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Preparation and evaluation of guava jelly (*Psidium guajava*)

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Abstract
The experiment was conducted to develop the guava fruit jelly using various varieties of guava viz. Lalit, Sweta, VNR-bihi and used different treatment combinations. The prepared guava fruit jelly filled in glass jars was labeled and stored at normal room temperature up to 90 days of storage period to evaluate their respective chemical constituents and sensory quality attributes. Evaluation for fresh as well as stored jelly samples was done at 30 days of interval up to 90 days of storage at room temperature (37 ^{0}C). There was gradual increase in TSS, titratable acidity of guava jelly during storage while gradual decrease in ascorbic acid content of guava jelly during storage. Treatment combination T3 of variety Lalit with 100% juice + 3g Citric Acid + 750g Sugar was found to be the superior than the other treatment combinations and acceptable in good condition even after 90 days of storage at room temperature.

Keywords: Guava, quality, jelly, lalit, sweta, VNR-bihi

Introduction
Jelly is a semi-solid product prepared by boiling a clear strained fruit extracts free from pulp after the addition of required amount of sugar, citric acid and pectin. It should contain minimum 65 percent of total soluble solids and minimum 45 percent of fruit portion (Dhawan, 1998) [4]. Guava comes under Myrtaceae family and its chromosome number is 2n=22.The genus *Psidium* covers approx. 150 species, but the most important fruit of this genus is *Psidium guajava* (Pommer and Murakami, 2009) [12]. Tropical America and Mexico (Somogyi *et al*.1996) [14] or Central America (Morton,1987) [10] is supposed to be the center of origin of guava.

Guava stands fifth in production among the most important fruit crops of India and can be grown in all over the country. Important guava growing states in the country are Uttar Pradesh, Madhya Pradesh,Maharashtra and Bihar,Allahabad district of Uttar Pradesh is very popular for growing the excellent quality of guava fruits in the world (Mitra and Bose, 1990) [9].

It is a very rich and cheap source of vitamin C (260 mg/100g of fruit), pectin (0.5-1.8%) (Verma and Shrivastava, 1965) which has industrial use for jelly production (Bose and Mitra, 2011) [3] and also contains a fair amount of calcium and phosphorus. Guava contains 84.2% water, 9.68% total soluble solids,50% ash, 4.45% reducing sugar, 5.23% non-reducing sugar, 1.25% acid, and 560 mg/100g vitamin C, which differ with the cultivar, stage of maturity, and season. It can be used to prepare excellent salad, pudding, jam, jelly, cheese, canned fruit, RTS, nectar, squash, marmalade, ice cream, toffees (Jain and Asati, 2004) [5] and bar. During harvesting season a market glut is occurred in the guava producing areas. Due to lack of marketing, storage facilities huge quantity of guava spoiled. As estimated by Lashely (1984) [8] an approximately 30 -50% fruit goes waste during post-harvest handling, storage and ripening. The post harvest losses can be mitigated through processing and preservation techniques. Different treatment combinations of guava jelly was developed and its quality evaluation is reported in this communication.

Materials and Methods
Fully matured uniform sized fruits with firm texture were selected. Healthy disease free fruits of Lalit, Sweta and VNR-bihi were sorted out separately and used for the preparation of jelly. The experimental material was collected from guava orchard of PFDC, College of Agriculture, Raipur (C.G.). Other raw materials including sugar, citric acid, glass jars, chemicals and preservatives were procured from the local market for the present study.

Treatment combinations: V1T1 Lalit 100% juice+ 3g Citric Acid +550g Sugar, V1T2 Lalit 100% juice + 3g Citric Acid + 650g Sugar,V1T3 Lalit 100% juice + 3g Citric Acid + 750g Sugar, V2T4 Sweta 100% juice+ 3g Citric Acid + 550g Sugar, V2T5 Sweta 100% juice +

3gCitric Acid + 650g Sugar, V2T6 Sweta 100% juice + 3g Citric Acid + 750g Sugar, V3T7 VNR-bihi 100% juice + 3g Citric Acid + 550g Sugar, V3T8 VNR-bihi 100% juice + 3g Citric Acid + 650g Sugar, V3T9 VNR-bihi 100% juice + 3g Citric Acid + 750g Sugar

Preparation of guava jelly

The extracted strained fruit juice was used to prepare guava jelly. The amount of guava juice, water, pectin, acid and sugar were calculated according to the formulation. The pulp, pectin, water and small amount of calculated sugar were then mixed and kept for heating for 3-5 minutes under agitation. Heating continued and remaining amount of sugar was then added. When it comes to boiling add citric acid and judge the end point. The end point is indicated by 65-68 per cent Total Soluble Solids in the mixture is determined by Refractometer. Jelly is then filled hot in the jar. It was then covered with melted wax and cooled. After cooling the cans or jars were labeled and stored at room temperature up to 90 days to determine the physico-chemical and sensory quality attributes of guava fruit jelly.

