestive disorders are effectively cured by Wheat grass therapy i.e. it shows its quick effect. The most common Diseases related to the Digestive System are constipation, indigestion, flatulent, nausea, vomiting, acidity, ulcers in the stomach and intestines, smelling on the intestines and worms [13,16]. It is an excellent laxative in the severity of rectal bleeding. No serious side effects were found Grass juice appeared effective and safe as a single or as added support to treat active ulcerative colitis. This enema is very helpful in disorders of the colon, mucous and ulcerative colitis, chronic constipation and bleeding piles.

5d Diseases related to Joints

This disease category included swelling on the joints, pain in the joints, osteoarthritis and bone rotting. Due to powerful anti-inflammatory effect of wheatgrass it manages bone and joint disorders. It can significantly help reduce pain, swelling and inflammation, and check subcutaneous and cutaneous bleeding quickly, thereby enhancing the natural healing process [13].

5e Kidney related ailments

Kidney related ailments are the problem of stone, inflammation of the urinary bladder, and inflammation of the kidneys. Wheatgrass juice with magnets give better results and the cure is faster [17].

5f Anticancer

Due to high antioxidant content of Wheatgrass juice, it is an integral part of the macrobiotic diet under the complementary and alternative medicine (CAM) approach of anticancer therapy [13]. The major source of chlorophyll, laetrile, and antioxidant enzyme superoxide dismutase is WGJ [18]. The intake of Wheatgrass enhances hemoglobin synthesis as chlorophyll bears a structural analogy to hemoglobin. This is indicated that the oxygen supply to all body cells including cancer cells which are highly vulnerable to high oxygen concentration due to the deleterious effects caused by the generation of reactive oxygen species. Wheatgrass implicated as an anticancer agent is the plant hormone abscisic acid (ABA). This hormone is 40 times more potent 4 h after cutting the wheatgrass plant. ABA can neutralize the effect of the hormone chorionic gonadotropin and a compound similar to this hormone has been found to be produced by the cancer cells. The WGJ appears beneficial include antioxidant activity preventing oxidative damage to deoxyribonucleic acid (DNA) and lipid peroxidation, stimulation of gap junction communication, effects on cell transformation and differentiation, inhibition of cell proliferation and oncogene expression, effects on immune function and inhibition of endogenous formation of carcinogens[15].

On Breast Cancer - Life threatening cause chemotherapy which due to damage of bone marrow (where new blood cells are made). WBC count and RBC count can become abnormally low. These blood cell

count can be built by medications, but this cause negative side effects and increased costs. It was found that drinking the green healing juice helped produce healthier blood levels while receiving the chemotherapy thus decreasing the need for blood building medications. Wheatgrass juice was found to not diminish effectiveness of chemotherapy [15].

5g Thalassemia

Thalassemia is not curable by 'green blood' method. This is found among patients taking this therapy is that the interval between blood transfusions has increased to 25-30 days. Earlier, thalassemia patients had to have a transfusion once in two weeks. However, we are still studying the efficacy of this treatment," Dr. Ram K Maratha of the pediatrics' department of PGI told *The Times of India*. Extracted Wheatgrass juice has been used as a general purpose health tonic for several years. Several patients in the thalassemia i.e. a hereditary form of anemia, occurring chiefly in people of Mediterranean origin, marked by the abnormal synthesis of hemoglobin and a consequent shortened life span of red blood cells, unit began consuming wheatgrass juice after anecdotal accounts of beneficial effects on transfusion requirements. These encouraging experiences prompted evaluations on the effect of wheatgrass juice on transfusion requirements in patients with transfusion dependent beta thalassemia [19].

6. Herbal Medicine: The History and the Present Scenario:

Herbal medicines are the synthesis of therapeutic experiences of generations of practicing physicians of indigenous systems of medicine for over hundreds of years. Due to better cultural acceptability, better compatibility with the human body and minimal side effects herbal medicines are now in great demand in the developing world for primary health care [20]. Although recent findings indicate that all herbal medicines may not be safe as severe consequences are reported for some herbal drugs. Most herbal products on the market today have not been subjected to drug approval process to demonstrate their safety and effectiveness. Valuable guidelines to the selection, preparation and application of herbal formulation are obtained from thousands of years.

