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# Studies on the preparation of carambola juice

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## Abstract
The present study was carried out to prepare the juice by using water, sugar and mint with the objective to assess the sensory acceptability of the product with physico-chemical and microbiological properties. Each treatment was replicated five times. Four juice formulations were prepared by mixing carambola juice with water in ratio (100:00, 90:10, 80:20, 73:30) and they were marked as $T_0$, $T_1$, $T_2$ and $T_3$ respectively. Sensory evaluation of the product was carried out under the criteria of 9 point Hedonic scale. The data obtained during the study was statistically using analyzing variance and critical difference techniques. All the experimental treatments were also analyzing chemically using AOAC procedure. On the basis of analysis, it was concluded that $T_2$(80% carambola juice, 20% water and 14% sugar) was found to be best among the four treatments from organoleptically, chemically and microbiologically point of view. The result revealed that less than 55x($10^3$cfu/ml) SPC and negative coliform test. Hence the product was acceptable a good quality of carambola juice can be prepared by diluting with water 20% and adding acceptable 14% quantity of sugar and mint as per flavour.

**Keywords:** Carambola, sugar, water, mint, sensory score, chemical, microbiological

## Introduction
Fruits have been a part of human's diet throughout the years. They are also considered as food supplements and are recommended as essential to healthy nutrition, because they contain high quantity and quality of water, vitamins, sugar and minerals (Wardlaw, 2004; Potter and Hotchkiss, 1996) [11, 8]. Fruits also contain phytochemicals which act against oxidative reactions in the human body (Vanamala *et al.,* 2006; Okwu and Emenike, 2006) [10, 7]. Some fruits have been reported as a rich source of these phytochemicals such as flavonoids, especially flavanones, which have been shown to posses several physiological properties which can help inhibit the cell proliferation and also promote cell differentiation (Vanamala *et al.,* 2006) [10]. Fruit juice is a popular beverage amongst consumers. The level of fruit juice contained in these drinks are found in the ingredients panel, usually on the back of the sealed pack. These drinks may include those that are purchased in ready to serve format, or those that are purchased as "cordial" also known as dilutable drinks. These require dilution prior to consumption, and are typically diluted with approximately four parts water to one part cordial. Fruit juices are common beverages in many countries of the world. In hot climate areas, cafes, restaurants and road side stalls have local facilities to extract the juice from fresh fruits and then serving the juice with ice, to the thirsty customers. Apart from nutritional quality improvement beverage can be improved in its sensory and flavour characteristics according to their raw materials. (Akin wale Jain 2000 and Khurdiya 2004) [1, 5]. Fruit juices providing vitamins and minerals like potassium, vitamin C and folate. It is also a convenient way for adults and children to help reach the recommended number of daily servings of fruits and vegetables.

India is one of the largest producers of Carambola (The Earth of India, 2012) [9]. It is still considered to flourish during two particular times: September through October, January through February. However, carambola seldom appear in other markets because of their high perishability nature and a lack of centralized market coordination. India's cultivation efforts are also fragmented and decentralized, which results in unpredictable fruit quality and incredible variation amongst carambola cultivars. The place where carambola found in India are mostly in the South and it is mostly cultivated almost in all states of North Eastern regions. In the north eastern region where in Meghalaya the star fruit is locally known as SohPyrshong. Carambola fruits is highly known for its nutritive value, underutilized horticultural crops are more important for medicinal properties. This is a multipurpose fruit (sweet, jams, candy, pickles shop, fruit, dishes etc.) which is gaining a lot of priority for its therapeutic potentials. The fruit contains an edible pulp which has the flavour and properties as that of green sour apple. It is also used for making products such as pickles, jams, jelly, and beverages.

The fruit itself contains a huge variety of bio-active components such as anti-oxidants, minerals, total phenolic, and dietary fibres. The starfruit gets its name from the shape of a cross-section of the fruit. It also has its colour in different shades like green, light green, yellowish green, greenish yellow and orange. This unique feature earns itself a status in the exotic fruit league, and slices of this smooth, juicy, crispy, and sour-sweet delight are often used in the adornment of cuisine and salads. Also known as carambola, which, in Portuguese meaning food appetizer. Carambola fruits possess good nutrition value, as they contain very low fat, are high in vitamin B and C content, and also a source of potassium and fiber. Carambola fruits contains moisture 92.0g, protein 0.7g, fat 0.1g, carbohydrate 5.0g, fiber 1.8g, calcium 7.0g, iron 0.4g, Beta carotene 1.55µg and vitamin $B_1$0.1g (Nutrient composition of Malaysian Foods. IMR, 1982). The Carambola juice acts as anti-inflammatory effect like heart-friendly, reduces weight, regulates blood pressure, boots digestion and diabetic-friendly. It helps with hair growth and healing of skin.

