



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 3102-3106
© 2023 TPI

www.thepharmajournal.com

Received: 15-02-2023

Accepted: 19-03-2023

Harshpreet Singh

Department of Food Technology and Nutrition, School of Agriculture, Lovely Professional University, Punjab, India

Tamana Saini

Department of Food Technology and Nutrition, School of Agriculture, Lovely Professional University, Punjab, India

Poonam Jaglan

Department of Food Technology and Nutrition, School of Agriculture, Lovely Professional University, Punjab, India

Potential applications of wheatgrass in functional foods and nutraceuticals

Harshpreet Singh, Tamana Saini and Poonam Jaglan

Abstract

Wheatgrass, the young shoots of the wheat plant (*Triticum aestivum*), has received a great deal of attention in recent years for its potential health benefits and rich nutritional profile. The purpose of this review is to explore the potential applications of wheatgrass in functional foods and nutraceuticals. The article first highlights the composition of wheatgrass, which includes vitamins, minerals, amino acids, enzymes, chlorophyll, and bioactive compounds. These components contribute to its antioxidant, anti-inflammatory, antimicrobial and immunomodulatory properties. In addition, the possible functional uses of wheatgrass in various foods are discussed in the review. Wheatgrass can be incorporated into beverages such as juices and smoothies, as well as baked goods, pasta and snacks, increasing their nutritional value. In addition, wheatgrass extracts can be used as natural food coloring or flavoring, adding a vibrant green hue and unique flavor to foods. This review also examines the nutraceutical potential of wheatgrass. Wheatgrass supplements have been linked to several health benefits, including detoxification, improved digestion, enhanced immune function, and potential anti-cancer effects. The review presents evidence from preclinical and clinical studies supporting these claims, although more research is needed to determine the efficacy and safety of wheatgrass-based nutraceuticals.

Keywords: Food applications, functional foods, health benefits, nutraceuticals, nutritional composition, wheatgrass

Introduction

Due to its high nutrient content and potential health advantages, wheatgrass, a young grass of the wheat plant, has grown in popularity as a functional food and nutraceutical in recent years. Since ancient times, people from many different cultures have used wheatgrass as a form of traditional medicine. It is frequently consumed in juice or supplement form. Vitamins, minerals, antioxidants, and other bioactive chemicals found in wheatgrass are abundant and have been linked to a number of health advantages (Bar-Sela *et al.*, 2015) ^[7]. These may have anti-inflammatory effects, immune system boosters, and advantages for digestive health. Additionally, some studies have suggested that consuming wheatgrass may benefit people with chronic illnesses like cancer, diabetes, and cardiovascular disease. Nutraceuticals are goods made from food sources that have therapeutic capabilities, whereas functional foods are those that offer health advantages above and above those of basic nutrition. Wheatgrass falls under both of these headings because it has been investigated for its possible therapeutic uses and includes a variety of health-promoting chemicals (Rana *et al.*, 2011) ^[8]. Even though wheatgrass is typically thought to be safe for the majority of people, there are some possible side effects and drug interactions that could occur if you consume it. Consumers should carefully analyse the source and processing techniques of any wheatgrass supplements they may be contemplating because the quality and safety of wheatgrass products can vary.

Wheatgrass refers to the young shoots of the wheat plant *Triticum aestivum*, which are harvested when they are less than 10 days old. These bright green blades of grass are commonly consumed in juice or powder form as a nutrient-dense functional food or nutraceutical (Kulkarni *et al.*, 2006) ^[9]. Wheatgrass has been used for medicinal purposes for centuries, with its origins dating back to ancient Egyptian and Mesopotamian civilizations. In modern times, wheatgrass has gained popularity as a healthy food due to its high content of vitamins, minerals, antioxidants, and other bioactive compounds. Wheatgrass is considered a natural source of essential vitamins, including vitamin A, vitamin C and vitamin E. It is also a rich source of minerals such as iron, magnesium and calcium. In addition, wheatgrass is rich in antioxidants, which are important to protect the body from oxidative stress and cell damage (Gore *et al.*, 2017) ^[10].

Corresponding Author:

Harshpreet Singh

Department of Food Technology and Nutrition, School of Agriculture, Lovely Professional University, Punjab, India

The potential health benefits of wheatgrass are tremendous, with some studies suggesting that it may support immune function, reduce inflammation, and improve digestion. Wheatgrass has also been studied for its potential anti-cancer properties.

