



**International Journal of Biology, Pharmacy  
and Allied Sciences (IJBPAS)**

*'A Bridge Between Laboratory and Reader'*

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**A COMPREHENSIVE REVIEW ON WHEAT GRASS (*TRITICUM  
AESTIVUM*)**

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Received 25<sup>th</sup> June 2022; Revised 18<sup>th</sup> Aug. 2022; Accepted 11<sup>th</sup> Dec. 2022; Available online 1<sup>st</sup> Sept. 2023

<https://doi.org/10.31032/IJBPAS/2023/12.9.7401>

**ABSTRACT**

*Triticum aestivum* Linn. (Hindi Name- gehun, kanak, Sanskrit name- godhuma) is called as a wheat grass, belonging to family: Gramineae. This narrative review sought to describe the Morphology, Phytochemistry, Uses, and Pharmacological Activities of *Triticum aestivum* due to the vast and dispersed medical benefits of this plant. It contains a lot of different antioxidants, including carotenoids, tocopherols, and tocotrienols, as well as dietary fibre, resistant starch, phenolic acids, alkylresorcinols, lignans, and phenolic acids. *Triticum aestivum* has a variety of pharmacological activities due to these ingredients, including anticancer, antibacterial, antidiabetic, hypolipidemic, antioxidant, laxative, and moisturising actions. This review sheds light on how to use this plant more effectively as a functional food in future studies.

**Keywords:** *Triticum aestivum* Linn., Botanical description, Uses, Phytochemistry, Pharmacological action

## 1. INTRODUCTION:

Approximately 80% of the global population, particularly in developing nations, still relies on traditional medicine for basic medical issues. Therefore, research has concentrated during the last ten years on the scientific assessment of conventional medications with plant origins. The evaluation of plants used in traditional medicine needs to be done immediately [1, 2]. The use of herbs for their therapeutic or medical properties is known as plant medicine, sometimes known as herbalism or botanical medicine. An herb is a plant or plant component that is prized for its therapeutic, savoury, or fragrant properties. Several active chemicals that have an impact on the body are produced and present in herb plants. A crucial step in finding the bioactive components of medicinal plants is the preliminary screening of phytochemicals, which can also lead to the development of new, ecologically friendly bioherbicides and drugs [3].

The main cereal crop is wheat (*Triticum aestivum* L.), which is a staple crop and provides food for more than 40% of the world's population [4]. Given that this crop is so important to global food security, it is the most commonly grown grain in the world. The STATISTA (2020) estimates that there are 215 million hectares of wheat planted worldwide, with a production of

765.41 million tonnes and a productivity of 3.56 tons/ha [5].

### Classification of wheat grass: [6]

Kingdom : Plantae  
 Subkingdom : Viridiplantae  
 Superdivision : Embryophyta  
 Division :  
 Tracheophyta/Magnoliophyta  
 Subdivision : Spermatophyta  
 Class : Liliopsida  
 Order : Poales  
 Family : Poaceae  
 Subfamily : Pooideae  
 Tribe : Triticeae  
 Genus : *Triticum*  
 Species : *aestivum*

Synonyms *Triticum hybernum* L., *Triticum sativum* Lam., *Triticum vulgare* Vill

**Botanical Description:** This annual grass grows in 2 to 3 and a half inch tall, leafy culms that are either single or tufted. The culms are upright, terete, light green, glabrous, and occasionally glaucous. Alternate leaves develop throughout the length of each culm. The leaf blades measure 5 to 12 inches long and 6 to 18 mm in width. The leaves are glabrous, occasionally glaucous, and appear bluish or greyish-green. These blades are floppy, rising, or arching. These blades frequently have circular auricles with wavy, scar-like borders at their bottoms. The properties of the open leaf sheaths are similar to those of

the leaves. The nodes are enlarged and glabrous, and the ligules are short-membranous and just 1-2 mm long. Each culm has an upright, 2-4 inch long flowery spike at the end. These flower spikes have additional deeper patterns and are similarly

greyish or bluish-green in colour. Each floral spike also includes numerous overlapping spikelets pressed up against the rachis, which is the core stalk of the spike and is likewise almost upright [7].