## Materials and methods

The experimental work was carried out in the research laboratory of Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (U.P.).

### Procurement and collection of ingredients

#### Carambola Fruit

It was collected and bought from the local markets of Shillong- Meghalaya.

#### Sugar

It was procured from the local markets of Prayagraj.

#### Mint leaves

It was bought from the local markets of Prayagraj.

### Chemical used

Chemicals (AR and GR grade) was procured from the laboratory department of Dairy Technology.

### Physio-Chemical Analysis

Carbohydrate – It was estimated by {100-(moisture + ash + fat + protein)}%. Fat - It was determined by Gerber method mentioned in A.O.A.C (1990) [3]. Moisture – It was estimated as per the procedure given in A.O.A.C (1990) [3]. Total soluble solids- The soluble solids content of samples was determined by Refractometer (0-32 Brix) at room temperature (28°C). Protein- The protein content of samples was determined by Kjeldhal method according to A.O.A.C. (1975) [2]. Ash- The ash content of samples was determined by muffle furnace (Ranganna, 1986) laid down in A.O.A.C. (1975) [2]. pH- The pH content of samples was determined by PH meter according to A.O.A.C. (1975) [2]. Acidity- Titrable acidity of samples was determined by titration with N/10 Sodium Hydroxide solution expressed as ascorbic acid. ISI: 2802, 1964. Vitamin C- The Vitamin C content of samples was determined by 2,6- Dichloroindophenol Titrimetric method. A.O.A.C (1975) [2].

### Microbiological Analysis

Standard plate count (SPC) FSSAI Manual of Methods of Analysis of Foods, 2012 and Coliform test FSSAI Manual of Methods of Analysis of Foods, 2012 [4].

**Organoleptic evaluation**: The Juice samples of different treatments was analyzed for organoleptic quality (flavor & taste, consistency, color & appearance and overall acceptability). Attributes was rated on 9-point Hedonic scale (Nelson and Trout, 1964) [6].

Judging panel: Five experienced staff members of Dairy Technology Department was served as a judging team and was evaluated the samples of and control and experimental of the juice. Numerical scores were allocated for flavor & taste, consistency, color & appearance, overall acceptability of the juice. The numerical score was used as an indication of the quality.

### Statistical analysis

The data was analyzed statistically by analysis of variance at 5% level of significance. Data obtained from the organoleptic, physio-chemical analysis and microbiological analysis data were statistically analyzed by using analysis of variance-two way classification and critical difference.

### Treatments Combination

| Treatments | Carambola | Water |
|---|---|---|
| $T_0$ | 100ml | - |
| $T_1$ | 90ml | 10ml |
| $T_2$ | 80ml | 20ml |
| $T_3$ | 70ml | 30ml |

