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## Evaluation of Ogolcho and Kingbird Bread Wheat (*Triticum Aestivum*) Varieties for Wheatgrass Juice Content

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### ABSTRACT

Wheatgrass juice is the young grass of the common wheat plant that is freshly pressed for human consumption. The main aim of this research work is to evaluate bread wheat varieties for wheatgrass juice content of two selected wheat varieties (Ogolcho and Kingbird) grown in Ethiopia. The experiments were carried out in a completely randomized design with wheat varieties as the factor of two levels (Ogolcho and Kingbird). The results showed that the total chlorophyll (71.47 mg/100 g and 62.68 mg/100 g), protein (3.30% and 3.59%), and total ash (1.40% and 1.03%) of the wheatgrass juices were for Ogolcho and Kingbird varieties, respectively. Minerals (Ca, Fe, K, Mg, Na, P and Zn) contents of wheatgrass juice variety were 36.2, 0.5, 503.4, 23.18, 8.6, 72.94 and 0.32 mg/100 g for Ogolcho variety and 35.8, 0.4, 395, 23.51, 7.8, 64.18 and 0.42 mg/100 g for Kingbird variety. The vitamins (A, C, D3, and E) were 0.15, 36.35, 0.018, and 0.244 mg/100 g in the juice of the Ogolcho variety while for the Kingbird variety were 0.15, 31.65, 0.018, and 0.236 mg/100g, respectively. The experimental analysis indicated that the number of majority parameters showed a significant difference ( $p \leq 0.05$ ) in the mean value of parameters. The result indicated that wheatgrass juice was high in nutrient composition than wheat grain (). Hence, the consumption of wheatgrass in the form of juice is beneficial in keeping away several health problems.

### INTRODUCTION

Wheatgrass juice is a young grass of a common wheat plant (*Triticum aestivum*) freshly squeezed for human consumption (Anwar *et al.*, 2015). Wheatgrass is grown on trays or mats to maintain its quality when supplied to food facilities (Treadwell *et al.*, 2013). The ideal conditions for growing wheatgrass are high light exposure, low humidity, and good air circulation. It is necessary and important to form chlorophyll and control mold growth (Dégraff, 2011).

Wheatgrass sown in winter and harvested at the time of joining contains the highest concentration of the active ingredient. At this stage, the plant reaches its highest nutritional value. After binding, the levels of chlorophyll, protein, and vitamins decrease sharply. Therefore, wheatgrass is harvested shortly before this stage of division, where soft shoots are at the peak of vegetative power. Wheatgrass grown outdoors is harvested, dehydrated at low temperatures, and sold in the form of tablets and powder concentrates. To grow wheatgrass indoors, it is usually necessary to bring wheat grains close together and grow them in small trays to produce high yields (Singh *et al.*, 2012). Growth changes were observed with changing conditions, and environmental parameters such as temperature, humidity, airflow, and the time it took to reach the target height were considered important for wheatgrass growth (Ashish *et al.*, 2012).

Wheatgrass juice (*Triticum aestivum* L.) is recognized as a healthy beverage due to its high antioxidant activity and phenolic compound content (Akbas *et al.*, 2017). Wheatgrass, the young grass of the common wheat plant, is pressed fresh or dried into a powder for use in animals and humans - both forms provide chlorophyll,

the minerals K, Ca, Fe, Mg, Na, and S, vitamins such as A, B, C and E, enzymes and 17 amino acids (Singh *et al.*, 2012). Two ounces (56.7 grams) of wheatgrass juice has a nutritionally equivalent amount called five pounds (2.27 kg) of the finest raw natural vegetables. For example, wheatgrass has twice as much vitamin A as carrots and higher vitamin C content than oranges. It contains all the B-complex vitamins, as well as calcium, phosphorus, magnesium, sodium, and potassium in adjusted ratios. Wheatgrass is a finite source of protein, providing most of the important amino acids and more. It contains about 20% of the total calories from protein. This protein is in the form of polypeptides, shorter and simpler chains of amino acids that the body uses more efficiently within the framework of the circulatory system and tissues (Thammana *et al.*, 2016). Wheatgrass is becoming a very popular green plant today due to its many useful roles in human diseases such as cancer, thalassemia, and cardiovascular disease. Wheatgrass juice is an impressive source of important nutrients; Antioxidants can neutralize the harmful effects of free radicals (Agrawal *et al.*, 2015). Wheatgrass is an important cereal grass in the world, a rich source of nutrients with remarkable nutritional and medicinal value. Wheatgrass is grown in indoor tanks and then used in powder and beverage form (Pasha *et al.*, 2018). Wheatgrass is a whole food that contains bioflavonoids, proteins, and other important nutrients and helps maintain bodily functions (Mogra and Rathi, 2013). The wheatgrass extract from the soft wheat plant (*Triticum aestivum*) is also known as “green blood” because it is immediately absorbed into the bloodstream and provides energy for about 20 minutes that lasts all day (Singhal *et al.*, 2012). Wheatgrass juice gives you more