Figure 1: Wheat Grass

**Geographical distribution:** The Levant region of the Near East was the origin of the wheat plant [8]. The *T. aestivum* plant is mostly grown in temperate, irrigated-to-dry, high-rainfall locations that are warm, humid-to-dry, and chilly. It is grown practically everywhere in the world and is native to southwest Asia and the Mediterranean region [9]. Out of the roughly 15-20 species of *T. aestivum* that have been widely described, 8 species of wheatgrass are allegedly present in India.

**2. PHYTOCHEMISTRY:** Bran, germ, and endosperm are the three fractions that make up wheat goods. Three main components make up 90% of the dry weight of ripe wheat grain: polysaccharides found in cell walls, proteins, and starch.

**2.1 Mineral content in Wheatgrass:** The most frequently found minerals in wheatgrass are those that play a substantial positive effect in the human body. Up to 30 ml of wheatgrass juice each day is advised [10, 11].

Table 1: Concentration of element and vitamins in wheat grass [12-16]

Elements	Concentration (mg per 100 g)	Vitamins	Concentration (mg per 100 g)	Bran component	% Dry matter
Zinc	8.3-14.0	Vitamin E (Tocopherol)	0.13-9.5	Protein	9.60-18.6
Manganese	0.9-1.1	Vitamin B1 (Thiamine)	0.51-1.6	Carbohydrate	60.0-75.0
Phosphorus	900-1500	Vitamin B2 (Riboflavin)	0.20-0.80	Starch	9.10-38.9
Iron	1.9-34.0	Vitamin B6 (Pyridoxine)	0.30-1.30	Moisture	8.1-12.7
Magnesium	530-1030	Vitamin B9 (Folate)	0.088-0.80	Dietary fibre	33.4-63.0

## 2.2 Chemical Constitutes:

**i) Phenolic Acid:** The most common phenolic acids found in whole wheat flour include 4- hydroxybenzoic acid, caffeic acid, vanillic acid, syringic acid, para-coumaric acid, trans- ferulic acid (FA), sinapic acid, and cis-FA. Trans-FA makes

up the majority of phenolic acids in wheat, making up more than 90% of all phenolic acids [17]. Phenolic acids come in a variety of shapes and are commonly defined in accordance with extraction protocols: Freely soluble, conjugated soluble, and bonded insoluble [18].

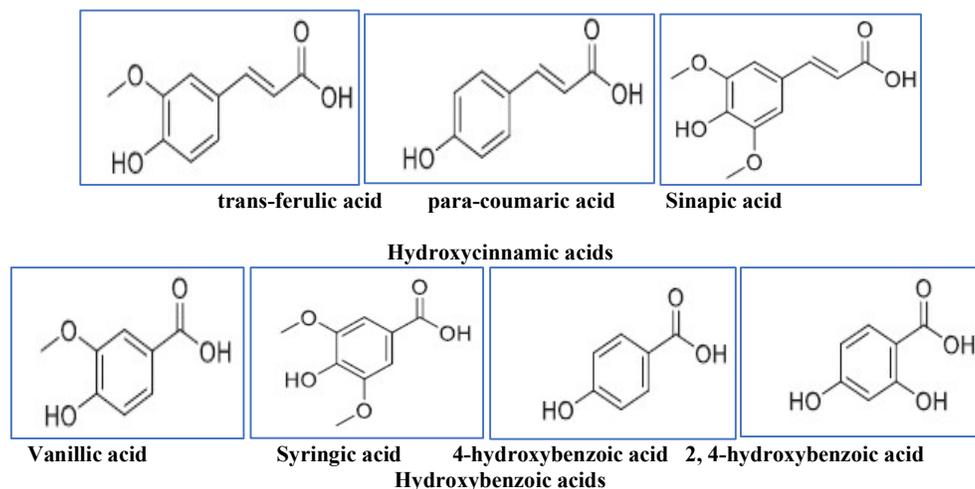


Figure 2: Phenolic Acids compounds of Wheat grass

**ii) Carotenoids:** Over 750 different carotenoids have been found in nature, with C40 terpenoids making up the majority of them [19]. Whole wheat flour contains lutein, zeaxanthin, cryptoxanthin, and beta-

carotene, which are common carotenoids. Carotenoids have been substantial research recently as provitamin-A and antioxidants in the human diet.

