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Development of Wheatgrass and Carrot Blended Juice

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ABSTRACT: This study aimed to develop a blended juice using wheatgrass and carrot and examine its storage stability under refrigerated conditions. The independent variables in the study were the proportions of wheatgrass juice (20-80%) and carrot juice (20-80%), which resulted in six different combinations. The study investigated the impact of these variables on various product responses, including pH, total soluble solutes (TSS), sensory score, vitamin C, viscosity, and β -carotene content. The findings revealed that as the concentration of wheatgrass juice increased, there was a decrease in TSS and sensory score, while pH, vitamin C, and β -carotene content increased. On the other hand, an increase in carrot juice concentration led to higher pH, TSS, sensory score, and β -carotene content. Based on the optimization process, the ideal ratio of ingredients was determined to be 40% wheatgrass juice and 60% carrot juice. The study findings highlight the influence of wheatgrass and carrot juice proportions on the various characteristics of the blended juice.

PRACTICAL APPLICATIONS

The wheatgrass-carrot blended juice offers numerous health benefits and can effectively combat various diseases. It provides a cost-effective solution for consumers to obtain maximum nutrients, reducing the dependence on fruits and vegetables alone. Given its potential health advantages, the wheatgrass-carrot blended juice can be commercialized to meet the demand for a functional and therapeutic beverage that promotes overall well-being.

I.INTRODUCTION

In recent times, there has been a growing popularity in the consumption of health drinks among people of all age groups due to their refreshing taste, nutritional value, and potential medicinal benefits. Various cereal grasses are used in the beverage industry as health drinks, with wheatgrass being particularly popular due to its numerous health advantages (Ben-arve 2002). Wheatgrass, derived from the cotyledons of the common wheat plant (*Triticum aestivum*) belonging to the Gramineae family (Mogra and Rathi 2013), is highly nutritious and commonly used as a dietary supplement to prevent various health issues and enhance immune function (Rana *et al.* 2011). It is often referred to as "green blood" because it promotes the production of red blood cells (Grunewald 2009), helps lower blood pressure (Locniskar 1988), boosts energy levels (Kulkarni *et al.* 2006), demonstrates efficacy against diabetes (Samagandi *et al.* 2012), aids in body detoxification, weight loss, and possesses antioxidant properties (Kulkarni *et al.* 2006; Siener *et al.* 2006; Singh *et al.* 2012), combats free radicals (Borek 2002; Kulkarni *et al.* 2006), and promotes healthy skin (Das *et al.* 2012). Over the past few decades, carrot juice (*Daucus carota*) has gained significant attention from both consumers and beverage producers due to its remarkable therapeutic potential. Carrot juice has been used not only as a beverage but also as a traditional medicinal remedy for centuries (Holland and Bar-Ya'akov 2008). It offers various health benefits, including antioxidant properties (Pantuck *et al.* 2006; Guo *et al.* 2008; Seeram *et al.* 2008), antimicrobial effects (Al-Zoreky 2009), anti-diabetic properties (Rosenblat *et al.* 2006; Bagri *et al.* 2009b), and anti-inflammatory effects (Adams *et al.* 2006; Lee *et al.* 2010).

II.MATERIALS AND METHODS

This describes the experimental setup, procedures and approaches used to accomplish the current research on

“Development of Wheatgrass and Carrot Blended Juice” carried out in the Department of Processing and Food Engineering, Bio-Processing Lab of All India Co-ordinates Research project on Post-Harvest Engineering and Technology, College of Technology and Engineering, Dairy-Chemistry Lab and Dairy and Food Engineering Lab of of College of Dairy and Food Technology, Department of Horticulture, Rajasthan College of Agriculture at Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan.

Extraction of Juice

After 8 days, wheatgrass was harvested with the help of stainless steel scissors. Centrifugal Juicer was used to extract the wheatgrass juice. The detail specification of juicer is presented in appendix. Wheatgrass of eight days maturity was used for juice extraction (Fig. 3.1).

