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STUDIES ON PREPARATION AND SHELF LIFE OF GUAVA (*PSIDIUM GUAJAVA* L.) CANDY CV. ALLAHABAD SAFEDA

UJJWAL SINGH[1], SAKET MISHRA[2], GAURAV SINGH VISHEN[3] AND RAJA KUMAR[4]

[1,2,3,4]Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj 211 007, U.P., India

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Abstract– An experiment was carried out at the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh) during the year 2021 to make guava candy. The experiment consisted of 9 treatments and 3 replications treated with potassium metabisulphite (T4 to T9= 0.2%) for 10 min, prior to candy preparation. The experiment also consists of 0.2% citric acid with three different concentrations of sugar syrup (45º B, 55ºB, 65ºB). Guava candy was prepared and stored for 3 months under ambient conditions in a plastic ziplock bag. From storage studies, it was revealed that T9 (Dipping in 650B syrup + blanching in 0.2% KMS solution+ 1% citric acid)is most suitable treatment in terms of their physico-chemical properties and organoleptic test of guava candy. On the basis of the results it is concluded that treatment T_9 can be used in commercialization of guava candy. The results indicated that the quality observations and sensory evaluation were affected by various treatments.

INTRODUCTION

Guava (*Psidium guajava* L.) is a tropical fruit popularly known as "Apple of Tropics" grows well under sub-tropical conditions. It belongs to the Myrtaceae family. In India it is considered as the fourth most important fruit in area and production after mango, banana and citrus. Guava is hardy, prolific bearer and highly remunerative fruit. It is highly favored fruit crop by the fruit growers due to its wide adaptability and higher return per unit area. The antioxidants in guava are believed to help in reducing the risk of cancer. The vitamin C (200-300 mg/100g) in guava makes absorption of vitamin E much more effective in reducing the oxidation of the cholesterol. It is rich in pectin, fiber, folic acid, minerals like potassium, copper, manganese, calcium, iron, phosphorus and vitamins like ascorbic acid, thiamine, riboflavin, nicotinic acid and vitamin

A. The fiber in guavas promotes digestion and ease bowel movements. The insoluble fiber in the guava fruit is beneficial in preventing and treating diverticulitis. The high content of vitamin A in guava plays an important role in maintaining the quality and health of eyesight, skin, teeth, bones and the mucus membranes. Guava is mainly consumed as fresh fruit during its availablity in winter season, though it's flowering and fruiting occurs around the year due to different bahar's. Various processed products are made from guava viz. jam, jelly, cheese, canned fruit segments, ready to serve drink, nectar, squash, dried powder, ice-cream, highly concentrated puree, candy, toffees, syrup, juice and concentrate. The processing of guava fruits for value addition minimizes post-harvest losses, enhances its economic and nutritive value by fortification and to increase the availability over an extended period. It has been observed that when there is a lots of production of guava, the fruits go waste due to its perishable nature. So there is a need to prevent post-harvest losses and regulate prices during glut period. Therefore, it is necessary to develop new technology for processing of guava fruits into value added products. Guava is also preferred for candy preparation as it is a highly valued indigenous fruit containing high amounts of nutrients. Besides, guava also contains good amount of dietary fiber

([1,4]M.Sc.Scholar, [2]Assistant Professor, [3]Ph.D Scholar)

having laxative effect. Its use as candies may prove to be a shelf stable delicious addition in the list of guava products. Therefore, it is necessary to utilize this fruit for making different products to increase its availability over an extended period and to stabilize the price. A fruit when impregnated with sugar free from syrup, drained and dried is called a candied fruit. The finished product is plump, tender, and exceedingly sweet with high flavor and without stickiness. Guava candies are becoming more and more popular because of high acceptability, minimum volume, higher nutritional value and longer storage life. To popularize the consumption of fruit processed products, the processing technology of segmented sweet and spiced candy may be standardized. The products will be easy to consume, stone less and non-sticky. These products also have additional advantage of being least thirst provoking ready-to-eat snacks. The dried products do save energy, money and space in packaging, storage and transportation (Nayak *et al*., 2012).The candied fruits may be used in baking industry for preparation of cakes, cookies, steamed puddings, sweet breads etc. The foremost benefit of processing fruit into candy is that it can be stored for a long period at ambient temperature as intermediate moisture product with high solids content. Candy manufacturing is beneficial to both the farmers as well as the entrepreneurs because of minimum equipment requirement and cost effective process. Keeping all these facts in view, the present study was carried out with the objective to find out the best treatment for sugar concentration and shelf life of guava candy and to evaluate their effect on sensory quality and to assess the storage stability of guava candy.