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energy by filling nutritional deficiencies and removing waste products that clog your cells, blood, tissues, and organs. 15 pounds (6.81 kg) of wheatgrass juice has a nutritional value equivalent to 350 pounds (158.9 kg) of leafy greens and vegetables (Mujoriya and Bodla, 2011). Wheatgrass is known to reduce fatigue, improve sleep, increase strength, regulate blood pressure and blood sugar naturally, aid in weight loss, improve digestion and detox, support healthy skin, teeth, eyes, muscles, and joints, and improve heart function and lungs and reproductive organs heal sores and skin sores, slows down cell aging, improves mental function and are beneficial in arthritis and muscle cramps, thalassemia, hemolytic anemia, cancer, asthma, allergies, inflammatory bowel disease and detoxification (Chauhan, 2014).

Despite the health benefits of wheatgrass consumption, its acceptance and use remain low throughout the world. This could be attributed to it being consumed only by people in poor health, having a short shelf life, having low organoleptic properties, and being difficult to obtain good quality wheatgrass (Ashish *et al.*, 2012). Wheat is commonly consumed as wheat grain products, such as bread, scones, and other baked or steamed products, but with the recognition of wheatgrass' value as a "functional juice," and because of its quick maturity, ability to be grown in a variety of medium, and dense nutrition, there is a need to explore wheatgrass as an alternative venture or "functional juice" resource, particularly in developing countries where there is a dual nutritional void. More study is needed in this field, according to studies, to make wheatgrass broadly accepted as an economic activity that will not only contribute to the battle against malnutrition but also enhance the overall health of the population in areas where it is grown (Ashish *et al.*, 2012). It is not well-known in Egypt, and there is a lack of understanding about the best growing conditions for high-quality wheatgrass (Anwar *et al.*, 2015).

Wheatgrass cultivation and processing are carried out on a large scale in numerous nations; however, the origin of wheatgrass is unknown (Rana *et al.*, 2011). Wheatgrass is available in the United States, East Asia, and Eastern Europe in the form of healthy diets (powders, tablets) (Anwar *et al.*, 2015). Wheat (*Triticum aestivum* L.) is the most extensively grown staple food crop in the world, with the majority of the world's population eating it. Wheatgrass is the name given to the sprouts produced by the germination of wheat grains during 6–10 days (Akbas *et al.*, 2017).

Wheatgrass is very easy to grow and produces juice in both rural and urban homes. As a result, the information derived from this research is critical for the introduction of wheatgrass juice in Ethiopia, as well as for wheatgrass producers to understand the steps involved in growing wheatgrass and producing juice, and especially for wheatgrass juice consumers to obtain fresh, healthy, high-quality, and flavorful juice. However, no research has been conducted on Ethiopian bread wheat varieties for the nutritional properties of wheatgrass juice from this crop

for human consumption. As a result, the current study is intended to fill this void with the objective of evaluating the wheatgrass juice content of ogolcho and kingbird bread wheat varieties.