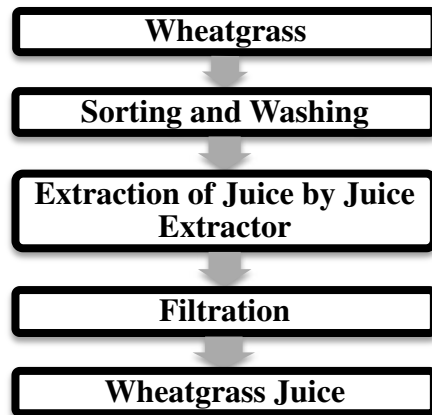


Fig. 3.1: Wheatgrass juice extraction process

Carrot juice was extracted from well matured carrots. The carrots were washed with tap water and peeled by peeler. The juice was extracted by juicer and filtered.

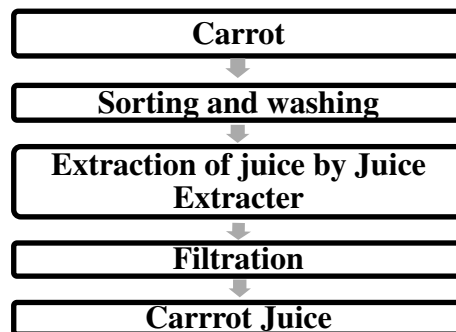


Fig. 3.2: Carrot juice extraction

Preparation of Wheatgrass and Carrot based Blend Juice

By making use of the techniques utilized by Eriq (2011), wheatgrass and carrot-based mix juice was extracted. The prepared juice was immediately poured into glass bottles with a capacity of 200 ml and PET bottles, and 2.5 cm of headspace was maintained and sealed with caps airtight. The closed bottles were pasteurized for two minutes at 85°C Hasani *et al.*, (2021). The bottles were allowed to cool for some time. Juice prepared from wheatgrass and carrots was blended by combining the two juices according to the Table 3.1.