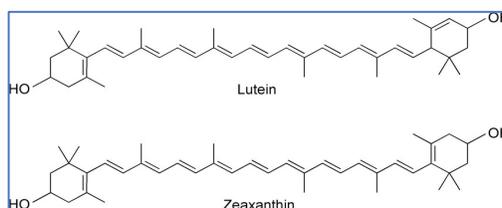


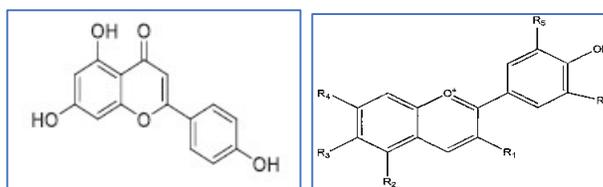
Figure 2: Carotenoids compound of Wheat flour

**iii) Flavonoids:** Flavonoids possess a 15-carbon skeleton consisting of two benzene rings and a heterocyclic ring (i.e., C6-C3-C6 structure). They are divided into six different classes based on the C6-C3-C6

skeletons: anthocyanidins, chalcones, flavones, flavonols, flavanones, and isoflavones [20]. Whole wheat contains flavonoids, which come in soluble and insoluble varieties, similar to phenolic

acids. 13 anthocyanins are found in wheat's flavonoids after qualitative examination, with cyanidin 3-glucoside predominating

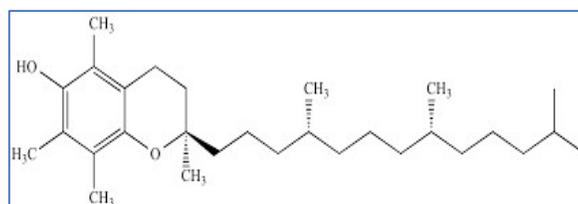
[21]. Wheat germs have been found to contain 72 flavone C- glycosyl derivatives, according to Geng *et al* [22].



**Apigenin**  
**Anthocyanin**  
**Figure 3: Flavonoid compound of wheat grass**

**iv) Tocopherols and tocotrienols:** There are eight common, naturally occurring isomers of vitamin E (alpha-, beta-, gamma-, and delta-tocopherols; alpha-, beta-, gamma-, and delta- tocotrienols). Unsaturated side chains are found in

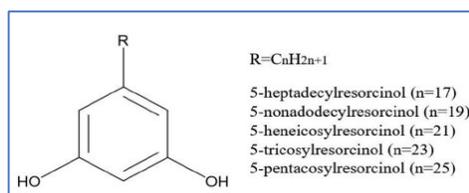
tocotrienols while saturated side chains are found in tocopherols. The main vitamin E type found in animal products is alpha-tocopherol, whereas tocotrienols are abundant in cereal grains [23].



**Figure 4: beta tocopherol**

**v) Alkylresorcinols:** Resorcinol lipids, sometimes referred to as alkylresorcinols (ARs), are phenolic lipids made up of resorcinol-type phenolic rings and odd-numbered aliphatic chains. However, whole grain barley, wheat, and rye were shown to be the main food sources for ARs. Previous

research has identified more than 100 types of ARs in plants and microbes [24]. The saturated aliphatic side chain in wheat grain ARs often has 17, 19, 21, 23, or 25 carbons. Additionally, ARs with unsaturated side chains have been discovered. [25]



**Figure 5: Alkylresorcinols (ARs) in whole grains**

**vi) Phytosterols:** With the exception of having an additional methyl or ethyl group, phytosterols have chemical structures that

are identical to those of cholesterol [26]. With almost 50% of all sterols coming from phytosterols, sitosterol dominates in

whole wheat. Campesterol, sitostanol, and campestanol are other popular phytosterols [27]. Before, it was thought that

phytosterols came in free, ester, glycoside, and acylated glycoside forms [28].

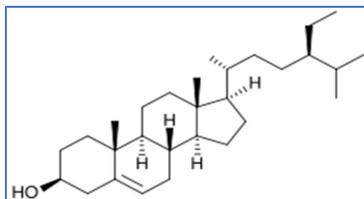


Figure 4: Phytosterols Compound Sitosterol

**vii) Benzoxazinoids:** Previously, BXs were believed to exist mainly in the roots and shorts of some cereals as an important part of the plants' defense system [29]. In recent years, studies found that BXs were also present in mature grains of wheat and rye [30]. BXs are generally divided into three

groups according to their structures: benzoxazolinones, lactams, and hydroxamic acids. Tanwir *et al.*, found that dihexose of 2,4-dihydroxy-1,4-benzoxazin-3-one (DIBOA-Glc-Hex) was the predominant form of BXs [31].