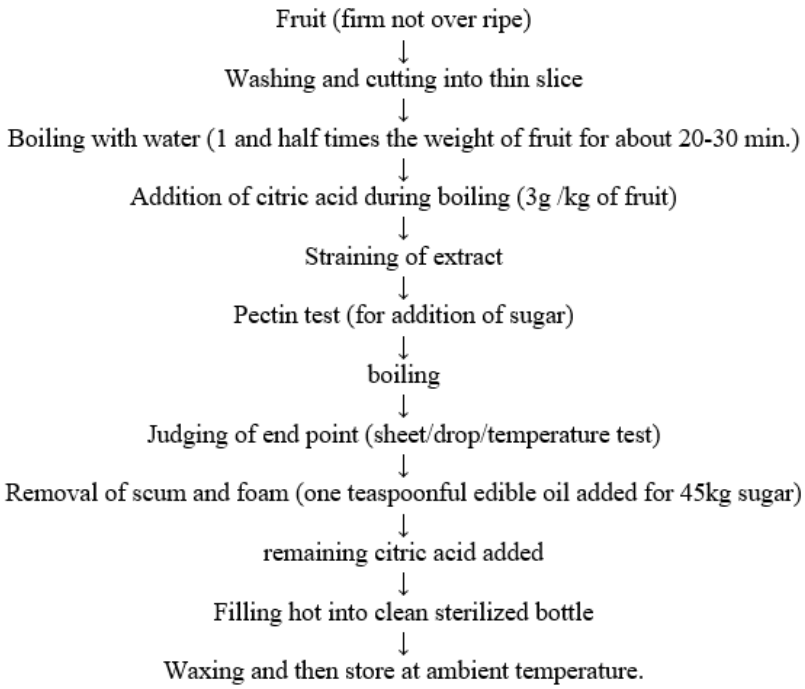

Fig 1: Flow chart for preparation of guava *(Psidium guajava* L.) jelly

Chemical analysis of guava jelly

Total soluble solids (TSS) were determined using a hand refra ctrometer. Titrable acidity was also determined. The calculation of ascorbic acidcontent using 2, 6-Dichlorophenol indophenols dye was titrimetrically dependent on the updated AOAC procedure (1984) [1]. Sensory assessment of various attributes was conducted on the hedonic scale using the specified sensory panel (Joshi, 2006) [6]. All determinations were made three times and the results were presented as average values.

Results and Discussions

TSS:

Effects of treatment combinations and storage times on TSS, t itrable acidity and ascorbic acid have been determined. The different combinations of sugar ratios with respect to the change in TSS content (^{0}Brix) during storage are shown in Table 1. It is clear that the TSS (° Brix) of samples increased with an increase in storage time at room temperature (Table 1). It is clear that the impact of treatment combinations and the length of storage has been shown to be significant. The study also showed that TSS increased with an increase in storage time, regardless of storage conditions. The rise in total soluble solids during storage may be due to the conversion of an insoluble to a soluble fraction. Similar findings have been documented by Aradhita *et al*., 1996 [2], Paul *et al*., 2007 [11] while working on guava jelly.

Titrable acidity: It is clear that the titrable acidity (%) of samples increased with increase in storage periods at room temperature. (Table 1). It is clear that the impact of treatment combinations and the length of storage has been shown to be significant. The reason for increase in titratable acidity might be due to formation of organic acids by the degradation of the ascorbic acid as it decreased with storage period of the jelly (Kumar and Deen, 2017) [7].