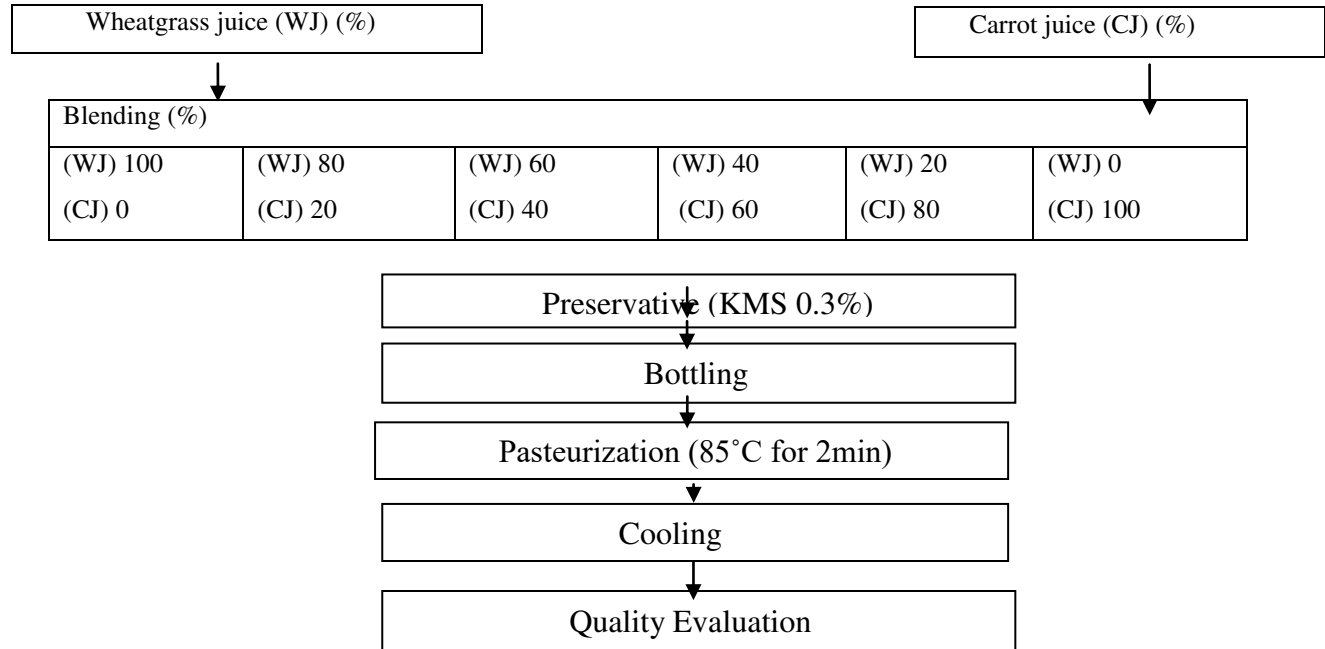


Fig.3.3: Blending of juice

III.RESULTS AND DISCUSSION

Table 4.1: Physical characteristic of wheatgrass and carrot

Sr.No.	Parameter	Wheatgrass	Carrot
1.	Colour	Bright green	Orange
2.	Shape	Long tapered	Cylindrical
3.	Size	Length: 15-17cm	Length:12-14cm Diameter: 3 - 4 cm
4.	Moisture content (w.b)	78%	86%

The leaves of wheatgrass, grown in the field, exhibited a bright green color, indicating the presence of chlorophyll responsible for its vibrant pigment. When fully grown, the length of wheatgrass varied but generally ranged from 15 to 20 centimeters (6 to 8 inches). The shape of the wheatgrass was long and tapered. It was found to have a moisture content of 78%, which aligns with similar findings reported by (Ashok, 2011). The carrots, obtained from the local market, displayed a vibrant orange color and had a cylindrical shape. They measured approximately 12 to 14 cm in length and had a diameter ranging from 3 to 4 cm. Analysis revealed that they contained a moisture content of 86%, which is similar to the result reported by (Sharma *et al.*, 2012). These observations provide valuable information about the visual characteristics and moisture content of the carrots used in the study.

Table 4.2: Variation of the wheatgrass and carrot in blended juice

Samples	Wheatgrass juice (WJ) (%)	Carrot juice (CJ) (%)
T ₀	100	00
T ₁	80	20
T ₂	60	40
T ₃	40	60
T ₄	20	80

4.3: Sensory Evaluation of Juice Samples

Table 4.3: Mean sensory score of juice samples

Samples	Colour	Flavor	Taste	Overall acceptability
T ₀	8.10	5.10	6.00	5.51
T ₁	6.20	6.20	6.21	5.81
T ₂	6.80	6.40	6.81	6.89
T ₃	7.89	7.61	8.31	8.41
T ₄	7.00	7.50	8.18	8.11
T ₅	7.81	7.56	8.13	8.31

4.3: Quality Evaluation of Developed juice

The juice, which was developed using different proportions of wheatgrass and carrot juice, underwent sensory evaluation. After the sensory evaluation, it was found that sample (T₃) had the best result. Therefore, sample (T₃) was selected for further quality evaluation and was also compared with a standard juice for a comprehensive analysis of its quality.

4.3.1: Physico-chemical characteristics of wheatgrass and carrot juice

The physico-chemical characteristics of wheatgrass and carrot juice, as determined in the present study, are listed in Table 4.4. Wheatgrass juice exhibited a total soluble solid content of 5.30 °Brix, pH of 4.30, β-carotene content of 2.30 mg per 100 ml, viscosity of 1.20 cp and 25.52 mg of vitamin C per 100 ml. These findings align with the results reported by (Eissa *et al.*, 2020). On the other hand, carrot juice demonstrated total soluble solids of 8.10 °Brix, pH of 5.10 and viscosity of 1.40 cp, 4.21 mg of vitamin C per 100 ml and β-carotene content of 8.33 mg per 100 ml. These results are consistent with the findings reported by (Sarker *et al.*, 2020). Sample (T₃), which was selected for further evaluation, exhibited a total soluble solid content of 11.12°Brix, pH of 4.27, β-carotene content of 9.01 mg per 100 ml, vitamin C content of 14.17 mg per 100 ml and viscosity of 1.40 cp. These results were similar to the findings reported by (Kashudhan *et al.*, (2016).

