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ANTICANCER PROPERTIES OF WHEATGRASS JUICE LINKED TO ITS ANTIOXIDATIVE PROPERTIES: A MINI REVIEW

Dr. Vijaya Shrivastava Kaushal*

Department of Botany and Microbiology, Govt. M.H. College of Home Science and Science for Women, Jabalpur 482001 (MP) India.

***Corresponding Author: Dr. Vijaya Shrivastava Kaushal**
Department of Botany and Microbiology, Govt. M.H. College of Home Science and Science for Women, Jabalpur 482001 (MP) India.

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ABSTRACT
Described as one of the most common herb in India, wheatgrass *Triticum aestivum* refers to the young grass of the common wheat plant which belongs to Poaceae family, portraying anti-inflammatory, antioxidant, anti-carcinogenic, immunodulatory, laxative, astringent, diuretic, antibacterial and anti ageing properties. Laboratory *in vitro* studies has demonstrated anti cancer potential and have identified apoptosis as a possible mechanism. Some *in vitro* experiments have demonstrated benefits of wheatgrass in cancer prevention and as an adjunct to cancer treatment, apart from combating the oxidative stress. Some clinical trials have also shown that wheatgrass may induce synergistic benefits during chemotherapy and may attenuate chemotherapy-related side effects. The scarce research data show the possibility that the antioxidants from wheatgrass juice may be helpful in combating cancer and also can be used as a chemo-protectant. Since, the popularity of wheatgrass continues to grow, the present review shows that possibilities and challenges on use of wheatgrass juice in the treatment and prevention of cancer.

KEYWORDS: Wheatgrass juice, *Triticum aestivum,* Antioxidants, Cancer, Anticarcinogenic.

INTRODUCTION
Wheatgrass juice (also known as “green blood” and “plant super food”) is considered as one of the best natural remedies for good health. In India, wheatgrass has been used as an herbal medicine since ages. Wheatgrass juice is a powerful, concentrated liquid nutrient. It contains the full spectrum of vitamins A, B and C, as well as important minerals, i.e., calcium, phosphorus, magnesium, sodium and potassium.[1] Wheatgrass has been an integral part of Indian culture for thousands of years and have been known for remarkable healing properties. Lack of substantial research has led to insufficient data for the utility and benefits of this particular herbal alternative.

Phytochemical constituents of wheat grass include high amounts of carbohydrates, proteins, alkaloids, flavonoids, saponins, gums and mucilages. The therapeutic qualities of wheatgrass juice 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.[2] Apart from nutrition, wheatgrass is known to exert strong antioxidant capabilities. A variety of studies have been performed showing the strong antioxidant activities in *in vitro* experiments.[3] An experiment was conducted to ascertain the antioxidant activity in a time dependent manner showed that the DPPH scavenging activity increased with time up to 9 days and gradually decreased afterwards. Highest antioxidant activity was found as 98.8% as compared to ascorbic acid (control) on the 9th day. There was a positive correlation between total flavonoids content and antioxidant activity.[4]

Anticancer Activity of Wheatgrass Juice
The anticancer activities of wheatgrass juice have been studied by various researchers, and some of these activities have been linked to the antioxidant activities of wheatgrass. Tandon et al. studied the free radical scavenging activity and antiproliferative activity of various extracts of *Triticum aestivum* by estimating Total Phenolic Content, DPPH and FRAP, followed by cell proliferation assay using MTT assay on breast cancer cell line MCF-7. Significant antiproliferative effect and cell death was observed in a dose dependent manner of wheatgrass extract on MCF-7 cells.[5] Another study demonstrated that quercetin (flavonoids) inhibits the activity of taxol (a polymerizing and stabilizing agent) and nocodanzole (a depolymerizing agent), through interference with the cell cycle in cancer cells. Authors concluded that long-term exposure of cancer cells to quercetin may prevent cell proliferation and survival of cancer cells.[6]

Aydos et al., studied the effects and oxidant/antioxidant status of aqueous and ethanol extracts of wheatgrass in human chronic myeloid leukemia (K562) cell line. Both the preparations inhibited the growth of leukemia cells in a time-dependent manner. The most apoptotic and antiproliferative effect were seen in the cell line treated with aqueous extract at 48 h. Increases in MDA level and catalase and superoxidase (antioxidative enzymes) activities were observed. This study, in particular, strengthens the use of wheatgrass juice, which is an aqueous extract, for the antioxidant and anticancer properties, as suggested by various traditional medical practitioners, including Ayurveda.[7]

Miranda and coworkers investigated the role of vitamins C, E, and carotenoid-rich pequi fruit pulp oil for individual protection and as an adjuvant in cancer therapy. The authors suggested that the efficiency and applicability of antioxidants in cancer treatment can be dependent on the nature of the antioxidant, the type and stage of cancer being treated, and the prevailing oxygen partial pressure in tissues, and type of antioxidant therapy chosen.[8]

The clinical study conducted on patients of transfusion dependent myelodysplastic syndrome has revealed that wheatgrass juice is an effective iron chelator and its use in reducing serum ferritin should be encouraged and in diseases requiring repeated blood transfusion.[9,10] The beneficial effect of wheatgrass juice revealed that wheatgrass juice taken during chemotherapy may reduce myelo-toxicity, dose reduction and the need for granulocyte colony stimulating factors support without diminishing the efficacy of chemotherapy.[11] Wheatgrass juice was found to be very effective and safe as a single or adjuvant treatment of active distal ulcerative colitis.[10,12] The effectiveness of wheatgrass juice therapy in patients with transfusion dependent β-Thalassemia showed that wheatgrass juice has the potential to lower transfusion requirements in Thalassemics.[13,14] Wheatgrass extract has an antioxidant activity, inhibits proliferation of leukemia cells, and induces apoptosis; thus, this finding may represent a novel therapeutic approach for the treatment of chronic myeloid leukemia.[15]

Challenges for use of wheatgrass juice

Wheatgrass in many forms has become a common nutritional supplement. The challenge faced with this medicinal boon herb is that only a few trials have been published. The driving force behind most of the clinical trials on wheatgrass that have been conducted is the anecdotal experience rather than preclinical research. Although the evidences have emerged from *in vitro* experiments on the anti-cancer potential of wheatgrass juice, thorough experiments and clinical trials are still needed to evaluate the wheatgrass juice as an effective drug. Controlled studies should also compare the immune-modulation related to their consumption and also studying about their behavioral or cognitive natures.

CONCLUSION

Wheatgrass generally contains no harmful substances with the exception of possible allergic reactions. Further, the presence of flavonoids[4] and other antioxidants is now an established fact. In recent years, it has been recognized that cancer cells grow because of two factors, opposite to each other, enhanced cell proliferation and decreased physiological cell death, i.e. apoptosis. Apart from inhibiting the cancer cell proliferation, prevention of cancer is a relatively new strategy to prevent cancer in healthy individuals. Plant-based diet is regarded one of the potential chemopreventive agents, including wheatgrass juice. Since such diet provide nutrition and, at least, antioxidants, the individual shall always benefit from such diet. Such diet might protect normal cells from the damage caused by reactive oxygen species, while it may also induce apoptosis and may inhibit proliferation in tumor cells. However, great amount of research is needed in this direction.

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