MATERIALS AND METHODS

An experiment was carried out at the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P) during the year 2021. Allahabad Safeda the most famous and demanded variety of guava was used. The fruit was collected from the local market of Prayagraj district of U.P. Before processing, the fruits were graded and washed thoroughly with continuous stream of water to remove adherent dirt particles and other foreign materials. Good quality crystal sugar and citric acid were purchased from local market and used for the preparation of guava candy, and then the fruit was cut into 1 cm sized pieces. These pieces were then pricked with stainless steel fork and dipped in the chemical solutions (T4-T9 0.2% KMS) for 10 minutes. The pricked and pre- treated guava fruitpieces were soaked in different sugar solution viz. 45, 55, 65 per cent sugar solution containing 1 per cent citric acid for T7, T8 and T9 and kept at room temperature overnight. The strength was raised by 8-10 per cent by adding sugar and concentrating the syrup after a day. The pieces were soaked overnight and the process was repeated at the interval of 24 hours for 2 to 3 days till the total soluble solids (TSS) of syrup reached 65°Brix. The syrup was then drained off and guava pieces were dried in a dehydrator at 50° ± 5°C beyond sticky condition. Theguava candies were stored in plastic ziplock bag for further storage studies of 3 months

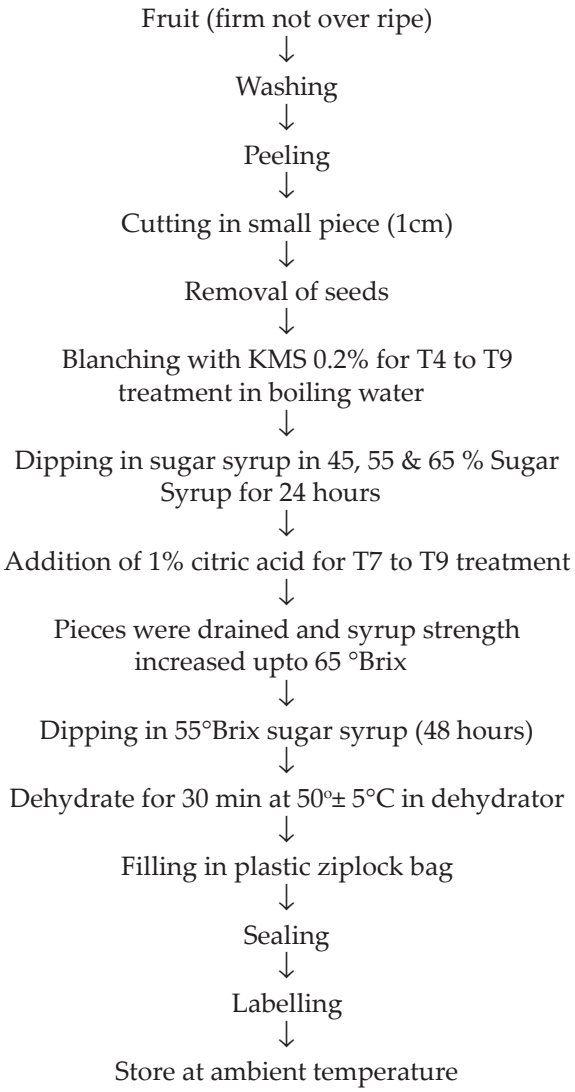

Fig. 1. Flowchart of candy making

at ambient conditions (as shown in Fig. 1). Fresh fruit and candy were analyzed for moisture (%) as per AOAC (2000) and total soluble solids (°B) by using hand refractometer (Erma, Japan). Titratable acidity was evaluated by titrating known volume of aliquots against 0.1 N NaOH and expressed as per cent citric acid, total sugars, reducing sugar and non-reducing sugars were estimated as per Lane and Eynon method. Ascorbic acid was determined using titrimetric method and expressed as mg/100g and pH using digital pH meter. Prepared candies were evaluated for sensory attributes such as appearance and colour, taste and flavour, texture and overall acceptability using 9- point hedonic scale. The data collected for different characteristics were analyzed with the help of Completely Randomized Design.