The branch of science in which plant based formulations are used to alleviate diseases is known as Herbal Medicine. Botanical medicine or phyto-medicine is another term of herbal medicine. Recently phyto-therapy has been introduced as more accurate synonym of herbal or botanical medicine. Herbal medicine was prime healthcare system as antibiotics or analgesics in the early twentieth century. Amid the emergence of allopathic system of medicine, herbal medicine gradually lost its popularity among people, which is based on the fast therapeutic actions of synthetic drugs [21].

Now a days it has been observed that a shift in universal trend from synthetic to herbal medicine, which can be said "Return to Nature". Medicinal plants have been known for renaissances and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments [22].

Herbal medicine is exceedingly well established and documented in Asia. International recognition of the medicinal plants come from China and India. The use of herbal medicine is increasing fast in Europe and North America, especially for correcting imbalances caused by modern diets and lifestyles. To

maintain good health as much as to treat illness many people now take medicinal plant products on a daily basis.

In the developing countries Herbal medicine is still the mainstay of about 75 - 80% of the world population, for primary health care (Kamboj, 2000). This is predominantly because of the general optimism that herbal drugs are without any side effects besides being cheap and locally available (Gupta and Raina, 1998). According to the World Health Organization (WHO), the use of herbal remedies throughout the world exceeds that of the conventional drugs by two to three times (Evans, 1994). The use of plants for healing purposes predates human history and forms the origin of much modern medicine. Examples include aspirin (willow bark), digoxin (from foxglove), quinine (from cinchona bark), and morphine (from the opium poppy) [23].

After establishment of the office of Alternative Medicine by the National Institute of Health USA, in 1992, the rising use of herbal medicines and other non-traditional remedies gets recognition. WHO encouraged developing countries to use traditional plant medicine to fulfill needs unmet by modern systems consequently Herbal medicine received a boost (Winslow and Kroll 1998).

6a Herbal Medicines in India:

Back to 5000 B. C, *Ayurveda*, meaning the “science of life,” is said to be the oldest and most complete medical system in the world and dates. There is no challenge the benefits of *Ayurvedic* treatments that several Indians and others across the globe have experienced. Foundational principles of panchamahabhutha (five basic elements of nature), tridosha (three humours) and prakrithi of *Ayurveda* are unique in diagnostic and treatment procedures. (Venkatasubramanian, 2007).

According to *Ayurveda*, every material (*dravya*) is a proclamation of five elements i.e. Earth, water, fire, air and space, in disparate proportions. The material (*dravya*) could be living as well as non-living things. On the basis of cardinal combination of the elements, nature can be categorized into three *doshas*, namely *vata*, *pitta* and *kapha* [24].

- Vata dosha is related to the air and space, the force that controls movement and the functioning of the nervous system in the body.
- Pitta dosha is related to the fire and water i.e. force of heat and energy, linked with the sun, that controls digestion and all biochemical processes in the body.
- Kapha dosha is related to the earth and water i.e. force of water and tides, influenced by the moon, the stabilizing influence that controls fluid metabolism in the body.

7. The Recent Development of Natural Drugs:

From the total identified 122 biologically active compounds, only 94 species derived from plants [25]. The number of flowering plants occurring on the planet of is approximate 2,50,000. Approximate 6% have been screened for biological activity and a reported 15% have been evaluated phyto-chemically (Turker and Usta 2008). UNESCO in 1996 has been observed that the use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health. Furthermore, an increasing reliance on the use of medicinal plants in the industrialized societies has

been traced to the extraction and development of several drugs and chemotherapeutics from these plants as well as from traditionally used rural herbal remedies (UNESCO 1998).