Nutraceutical is a term that refers to products derived from food sources that have medicinal or health-promoting properties beyond basic nutrition. These products can include dietary supplements, functional foods, and herbal products. Nutraceuticals are often used as a natural alternative to traditional medicines or to complement existing therapies (Shukla *et al.*, 2009) ^[11]. They typically consist of bioactive compounds found in foods such as vitamins, minerals, antioxidants, probiotics, and plant extracts. Examples of nutraceuticals are dietary supplements with omega-3 fatty acids, probiotics and herbal remedies such as echinacea or ginseng. Functional foods, i.e. foods that have been fortified or fortified with additional nutrients or bioactive compounds, can also fall under the term nutraceuticals. Examples of functional foods are fortified cereals, energy bars, and beverages with added vitamins or antioxidants (Annapurna, 2011) ^[12]. Nutraceuticals are often marketed as safe and natural., with fewer side effects than traditional drugs. In this

article potential applications of wheatgrass juice are explained.

Nutritional and Bioactive Properties of Wheatgrass

Wheatgrass is a rich source of vitamins A, C, E and K, as well as minerals such as iron, calcium and magnesium. It's also a good source of B-complex vitamins, including thiamine, riboflavin, niacin, and folic acid (Table no 1). Wheatgrass contains several antioxidant compounds, such as flavonoids, phenolic acids, and carotenoids (Mujoriya and Bodla, 2011) ^[13]. These compounds help protect the body from free radical damage, which can lead to chronic diseases. Wheatgrass is a good source of chlorophyll, a green pigment found in plants. Chlorophyll has been shown to have several health benefits such as: B. reducing inflammation and promoting detoxification. Wheatgrass contains several enzymes including protease, amylase, and lipase that aid in digestion and absorption of nutrients. Wheatgrass contains all nine essential amino acids, which are the building blocks of proteins (Ghumman *et al.*, 2017) ^[14]. These amino acids are necessary for the growth and repair of tissues in the body. Wheatgrass has an alkalinizing effect on the body, helping to balance pH and reduce acidity.

Table 1: Nutritional profile of wheatgrass

Contents	mg/100g	Benefits	References
Ash (Total)	0.15 - 0.28	Tells about the quantity of minerals and different elements in food	Rosenfelder <i>et al.</i> 2013 ^[1]
Calories	18 - 21	Provide energy to do work	Padalia <i>et al.</i> 2010 ^[2]
Carbohydrates	1.3- 4	Aids digestion, helps in maintaining blood cholesterol levels	Thakur <i>et al.</i> 2019 ^[3]
Chlorophyll	42-112	Detoxification, blood building and wound healing	Dholi, 2018 ^[4]
Dietary Fiber	< 0.1	Maintain blood sugar levels, aids in gaining weight and lower cholesterol level	Padalia <i>et al.</i> 2010 ^[2]
Fat	0- 0.06	Helps in absorption of vitamins	Chouhan and Mogra, 2014 ^[5]
Protein	1.61-1.91	Helps in muscle building	Han <i>et al.</i> , 2015 ^[6]
Vitamin A (Retinol)	0.25-0.35	Maintain normal vision and good immune system	Ghumman <i>et al.</i> , 2017 ^[14]
Vitamin B1 (Thiamine)	2-5.5	Good for diabetes and prevents heart and kidney problems	Thakur <i>et al.</i> 2019 ^[3]
Vitamin B2 (Riboflavin)	1.5-5	Helps in breakdown of fats, proteins, carbohydrates and ATP production	Shukla <i>et al.</i> , 2009 ^[11]
Vitamin B3 (Niacinamide)	3-6	Improves skin health, brain function and reduce blood pressure	Padalia <i>et al.</i> 2010 ^[2]
Vitamin B5 (Pantothenic Acid)	5-6	Maintain digestive tract health and helps withstand stressful conditions	Ghumman <i>et al.</i> , 2017 ^[14]
Vitamin B6 (Pyridoxine)	0.2-1.3	Helps in regulation of genes and cellular function	Shukla <i>et al.</i> , 2009 ^[11]
Vitamin B12 (Cyanocobalamin)	0.3-0.5	Helps in cell division and functioning of erythrocytes	Padalia <i>et al.</i> 2010 ^[2]
Vitamin C (Ascorbic Acid)	2-4	Affects the increase of white blood cells production	Thakur <i>et al.</i> 2019 ^[3]
Vitamin E	6.5-8.5	Prevents aging, arthritis and cancer	Chauhan M 2014 ^[15]
Calcium	24-29	Maintain good bone health	Rosenfelder <i>et al.</i> 2013 ^[1]
Iron	24-26	Prevents anemia	Chauhan M 2014 ^[15]
Magnesium	19-24	Helps in muscular contraction and maintaining blood pressure	Shukla <i>et al.</i> , 2009 ^[11]
Phosphorus	15-21	Formation of bones and teeth	Rosenfelder <i>et al.</i> 2013 ^[1]
Potassium	42-57	Helps in regulation of ATP	Chauhan M 2014 ^[15]
Sodium	10-12	ATP regulation with potassium	Han <i>et al.</i> , 2015 ^[6]
Zinc	0.2-0.3	Required for enzyme production	Ghumman <i>et al.</i> , 2017 ^[14]

