*Biological Forum – An International Journal* 15(10): 1097-1101(2023)

**ISSN No. (Print): 0975-1130**
**ISSN No. (Online): 2249-3239**

# Studies on Preparation of Jaggery Based Guava (*Psidium guajava* L.) Jelly

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*(Received: 09 August 2023; Revised: 27 September 2023; Accepted: 04 October 2023; Published: 15 October 2023)*
*(Published by Research Trend)*

**ABSTRACT: Gauva (*Psidium guajava* L.) is a popular fruit crop of tropical and sub-tropical zones, which is commonly called as "poor man's apple". The fruit is rich in vitamins and minerals and also pectin content. About 10-15 percentage of the production of fruit is being wasted from picking to consumption. Based on the richness of pectin content, the fruit was used for value addition process that is jaggery based guava jelly. Jaggery based guava jelly were developed with different recipes containing 3 levels of jaggery, two levels of citric acid, constant levels of fruit extract and pectin, sugar was used as a reference check for comparison. Physico-chemical characteristics like yield, moisture content, water activity, titratable acidity, ascorbic acid, total sugars, reducing sugars, non-reducing sugars, minerals and optical density were analysed in the freshly prepared guava jelly. The sensory quality parameters *viz*., colour and appearance, texture, aroma, taste and overall acceptability of guava jelly were determined using a 9 point hedonic scale. Among different treatment combinations, the recipe with 1000 ml of extract + 800 g of jaggery + 5 g of citric acid + 5 g pectin recorded excellent physicochemical properties and organoleptic score.**

**Keywords:** Guava, Jelly, Jaggery, sugar, ascorbic acid, aroma.

## INTRODUCTION

Guava is one of the most popular and important fruit in India. It comes under the Myrtaceae family and its chromosome number is 2n=22 (Somogyi *et al.*, 1996). It is considered as one of the exquisite, nutritionally useful and lucrative crop, bears heavy crop each year and provides significant economic returns. The fruit is a very rich and cheaper source of vitamin C (260 mg/100g of fruit), contains 0.5-1.8 per cent pectin (Verma and Shrivastava 1965), due to which it has industrial use for jelly preparation (Bose *et al.*, 1999) and a fair amount of minerals like phosphorus (23-37 mg/100g), calcium and iron (0.6-1.4 mg/100g), water (84.2%), TSS (9.68%), ash (50%), reducing sugar (4.45%), non-reducing sugar (5.23%). The high vitamin C content in fruit is a powerful weapon in fighting free radicals that are major enemies which cause a number of inflammatory illness and also helps in the absorption of vitamin E, which is effective in minimizing the oxidation of the LDL cholesterol and enhancing good cholesterol. The higher amount of vitamin A in the guava performs very crucial role in promoting health and quality of eye sight, mucus membranes, bones and teeth. The primary sweetening agents used in many processed sweet products are sugar and jaggery. Long term consumption of sugar leads to Type II diabetes, obesity and heart diseases, hence many people diffuse to eat sugar based products (Doddanavar, 2018). Jaggery is far complex than sugar and delivers energy gradually and not immediately (Dubey *et al*., 2022). It is known as 'medicinal sugar' which is used for pharmaceutical compositions. Additionally, it has numerous health benefits *i.e.* improves digestion, helps to cleanse the liver, eases constipation, increases energy, maintain blood purity, anti-toxic and anti-carcinogenic properties, relieves tension, treats bronchial infections and pre-menstrual syndrome. Generally fresh fruits have a shorter life after harvest and are very susceptible to spoilage even when stored in refrigerated state. Jelly is a major product prepared from guava fruit. The act of developing the guava jelly will do a better job in retaining the taste, appearance, nutrient content of fresh fruit and also helpful to our health. Therefore, a study was undertaken to exploit the excellent and delightful pulp characters having potential nutritional benefits of guava by converting it into guava jelly which would help to overcome market glut and thereby assure economic prices to the fruits.

## MATERIAL AND METHODS

An experiment was carried out during 202-23 in the Department of Postharvest Management, KRC College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka.

In order to prepare jelly, the mature, firm fruits (VNR – Bihi) were cut into slices and boiled with water for 20-30 minutes until they become soft. Then extract was drained by using muslin cloth and used to prepare jelly. The clear fruit extract was poured in a stainless steel pan, boiled and then required amount of jaggery as per treatment details, was added after conducting pectin test. Five gram of pectin was added uniformly in all the treatments. The citric acid was added and boiling was continued until the desired consistency is reached and it is important to remove the scum raised on top of the boiling mass occasionally with the laddle during preparation. The end point was examined through sheet test. After judging the end-point, the finished hot jelly was cut into pieces, packed in cellophane wrapper and stored in wide mouth PET bottles.