Recent advance in the analytical and biological sciences, along with innovations in genomics and proteomics can play an important role in validation of these therapies. Western scientific community views traditional medicines cautiously and stresses the concerns related to research, development and quality (Patwardhan et al. 2003; Fabricant and Farnsworth 2001). With the aid of ethno botanical knowledge of their traditional uses medicinal compounds have been discovered. The rich knowledge base of countries like India and China in medicinal plants and health care has led to the keen interest by pharmaceutical companies to use this knowledge as a resource for research and development programs in the pursuit of discovering novel drugs (Krishnaraju et al. 2005).

Herbal medicine became as interdisciplinary science by rapid pace of research and development. Scientific monograph of a medicinal plant concluded that knowledge of Alternative and Complementary Systems of Medicines like Ayurveda, botany, pharmacognosy and phytochemistry, biochemistry, ethno pharmacology and toxicology is integral part of herbal medicine [26]. Data analysis has shown that more and more people are consulting the herbal medicine practitioners. World Health Organization has also identified the importance of herbal medicines. According to a study from U.S., 60-70% patients living in rural areas are dependent on herbal medicine for their day to day diseases. Several authors have reported favorable results with herbal drugs (mostly in the form of extracts) either in animal or in human studies (Padma 2005).

8. Theories on *Triticum Aestivum* (Wheatgrass):

8a. *Triticum Aestivum* (Wheatgrass Therapy):

Anne Wigmore, a Boston area resident conceived that wheatgrass can benefit in serious disease. Wigmore trusted in astrology, and described herself as a dreamer who saw life from the spiritual viewpoint to the neglect of the physical. Wigmore's theory on the healing power of grasses was predicated upon the Biblical story of Babylonian king Nebuchadnezzar who spent seven insane years living like a wild animal eating the grass of the fields. Because he recovered, Wigmore presumed that the grasses had cured his insanity. Wigmore speculated that rotting food in the intestine forms toxins that circulate in the bloodstream and cause cancer. Wigmore suggested that the life span of the wheatgrass juice was less than three hours, so it had to be cut from growing plants, juiced and consumed fresh. She proposed that the enzymes found in raw wheatgrass were alive and could "detoxify" the body by oral ingestion and by enemas[27]. Wheatgrass is prepared by sprouting wheat berries and growing them until they form chlorophyll. It was the chlorophyll in wheatgrass that enthused Wigmore. She called chlorophyll "the life blood of the planet." Enzymes are complex protein molecules produced by living organisms exclusively for their own use in promoting chemical reactions. Orally ingested enzymes are digested in the stomach and have no enzymatic activity in the eater. Enzymes do not fulfill the biological criteria for living things, because they do not consist of cellular units, possess reproductive ability, demonstrate irritability, carry on metabolism and grow[28,29].

8a-1 Wheatgrass Extract as an Antioxidants:

Antioxidant Activity of Wheat Sprouts Extract in Vitro: Reluctance of DNA Oxidative Damage

Background: It has been observed that extracts of wheat sprouts contain very high levels of natural antioxidants, but the scientific effect of these antioxidants has taken some time. When normal oxidation processes get out of control in body then antioxidants prevent DNA damage. On the basis of this study observation account the ability of wheat sprout extracts to protect DNA. The researchers also looked at how the levels of antioxidants changed as the plant germinated, sprouted and grew [30, 31].

Laboratory Techniques: To protect a type of viral DNA from damage by oxidation, scientist used a standard assay the “Fenton reaction” as wheat sprouts extract to determine.

Interpretations: The analysis reveal that extracts from wheat sprouts could protect DNA from damage from oxidation. It also manifest that the highest levels of antioxidants were found in the wheat sprouts.

8a-2 Wheatgrass Extract as an Anticancer (Effect on CML Cells):

*Antiproliferative and apoptotic activities of wheatgrass (*Triticum aestivum L.*) extract on CML (K562) cell line*

Background: Anti-cancer factors are present in Wheatgrass extracts. This study examine on activities in a human chronic myeloid leukemia cell line, K562.

Laboratory Techniques: Scientist treated the cell line, K562, with both Water and alcohol extracts of wheatgrass. They used a number of different approaches to see the effects that the wheatgrass extract had on this type of leukemia. They examined the cells under a microscope to check whether the extract could kill the cells and still reproduce. They assessed the fragmentation of DNA cells and observed that the cells were dying [32].