Functional Foods and Nutraceuticals

Functional foods and nutraceuticals are terms used to describe food products that provide additional health benefits beyond their basic nutritional value. These products are intended to promote health, prevent diseases or increase general well-being. Functional foods are typically whole foods or fortified foods that contain bioactive compounds such as vitamins, minerals, fiber, probiotics, or antioxidants. These compounds have been shown to have beneficial effects on specific bodily

functions or physiological processes (El Sohaimy, 2012) ^[16]. Examples of functional foods are fortified cereals, eggs fortified with omega-3 fatty acids, or yogurt with probiotics. Nutraceuticals, on the other hand, are isolated compounds or extracts from food sources that have medicinal or therapeutic properties. These products are typically available in pill, capsule, or liquid form and are taken as dietary supplements. Examples of nutraceuticals are fish oil capsules, green tea extract supplements, or glucosamine chondroitin tablets

(Siciliano *et al.*, 2021) [17]. Both functional foods and nutraceuticals have grown in popularity in recent years due to growing interest in preventive healthcare and the desire for natural alternatives to traditional medicines. They are often marketed as promoting specific health benefits, such as improving cardiovascular health, boosting immune function, improving cognitive performance, or supporting joint health. It is always recommended to consult a doctor before adding any new supplements into your routine, especially if you have any health conditions or are taking any medication (Daliri and Lee, 2015) [18].

Potential Applications of Wheatgrass in Functional Foods and Nutraceuticals

Wheatgrass is the young grass of the common wheat plant (*Triticum aestivum*). It is considered a nutrient-dense superfood and is used in functional foods and nutraceuticals for its potential health benefits. Wheatgrass can be incorporated into various functional food products such as energy bars, smoothies, juices and health drinks. It is rich in essential vitamins (A, C, E and K), minerals (iron, magnesium, calcium), amino acids, enzymes and chlorophyll (Adhikary *et al.*, 2021) [19]. These nutrients can enhance the nutritional profile of foods and offer potential health benefits. Wheatgrass contains high levels of antioxidants, including flavonoids and phenolic compounds. These antioxidants help neutralize free radicals in the body and protect against oxidative stress associated with various chronic diseases. Wheatgrass extracts or powder can be used in nutraceutical formulations for antioxidant support (Iyer *et al.*, 2011) [20]. Wheatgrass is often associated with its detoxifying and

cleansing properties. It is believed to help remove toxins from the body, support liver function, and improve digestion. Nutraceutical products like detox supplements or cleansing powders can include wheatgrass as an ingredient for these potential benefits. Wheatgrass contains various bioactive compounds that may support immune system function. It contains compounds like chlorophyll, flavonoids, and enzymes that have been linked to reducing inflammation in the body (Shyam *et al.*, 2007) [21]. This makes wheatgrass a potential ingredient in functional foods or nutraceuticals to treat inflammation-related diseases.

Health Benefits of Wheatgrass in Functional Foods and Nutraceuticals

Nutritional powerhouse

Wheatgrass is packed with essential vitamins, minerals and enzymes. It contains vitamins A, C and E as well as minerals such as iron, magnesium and calcium. These nutrients play important roles in various bodily functions, such as supporting immune function, promoting healthy skin, and aiding in energy production (Rodríguez *et al.*, 2022) [22].