### Plan of work

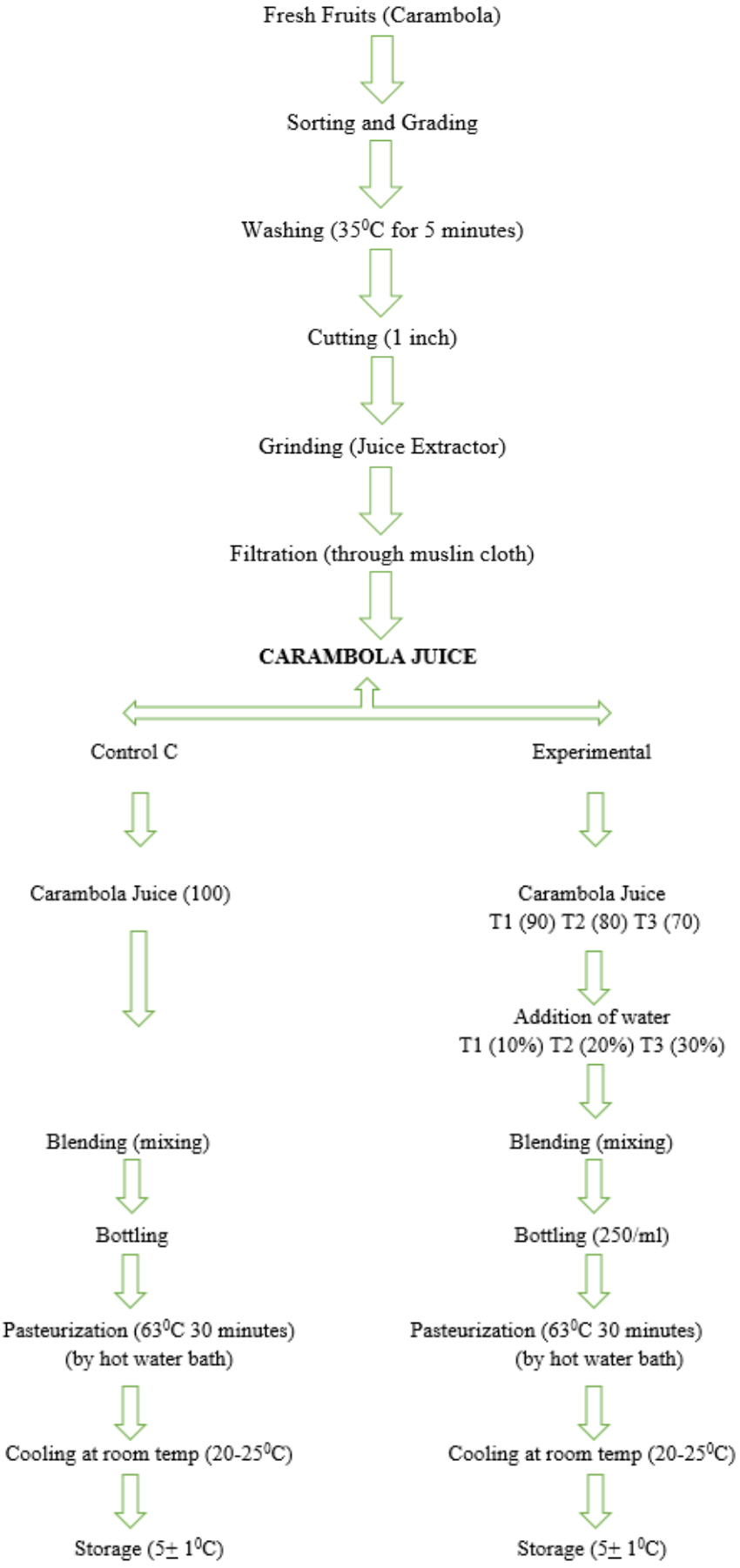


**Fig 1:** Flow Diagram of Preparation of Carambola Juice

## Results and discussion

The present studies was based on "Studies on the Preparation of Carambola Juice" the data collected on different aspects were tabulated and analyzed statistically using method of analysis of variance significant and non-significance difference were observed within the treatments and were had been compared with critical difference value in terms of physico-chemical, microbiological and sensory analysis.

**Table 1:** Average data on physico-chemical analysis of different parameters of control and experimental of Carambola Juice.

| Parameter | $T_0$ | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| 1. Physico-Chemical analysis | | | | |
| Carbohydrate % | $5.00^{a}\pm0.28$ | $4.50^{b}\pm0.36$ | $4.00^{c}\pm0.13$ | $3.50^{d}\pm0.12$ |
| Protein % | $0.70^{a}\pm0.04$ | $0.63^{b}\pm0.06$ | $0.56^{c}\pm0.03$ | $0.49^{d}\pm0.05$ |
| Fat % | $0.10^{a}\pm0.02$ | $0.23^{b}\pm0.05$ | $0.40^{c}\pm0.03$ | $0.90^{d}\pm0.04$ |
| Ash % | $0.29^{a}\pm0.04$ | $0.28^{a,b}\pm0.06$ | $0.27^{a,b,c}\pm0.04$ | $0.26^{a,b,c,d}\pm0.05$ |
| Total Solid % | $6.31^{a}\pm0.04$ | $6.09^{b}\pm0.13$ | $5.23^{c}\pm0.12$ | $4.88^{d}\pm0.05$ |
| Moisture % | $88.69^{a}\pm0.06$ | $88.91^{b}\pm0.04$ | $89.77^{c}\pm0.05$ | $90.52^{d}\pm0.06$ |
| Total Soluble Solid % | $8.50^{a}\pm0.28$ | $9.60^{a,b}\pm0.13$ | $10.00^{c}\pm0.26$ | $10.50^{d}\pm0.28$ |
| Acidity % | $0.27^{a}\pm0.04$ | $0.25^{a,b}\pm0.06$ | $0.24^{a,b,c}\pm0.02$ | $0.23^{a,b,c,d}\pm0.03$ |
| pH | $6.00^{a}\pm0.04$ | $6.10^{b}\pm0.05$ | $6.50^{c}\pm0.06$ | $6.80^{d}\pm0.03$ |
| Total Sugar % | $9.73^{a}\pm0.03$ | $9.00^{b}\pm0.04$ | $8.50^{c}\pm0.06$ | $7.90^{d}\pm0.03$ |