Interpretations: The water-extract of wheatgrass was able to decrease the vitality of the cells by 14% and alcohol-extract by 39%. It also found a significantly increased anti-oxidant activity in both the water and alcohol extract. The water and alcohol extracts of wheatgrass were able to increase the rate of cell death in this human leukemia cell line.

8a-3 Wheatgrass Extract Effect on second degree burns:

Fitostimoline Efficacy and tolerability in two different forms (soaked gauzes and cream) and topical treatment of Citrizan Gel for second - degree superficial cutaneous burns.

Background: Fitostimoline is a topically applied agent whose main active ingredient is a water extract of *Triticum vulgare*, a species of wheat. Citrizan Gel is a product that contains an enzyme (catalase) derived from horses. Both of these agents have been reported to improve wound healing. The current study compared them to determine if one was superior.

Clinical Investigation: Clinical investigation has been done on 227 patients with of blistering burns. Three possible treatments, a wheatgrass extract (Fitostimoline) cream, Fitostimoline-soaked gauze, or Citrizan Gel were applied on patients up to 20 days. Approximately 97.3% of patients treated with Fitostimoline gauze and 91.5% of those treated with Fitostimoline cream healed in the study period. Only 84.5 of patients treated with Citrizan Gel were fully healed in that time. The difference is made even more impressive by the fact that, on average, the wounds were slightly smaller in the Citrizan Gel group at start (not statistically significant, however). Interestingly, the overall speed of burn wound healing was not significantly different between treatment groups. Combined Fitostimoline-treated groups reported slightly but significantly fewer overall symptoms, pain, and burning than catalase gel at end of study [33].

Interpretations: The wheat product, Fitostimoline, facilitated healing

8a-4 Protective effect in breast cancer patients during chemotherapy:

Improvement of hematological toxicity related to chemotherapy in breast cancer patients

Background: Cancer treatment by Chemotherapy has greatly improved our ability, but the treatment is physically costly. Chemotherapy has troubling and dangerous side effects of hematological toxicity. Chemotherapy is designed to kill cancer cells. Chemotherapy RBC, WBC and platelets which causes anemia, immune system deficits and blood clotting disorders,

Clinical Investigation: Israeli students studied the effect of wheatgrass juice on patients undergoing chemotherapy for breast cancer. They investigated 60 patients receiving cytotoxic chemotherapy, from which approximately 50% patients treated with wheatgrass juice and the other 50% with routine care. The patients of the wheatgrass juice group had serious events of blood toxicity than the standard care group. The wheatgrass juice group had fewer instances of neutropenia fever, leucopenia with infection, and prolonged neutropenia (low white blood cells). Hemoglobin levels affected by chemotherapy to a much lower degree in the wheatgrass juice group. Patients taking wheatgrass needed fewer drugs to support blood cell number and function. The one reported side effect of wheatgrass juice was that a consuming the juice because of its strong odor and taste. This led to increased nausea [34-36].

Interpretations: Along with chemotherapy, Wheatgrass juice helped to maintain healthier levels of blood cells and reduced the need for additional supportive medications. Due to strong flavor of the substance in its raw state the use of wheatgrass juice is limited.

8a-5 Effectiveness of Wheatgrass Juice for ulcerative colitis:

The treatment of ulcerative colitis by Wheat grass juice: A randomized double-blind placebo-controlled trial.

Background: An inflammatory bowel disease Ulcerative colitis, in which lesions form in the lining of the large intestine (colon). This disease can cause bloody diarrhea, cramping, bloating, fever, weight loss. In prolonged time, ulcerative colitis can have serious complications. Corticosteroids are used to treat acute bouts of the disease and other medications are for maintenance or to prevent flare-ups.