Antioxidant Activity

Wheatgrass is known for its high levels of antioxidants, including flavonoids, phenolic compounds and chlorophyll. Antioxidants help protect the body from free radical oxidative stress, which can lead to cell damage and contribute to chronic disease. By including wheatgrass in functional foods and nutraceuticals, its antioxidant properties can support overall health and well-being (Fig 1).

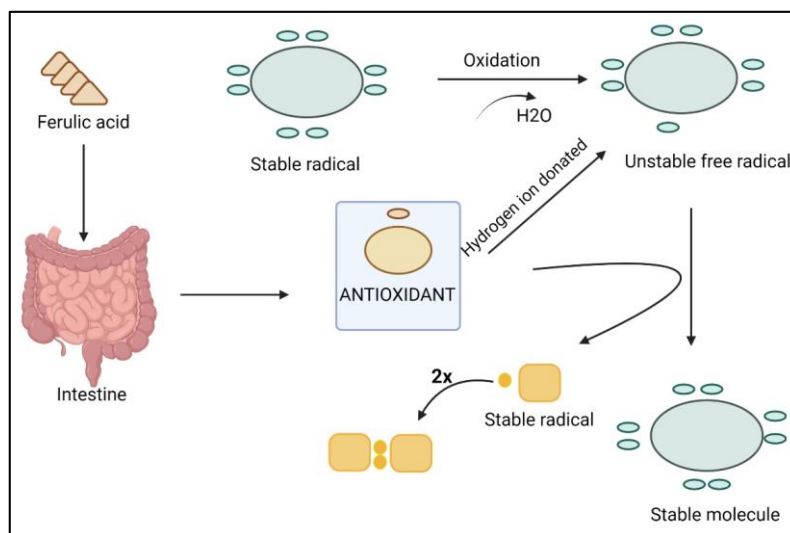


Fig 1: Antioxidant activity of bioactive compound ferulic acid present in wheatgrass

Detox Support

Wheatgrass is often associated with detoxification because it can potentially help remove toxins from the body. It contains compounds that may support liver function and digestion. Including wheatgrass in functional foods and nutraceuticals to support detoxification can help promote a healthy detoxification process (Zhang *et al.*, 2019) [23].

Alkalinizing Properties

Wheatgrass is considered an alkalinizing food, meaning that it helps maintain the body's pH balance. A more alkaline

environment is believed to support overall health and reduce the risk of certain diseases. The inclusion of wheatgrass in functional foods and nutraceuticals can contribute to the body's alkaline balance (Rana *et al.* 2011) [8].

Potential Anti-Inflammatory Effects

Some studies suggest that wheatgrass may possess anti-inflammatory properties. Chronic inflammation is linked to various health conditions, including cardiovascular disease, arthritis, and certain types of cancer. Including wheatgrass in functional foods and anti-inflammatory nutraceuticals may

help reduce inflammation and promote overall wellness (Nalini *et al.*, 2011) ^[24].

Safety and Quality Control of Wheatgrass Products

The safety and quality control of wheatgrass products includes several important aspects to ensure they are safe for consumption and meet desired standards. Wheatgrass products should be sourced from reputable suppliers who employ good agricultural practices. This includes using high-quality seeds, organic or pesticide-free cultivation methods, and ensuring adequate soil and water quality. Wheatgrass should be harvested at the right time to maximize its nutrient content. The cutting process should be clean and free from contamination (Islam *et al.*, 2021) ^[25]. Proper processing techniques are critical to maintaining the safety and quality of wheatgrass products. The grass should be washed thoroughly to remove dirt, debris and possible microbial contamination. The drying process should be done carefully to preserve the nutritional value of the weed (Das *et al.*, 2012) ^[26]. Regular quality checks are essential to ensure wheatgrass products meet safety standards. This includes testing for microbial contamination, heavy metals, pesticides and other potential contaminants. The tests should be performed by reputable third-party laboratories (Skoczylas *et al.*, 2018) ^[27]. Wheatgrass products should be packaged in clean and sanitary conditions, using appropriate materials that protect the product from moisture, light and oxygen. Proper labeling should include information about the product's contents, expiration date, and storage instructions. Proper storage conditions such as cool and dry environments should be maintained to prevent spoilage and preserve product quality. Manufacturers should comply with relevant food safety regulations and local authority guidelines. This ensures that the production, labeling and distribution of wheatgrass products comply with legal requirements and consumer safety standards (Rodriguez *et al.*, 2022) ^[22]. Look for wheatgrass products that are certified organic, as they are likely subject to stricter quality control measures. Certifications from reputable organizations can ensure product quality and safety.