Treatment details

T1 -Stepping in 45 °B syrup T2-Stepping in 55 °B syrup T3 -Stepping in 65 °B syrup
T4 -Stepping in 45 °B syrup + blanching in 0.2% KMS solution T5 -Stepping in 55 °B syrup + blanching in 0.2% KMS solution T6 -Stepping in 65 °B syrup + blanching in 0.2% KMS solution
T7 -Stepping in 45 °B syrup + blanching in 0.2% KMS solution + 1% citric acid T8 -Stepping in 55 °B syrup + blanching in 0.2% KMS solution + 1% citric acid T9 -Stepping in 65 °B syrup + blanching in 0.2% KMS solution + 1% citric acid

RESULTS AND DISCUSSION

Total soluble solid (T.S.S.) (ºBrix)

T.S.S. of guava candy was found to increase with increase in storage period. The highest mean value was recorded in T_9 (74.17 ºBrix) while minimum score was recorded in T_2 (69.06º Brix). An increased in TSS content may possibly be due to hydrolysis of polysaccharides and oligosaccharides into monosaccharide (reducing sugar).

pH

The pH has great importance to maintain shelf stability, pH can also influence the flavor and texture. Highest mean value was observed in T2 (6.02) while the minimum value was observed in T7 (4.45) during the storage. There was a negligible increase in pH of guava fruit candy which was noticed in all the treatments, it might be due to formation of free acids and hydrolysis of pectin (Imran *et al*., 2000). Parallel results were obtained on mango pulp by Durrani *et al*., (2010) and wood apple bar by Vidhya and Narain (2011).

Acidity (%)

Acid gives the characteristic sourness to the product. An observation recorded on change in acidity was found highest (0.35) in treatment T_9 while lowest (0.21) was observed in T_5 and T_7. The data were found to reveal statistically at 0, 30, 60 and 90 days of storage. The data regarding acidity in different treatments was gradual decrease in acidity in all treatments during storage up to 90 days. There was a slight decrease in acidity during storage might be due to salt formation i.e., due to acid base reactions (Kuchi *et al*., 2014). Similar results were recorded on apricot fruit candy by Sharma *et al*., (2013) and papaya candy and leather by Attri *et al*., (2014).

Moisture content (%)

A significant decrease was observed in moisture content during total period of storage. The highest mean value was observed in T_9 (19.26) while minimum was recorded in T_1 (16.22). The decrease in moisture content may be due to evaporation during storage. Similar observations were also reported by Daisy and Gehlot (2006) in Aonla preserve and Madan and Dhawan (2005) in carrot candy.

Ascorbic acid (mg/100gm)

A significant decrease of ascorbic acid was observed during the storage. The highest mean value was observed in T_9 (77.59) while minimum was recorded in T4 (67.54). Ascorbic acid is sensitive to heat, light and is oxidized quickly in the presence of oxygen. Hence, it might have been destroyed during processing and subsequently during storage period. Similar reduction in ascorbic acid content was also recorded by Kumar *et al*. (2009) in guava candy and Hemalatha *et al*., (2014).

Total Sugar (%)

A significant increase was observed in total sugar during total period of storage. The highest mean value was observed in T_9 (81.63) while minimum was recorded in T_1 (73.91). An increase in the total sugars might be due to hydrolysis of polysaccharides like pectin, starch etc. into simple sugars as well as evaporation of moisture during storage. Among soaking treatments significantly highest total sugars content was found in potassium

Table 1. Change in T.S.S, pH and Titrable Acidity of guava candy during storage at ambient condition