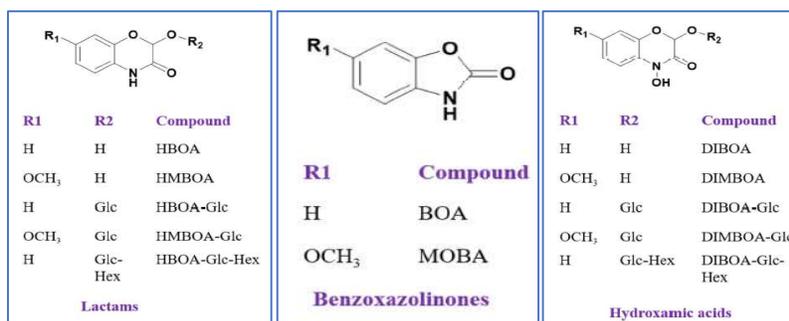


Figure 4: Structure of the Common Benzoxazinoids (BXs) in Whole Grains

BOA, benzoxazolin-2-one; MBOA, 6-methoxy-benzoxazolin-2-one; HBOA, 2-hydroxy-1,4-benzoxazin-3-one; HMBOA, 2-hydroxy-7-methoxy-1,4-benzoxazin-3-one; HBOA-Glc, 2-β-D-glucopyranosyloxy-1,4-benzoxazin-3-one; HMBOA-Glc, 2-β-D-glucopyranosyloxy-7-methoxy-1,4-benzoxazin-3-one; HBOA-Glc-Hex, dihexose derivative of HBOA; DIBOA, 2,4-dihydroxy-1,4-benzoxazin-3-

one; DIMBOA, 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one; DIBOA-Glc, 2-β-D-glucopyranosyloxy-4-hydroxy-1,4-benzoxazin-3-one; DIMBOA-Glc, 2-β-D-glucopyranosyloxy-4-hydroxy-7-methoxy-1,4-benzoxazin-3-one; DIBOA-Glc-Hex, dihexose derivative of DIBOA

**viii) Vitamins and minerals:** It contain various types of vitamins and minerals such as Vitamins A, Vitamins B 1, 2, 3, 5, 6, 8,

and 12; C, E and K, ascorbic acid, Iron, potassium, sodium, sulfur, selenium, copper, calcium, aluminium, phosphorus, iodine, magnesium, Zinc.

**ix) Enzymes:** Superoxide dismutase (SOD), Protease, transhydrogenase, lipase, amylase, cytochrome oxidase.

**x) Other special components:** It contain different types of Amino acids such as aspartic acid, glycine, asparagines, threonine, arginine, leucine, proline, tyrosine, histidine, glutamine, phenylalanine, alanine, valine, methionine, isoleucine, lysine, tryptophan and serine, P4D 1 (gluco-protein), muco-polysaccharides, and chlorophyll, bioflavonides like apigenin, quercetin and luteonin, indole compounds, choline and laetrile (amygdalin) [32].

### 3. USES OF WHEAT GRASS

- Wheatgrass, which is rich in vitamins, functions as an antioxidant and slows down the body's cells from ageing, which can lead to heart and brain issues. Wheatgrass's components play a variety of useful roles, including being a powerful tonic and being helpful for conditions including arthritis, skin allergies, greying or hair loss, weakness, weak eyesight, kidney stones, pyorrhea, dental infections, and weariness. In severe

cases of heart illness, acute stomach pain, digestive tract infections, gas, asthma, leukaemia, paralysis, diabetes, constipation, leucoderma, and other cancers, it is also incredibly helpful [33].

- Because chlorophyll has a high magnesium level, it helps menopause be easier to handle while also restoring fertility and promoting youthfulness. Drinking wheatgrass juice is a quick and effective approach to rid your body of environmental toxins. Due to its high concentration of enzymes and amino acids, it functions as a natural cleaner to detoxify the liver, remove harmful heavy metals from the blood, break down impacted matter in the colon, and get rid of waste materials from the body [34].
- Chlorophyll and wheatgrass are phytonutrients that support each other in boosting immunity because they are both high in minerals, vitamins, fibre, amino acids, and enzymes. It strengthens resistance to infections, gets rid of bodily impurities, and thanks to its alkaline qualities, it helps with urinary issues. It increases metabolism and balances blood alkalinity, and the number of alkaline minerals it

contains helps to lower excessive blood acidity [35].

