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Therapeutic Potential of Organic *Triticum aestivum* Linn. (Wheat Grass) in Prevention and Treatment of Chronic Diseases: An Overview

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ABSTRACT

Shoot of *Triticum aestivum* Linn. (Hindi Name- gehun, kanak, Sanskrit name- godhuma) is called as a wheat grass, belonging to family: Gramineae, which posses high chlorophyll content and essential vitamins, minerals, vital enzymes, amino acids, dietary fibers. Wheat grass has been shown to posses anti-cancer activity, anti-ulcer activity, antioxidant activity, anti-arthritic activity, and blood building activity in Thalassemia Major. It has been argued that wheat grass helps blood flow, digestion and general detoxification of the body. The major clinical utility of wheat grass in diseased conditions might be due to the presence of biologically active compounds and minerals in it and due to its antioxidant potential which is derived from its high content of bioflavonoids such as apigenin, quercitin, luteoline. Furthermore, indole compounds namely choline and laetrile present in it might be also responsible for its therapeutic potential. The presence of 70% chlorophyll, which is almost chemically identical to hemoglobin, in wheat grass makes it more useful in various clinical conditions involving hemoglobin deficiency and other chronic disorders. The present review article focuses onto various studies conducted on the use of wheatgrass in various disease conditions. Since very little clinical studies have been made on this very promising herbal drug, efforts are needed to conduct extensive studies on the wheat grass both in experimental models and human subjects to develop wheat grass therapy with no side effects in prevention, cure and management of chronic diseases for which our modern systems have lost their hopes.

Keywords: *Triticum aestivum* Linn., Anti-cancer, Anti-ulcer, Antioxidant, Anti-arthritic, Thalassemia.

INTRODUCTION

Shoot of *Triticum aestivum* Linn. (Hindi Name- gehun, kanak, Sanskrit name- godhuma) is called as a wheat grass, belonging to family: Gramineae. [1] *Triticum* is a genus of annual and biennial grasses, yielding various types of wheat, native to south west Asia and the Mediterranean region. *T aestivum* Linn. common or bread wheat, is widely cultivated almost all over the world. Generally, 15-20 species are recognized, of which 8 have been reported to occur in India. Wheat grass is a good source of mineral nutrients. It contains significant amount of iron, phosphorus, magnesium, manganese, copper & zinc. Wheatgrass is a rich source of tocopherols with high vitamin E potency. Wheatgrass stimulates metabolism, restores alkalinity to the blood, its abundance of alkaline minerals helps reduce over acidity in the blood. Wheatgrass is also a de-toxificant and helps restore healthy cells. [2] Wheat grass**,** young grass of common wheat plant, is freshly juiced or dried into powder for animal and human consumption- both the forms provide chlorophyll, amino acid, minerals, vitamins and enzymes.

The consumption of wheatgrass in the Western world began in the 1930s as a result of experiments conducted by Charles F. Schnabel, a food scientist who experimented with various mixtures of grain and feed and found that chickens fed on mixtures that contained a high proportion of wheat grass had grown better, were more healthy and had 150% better egg production than other hens. Further experimentation on other animals yielded the same results. Animals fed on wheatgrass were undoubtedly healthier than those fed on other grains. [3]

Wheat Grass Juice (WGJ) is an extract squeezed from the mature sprouts of wheat seeds (*T. aestivum*). The use of WGJ for therapeutic purposes was developed and popularized by Dr. Ann Wigmore, as part of herb therapeutic nutritional approach. [4]

The therapeutic qualities of WGJ have been attributed to its nutritional content, including chlorophyll, vitamins (A, C, and E), Bioflavonoids, Iron, minerals (calcium and magnesium) and 17 amino acid, eight of which are essential. [5] Although proponents of WGJ have recommended it for four decades as a treatment for various diseases, yet very little clinical data exists to support its use. In order to develop holistic approach for the treatment of chronic

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diseases, for which modern medical system has no permanent cure, scientists and clinicians world over are now a days conducting extensive studies on animal models and also on human systems in order to develop herbal medicines/ dietary supplements as alternative or complimentary therapy with almost no side effects or adverse reactions for the treatment of chronic diseases. Towards this attempt, few studies have been conducted to evaluate the efficacy of wheat grass (in form of powder or juice) in the treatment of chronic diseases like cancer [6], rheumatoid arthritis [7], ulcer [8], etc**.** In our Institute, International Institute of Herbal Medicine (IIHM), Lucknow, India, we have developed organic wheat grass in powder form, which is being clinically investigated in various disease conditions and its beneficial effects have been observed. In the present review, attempts have been made to provide state of art of scientific and clinical studies made on the use of *Triticum aestivum* Linn. in the prevention and treatment of various ailments for better understanding of therapeutic potential of this medicinal grass.