Clinical Investigation: Israeli scholars treated patients of acute ulcerative colitis with 100 ml of wheatgrass juice orally. Patients with active ulcerative colitis were assorted randomly into two groups, one received wheat grass juice and the other received a placebo beverage (no wheatgrass). After randomization, the results were measured by instrument Disease Activity Index on basis of symptom severity. This instrument includes a measure of rectal bleeding, stool frequency, sigmoidoscopic score (direct visualization of the distal colon) and physician's assessment. Patients receiving wheatgrass juice had a statistically significant improvement in the overall Disease Activity Index and in the physician global assessment and rectal bleeding-diary results. Patients on placebo got significantly worst results. Patients in the placebo group had significant deterioration in overall Disease Activity Index, physician global assessment, and rectal bleeding-diary results [37].

Interpretations: Wheat grass juice, when consumed daily during active ulcerative colitis reduced symptom severity and rectal bleeding. Moreover, patients who did not drink wheat grass juice did worse on these clinical tests. Wheat grass juice appears.

9. Phytochemical Study of Wheat Grass:

Medicinal plants constitute the main source of new pharmaceuticals and healthcare products (Ivanova et al. 2005). Extraction and characterization of several active phyto compounds from these green factories have given birth to some high activity profile drugs (Mandal et al. 2007). Phytochemical screening of plants has affirmed the presence of numerous chemicals viz; alkaloids, tannins, flavonoids, steroids, glycosides, saponins etc.

9a. Pharmacognostic studies:

Wheat grass samples then have to be grown in plastic trays as per the standard procedure described by (Wigmore 1985). To characterize and analyze wheatgrass, the grass is subjected to microscopic study, which included transverse sections, surface preparations and powder study etc[38].

9b-Extraction:

For Methanolic extract, 100 gram of fresh wheatgrass is to be crushed thoroughly, using mortar and pestle. The crushed wheatgrass is completely exhausted by adding small quantities of methanol and filtering off every time in a successive manner, to yield final volume of 1 liter. The methanolic extracts of different varieties of fresh wheatgrass, and also dried wheatgrass powders, obtained from different types of drying processes, is prepared by above-mentioned procedure. These extracts are subjected to thin layer chromatography [37].

9c-Estimation of antimicrobial activity -

Antibacterial study of wheatgrass juice has been already done. For antimicrobial activity against isolated *E. coli*, 50% water extract of wheat grass (*Triticum aestivum* L.) treated. It has been reported that maximum inhibition zone (28.66 mm) seen by extract (concentration 50µg/ml) of 5 days old wheat grass and extract of wheat sprouts showed 27.66 mm inhibition zone against *E. coli*. Further, results suggested that as growth of plant is increased than decrease in antimicrobial activity against *E. coli* [38].

Samples on different days	Mean of WGJ (50µg/ml)	Norfloxacillin antibiotic (100 µg /ml)
Sprouts	27.66 mm	41 mm
5th Day old wheat grass	28.66 mm	41 mm
10th Day old wheat grass	16 mm	40 mm
15th Day old wheat grass	16 mm	41 mm

Table 6 Antimicrobial Activity

10. Conclusion

Wheat grass (*Triticum aestivum*) presumes itself as most versatile plant having different parts in medical system for human and animals. Wheat is a significant part of the human eating regimen, and the impact on human strength of bioactive mixtures present in wheat. The valuable impacts of wheat are still need to be investigated of potential wellbeing advancing parts present in the grains and the intricacy of contemplating their organic impacts. Wheat herb has been reported for numerous pharmacological potentials such as antioxidant, anticancer, for treatment of second degree burns, breast cancer and ulcerative colitis. In conclusion, it has been used an extensive plant in the treatment of various illnesses due to its unique medicinal properties with easy availability.

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Referances:

- Wigmore A.** *The wheat grass Book*, New York. Avery Publishing group 1986.
- Wheatgrass (Online)**, URL: <http://en.wikipedia.org/wiki/wheatgrass>.
- Shashikiran Hingade and Sharda Patekar**, Wheatgrass: A Natural and Holistic Medicine for Generation, *Acta scientific nutritional health* (ISSN:2582-1423) Volume 3 Issue 12 December 2019
- Pathak V and Shubham Shrivastav.** "Biochemical studies on wheat (*Triticum aestivum* L.)". *Journal of Pharmacognosy and Phytochemistry* 4.3 (2015): 171-175.
- USDA, U.S. Department of Agriculture (USDA) in South Asia**