The Product were analyzed for moisture content using a moisture analyzer (Model: P1019319, A & D Company Limited, Japan). The water activity was measured using a digital water activity meter. TSS (ºB) was measured using an 'Erma' make hand refractometer after necessary corrections. Titratable acidity (%) and ascorbic acid (mg/100 g) content were estimated as per the modified procedure of AOAC (Anon., 1984). The optical density (OD value) was estimated according to the procedure of Srivastava and Sanjeevkumar (1998). Reducing sugars were estimated as per the Dinitro-salicylic acid method (Miller, 1972). The total sugar content was estimated as per the procedure given in AOAC (Anon., 1984). The per cent non-reducing sugars were obtained by subtracting the values of reducing sugars from that of total sugars. The minerals such as potassium, calcium, phosphorus and iron present in the guava jelly were estimated as per the procedure given in AOAC (Anon., 1990). The organoleptic characters were evaluated by a panel of semi-trained judges consisting of teachers and post-graduate students of KRC College of Horticulture, Arabhavi, on a nine- point hedonic scale as per the method of Ranganna (2003). The data recorded on the physico-chemical and organoleptic parameters were subjected to statistical analysis in CRD. The interpretation of the data was carried out in accordance with Panse and Sukhatme (1985). The level of significance used in the 'F' test was p=0.01.

**Table 1: Guava jelly prepared by incorporating fruit extract, jaggery, citric acid and pectin.**

| Treatment | Guava extract (ml) | Jaggery (g) | Citric acid (g) | Pectin (g) |
|---|---|---|---|---|
| $T_1$ | 1000 | 600 | 2.5 | 5.0 |
| $T_2$ | 1000 | 700 | 2.5 | 5.0 |
| $T_3$ | 1000 | 800 | 2.5 | 5.0 |
| $T_4$ | 1000 | 600 | 5.0 | 5.0 |
| $T_5$ | 1000 | 700 | 5.0 | 5.0 |
| $T_6$ | 1000 | 800 | 5.0 | 5.0 |
| $T_7$ | 1000 | 600 (Sugar) | 5.0 | 5.0 |

**Note:** $T_7$ was used as a standard check for comparison

## RESULTS AND DISCUSSION

*A. Effect of different recipes on the nutritional quality of guava jelly*

There were differences in the yield of freshly prepared guava jelly between the treatments. However, the maximum (1.063 kg) yield was documented in $T_6$ and the minimum (0.826 kg) yield was recorded in $T_1$. The variations made to the recipe (jaggery and citric acid) used to make jelly may be the cause of the variation in the jelly yield (Table 2). The moisture content of guava jelly ranged from 21.84 to 24.83 per cent. Since, jelly is an intermediate moisture food (IMF) product. Generally, it contains moderate levels of moisture, 20-50 per cent by weight. There was a significant difference in the water activity of fresh guava jellies among the treatments and they varied from 0.54 to 0.50. Similar observations on moisture content and water activity were reported by Sultana *et al.* (2021) in jackfruit rind jelly; Bansode *et al.* (2020) in sweet potato jelly; Molla *et al*. (2022) in guava-pineapple jelly. The TSS values in freshly prepared jelly varied between 63.24 to 67.03 ºB (Table 2). The TSS of the fresh jelly was measured, to check if the product met the FSSAI jelly preparation standards. Possible causes for variations in TSS include variations in the recipe (Jaggery and citric acid levels) and moisture content of the jelly. Similar findings (TSS ranges) were made by Monde *et al*. (2018) in guava blended with pomegranate jelly; Molla *et al*. (2022) in guava-pineapple jelly. The analyzed data related to titratable acidity of freshly prepared guava jelly showed a significant difference among the treatments (Table 2). The maximum per cent titratable acidity of freshly prepared guava jelly was in $T_6$ (0.55%). However, minimum was found in $T_1$ (0.36%). It might be due to variations made in the treatments. The same inference was also achieved by Kuchi *et al*. (2014) in guava jelly. The retention of ascorbic acid in the freshly prepared guava jelly was discovered to have significant differences among the recipes. At initial period, treatment $T_3$ recorded the higher amount of ascorbic acid (16.83 mg/100 g, respectively) whereas, minimum ascorbic acid content (15.29 mg/100 g, respectively) was recorded in $T_7$ (Table 2). Additionally, a greater ascorbic acid concentration was discovered in recipes containing a higher percentage of jaggery than sugar. This is likely because of the presence of higher ascorbic acid concentrations in jaggery than sugar. In contrast to sugar, which had no ascorbic acid, jaggery had an ascorbic acid level of about 7.0 mg/100g. These findings are supported by the result of Kumar and Deen (2017) in wood apple jelly from 0.4 to 0.02 (mg/100mL); Panchal *et al.* (2018) in dragon fruit jelly from 2.96 to 2.47 (mg/100g); Jolhe *et al.* (2020) in guava jelly. There was a noticeable difference existed among the treatments in the optical density of freshly prepared guava jelly. The minimum (0.032 O.D.) optical density was recorded in $T_7$ (1000 ml extract + 600 g sugar + 5 g citric acid) whereas, the maximum optical density value (0.077 OD) was observed in $T_6$ (1000 ml extract + 800 g jaggery + 5 g citric acid + 5 g pectin). Recipes containing jaggery has recorded more