Table 4.4: Physico-chemical properties of juice

Constituents	(WJ)100% (T ₀)	(WJ)40%+(CJ)60% (T ₃)	(CJ)100% (T ₅)
pH	4.30	4.27	5.10
TSS (°Brix)	5.30	11.12	8.10
Vitamin-C (mg/100ml)	25.52	14.17	4.21
β-carotene (mg/100ml)	2.30	6.01	8.33
Viscosity (cP)	1.20	1.40	1.40

4.4: Storage Study of Developed Juice

A storage study of developed juice was conducted to assess its shelf life and quality over time. The study involved monitoring the juice's physical and chemical attributes during storage under various conditions such as temperature and packaging. The results provided valuable insights into the optimal storage conditions and duration for maintaining the juice's freshness, flavor and nutritional value, ensuring its quality and consumer satisfaction.

4.4.1: Effect of refrigeration temperature on the physico-chemical properties of juice sample packed in a plastic bottle during storage

Juice was prepared by combining wheatgrass and carrot juice. The Total Soluble Solids (TSS), pH, vitamin C, β-carotene and viscosity levels of the sample (T₃) and two standard samples (T₀, T₅) were evaluated. Subsequently, these samples were subjected to refrigeration storage to observe the alterations in their physico-chemical properties throughout the preservation period. The purpose of this study was to investigate and document the changes that occurred in the juice's physico-chemical attributes during storage at a refrigeration temperature.

4.4.2 Effect on pH

During a 60 day period of refrigeration storage, the pH levels of both the blended juice and standard juice, which were packaged in plastic bottles, were analyzed. The purpose of this analysis was to examine the impact of the storage duration on the pH of the juices. The results of this study, including the observed changes in pH, are presented in Table 4.5.

Table 4.5: The impact of storage temperature on juice pH

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days
T ₀	4.30	4.30	3.99	3.51	3.11
T ₃	4.27	4.21	4.01	3.88	3.68
T ₅	5.10	5.01	4.58	3.99	3.88

In the given period of 0 to 60 days, the pH values of the juice samples showed a noticeable variation. Treatment T₀ exhibited a significant decrease of 27.21% in pH, starting from 4.30 at 0 days and reaching 3.11 at 60 days. Similarly, treatment T₃ also showed a decrease in pH, albeit at a lesser magnitude of 13.98%. The pH value decreased from 4.27 at 0 days to 3.68 at 60 days. Treatment T₅ had a pH value of 5.10 at 0 days, which decreased to 3.88 at 60 days, resulting in a variation of 24.71%. These variations (Fig. 4.2) in pH indicate a gradual increase in acidity over the course of 60 days for all the treatments. It is essential to consider these changes in pH as they can significantly affect the sensory and chemical properties of the juices. Further analysis and investigation are required to understand the implications of these pH variations on the overall quality and stability of the juice samples. During

storage, the pH of the juice decreased significantly, as indicated in Fig. 4.2. This decline in pH could be attributed to an increase in titrable acidity, as acidity and pH are known to have an inverse relationship, as explained by (Jan and Masih, 2012).

4.5.2 Effect on TSS

The total soluble solids (TSS) content in both standard juice and blend juice increased as the storage time progressed, with the highest value being observed on day 60. When examining the TSS levels on days 15, there was only a minimal change observed compared to the initial measurement. However, on days 30 and 45 of storage, a noticeable difference in TSS content was observed (as depicted in Table 4.6). The Table 4.6 suggests that the TSS concentration in both standard and blend juices gradually increased as the storage time increased. The peak TSS value was achieved at 60th days of storage. On the other hand, during the initial 15 days of storage, there was little to no change in TSS content, suggesting that the juices remained relatively stable during this period. However, starting from day 30 and continuing until day 45, there was a discernible difference in TSS concentration, indicating a more pronounced change in the juice composition during this period.