## MATERIALS AND METHODS

### Experimental Location

The experiment was conducted at Oromia Agricultural Research Institute in the food science laboratory, Addis Ababa; Ethiopian Public Health Institute, Addis Ababa; Ethiopian Conformity Assessment Enterprise, Addis Ababa and Jije Laboglass Plc (Analytical Testing Service Laboratory), Addis Ababa. Total chlorophyll was determined at Jije Analytical Testing Service Laboratory. Protein and vitamins (A, D3, and E) were determined at the Ethiopian Conformity Assessment Enterprise, vitamin C was conducted at the Ethiopian Public Health Institute and ash and minerals were determined at Oromia Agricultural Research Institute in the food science laboratory, respectively.

### Experimental Materials

The samples for evaluation, 5 kg grains of each ogolcho and kingbird bread wheat variety were obtained from the Ethiopian Seed Enterprise (ESE), Asella. Wheat grains were cleaned manually to remove germination inhibitors like foreign materials, and immature and damaged grains and were packed in polyethylene plastic bags and stored at room temperature (25°C).

### Experimental Design

The experiment was planned in a completely randomized design (CRD) which has one factor i.e. wheat variety. The factor was wheat (*Triticum aestivum* L.) varieties, which were Ogolcho and Kingbird. The raw wheat nutrient content standards of the two varieties were used as a control. Treatment was done in triplicate. The total runs were 9.

### Wheatgrass Production Methods and Processing Techniques

The production method for wheat grain sprouting was the tray method, using about 250 gm of wheat grain for sprouting. The sheet metal rectangular trays with sizes (40 x 24 x 11 cm) were developed in Asella Agricultural Engineering Research Center (AAERC) workshop. Grains of wheat were cleaned, washed, and soaked in tap water, and placed in 0.7-liter capacity glass jars for each replicate for 15 hours. Wheat seeds were rinsed with tap water 3–4 times before soaking. Draining of seed was carried out for 15 hours after which the seeds were found to be sprouted. Wheatgrass trays were prepared using soil and cow dung manure mixed in a ratio of 2:1. Sprouted seeds were spread over the soil in which the trays prevented the overlapping and increasing proximity between the seeds. After a little growth in height, the trays were transferred to a relatively warmer place with indirect sunlight and proper air circulation conditions for the development of

green color. When the wheatgrass reached a height above 7 inches, they were cut half an inch above the surface of the soil and harvested for wheatgrass juice production after 8 days from grain sowing or 13 days from grain soaking. The wheatgrass juice was extracted by manual or electric juicer and filtered to remove the suspended matter.



**Figure 1:** Flow diagram of wheatgrass growing and extracting (Ashish *et al.*, 2012)

### Nutrient composition Analysis

Collected wheatgrass juice from two wheatgrass varieties after being squeezed was placed in a container for cold storage (in a common refrigerator or freezer) prior to the analysis period. The major chemical constituents that make wheatgrass a valuable food such as protein according to AOAC (2012), Total chlorophyll according to Arnon (1949), and ash and minerals according to AOAC. (2012), and vitamins according to Freed (1966), were analyzed.

### Statistical Analysis

Nutrient composition data were statistically analyzed using the analysis of variance (ANOVA). The statistical

package used was R-software (version 3.4.3, 2017). Statistical differences in samples were tested at  $P < 0.05$  and the differences between means were compared using the least significant difference (LSD). The result was expressed as the mean  $\pm$  standard deviation.

## RESULTS AND DISCUSSIONS

A nutrient composition like total chlorophyll, protein, vitamins, and minerals of the two wheatgrass varieties juice (Ogolcho and Kingbird), was determined. The wheatgrass was produced in the same geographical region and harvested during the same season; this may lessen the influence of environmental factors in the analysis. The differences reflected in these properties between two wheatgrass varieties of juice can be attributed mainly to their genotypic characteristics. The results of all the determining parameters are discussed in the following sections.

### Total Chlorophyll and Proximate Contents of Wheatgrass Juice

Table 1 shows the total chlorophyll, protein, and ash content of wheatgrass juice types. The Ogolcho variety wheatgrass juice contained 71.47 mg/100 g total chlorophyll content, 3.3% protein, and 1.4% ash. Similarly, the Kingbird variety wheatgrass juice had 62.68 mg/100g total chlorophyll content, 3.59% protein, and 1.03% ash. Juice of Ogolcho wheatgrass variety showed a significant difference ( $P < 0.05$ ) higher value of total chlorophyll and ash contents than the juice of Kingbird wheatgrass variety, whereas Kingbird variety wheatgrass juice had greater protein than Ogolcho variety wheatgrass juice.