OD values when compared to sugars. The same type of findings were noticed by Kumar and Deen (2017) in wood apple jelly; Khan *et al*. (2019) in wood apple jelly. The results of total sugars content as affected by different treatments in fresh jelly are given in Table 3. The highest per cent of total sugars (55.15%) was recorded in treatment ($T_7$) whereas, statistically least per cent of total sugars was documented in $T_1$ (52.05%), respectively. Significantly highest amount of reducing sugars was in $T_7$ *i.e.* 1000 ml extract + 600 g sugar + 5 g citric acid + 5 g pectin (26.93%) whereas, lowest percentage of reducing sugars was noticed in $T_4$ (22.83%), respectively. The non-reducing sugars of freshly prepared guava jelly as influenced by different treatments varied significantly. Among the different treatments, the maximum non reducing sugars (30.41%) was recorded in $T_4$ (1000 ml extract + 600 g jaggery + 5 g citric acid + 5 g pectin). On the contrary, the minimum per cent of non reducing sugars was in $T_6$ (26.21%). This might be due to variation in the sucrose content in sugar and jaggery. Jaggery has a sucrose level of between 70 to 80 per cent while, sugar has a composition of approximately 99.5 per cent, according to Kumar and Singh (2020). The results were in accordance with the findings of Kuchi *et al*. (2014); Shigihalli *et al.* (2018) in ivy gourd jelly. The minerals *viz*., potassium, calcium, phosphorus and iron content of fresh jelly ranged from 1178.10 to 351.42 mg/100 g, 61.42 to 11.87 mg/100 g, 71.03 to 23.47 mg/100 g and 6.88 to 0.83 mg/100 g, respectively (Table 3). This variation in mineral content is due to variation in concentration of jaggery used, as it is rich in significant minerals. Treatments $T_3$ and $T_6$ are mentioned to have higher concentrations of jaggery, making them rich in mineral content. In contrast, sugar is noted to be devoid of minerals. The variations in mineral concentration over storage periods were explored in literatures like Panchal *et al.* (2018) in dragon fruit jelly and Molla *et al*. (2022) in guava-pineapple jelly.

*B. Effect of different recipes on organoleptic quality guava jelly*

The guava jelly exhibited significant variations with respect to all the sensory quality parameters (Table 4). Significantly uppermost score for colour and appearance (8.83) of guava jelly was recorded in $T_7$ and the lowest score was recorded in $T_1$ (7.83) in the freshly prepared jelly. This is due to darker appearance of jaggery based jelly when compared to sugar based jelly. The highest score for texture was registered in $T_7$ (8.50) while, the minimum score was documented in $T_{1,}$ $T_2$ and $T_3$ (8.00 each), respectively. The highest score (7.67 each) for aroma of guava jelly was obtained in the treatment $T_6$ and $T_{7,}$ while minimum (7.25 each) was scored in $T_1$ and $T_2$. Significantly highest sensory score for the taste was recorded in $T_3$, $T_6$ and $T_7$ (8.50 each) initially whereas, the treatment $T_1$ and $T_4$ recorded the lowest score (8.17 each). The highest score (8.38) for overall acceptability was achieved in $T_7$. However, the lowest score (7.81), was detected in treatment containing 1000 ml extract + 600 g jaggery + 2.5 g citric acid + 5 g pectin ($T_1$), respectively. The changes made to the recipes led to variations in the guava jelly's sensory scores. The sugar based jelly was more preferred compared to jaggery based jelly. Similar sensory scores were obtained by Singh and Chandra (2012) in guava-carrot jelly; Kuchi *et al*. (2014) in guava jelly; Jolhe *et al*. (2020) in guava jelly.