#### 4. PHARMACOLOGICAL ACTION

**i) Anti-oxidant potential:** anti-hyperglycemic, hypolipidemic, and cell reinforcement influence of aqueous extract of *T. aestivum* grass was evaluated. With a high-fat diet and a single intravenous infusion of STZ (45 mg/kg), two models of insulin blockage were used (fructose 10% w/v, p.o., not required). In terms of results, TAGE effectively reduced plasma glucose, lipids, MDA levels, and increased SOD activity. Additionally, insulin blockage that is identical to that of a typical and routine gathering was further established [36, 37].

**ii) Anti-hypertensive effect:** Recent studies compared the effects of *Triticum aestivum* aqueous extracts on blood glucose levels to glibenclamide at doses more than 50 mg/kg body weight. The investigation of the chronic toxicity of *Triticum aestivum* aqueous extracts taken orally and delivered at large non-therapeutic doses revealed no evidence of harm after long-term use. In last, *Triticum aestivum* aqueous extract has a strong antihyperglycemic effect and is safe in therapeutic levels [38].

**iii) Anti-diabetic effect:** Antidiabetic effect of *T. aestivum* on rats. *Rattus norvegicus* rodents with light skin were divided into four groups, each contain 10 animals. The intraperitoneal injection of 150 mg/kg body weight of alloxan

monohydrate caused diabetes. It is believed that providing diabetic patients with a diet based on *Triticum aestivum* (wheat) might help with the management of diabetes mellitus [39].

**iv) Immunomodulatory effects:** In order to demonstrate that wheatgrass is a potent anticancer agent, this experiment used wheatgrass juice and powder. Researchers developed a different extraction technique to separate chemicals, and in this way, they evaluated their bioactivities, particularly their immunomodulatory and anti-tumor activities. In concludes that wheatgrass juice and powder incorporate constituents with restorative worth that can be utilized for additional examination as an enemy of malignancy specialist [40].

**v) Antacid activity (in-vitro):** The in vitro stomach settling agent movement of rough fluid and ethanolic leaf concentrates of *T. aestivum* L. and *H. vulgare* L. was assessed using the primer stomach settling agent test, assurance of corrosive balance limit, corrosive killing impact, term of predictable balance, and buffering limit. The results of the primer stomach settling agent test indicated that fluid concentrates would be recommended since they have a higher potential as an acid neutralizer than ethanolic eliminates. *T. aestivum* fluid concentrate had the strongest activity in vitro stomach settling agent movement [41].

**vi) Rheumatoid Arthritis:** This may be due to the presence of wheatgrass, which contains vitamins A, B 1, B2, B3, BS, B6, and B12, vitamin C, E, and K, calcium, iodine, selenium, zinc, and many other minerals, such as superoxide dismutase, muco-polysaccharides, and chlorophyll. In a study, when 8.5g of fermented wheatgrass extract (Avenar) taken twice daily with water, by lowering pain and swelling, the anti-inflammatory characteristics have a good impact on bone and joint issues [42].

**vii) Anti-carcinogenic effect:** The ethanol extract of the wheat grass plant yielded methylphosphorbide a (MPa), which was separated. Hydroxyl radical scavenging activities and reducing capacity, which are dramatically upregulated compared to the plant's aqueous extract, are used to measure the antioxidative efficacy of the substance. On HeLa and Hep G2 cells, it exerts antioxidative and cytotoxic actions. The ability of malignant cells to survive declines as MPa concentration rises. These findings support the traditional application of the wheat grass plant in the management of oxidative stress, cancer, and iron overload illnesses [43].

**viii) Iron Chelating Property:** The antioxidants and chelating properties of phenolic and flavonoid content, which are abundant in wheat grass, are well recognised. The purpose of this study was to assess the protective effects and mode of

action of *T. aestivum* on animals with iron overload caused by iron dextran. Reduced blood iron levels and ferritin levels are caused by a rise in iron excretion in the urine and faeces, which may indicate that *Triticum aestivum* has iron-chelating characteristics. As a result of its iron chelation property, our data indicate *Triticum aestivum* has a positive impact on illnesses associated with iron overload [44].