4.5.3 Effect on Vitamin-C

The study investigated the influence of storage temperature on the vitamin C content of juice. Table 4.7 provides a summary of the findings, which involved analyzing two standard samples (T_0 , T_5) and one blended sample (T_3) at various storage times under refrigeration conditions. During the 60-day storage period, a consistent decrease in vitamin C content was observed across all samples. This decline in ascorbic acid, also known as vitamin C, can be attributed to the sensitivity of ascorbic acid to oxygen, light, and heat. In the presence of oxygen, both enzymatic and non-enzymatic catalysts can facilitate the oxidation of ascorbic acid, leading to its degradation. Similar result was found by (Jan and Masih, 2012).

Table 4.7: Effect of temperature and packaging material on juice vitamin-C content

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days
T_0	25.52	25.50	24.98	24.56	24.11
T_3	14.17	14.14	13.81	13.08	12.84
T_5	4.21	4.18	4.08	3.76	3.48

Effect on β -carotene

The β -carotene content in both the standard and blended juice decreased as the storage time increased. The highest degradation of β -carotene was observed at day 60, according to the data presented in Table 4.8. At day 15 of storage, there was very little change in the β -carotene content. However, at days 30, 45, and 60, significant differences were observed, indicating a noticeable decrease in β -carotene levels over time. It is important to note that preserving the β -carotene content in juices is crucial to maintain their nutritional quality. β -carotene is sensitive to degradation, particularly due to its many conjugated double bonds. Factors such as temperature, light and free radicals accelerate the degradation of β -carotene. This degradation can affect the nutrient's bioavailability and stability during food processing and storage (Lavelli and Sereikaite, 2022).

Table 4.8: Effect of temperature and packaging on juice β -carotene content

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days
T ₀	2.30	2.20	2.11	2.01	1.78
T ₃	6.27	6.21	6.01	5.88	5.68
T ₅	8.33	8.03	8.01	7.79	7.04

4.5.4 Effect on viscosity

Table 4.9 displays the variance in juice viscosity for three different treatments over a period of 60 days. The range of variation in viscosity measurements among different samples after 60 days of storage is as follows: for Treatment T₀, the range is from 1.20 to 1.52 cP; for Treatment T₃, the range is from 1.40 to 1.63 cP; and for Treatment T₅, the range is from 1.40 to 1.62 cP. These ranges indicate the spread of viscosity values observed across the samples within each treatment group at the 60-day mark. The values suggest that there is variability in the viscosity of the juice across the treatments, with Treatment T₀ having the narrowest range of variation and Treatment T₃ and T₅ exhibiting slightly wider ranges. This information provides insight into the degree of consistency or variability in the viscosity measurements for each treatment, which may have implications for the stability and quality of the juice over time.

Table 4.9: Effect of temperature and packaging on juice viscosity

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days
T ₀	1.20	1.30	1.38	1.45	1.52
T ₃	1.40	1.46	1.52	1.58	1.63
T ₅	1.40	1.47	1.51	1.55	1.62

IV. CONCLUSIONS

The purpose of this study was to find the best combination of ingredients for wheatgrass-carrot juice that would be highly nutritious and have a high sensory score, ensuring maximum acceptance in the market. The researchers also examined how the quality of the juice changed under different storage conditions. The concentration of carrot and wheatgrass juice had a significant impact on various quality parameters such as pH, TSS (total soluble solids), sensory score, vitamin C, and β -carotene. Increasing the percentage of wheatgrass juice led to a decrease in the sensory score. In conclusion, the optimal ingredients for creating a blended juice were found to be 40% wheatgrass juice and 60% carrot juice.

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