**Table 2: Effect of different recipes on yield, moisture content, water activity, total soluble solids, titratable acidity and ascorbic acid of freshly prepared jaggery based guava jelly.**

| Treatments | Yield (kg /kg of extract) | Moisture content (%) | Water activity ($a_w$) | Total soluble solids (º B) | Titratable acidity (%) | Ascorbic acid (mg/100 g) |
|---|---|---|---|---|---|---|
| **$T_1$** | 0.826 | 24.83 | 0.54 | 63.24 | 0.36 | 15.96 |
| **$T_2$** | 0.945 | 24.12 | 0.52 | 65.03 | 0.38 | 16.33 |
| **$T_3$** | 1.054 | 23.07 | 0.52 | 65.32 | 0.39 | 16.83 |
| **$T_4$** | 0.843 | 24.67 | 0.53 | 63.35 | 0.51 | 16.02 |
| **$T_5$** | 0.951 | 24.09 | 0.52 | 64.93 | 0.53 | 16.27 |
| **$T_6$** | 1.063 | 23.11 | 0.53 | 65.41 | 0.55 | 16.74 |
| **$T_7$** | 1.010 | 21.84 | 0.50 | 67.03 | 0.53 | 15.29 |
| **Mean** | **0.95** | **23.67** | **0.52** | **64.90** | **0.46** | **16.20** |
| **S.Em±** | 0.004 | 0.029 | 0.005 | 0.031 | 0.011 | 0.016 |
| **C.D.@1%** | 0.016 | 0.124 | 0.024 | 0.132 | 0.048 | 0.068 |

**Treatment details**

$T_1$ –1000 ml extract + 600 g jaggery + 2.5 g citric acid + 5 g pectin $T_5$ –1000 ml extract + 700 g jaggery + 5 g citric acid + 5 g pectin
$T_2$ –1000 ml extract + 700 g jaggery + 2.5 g citric acid + 5 g pectin $T_6$ –1000 ml extract + 800 g jaggery + 5 g citric acid + 5 g pectin
$T_3$ –1000 ml extract + 800 g jaggery + 2.5 g citric acid + 5 g pectin $T_7$ –1000 ml extract + 600 g sugar + 5 g citric acid + 5 g pectin
$T_4$ –1000 ml extract + 600 g jaggery + 5 g citric acid + 5 g pectin

**Table 3: Effect of different recipes on total sugars, reducing sugars, non reducing sugars, potassium, calcium, phosphorus and iron content of freshly prepared jaggery based guava jelly.**

| Treatments | Total sugars (%) | Reducing sugars (%) | Non reducing sugars (%) | Potassium (mg/100 g) | Calcium (mg/100 g) | Phosphorus (mg/100 g) | Iron (mg/100 g) |
|---|---|---|---|---|---|---|---|
| **$T_1$** | 52.05 | 23.17 | 27.43 | 929.18 | 51.15 | 63.87 | 4.24 |
| **$T_2$** | 54.03 | 23.49 | 29.01 | 1034.24 | 55.07 | 68.23 | 5.89 |
| **$T_3$** | 54.48 | 23.81 | 29.13 | 1178.10 | 60.62 | 71.03 | 7.92 |
| **$T_4$** | 54.85 | 22.83 | 30.41 | 973.62 | 52.54 | 64.12 | 4.39 |
| **$T_5$** | 53.66 | 24.97 | 27.25 | 1021.06 | 56.39 | 67.96 | 5.63 |
| **$T_6$** | 53.26 | 25.67 | 26.21 | 1156.23 | 61.42 | 70.88 | 6.88 |
| **$T_7$** | 55.15 | 26.93 | 27.95 | 351.42 | 11.87 | 23.47 | 0.83 |
| **Mean** | **53.92** | **24.41** | **28.19** | **949.12** | **49.86** | **61.36** | **5.11** |
| **S.Em±** | 0.026 | 0.020 | 0.030 | 2.871 | 0.034 | 0.041 | 0.012 |
| **C.D.@1%** | 0.111 | 0.087 | 0.129 | 12.089 | 0.146 | 0.176 | 0.051 |