*Data are presented as Mean± S.D.

**The superscripts a,b,c and d in each column indicated significant difference ($P$<0.05).

### Physio-chemical characteristics of Carambola juice

### Carbohydrate percentage in Carambola Juice

Table 1 reveals that physico-chemical parameters of control and experiments of carambola juices. The carbohydrate percentage of Carambola Juice, highest mean carbohydrate percentage was recorded in $T_0$ (5.00) followed by $T_1$ (4.50), $T_2$ (4.00) and $T_3$ (3.50). It was observed that increase the proportion of water then decrease the mean value of carbohydrate in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

### Protein percentage in Carambola Juice

Protein percentage of control and experiments of Carambola Juice, highest mean Protein percentage was recorded in $T_0$(0.70) followed by $T_1$(0.63), $T_2$ (0.56) and $T_3$(0.49). Carambola prepared with 30 percentage water had lowest (0.49) percent of protein content i.e. $T_3$.

### Fat percent in Carambola Juice

The present study reported that the fat percentage in the range as 0.10 to 0.90. Fat percentage of control and experiments of Carambola Juice, highest mean Fat percentage was recorded in $T_3$(0.90) followed by $T_2$(0.40), $T_1$ (0.23) and $T_0$(0.10). It was observed that increase the proportion of water then also increase the mean value of fat in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

### Ash percentage in Carambola Juice

From the above table 1, Ash percentage of control and experiments of Carambola Juice, highest mean Ash percentage was recorded in $T_0$ (0.29) followed by $T_1$ (0.28), $T_2$ (0.027) and $T_3$ (0.26). It was observed that increase the proportion of water then marginally decrease the mean value of ash in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

### Total Solid Percent in Carambola Juice

The present study reported that the Total Solid percentage in the range as 4.88 to 6.31. Total Solids percentage of control and experiments of Carambola Juice, highest mean Total Solid percentage was recorded in $T_0$(6.31) followed by $T_1$(6.09), $T_2$(5.23) and $T_3$(4.88). As evident from the result of ANOVA, the F (Cal) value (1930.76) was greater than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on total solids percentage.

### Moisture percent in Carambola Juice

The moisture percentage of control and experiments of Carambola Juice, the highest mean moisture percentage was recorded in $T_3$ (90.52) followed by $T_2$ (89.77), $T_1$ (88.91) and $T_0$ (88.69). The control carambola juices $T_0$ had lowest moisture content (93.69%). While carambola juices with 30% water had highest moisture (92.52) percentage i.e. $T_3$. Carambola juice recorded highest moisture percent with increase the level of water.

### TSS percent in Carambola Juice

The present study reported that the TSS percentage in the range as 5.50 to 10.50. The TSS percentage of control and experiment of Carambola Juice, highest mean of TSS percentage was recorded in $T_3$(10.50) followed by $T_2$(10.00), $T_1$ (9.60) and $T_0$(8.50). It was observed that increase the proportion of water then increase the mean value of TSS in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

### Acidity percentage in Carambola juice.

The present study reported that the acidity percentage in the range as 0.23 to 0.27. The highest acidity percentage of control and experiments of carambola juice was recorded in $T_0$(0.27) followed by $T_1$(0.25), $T_2$ (0.24) and $T_3$ (0.23). It was observed that increase the proportion of water then marginally decrease the mean value of acidity in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

### pH value of Carambola juice

pH value of control and experiments of Carambola juice, the highest pH value was recorded in $T_3$(6.80) followed by $T_1$(6.50), $T_2$(6.10) and $T_3$(6.00). As evident from the result of ANOVA, the F (Cal) value (278.01) was greater than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on pH.