SOURCE AND CHEMICAL CONSTITUENTS

Classification of *Tritium aestivum*

Kingdom	:	Plantae
Division	:	Magnoliophyta
Class	:	Liliopsida
Order	:	Cyperales
Family	:	Gramineae
Genus	:	*Triticum*
Species	:	*aestivum*

Shoot of Organic Wheatgrass
(*developed by IIHM)*

Organic Wheatgrass Powder
(*developed by IIHM)*

Organic Wheatgrass Capsules
(*developed by IIHM)*

The major Indian source of wheat grass is *Triticum aestivum.* Other varieties of wheat grass in various plant genera found in temperate region of Europe and United States are mentioned below:

Aropyron spicatum (bluebunch wheat grass)
Agropyron critatum (Crested Wheatgrass)
Agropyron trachhycaulum (slender wheat grass)
Elytrigia
Eremopyrum
Pascopyrum
Pseudoroegneria

According to Schnabel's research on wheatgrass grown outdoors, the environment in which wheatgrass grows affects its vitality. The wheatgrass sown through the winter and early spring and harvested at the jointing stage has maximum concentration of active principles. At this stage the plant reaches its peak nutritional value; after jointing, concentrations of chlorophyll, protein, and vitamins decline sharply. [9] Thus wheatgrass is harvested just prior to this jointing stage, when the tender shoots are at their peak of nutritional potency. Wheatgrass grown outdoors is harvested, dehydrated at a low temperature and sold in tablet and powdered concentrates.

Growing wheat grass indoors usually requires the grass to be grown in small trays with the wheat grains close together for a high yield. Not every wheat seed will sprout. Ungerminated seeds can develop mold which may spread to nearby sprouted plants. This may cause an unpalatable taste and, in extreme cases, an allergic reaction. [10] The major chemical constituents present in *Tritium aestivum* (Wheat Grass) are given below which make the wheat grass valuable in boosting the health and vitality. [11-14]

1. Vitamins and minerals: Vitamins A, B1, 2, 3, 5, 6, 8, and 12; C, E and K, ascorbic acid, dehydrated ascorbic acid, carotene, sulfur, sodium, alumenium, copper, calcium, iodine, phosphorus, magnesium, alkaline earth metal, potassium, selenium, Iron, Zinc, boran and molybdenum.

2. Enzymes: Protease, amylase, lypase, cytochrome oxidase, transhydrogenase, superoxide dismutase (SOD)

3. Other special components: Amino acids such as aspartic acid, threonine, asparagines, glutamine, proline, glycine, arginine, alanine, valine, methionine, isoleucine, leucine, tyrosine, phenylalanine, lysine, histidine, tryptophan and serine, P4D1 (gluco-protein), muco-polysaccharides, and chlorophyll, bioflavonides like apigenin, quercitin and luteonin, indole compounds, choline and laetrile (amygdalin).

PHARMACOLOGICAL ACTIVITIES

Anticancer activity

The prospective matched control study on patients with breast carcinoma on chemotherapy to evaluate the beneficial effect of wheat grass juice (WGJ) reveled that WGJ taken during FAC (5–fluorouracil, doxorubicin and cyclophospamide) chemotherapy may reduce myelo-toxicity, dose reduction and need for granulocyte colony stimulating factors(GCSF) support, without diminishing efficacy of chemotherapy. [15] In another study, Dey *et al* [6] found that Wheat grass juice helped to improve the health status and lifespan in terminally ill cancer patients. The extract of wheat grass when applied to known chemical mutagens, decreased their cancer causing ability by up to 99 percent [16-17] which suggests that wheat grass may have cancer preventing property. The clinical studies conducted on human breast cancer have shown that chlorophyllin, a compound that is similar to chlorophyll produced synthetically, has capability to reduce the risk of breast cancer. [18] Furthermore, chlorophyll derivatives have also been found to provide beneficial effect in liver, colon, stomach and gastrointestinal cancer cases. [19-22] *In vitro* studies with chlorophyllin on animal model have shown that chlorophyllin is an inhibitor of the cytochrome P-450 liver enzymes. [23] All *in vivo* (whole animal) studies where cytochrome P-450 enzyme activity is reduced resulted in lower cancer rates and longer