**Treatment details**

$T_1$ – 1000 ml extract + 600 g jaggery + 2.5 g citric acid + 5 g pectin
$T_2$ – 1000 ml extract + 700 g jaggery + 2.5 g citric acid + 5 g pectin
$T_3$ – 1000 ml extract + 800 g jaggery + 2.5 g citric acid + 5 g pectin
$T_4$ – 1000 ml extract + 600 g jaggery + 5 g citric acid + 5 g pectin
$T_5$ – 1000 ml extract + 700 g jaggery + 5 g citric acid + 5 g pectin
$T_6$ – 1000 ml extract + 800 g jaggery + 5 g citric acid + 5 g pectin
$T_7$ – 1000 ml extract + 600 g sugar + 5 g citric acid + 5 g pectin

**Table 4: Effect of different recipes on optical density, organoleptic characters (colour and appearance, texture, aroma, taste and overall acceptability) of freshly prepared jaggery based guava jelly.**

| Treatments | Optical density (OD value) | Colour and appearance | Texture | Aroma | Taste | Overall acceptability |
|---|---|---|---|---|---|---|
| **$T_1$** | 0.052 | 7.83 | 8.00 | 7.25 | 8.17 | 7.81 |
| **$T_2$** | 0.062 | 7.92 | 8.00 | 7.25 | 8.33 | 7.88 |
| **$T_3$** | 0.069 | 8.17 | 8.00 | 7.58 | 8.50 | 8.06 |
| **$T_4$** | 0.056 | 8.00 | 8.08 | 7.33 | 8.17 | 7.90 |
| **$T_5$** | 0.071 | 8.17 | 8.17 | 7.33 | 8.25 | 7.98 |
| **$T_6$** | 0.077 | 8.50 | 8.17 | 7.67 | 8.50 | 8.21 |
| **$T_7$** | 0.032 | 8.83 | 8.50 | 7.67 | 8.50 | 8.38 |
| **Mean** | **0.059** | **8.20** | **8.13** | **7.44** | **8.34** | **8.02** |
| **S.Em±** | 0.001 | 0.070 | 0.077 | 0.089 | 0.094 | 0.051 |
| **C.D.@1%** | 0.004 | 0.296 | 0.324 | 0.375 | 0.397 | 0.214 |

**Treatment details**

$T_1$ – 1000 ml extract + 600 g jaggery + 2.5 g citric acid + 5 g pectin
$T_2$ – 1000 ml extract + 700 g jaggery + 2.5 g citric acid + 5 g pectin
$T_3$ – 1000 ml extract + 800 g jaggery + 2.5 g citric acid + 5 g pectin
$T_4$ – 1000 ml extract + 600 g jaggery + 5 g citric acid + 5 g pectin
$T_5$ – 1000 ml extract + 700 g jaggery + 5 g citric acid + 5 g pectin
$T_6$ – 1000 ml extract + 800 g jaggery + 5 g citric acid + 5 g pectin
$T_7$ – 1000 ml extract + 600 g sugar + 5 g citric acid + 5 g pectin

## CONCLUSIONS

From the above results, jaggery based guava jelly prepared by using a recipe containing 1000 ml of extract + 800 g of jaggery + 5 g of citric acid + 5 g pectin ($T_6$) resulted in excellent quality in terms of physico-chemical characteristics and organoleptic traits. In terms of mineral richness, jellies made from jaggery were clearly superior than those made from sugar.

## FUTURE SCOPE

The nutritional values, as well as the medicinal properties of guava and jaggery, can be well exploited through different value-added products. Development of jaggery based fruit products could open up new avenues in the market, but it would likely require a comprehensive approach involving research, product development, marketing and possibly changes in consumer preferences and awareness.

**Acknowledgment.** I feel privileged and express my deep sense of gratefulness and indebtedness to the Chairman, members of the advisory committee and staff of the Department of Postharvest Management, Kittur Rani Channamma College of Horticulture, Arabhavi.
**Conflict of Interest.** None.

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**How to cite this article:** Shruti Chulke, Kirankumar Gorabal, Laxman Kukanoor, Anil I. Sabarad and Sachinkumar T. Nandimath (2023). Studies on Preparation of Jaggery Based Guava (*Psidium guajava* L.) Jelly. *Biological Forum – An International Journal, 15*(10): 1097-1101.