### Total sugar percentage in Carambola Juice

From the above presented data on table 1, The Total Sugars percentage of control and experiments of Carambola Juice,

highest mean Total Sugar percentage was recorded in $T_0$(9.73) followed by $T_1$(9.00), $T_2$(8.50) and $T_3$(7.90). It was observed that increase the proportion of water then marginally decrease the mean value of Total sugar in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

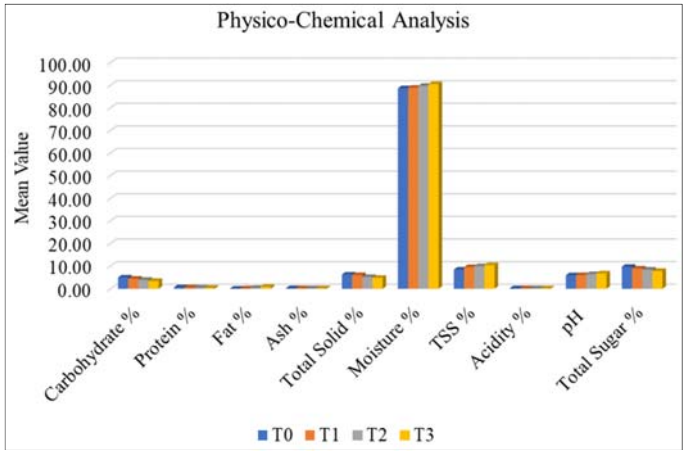


**Fig 2:** Graph showing physico-chemical analysis of control and experimental samples of carambola juice Microbiological characteristics of control and Carambola Juice

**Table 2:** Average data on microbiological analysis of different parameters of control and experimental of Carambola Juice.

| Parameter | $T_0$ | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| 1. Microbiological Analysis | | | | |
| SPC ($10^3$cfu/gm) | $4.80^{a}$±0.83 | $5.20^{a,b}$±0.44 | $4.60^{a,b,c}$±0.54 | $4.80^{a,b,c,d}$±0.83 |
| Coliform | Nil | Nil | Nil | Nil |

*Data are presented as Mean± S.D.

**The superscripts a,b,c and d in each column indicated significant difference (P < 0.05).

**Standard Plate Count of Carambola Juice**

The present study reported that the standard plate count ($10^3$ cfu/ml) in the range as 4.60 to 5.20. The standard plate count content in control and experimental of Carambola Juice, highest mean standard plate count was recorded in $T_1$(5.20) followed by $T_3$(4.80), $T_0$(4.80) and $T_2$(4.60).

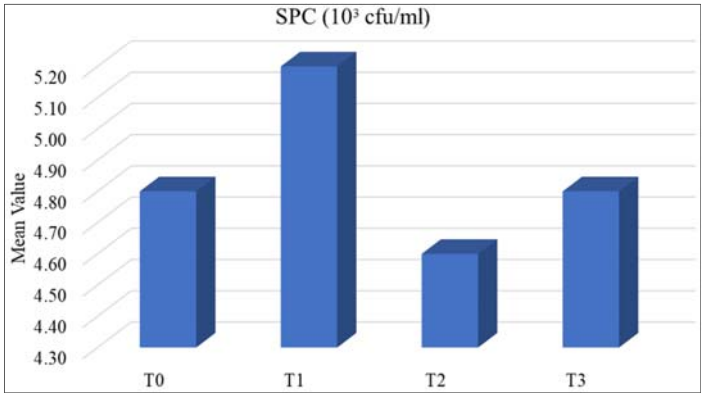


**Fig 3:** Graph showing standard plate count of control and experimental samples of carambola juice

**Coliform test (Cfu/ml)**

**The average of Coliform test (cfu/ml) of Carambola Juice**

The coliform test control and experimental of Carambola Juice were found to be absent. It shows (Gram negative bacteria) results, which mean that strict hygienic procedure was observed during it preparation.

**Organoleptic characteristics of Carambola Juice**

**Table 3:** Average data on Organoleptic analysis of different parameters of control and experimental of Carambola Juice.

| Parameter | $T_0$ | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| 1. Organoleptic scores (9 point hedonic scale) | | | | |
| Colour & Apparence | $7.44^{a}$±0.11 | $8.44^{b}$±0.49 | $8.50^{b,c}$±0.65 | $7.86^{a,b,d}$±0.39 |
| Consistency | $7.78^{a}$±0.16 | $6.70^{b}$±0.48 | $8.78^{c}$±0.43 | $7.50^{a,d}$±0.92 |
| Flavour | $7.24^{a}$±0.28 | $6.76^{a,b}$±0.53 | $8.50^{c}$±0.65 | $7.86^{a,c,d}$±0.39 |
| Overall acceptability | $7.14^{a}$±0.84 | $6.72^{a,b}$±0.50 | $8.58^{c}$±0.53 | $7.12^{a,b,d}$±0.95 |

*Data are presented as Mean± S.D.