The total chlorophyll content of two wheatgrass varieties of juice was significantly different ( $P < 0.05$ ) from each other. The average values of Ogolcho and Kingbird wheatgrass varieties juice were 71.47 and 62.68 mg/100 g, respectively. Padalia *et al.* (2010) and Devi Sowjanya *et al.* (2015) reported 42.2 mg/100 g of total chlorophyll in the juice of wheatgrass which is lower than the present finding and Skoczylas *et al.* (2017) reported the total chlorophyll content of wheatgrass varieties juice as 39.4 mg/100 g. Ghumman *et al.* (2017) also reported in the range of 669 and 705 mg/100 g in wheatgrass juice powder, higher than the result obtained in this work.

**Table 1:** Total chlorophyll and proximate contents of wheatgrass juice

Variety	Total Chlorophyll (mg/100g)	Protein %	Ash %
Ogolcho	71.47a $\pm$ 1.13	3.30b $\pm$ 0.01	1.40a $\pm$ 0.57
Kingbird	62.68b $\pm$ 2.99	3.59a $\pm$ 0.01	1.03b $\pm$ 0.10
CV	3.37	0.16	6.71
LSD	5.12	0.01	0.18

Where CV = coefficient of variation; values are mean  $\pm$  SD and mean values followed by the same letter in a column are not significantly different at a 5% level of significance; LSD = least significance difference

The protein content of two wheatgrass varieties' juice was found to be significantly ( $P < 0.05$ ) different from each

other with values of 3.30 and 3.59% for Ogolcho and Kingbird wheatgrass varieties, respectively. The protein content of the wheatgrass varieties juice evaluated in this work showed relatively similar to the values obtained by Anwar *et al.* (2015) which ranged from 3.03 to 3.39% or 3.03g / 100 ml to 3.39 g/100 ml. Pasha *et al.* (2018)

reported 21.6% protein content in wheatgrass powder and Ghumman *et al.* (2017) found 22.01% to 25.77% of protein content in wheatgrass juice powder, higher than the result obtained in this work.

Ash content of two wheatgrass varieties of juice was significantly ( $P < 0.05$ ) different from each other. Ogolcho and Kingbird wheatgrass juice resulted in 1.40 and 1.03% ash, respectively. These values are higher than those of freshly squeezed wheatgrass juice reported by Skoczylas *et al.* (2017) which ranged from 0.783 to 0.833% and lower than those of wheatgrass juice powder reported by Ghumman *et al.*, 2017, which ranged from 7.55% to 18.51% of ash content.

### 3.2. Mineral Contents of Wheatgrass Juice

Table 2 shows the concentration of calcium, iron, potassium, magnesium, sodium, phosphorus, and zinc in wheatgrass types of juice (Ogolcho and Kingbird). In wheatgrass types juice (Ogolcho and Kingbird), calcium, iron, potassium, magnesium, sodium, phosphorus, and zinc content were 36.2, 0.5, 503.4, 23.18, 8.6, 72.94, 0.32 mg/100 g and 35.8, 0.4, 395, 23.51, 7.8, 64.18, 0.42 mg/100 g, respectively. The juice of Ogolcho wheatgrass varieties had significantly ( $P \leq 0.05$ ) higher iron, potassium, and phosphorus content than the juice of Kingbird wheatgrass variety, but the calcium, magnesium, sodium, and zinc content of Ogolcho and Kingbird wheatgrass varieties were not significantly different ( $P \geq 0.05$ ).

Ogolcho and Kingbird wheatgrass juice had calcium content of 36.2 and 35.8 mg/100 g, respectively. Padalia *et al.* (2010) and Roshan *et al.* (2021) recorded wheatgrass juice concentrations of 24.2 mg/100 g and 29 mg/100 g, respectively. Wheatgrass is high in calcium, which helps

to develop strong bones and teeth, as well as regulate heartbeat and function as a buffer to restore blood pH equilibrium (Roshan *et al.*, 2021). Ca levels were observed to be greater in wheatgrass juice. on the other hand, cultivated wheatgrass in the open field, had a higher Ca content than wheatgrass grown in the laboratory (Anwar *et al.*, 2015).