**ix) Anti-inflammatory activity:** In animal models, the anti-inflammatory properties of the *Triticum aestivum* (wheat grass) aqueous, methanolic, and acetone extract were studied. The methanolic extract of *Triticum aestivum* had a considerable anti-inflammatory effect. *Triticum aestivum* extracts in acetone and water have also demonstrated strong anti-inflammatory action, but less so than the methanolic extract and conventional medication. Phytoconstituents found in the examined extract were said to be responsible for the action [45].

**x) Antidepressant:** Swiss Albino rats were used as chronic models for the Tail Suspension Test (TST) and Forced Swim Test (FST) to assess the potential antidepressant effects of wheatgrass ethanol extract. Wheat grass was collected, then dried wheat grass was extracted using a Soxhlet system to produce ethanol. The ethanolic extract of wheatgrass has flavonoids, alkaloids, saponins, tannins,

terpenoids, sterols, and other chemicals, according to a preliminary phytochemical investigation. According to the results of this study, wheatgrass may be utilised as an adjuvant in the treatment of depression [46].

**xi) Antimicrobial activity:** For the evaluation of antimicrobial properties two wheat varieties namely Kheri and Pavon 76 were considered for this study. Extracts of methanol and ethanol were used against three gram positive and one gram negative bacteria at different concentration levels. Whole plant extracts in methanol and ethanol represented highest inhibition zone against *E. coli* in case of Pavon76. It is an indication of the broad spectrum antibacterial potential of wheat which makes the plant a candidate for bio-prospecting of antibiotic drugs [47].

**xii) Alzheimer's disease:** The Morris water maze test was used to measure memory function after aluminium chloride (4.2 mg/kg) was used to create memory impairment. To test its effectiveness, wheat grass (100 mg/kg, p.o.) and aluminium chloride were administered to Wistar rats for 28 days. Malondialdehyde levels were decreased while superoxide dismutase and catalase levels were up in wheatgrass, which considerably increased the ability to reduce oxidative stress. Antioxidant qualities in wheat grass have been

discovered; this unexpected benefit may be exploited to treat Alzheimer's disease [48].

**xiii) Antilithiatic activity (In-vitro):** In some circumstances, urolithiasis might result in the loss of renal function. In this study, polarised microscopy, FTIR spectroscopy, and wheat bran (*Triticum aestivum* L) extract were used to investigate the wheat bran extract's ability to prevent calcium oxalate crystallisation in a turbidimetric model. The outcomes demonstrate that this plant extract significantly inhibits the crystallisation of calcium oxalate [49].

**xiv) Anti-ulcer activity:** In a randomised, double-blind, placebo-controlled research, WGJ Ben-Arye *et al.* [50] found that the use of wheat grass (*Triticum aestivum*) juice as a single or adjuvant treatment of active distal Ulcerative colitis is very effective and safe (UC). Rats under stress responded favourably to green juice and fractions from it that contained water-soluble organic chemicals and water-soluble proteins, which prevented stomach ulcers.

**xv) Blood building activity in Thalassemia major:** In a pilot study by Marwaha *et al.*, to scientifically assess the effectiveness of wheat grass juice therapy in patients with transfusion-dependent beta-thalassemia, it was found that 50% of the patients consumed wheat grass juice, which had a favourable influence on their

transfusion needs. According to the study, WGJ may help thalassemic patients with less frequent transfusions [51].

**5. CONCLUSION:** The variety of wheat constituents, including dietary fibres, polyphenolic chemicals, and alkylresorcinols, as well as the many cultivars and variations, may play a significant role in the biological and pharmacological actions of this cereal grain. Numerous pharmacological potentials of wheat herb have been documented, including its ability to be anti-genotoxic, anti-cancer, anti-inflammatory, anti-diabetic, antacid, iron-chelating, fertility-boosting, anti-hypertensive, anti-oxidant, and anti-hyperlipidemic. Wheat grass can also be used to treat and prevent conditions including diabetes, anaemia, ulcers, arthritis, cancer, thalassemia, and other major illnesses like diabetes mellitus. In conclusion, because of its distinctive therapeutic characteristics and ease of availability, it has been widely utilised as a plant in the treatment of many disorders.

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