Table 1: Changes in Physico-chemical attributes of guava fruit jelly during storage

Treatments	TSS (° Brix)				Titrable acidity (%)				Ascorbic acid(mg/100g)			
	Storage period											
	0	30	60	90	0	30	60	90	0	30	60	90
V1T1	65	65.42	66.12	67.07	0.15	0.15	0.24	0.317	97.497	97.42	96.557	95.933
V1T2	66.03	67	68.2	71.13	0.167	0.167	0.303	0.33	93.267	92.913	92.403	91.807
V1T3	67.03	67.77	68.31	71.23	0.31	0.31	0.36	0.437	112.25	111.9	111.32	110.71
V2T4	64.03	64.25	65.1	66	0.1	0.1	0.207	0.26	96.163	95.817	95.233	94.623
V2T5	64	64.65	65.1	66.17	0.167	0.167	0.27	0.3	87.39	87.08	86.5	85.89

V2T6	65.07	65.63	66.13	67.13	0.21	0.21	0.307	0.34	92.333	92.027	91.443	90.863
V3T7	66.05	66.53	67.12	67.77	0.21	0.21	0.3	0.337	97.76	97.443	96.953	96.373
V3T8	66.48	66.9	68.13	68.73	0.217	0.217	0.33	0.353	93.243	92.933	92.443	91.863
V3T9	64	64.5	65.22	66.03	0.24	0.24	0.34	0.37	89.803	89.497	89	88.413

Table 2: Change in sensory attributes of guava fruit jelly during storage

Treatments	Colour and Appearence				Texture				Taste				Overall Acceptability			
	Storage Period(days)															
	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90
V1T1	8.2	8	8.1	8.1	8.4	8.1	8	8.3	7.2	7.8	8	8.2	5	6.9	8	8.2
V1T2	8	8.3	8.3	8.4	8	8.2	8.3	8	8	8	8.2	8	8.9	8.7	8.2	8.6
V1T3	8.8	9	9	8.8	9	8.9	8.8	9	8.5	8.3	8.5	8.8	9	9	9	9
V2T4	7.5	5	7.3	7.1	7.5	7.2	7.5	7.2	4.3	7.1	7.5	7.5	7.8	7.1	8.1	7.7
V2T5	5.9	5.3	6.4	6	6	6.2	7.4	6	5.8	6.2	7.4	5.9	6	4.7	6.4	5.8
V2T6	8	5.2	7	7.1	8	5	6	8	4.8	5	6.4	8	7.2	7.4	7	7.5
V3T7	8.5	6.5	6.4	6.5	8.5	6.5	8	8.6	5.4	6.4	8	8.5	4.1	4.5	6	4.9
V3T8	7	7	8.4	7	7	7	7.1	7	7.5	7	7.1	7	7.5	6	8.5	7.9
V3T9	7	6.8	7	7.5	7	8	7	7	4	7.9	7	7	4	4	6.3	4.5

Ascorbic acid

The different combinations of sugar ratios with respect to the change in ascorbic acid (mg/100g) during storage are shown in Table 1.It is clear that the ascorbic acid of samples decreased with increase in storage periods at room temperature. This might be due to oxidation of ascorbic acid to dehydro ascorbic acid followed by further degradation to 2,3- diketogulonic acid and finally to furfural compounds and also its oxidation due to temperature and greater catalytic activity of fructose in the catabolization of vitamin-C could be the reason for its decrease (Kumar and Deen, 2017) [7].

Sensory Evaluation

The sensory evaluation scores of fresh and stored guava jelly samples for parameters like color and appearance, texture, taste and overall acceptability were evaluated. Nine points Hedonic rating test method as recommended by Joshi, (2006) [6] was used for the purpose of sensory evaluation and mean scores obtained by various treatment combinations for different sensory attributes are presented in Table 2.The colour and appearance, texture, taste, overall acceptability score of 9 cv. Lalit treatment combination T3 (100% juice + 3g Citric Acid + 750g Sugar) was found to be the superior than others. While the minimum overall acceptability score of 4.5 of cv. VNR-bihi was obtained to that sample which had 100% juice+ 3g Citric Acid + 750g Sugar after 90 days of storage at room temperature.

Summary and Conclusion

The maximum overall acceptability score for the fresh jellies prepared from cv. Lalit treatment combination T3 (100% juice + 3g Citric Acid + 750g Sugar) were awarded as 9. However, the minimum overall acceptability score of 4.5 of cv. VNR-bihi was obtained to that sample which had 100% juice+ 3g Citric Acid + 750g Sugar after 90 days of storage at room temperature. There was gradual decrease in mean score for color and appearance, flavor, texture, taste and overall acceptability of guava bar with increase in storage period.

It was concluded that guava fruit jelly prepared with cv. Lalit 100% juice + 3g Citric Acid + 750g Sugar found to be superior to those prepared with other ratios and can be stored for 3 months without any spoilage at room temperature.

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