The iron level was 0.5 mg/100 g in Ogolcho wheatgrass juice and 0.4 mg/100 g in Kingbird wheatgrass juice, respectively. The values were substantially different ( $P \leq 0.05$ ) from one another, and the iron level of both kinds corresponded with Devi Sowjanya *et al.* (2015) reported 0.61 mg/100 g of iron in wheatgrass juice. Iron levels in wheatgrass juice were substantially lower in both kinds than the 77.2 mg/100 g wheatgrass powder reported by Kaur *et al.* (2021).

Potassium levels in Ogolcho and Kingbird wheatgrass juice were 503.4 mg/100g and 395 mg/100g, respectively, and were substantially different ( $P \leq 0.05$ ). The potassium levels in both varieties of wheatgrass juice were higher than the 147 mg/100 g potassium content reported by Padalia *et al.* (2010) and the 363 mg/100 g potassium content reported by Roshan *et al.* (2021).

Ogolcho and Kingbird wheatgrass juices have magnesium levels of 23.18 mg/100g and 23.51 mg/100g, respectively. The magnesium amount of both wheatgrass juice kinds is comparable to Devi Sowjanya *et al.* (2015) reported wheatgrass juice, which has a magnesium content of 24 mg/100g. Wheatgrass contains the same amount of magnesium as broccoli, Brussels sprouts, beets, carrots, or celery. In cases of fatty infiltration, this mineral is also important for pulling fat out of the liver (Roshan *et al.*, 2021).

Table 2: Mineral contents (mg/100g) of wheatgrass juice

Variety	Calcium	Iron	Potassium	Magnesium	Sodium	Phosphorus	Zinc
Ogolcho	36.2a $\pm$ 3.6	0.5a $\pm$ 0.04	503.4a $\pm$ 31.8	23.18a $\pm$ 1.83	8.6a $\pm$ 0.84	72.94a $\pm$ 2.19	0.32a $\pm$ 0.02
Kingbird	35.8a $\pm$ 2.9	0.4b $\pm$ 0.01	395b $\pm$ 21.8	23.51a $\pm$ 2.09	7.8a $\pm$ 0.37	64.18b $\pm$ 1.3	0.42a $\pm$ 0.01
CV	9.15	6.92	6.08	8.42	7.93	2.63	3.82
LSD	7.48	0.07	61.96	4.46	1.48	4.09	0.03

CV = coefficient of variation; values are mean  $\pm$  SD and mean values followed by the same letter in a column are not significantly different at a 5% level of significance; LSD = least significance difference.

The sodium content of Ogolcho and Kingbird wheatgrass juices was 8.6 and 7.8 mg/100g, respectively. These values were lower than the 10.3 mg/100g found in wheatgrass juice by Padalia *et al.* (2010). Both varieties' values are also significantly lower than the 655.33 mg/100g wheatgrass juice powder reported by Kaur *et al.* (2021). As a result, wheatgrass was a great source of sodium.

The phosphorus content of Ogolcho and Kingbird wheatgrass juices was 72.94 and 64.18 mg/100g, respectively, and was significantly different ( $P \leq 0.05$ ) from each other, with Ogolcho having more. The phosphorus content of both wheatgrass juice varieties is comparable to the wheatgrass juice at 75.2 mg/100g reported by Padalia *et al.* (2010). The levels of phosphorus in both

varieties of wheatgrass juice were much lower than the 260.86 mg/100 g of wheatgrass powder reported by Kaur *et al.* (2021).

Zinc level was 0.32 mg/100g in Ogolcho wheatgrass juice and 0.42 mg/100g in Kingbird wheatgrass juice, respectively. The zinc content of both wheatgrass juice varieties is comparable to the 0.33 mg/100g zinc content reported by Padalia *et al.* (2010). Zinc levels in both varieties of wheatgrass juice were lower than the 4.41 mg/100 g of wheatgrass powder reported by Kaur *et al.* (2021).