Future perspective

As people become more health conscious and seek natural and nutrient rich foods, the demand for wheatgrass products is likely to increase. Wheatgrass is popular for its high levels of vitamins, minerals, antioxidants, and chlorophyll, which are believed to provide various health benefits. Manufacturers could explore new ways to incorporate wheatgrass into various food and beverage products to appeal to a broader consumer base. This can include wheatgrass-infused juices, smoothies, energy bars, snacks, and even wheatgrass-based supplements. With advances in agricultural technology, there may be innovations in wheatgrass growing techniques. This can include vertical farming, hydroponics or farming in controlled environments to optimize growing conditions, increase yields and ensure consistent product quality. Sustainable agricultural practices and organic farming methods are likely to gain in importance. Consumers are increasingly concerned about the environmental impact of food production. Therefore, wheatgrass products that are produced using sustainable methods such as regenerative agriculture or CO₂-neutral approaches could become more in demand. As with any new product, consumer education and awareness will continue to play a crucial role in the future of wheatgrass products. Manufacturers may invest in educational

campaigns to highlight the benefits, uses, and precautions associated with eating wheatgrass.

Conclusion

In summary, wheatgrass products have grown in popularity due to their perceived health benefits and nutrient-dense profile. Ensuring the safety and quality control of these products is vital to consumer satisfaction and well-being. Practices such as sourcing from reputable suppliers, proper cultivation, careful processing, rigorous quality testing, and compliance with regulations are essential steps in maintaining the safety and quality of wheatgrass products. Looking ahead, demand for wheatgrass products is expected to increase as more and more people choose healthy and natural foods. Product innovation, advanced farming practices, sustainable production practices, scientific advances, and consumer education are likely to shape the future of wheatgrass products. Stricter quality control measures and industry standards may also be introduced to meet growing consumer expectations. However, it is important to remember that individual reactions and allergies can vary and it is always advisable to consult a doctor before incorporating wheatgrass products into the diet. As with any emerging market, the future development of wheatgrass products will depend on various factors including market trends, technological advances and scientific discoveries.

References

1. Rosenfelder P, Eklund M, Mosenthin R. Nutritive value of wheat and wheat by-products in pig nutrition: A review. *Animal Feed Science and Technology*. 2013 Oct 25;185(3-4):107-125.
2. Padalia S, Drabu S, Raheja I, Gupta A, Dhamija M. Multitude potential of wheatgrass juice (Green Blood): An overview. *Chronicles of young scientists*. 2010 Apr 1;1(2):23-28.
3. Thakur N, Dhaliwal HS, Sharma V. Chemical composition, minerals and vitamins analysis of lyophilized wheatgrass juice powder. *International Journal on Emerging Technologies*. 2019;10(4):137-144.
4. Dholi UK. Phytochemical screening and estimation of nutritional content of wheatgrass powder and wheatgrass juice; c2018.
5. Chouhan SK, Mogra R. Development and quality evaluation of wheatgrass powder. *Food Science Research Journal*. 2014;5(1):26-9.
6. Han SW, Chee KM, Cho SJ. Nutritional quality of rice bran protein in comparison to animal and vegetable protein. *Food chemistry*. 2015 Apr 1;172:766-769.
7. Bar-Sela G, Cohen M, Ben-Arye E, Epelbaum R. The medical use of wheatgrass: review of the gap between basic and clinical applications. *Mini reviews in medicinal chemistry*. 2015 Oct 1;15(12):1002-1010.
8. Rana S, Kamboj JK, Gandhi V. Living life the natural way—Wheatgrass and Health. *Functional foods in health and disease*. 2011 Nov 30;1(11):444-456.
9. Kulkarni SD, Tilak JC, Acharya R, Rajurkar NS, Devasagayam TP, Reddy AV. Evaluation of the antioxidant activity of wheatgrass (*Triticum aestivum* L.) as a function of growth under different conditions. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*. 2006 Mar;20(3):218-227.