lifespan. [24] Finch *et al* [25] observed that in stage 2 liver detoxification, enzymes called glutathione transferase because glutathione to react with the carcinogens formed from cytochrome P-450 activity to produce harmless additional products, but this process is not very efficient. The Chlorophyllin, however, makes this conversion more efficient by lowering cytochrome P-450 enzyme activity in the first place and by reacting with carcinogens to produce harmless complexes, just as the glutathione transferase do. Thus, chlorophyllin is not an inducer of glutathione transferases but mimics glutathione transferase activity. The studies have shown that the beneficial effect of wheat grass might be due to antioxidant activity preventing oxidative damage to deoxyribonucleic acid (DNA) and lipid peroxidation, stimulation of gap junction communication, effect on cell transformation and differentiation, inhibition of cell proliferation and oncogene expression, effects on immune function and inhibition of endogenous formation of carcinogens. [26-27] The clinical studies conducted on patients of transfusion dependent myelodysplastic syndrome (pre leukemia) have revealed that WGJ is an effective iron chelator and its use in reducing serum ferritin should be encouraged in myelodysplastic syndrome and other diseases where repeated blood transfusion is required. [28]

A supernatant extract from wheat grass has been shown to reduce the production of carcinogenic, aromatic hydrocarbon (Benzopyerene) derivative, to inhibit benzopyerene mutagenecity with non chlorophyll containing Wheat sprout extract which suggests that chlorophyll is not the main compound responsible for anticancer activity. [29]

Anti-ulcer activity

In a randomized, double-blind, placebo-controlled study on WGJ Ben-Arye *et al* [8] observed that the use of wheat grass (*Triticum aestivum*) juice is very effective and safe as a single or adjuvant treatment of active distal Ulcerative colitis (UC). Green juice and fractions from green juice of young barley leaves containing water soluble proteins and water soluble organic compounds showed anti- stomach ulcer activity in stressed rats. In another clinical study related to the use of water-soluble derivatives of chlorophyll in over 400 cases over a period of nine months, several major effects, notably: loss of odour associated with infected wounds; a stimulating effect on tissue formation (granulation tissue) when used as a dressing particularly for burns; and a drying effect in the case of abscesses, sinus tracts, surface lesions and osteomyelitis were observed. The results of the study showed that chlorophyll was found effective in treatment of cyst wounds, fistula-in-ano (6 cases), sarcoma/carcinoma (4 cases), ulcerative colitis (1 case), thoracic empyema (several cases, 2 particularly effective), gunshot wound sinus tracts (17 cases), decubitus ulcer (4 cases) and burns (4 patients). Further it has been observed that in 119 cases of compound fractures to limbs chlorophyll reduced odour and enhanced healing, in some cases with exceptional results, e.g. legs saved from seemingly inevitable amputation. These clinical studies suggest that chlorophyll may be best agent known for use in the treatment of suppurative diseases, indolent ulcers or wherever stimulation of tissue repair is desired. [30] Studies are in progress to evaluate WGJ as possible therapy for ulcerative colitis as it is rich in bioflavonoid which are believed to possess both anti-inflammatory and antioxidant properties. One of these bioflavonoid, api-genin, has been shown to inhibit tumour necrosis factor (TNF) induced transactivation. [31-33]

In another study chlorophyll was used in an experiment with cutaneous wounds in guinea pigs, and in treating dermatome donor sites, clinical burns and surgical wounds and ulcers in human patients. The results of this experimental study indicated that wound healing in guinea pigs showed acceleration in only 30% of cases, and did not enhance healing time for dermatome grafts. In clinical burns cases the chlorophyll ointment was a satisfactory dressing but did not appear to contribute to wound healing. [34]

The studies related to the use of chlorophyll in stimulating tissue growth have shown that chlorophyll ointment and aqueous solution is useful in the treatment of skin ulcer. [35]

Further chlorophyll derivatives have also been shown to exhibit anti-inflammatory, wound healing and odor reducing capabilities. Chlorophyllin has bacteriostatic properties aiding in wound healing, and stimulates the production of hemoglobin and erythrocytes in anemic animals. It has been used to treat various kinds of skin lesions, burns and ulcers where it acts as a wound healing agent, stimulating granulation tissue and epithelization. [36]