### Vitamin Contents of Wheatgrass Juice

Table 3 shows the vitamin A, C, D3, and E concentrations of wheatgrass varieties juice. Wheatgrass juice from the Ogolcho variety contained 0.15 mg/100 g of vitamin A, 36.35 mg/100 g of vitamin C, 0.018 mg/100 g of vitamin D3, and 0.244 mg/100 g of vitamin E. Similarly,

wheatgrass juice from the Kingbird variety contained 0.15 mg/100 g vitamin A, 31.65 mg/100 g vitamin C, 0.018 mg/100 g vitamin D3, and 0.236 mg/100 g vitamin E. The juice of the Ogolcho wheatgrass variety contained significantly more vitamin C ( $P \leq 0.05$ ) than the juice of the Kingbird wheatgrass variety.

The vitamin A content of both wheatgrass juice varieties was 0.15 mg/100 g. The vitamin A content of both

wheatgrass juice varieties is comparable to the 427 IU or 0.128 mg/100g reported by Padalia *et al.* (2010). Young barley grass (BG) is extremely valuable due to its high content of beta carotene and provitamin A, which act as powerful antioxidants and protect the body from the harmful effects of free radicals and sun rays both externally and internally (Brezinová *et al.*, 2010).

**Table 3:** Vitamin contents (mg/100g) of wheatgrass juice

Variety	Vitamin A	Vitamin C	Vitamin D3	Vitamin E
Ogolcho	0.15a $\pm$ 0.01	36.35a $\pm$ 0.90	0.018a $\pm$ 5.7	0.244a $\pm$ 0.01
Kingbird	0.15a $\pm$ 0.01	31.65b $\pm$ 0.24	0.018a $\pm$ 1.0	0.236a $\pm$ 0.01
CV	3.60	1.95	0.45	4.81
LSD	0.01	1.51	0.00	0.02

CV = coefficient of variation; values are mean  $\pm$  SD and mean values followed by the same letter in a column are not significantly different at a 5% level of significance; LSD = least significance difference.

The vitamin C content of the two wheatgrass juice varieties was significantly different ( $P \leq 0.05$ ). Vitamin C levels in Ogolcho and Kingbird wheatgrass juice were 36.35 mg/100g and 31.65 mg/100g, respectively. These values were significantly higher than the 3.64 mg/100g found in wheatgrass juice varieties reported by Padalia *et al.* (2010), and Chauhan (2014) reported 25.2 mg/100 mL vitamin C contents in wheatgrass juice. Citrus fruits, such as lemons, limes, and oranges, are commonly associated with vitamin C in wheatgrass. On the other hand, wheatgrass juice contains more vitamin C than orange (Roshan *et al.*, 2021).

Ogolcho and Kingbird wheatgrass juices contained 0.244 and 0.236 mg/100g of vitamin E, respectively. These values were lower than the 1.01 mg/100g observed in wheatgrass juice varieties reported by Roshan *et al.* (2021), as well as the 15.2 IU vitamin E content in wheatgrass juice reported by Padalia *et al.* (2010). Vitamin E content (particularly Durum cultivar) was found to be higher in the juices of Triticum species when compared to other grasses (Ozköse *et al.*, 2016). At the same time, einkorn wheatgrass contains more total vitamin E than emmer, durum, and wheat bread (Karakas *et al.*, 2021).

## CONCLUSIONS

Wheatgrass is the young grass of the common wheat plant (*Triticum aestivum*), and it can be found growing in all types of environments. Wheatgrass juice is good for your health since it contains more protein, bioflavonoids, chlorophyll, minerals like Ca, Fe, Mg, Zn, Na, K, and P, vitamins like A, C, B, and E, and 17 different amino acids. Juice of Ogolcho and Kingbird Bread wheatgrass can be highly recommended as a remedy for different health problems due to its high medicinal potential and health benefits, antioxidant (chlorophyll) content, and therapeutic capabilities. Juice of these two varieties could be the greatest alternative in poor nations like Ethiopia for the treatment of many disorders such as high blood pressure, diabetes, malnutrition, and so on. Extensive

research work is needed to characterize and assess more varieties of Ethiopian wheat grain for the production of wheatgrass powder and to assess the efficacy of wheatgrass juice in patients suffering from a COVID-19 epidemic.

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