**The superscripts a,b,c and d in each column indicated significant difference ($P$<0.05).

**Colour and appearance of Carambola Juice**

Table 2 reveals that organoleptic score of control and experiment of carambola juice. The colour and appearance score in Carambola Juice samples of different treatments and control, the highest mean colour and appearance score was recorded in $T_2$(8.50) followed by $T_1$ (8.44), $T_3$ (7.86) and $T_0$(7.44). It was observed that increase the proportion of water and sugar then marginally increase the mean value of colour and appearance in carambola juices from treatment $T_0$ to $T_3$ with significant difference ($P$<0.05).

**Consistency score in control and Carambola Juice**

The consistency score of juice samples, it can be seen that the highest score was obtained in case of $T_2$(8.78) followed by $T_0$ (7.78), $T_3$(7.50) and $T_1$ (6.70). As evident from the result of ANOVA, the F (Cal) value (16.07) was greater than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on consistency score.

**Flavour score in Carambola Juice**

Flavour score of control and treatment of carambola juice, highest mean flavor score was recorded in the Carambola Juice of $T_2$(8.50) followed by $T_3$ (7.86), $T_0$(7.24) and $T_1$(6.76). It was observed that increase the proportion of water and sugar then increase the mean value of flavour score in carambola juices from treatment $T_2$ to $T_3$ with significant difference ($P$<0.05).

**Overall acceptability in Carambola Juice**

The present study reported that the overall acceptability mean score of carambola juice in the range of 6.72 to 8.58. The overall acceptability in Carambola Juice samples of different treatments it has been observed that the mean overall acceptability was recorded in higher in $T_2$(8.58) followed by $T_0$(7.14), $T_3$(7.12), and $T_1$(6.72) of Carambola Juice respectively.

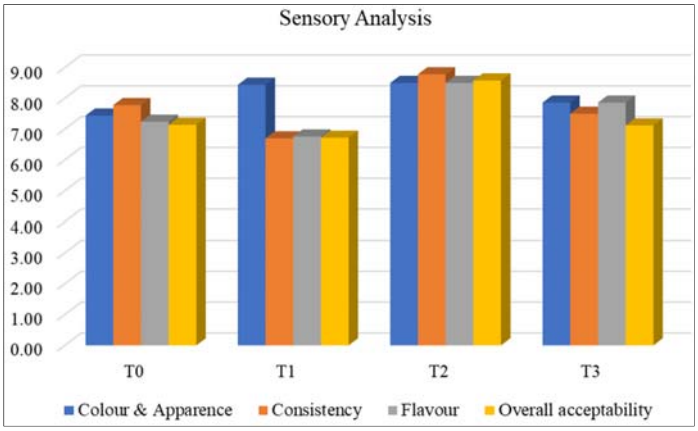


**Fig 4:** Graph showing sensory analysis of control and experimental samples of carambola juice

**Conclusion**

Carambola juice was prepared from water, sugar and mint. From the result, it was concluded that on the basis of organoleptic evaluation, $T_2$ carambola juice was optimized over the other sample under study. The optimized product $T_2$ contains carbohydrate 4.00%, protein 0.56%, fat 0.40%, ash 0.27%, Total solid 5.23%, moisture 89.77%, Total soluble Solid 10.00%, acidity 0.24%, pH 6.50 and Total Sugar 8.50%. On microbiological study, optimized product contains 4.60 SPC ($10^3$cfu/ml) and coliform nil. The highest mean of Carbohydrate, protein, ash, Total Solid, TSS and acidity percentage was recorded in the Carambola Juice by using water, sugar, and mint as per flavor in control ($T_0$), while highest mean of fat, moisture, pH mean value was recorded in the Carambola Juice in ($T_3$). The highest mean of SPC score was recorded in Carambola Juice by using water, sugar, and mint as per flavor in $T_2$(5.20) and the coliform count was found to be absent. The highest mean of Colour and Appearance, consistency, flavour and overall acceptability score was recorded in the Carambola Juice by using water, sugar, and mint as per flavour in $T_2$.

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