Antioxidant activity

The antioxidant activity of wheatgrass, which is consumed as a dietary supplement, was estimated at different levels. Aqueous and ethanol extracts of wheatgrass grown under different conditions over a period of 6, 7, 8, 10 and 15 days were used. Lipid per oxidation and oxygen radical absorbance capacity (ORAC) were determined and utilized to check the potency of a few selected extracts. Different conditions used for growth were (1) tap water, (2) tap water with nutrients, (3) soil and tap water, and (4) soil with nutrients. For comparison, a commercially available wheatgrass tablet was analysed. The ORAC values of aqueous and ethanol extracts of day 10 with condition 4 were found to be 39.9 and 48.2, respectively, being higher than those reported for many natural extracts or vegetables. [37-38]

Wheat grass contains antioxidant enzyme super oxide dismutase (SOD) which converts dangerous free radical reactive oxygen species (ROS) into hydrogen peroxides (having extra oxygen molecule to kill cancer cells) and an oxygen molecule. [39]

Anti-arthritic activity

In a study to see the effect of uncooked vegetarian diet rich in lactobacilli, in rheumatoid patients randomized into diet and control groups, it has been observed that and uncooked vegetarian diet, rich in lactobacilli, decreased subjective symptoms of rheumatoid arthritis. The studies indicated that the following group of dietary factors was partially (48%) responsible for the observed decrease in the disease activity index: fermented wheat drink, wheat grass drink, dietary fiber and iron. The studies showed significant response in arthritic patients. [7]

Blood building activity in Thalassemia major

Marwaha *et al* conducted a pilot study to scientifically evaluate the effect of wheat grass juice therapy in patients with transfusion dependent Beta-Thalassemia and it was observed that consumption of wheat grass juice was found to have beneficial effect on the transfusion requirements in 50% of patients in this pilot study. The study suggested that WGJ has the potential to lower transfusion requirements in thalassemics. [40-41]

Triticum aestivum Linn. with a large number of biologically active constituents such as chlorophyll, amino acids, minerals, vitamins and enzymes has been found to provide health benefits ranging from supplementation nutrition to unique curative properties. The results of the studies conducted on experimental animals and human subjects, as described above, clearly reflects the usefulness of wheatgrass in the management of chronic disorders including cancer, rheumatoid arthritis, ulcerative colitis, thalassemia, etc.

It has been argued that wheat grass helps blood flow, digestion and general detoxification of the body. The indole compounds present in wheatgrass might be responsible for the deactivation of carcinogens by increasing the activity of phase I and phase –II xenobiotic metabolic enzyme in the liver and intestinal mucosa. [42-43]

The major clinical utility of wheat grass in diseased conditions might be due to the presence of biologically active compounds and minerals in it and due to its antioxidant potential which is derived from its high content of bioflavonoids such as apigenin, quercitin, luteoline. Furthermore, indole compounds namely choline and laetrile present in it might be also responsible for its therapeutic potential. The presence of 70% chlorophyll, which is almost chemically identical to hemoglobin, in wheat grass makes it more useful in various clinical conditions involving hemoglobin deficiency and other chronic disorders. At clinic of **International Institute of Herbal Medicine (IIHM)**, we have treated thousands of patients including chronic ailments such as cancer, diabetes, arthritis, ulcerative collitis, liver disorders, etc. with organic herbal formulations. Clinical studies are in progress to evaluate the therapeutic efficacy of wheat grass, grown through the concept of organic farming and free from pesticides, herbicides, insecticides, heavy metals and other harmful chemicals and toxins, in various disease conditions and the patients are being benefitted by the multitude potential of wheat grass. It is heartening to mention that wheat grass in combination with *Withania somnifera* and *Ocimum sanctum* is providing better results in cancer patients. [44] Considering the facts that very little scientific and clinical studies have been made on the use of wheat grass in various diseases, efforts are needed to conduct extensive studies on the wheat grass both in experimental models and human subjects to develop wheat grass therapy with no side effects in prevention, cure and management of chronic diseases for which our modern systems have lost their hopes. Since the production of organic wheat grass is cheap and it does not require for the involvement of pharmaceutical industry, wheat grass therapy could be easily developed as an alternative or complimentary therapy for the benefit of large number of people suffering from chronic diseases in developing countries. Wheatgrass naturally rich in essential vitamins, minerals, enzymes, amino acids, dietary fibers and world's best antioxidant "chlorophyll" may be useful for all age groups. Thus wheatgrass therapy may serve as a preventive and curative measure for such health problems which may lead to serious diseases like diabetes mellitus, anemia, ulcers, arthritis, cancer, thalassemia and others.

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