6. **Dr. George Kohler** *Nutrition Almanac* ,cereal grass 1994
7. **Kong et al** , Analysis and biological activities of anthocyanins, *Phytochemistry* 2003
8. **Ebadi** ,Pharmacodynamic basis of Herbal Medicine,2007
9. **Hänninen O, Rauma AL, Kaartinen K, Nenonen M.** Vegan diet in physiological health promotion. *Acta Physiol Hung* 1999;86:171-80.
10. **Neethu S. Kumar et al**, Green Blood Therapy of Wheat Grass - Nature's Finest Medicine'- A Literature Review, *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, Volume 11, Issue 2 Ver. IV (Mar.- Apr.2016)
11. **Ritu Mathur et al** Therapeutic Use of Wheat Grass Juice for the Treatment of Anemia in Young Women of Ajmer City (Rajasthan, India), *International Journal of Nutritional science*, 2017; 2(1): 1014.
12. **Grime's Wheatgrass** , Nutritional facts of wheatgrass powder,1988
13. **Rajesh Mujoriya ,Dr. Ramesh Babu Bodla**, A study on wheat grass and its Nutritional value ISSN 2224-6088 ,ISSN 2225-0557, 2, 2011, URL: www.iiste.org
14. **Nilima Jain**, Green blood wheatgrass juice, 2012
15. **M. Chouhan**, A pilot study on wheat grass juice for its phytochemical, nutritional and therapeutic potential on chronic diseases, *International journal of chemical studies*, 2014; 2(4): 27-34
16. **Sunil Kumar K, Kumar SK.** Pharmacognostical and preliminary chemical analysis to derive quality standards of Godhuma patra (*Triticum aestivum* Linn. leaf). *Journal of Ayurvedic and Herbal Medicine* [Internet]. 2015, http://www.ayurvedjournal.com/JAHM_201513_03.pdf
17. **Satyavati Rana, Jaspreet Kaur Kamboj, Vandana Gandhi**, Living life the natural way – Wheatgrass and Health, *Functional Foods in Health and Disease*,2011
18. **Sabeeha Shafi**, Green blood therapy in modern medicine, international journal of pharmaceutical, chemical and biological sciences, *ijpebs* 2015, 5(3), 497-503
19. **Mutha AS, Shah KU, Kinikar AA, Ghongane BB**, Efficacy and Safety of Wheat Grass in Thalassaemic Children on Regular Blood Transfusion, , 2018 Mar; 10(3): e2306
20. **Sanjoy Kumar Pal1, Yogeshwer Shukla** Herbal Medicine: Current Status and the Future, *Asian Pacific Journal of Cancer Prevention*, 4, 2003, 281-288
21. **Singh A**, "Herbal Medicine–Dream Unresolved," *Ethnobotanical Leaflets*: Vol. 2007 : Iss. 1 , Article 18.
22. **Sharma et al** , Medicinal Plants used for primary healthcare by Tharu Tribe of Udham Singh Nagar Uttarakhand, India, *Int.j.med.ant.plant*, 2011
23. **William T. Jarvis**, Wheatgrass Therapy, URL: <http://www.ncahf.org/articles/s-z/wheatgrass.html>
24. **Fuller HJ.** *The Plant World* New York: Henry Holt & Co., 1956, pp.6-7.
25. **Vickers, A. and Zollman, CAB C.** of Complementary Medicine: Herbal Medicine. *British Medical Journal*, 319, 1050-1053. 1999
<http://dx.doi.org/10.1136/bmj.319.7216.1050>