10. Gore RD, Palaskar SJ, Bartake AR. Wheatgrass: Green blood can help to fight cancer. *Journal of Clinical and Diagnostic Research: JCDR*. 2017 Jun;11(6):ZC40.
11. Shukla V, Vashistha M, Singh SN. Evaluation of antioxidant profile and activity of amalaki (*Emblca officinalis*), spirulina and wheat grass. *Indian Journal of Clinical Biochemistry*. 2009 Jan;24:70-75.
12. Annapurna A. Wheat grass health benefits. *Asian Journal of Pharmaceutical Research and Health Care*, 2011, 3(3).
13. Mujoriya R, Bodla RB. A study on wheat grass and its nutritional value. *Food Science and Quality Management*. 2011;2:1-8.
14. Ghumman A, Singh N, Kaur A. Chemical, nutritional and phenolic composition of wheatgrass and pulse shoots. *International journal of food science & technology*. 2017 Oct;52(10):2191-200.
15. Chauhan M. 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. El Sohaimy SA. Functional foods and nutraceuticals-modern approach to food science. *World Applied Sciences Journal*. 2012;20(5):691-708.
17. Siciliano RA, Reale A, Mazzeo MF, Morandi S, Silvetti T, Brasca M. Paraprobiotics: A new perspective for functional foods and nutraceuticals. *Nutrients*. 2021 Apr 8;13(4):1225.
18. Daliri EB, Lee BH. Current trends and future perspectives on functional foods and nutraceuticals. *Beneficial microorganisms in food and nutraceuticals*. 2015:221-44.
19. Adhikary M, Mukhopadhyay K, Sarkar B. Flavonoid-rich wheatgrass (*Triticum aestivum* L.) diet attenuates diabetes by modulating antioxidant genes in streptozotocin-induced diabetic rats. *Journal of Food Biochemistry*. 2021 Apr;45(4):e13643.
20. Iyer U, Dhruv S, Elayath N, Khalsa AK. Development, Acceptability, Physico-Chemical Properties and Tolerance Studies on an Antioxidant Rich Health Drink Enriched with Wheatgrass (*Triticum aestivum* Grass) and Indian Gooseberry (*Emblca officinalis*). *Inventi Impact: Nutraceuticals*. 2011 Oct 15;3:120-3.
21. Shyam R, Singh SN, Vats P, Singh VK, Bajaj R, Singh SB, Banerjee PK. Wheat grass supplementation decreases oxidative stress in healthy subjects: A comparative study with spirulina. *The Journal of Alternative and Complementary Medicine*. 2007 Oct 1;13(8):789-92.
22. Rodríguez FC, Gallagher E, Rai DK, Burgess CM. Nutritional and physiochemical properties of wheatgrass juice and preservation strategies. *Food Chemistry Advances*. 2022 Nov 10:100136.
23. Zhang L, Rylott EL, Bruce NC, Strand SE. Genetic modification of western wheatgrass (*Pascopyrum smithii*) for the phytoremediation of RDX and TNT. *Planta*. 2019 Apr 11;249:1007-15.
24. Nalini GK, Patil VM, Ramabhimaiah S, Patil P, Vijayanath V. Anti-inflammatory activity of wheatgrass juice in albino rats. *Biomedical & Pharmacology Journal*. 2011;4(2):301.
25. Islam MZ, Park BJ, Lee YT. Bioactive phytochemicals and antioxidant capacity of wheatgrass treated with salicylic acid under organic soil cultivation. *Chemistry & Biodiversity*. 2021 Feb;18(2):e2000861.
26. Das A, Raychaudhuri U, Chakraborty R. Effect of freeze drying and oven drying on antioxidant properties of fresh wheatgrass. *International journal of food sciences and nutrition*. 2012 Sep 1;63(6):718-721.
27. Skoczylas Ł, Korus A, Tabaszewska M, Gędoś K, Szczepańska E. Evaluation of the quality of fresh and frozen wheatgrass juices depending on the time of grass harvest. *Journal of Food Processing and Preservation*. 2018 Jan;42(1):e13401.