26. **Sachin Sharma, Vivek Kumar Shrivastav, Archana Shrivastav, B. R. Shrivastav** Therapeutic Potential of Wheat grass (*Triticum aestivum* L.) in Prevention and Treatment of Chronic Diseases, *South Asian Journal of Experimental Biology* **3(6)** (Special), 308-313; 2013, URL: www.academia.edu
27. **Swati Padalia, Sushma Drabu, Indira Raheja, Alka Gupta, Mamta Dhamija** Multitude potential of wheatgrass juice (Green Blood): *Chronicles of Young Scientists* **1(2)** 2010, 23-28 URL: www.opubs.com/cys
28. **N. Singh, P. Verma, B. R. Pandey** Therapeutic Potential of Organic *Triticum aestivum* Linn. (*Wheat Grass*) in Prevention and Treatment of Chronic Diseases, URL: www.ijpsdr.com
29. **Vaghasiya, Yogeshkumar, (2009)** Screening of some Medicinal Plants for Antimicrobial Properties- Phytochemical and Pharmacological Studies of a Selected Medicinal Plant, URL: <http://theses.saurashtrauniversity.edu/id/eprint/591>
30. **K.Pallavi, G. Kumara Swamy, Shruthi K.Pallavi et al.** Pharmacognostic investigation and antibacterial activity of *Triticum aestivum*, *Journal of Pharmacy Research* 2011, **4(10)**, 3355-3359, URL: www.ipronline.info
31. **Falcioni, G., Fedeli, D., Tiano, L., Calzuola, I., Mancinelli, L., Marsili, V., Gianfranceschi, G.,** Antioxidant Activity of Wheat Sprouts Extract In Vitro: Inhibition of DNA Oxidative Damage, *J Food Science*, 2006. 1365-26.2210, URL: http://drwheatgrass.com/_blog/Wheatgrass_Research
32. **Aydos, OS., Avci, A., Ozkan, T. KARADAG, A., Gurleyik, E., Altinok, B., Turk Sunguroglu, A.,** Antiproliferative, apoptotic and antioxidant activities of wheatgrass (*Triticum aestivum* L.) extract on CML (K562) cell line, *J Med Sci*, **41(4)**: 657-663, 2011. URL: http://drwheatgrass.com/_blog/Wheatgrass_Research
33. **Martini, P., Mazzatenta, C. & Saponati, G. (2011)** Efficacy and tolerability of Fitostimoline in two different forms (soaked gauzes and cream) and Citrizan Gel in the topical treatment of second-degree superficial cutaneous burns. *Derm. Res. and Practice*, **2011**, **1-8**. URL: http://drwheatgrass.com/_blog/Wheatgrass_Research
34. **Bar-Sela G, Tsalic M, Fried G, Goldberg H.,** Wheat grass juice may improve hematological toxicity related to chemotherapy in breast cancer patients: a pilot study, *Nutr Cancer* 2007, **58(1)**:43-48. http://drwheatgrass.com/_blog/Wheatgrass_Research
35. **Rucha Diwakar Gore,** Wheatgrass: Green Blood can Help to Fight Cancer, *J Clin Diagn Res.* 2017 Jun; 11(6): ZC40–ZC42
36. **Dr. Mahfoudh Abdulghani,** Role of Herbal Medicines in Cancer Prevention, URL: <http://esciencecentral.org/ebooks/practice-of-cancer-prevention/role-of-herbal.php>

37. **Ben-Ayre E.; Goldin E.; Wengrower D.; Stamper A.; Kohn R.; Berry E.** 2002. Wheat grass juice in the treatment of active distal ulcerative colitis: A randomized double-blind placebo-controlled trial. *Scand. J. Gastroenterology*, **37**,4, 444-449 (6)
38. **Shankul, Kumar; Satish, V.; Ravi Chandra, V. D.; Rahul, S.; Kambhoja, S.; Ashutosh, M.** Pharmacognostical Investigation on Wheat Grass, *International Journal of Pharma & Bio Sciences*; Apr-Jun2010, **1** (2), 1
39. **Desai, Tusharbindu R., 2005**, Investigation into the Mechanism of Action and Effects of Triticum Aestivum (WheatGrass), URL: <http://theses.saurashtrauniversity.edu/id/eprint/188>
40. **Deshwal VK* and Deepshikha**, Antimicrobial Investigation of Wheat Grass (*Triticum Aestivum L.*) Against escherichia coli, *European Journal of Molecular Biology and Biochemistry*. 2018; 5(1): 9-12