Treatments	TSS (ºBrix)					pH					Titrable Acidity (%)				
	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean
T1	67.33	68.35	70.71	71.60	69.49	4.69	4.89	5.09	5.19	4.96	0.34	0.33	0.31	0.28	0.31
T2	67.41	68.33	69.73	70.79	69.06	5.49	5.69	5.79	5.89	5.71	0.35	0.34	0.32	0.29	0.32
T3	67.85	69.45	72.01	72.58	70.47	5.53	5.70	5.90	6.00	5.78	0.36	0.35	0.33	0.30	0.33
T4	68.51	68.65	70.43	71.50	69.77	5.45	5.58	5.68	5.75	5.61	0.32	0.31	0.29	0.26	0.29
T5	69.45	69.67	72.07	73.51	71.17	5.77	5.94	6.14	6.24	6.02	0.24	0.23	0.21	0.18	0.21
T6	70.96	71.69	73.48	74.70	72.70	5.09	5.32	5.42	5.42	5.31	0.28	0.28	0.26	0.23	0.26
T7	71.52	72.00	74.62	75.60	73.43	5.51	5.71	5.78	5.88	5.72	0.24	0.23	0.21	0.18	0.21
T8	71.83	71.74	74.43	75.51	73.37	5.19	5.36	5.47	5.63	5.41	0.25	0.24	0.22	0.19	0.22
T9	73.98	74.26	75.67	76.79	74.17	4.32	4.49	4.52	4.57	4.45	0.38	0.37	0.35	0.32	0.35
F-test	S	S	S	S		S	S	S	S		S	S	S	S	
S.Ed (±)	0.773	0.816	0.913	0.888		0.436	0.492	0.410	0.419		0.023	0.024	0.024	0.024	
C.D.at 5%	1.637	1.727	1.932	1.879		0.923	1.041	0.869	0.887		0.052	0.050	0.051	0.051	

Table 2. Change in Moisture content, Ascorbic acid and Total Sugar of guava candy during storage at ambient condition

Treatments	Moisture content (%)					Ascorbic acid (mg/100 g)					Total Sugar (%)				
	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean
T1	18.14	17.07	15.00	14.67	16.22	71.67	70.66	69.00	68.00	69.83	71.14	73.67	74.66	76.20	73.91
T2	19.13	18.14	16.00	15.66	17.23	74.59	73.26	71.59	70.59	72.50	72.22	75.33	76.67	78.60	75.70
T3	19.85	18.78	16.33	16.00	17.74	76.00	75.00	73.33	72.66	74.24	73.16	76.00	78.25	79.25	76.66
T4	19.55	17.40	15.33	15.00	16.82	69.63	68.29	66.63	65.63	67.54	71.77	77.00	79.41	80.74	77.23
T5	20.10	18.14	15.00	14.71	16.98	74.98	73.65	71.98	70.98	72.89	73.52	78.00	79.89	81.55	78.24
T6	20.88	19.44	17.00	16.66	18.49	77.28	75.95	74.28	73.28	75.19	74.19	79.00	80.47	82.47	79.03
T7	19.41	18.08	15.67	14.33	16.87	71.87	70.54	68.87	67.87	69.78	72.83	78.33	80.93	82.59	78.67
T8	19.96	17.70	14.00	13.66	16.33	77.25	75.91	74.58	73.58	75.33	75.07	79.00	80.73	82.40	79.30
T9	20.92	19.80	19.33	17.00	19.26	79.26	77.93	76.93	76.26	77.59	76.00	81.67	83.11	85.77	81.63
F-test	S	S	S	S		S	S	S	S		S	S	S	S	
S.Ed (±)	1.048	0.932	0.875	0.720		1.440	1.461	1.632	1.726		0.680	1.832	1.997	2.338	
C.D.at 5%	2.220	1.974	1.852	1.524		3.048	3.092	3.455	3.655		1.440	3.880	4.227	4.951	

Table 3. Change in Reducing Sugar, Non-Reducing Sugar & Overall acceptability of guava candy during storage at ambient condition

Treatments	Reducing sugar (%)					Non- Reducing sugar (%)					Overall acceptability				
	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean
T1	36.11	39.14	40.66	41.18	39.27	31.16	32.30	33.82	38.16	33.86	7.33	6.66	6.37	6.04	6.60
T2	34.64	37.10	39.47	42.21	38.35	32.23	33.41	34.91	36.99	34.38	7.33	6.33	6.11	5.78	6.38
T3	34.65	37.36	39.72	43.10	38.70	33.17	34.38	36.22	40.14	35.98	8.00	7.00	6.77	6.43	7.05
T4	33.13	36.32	38.45	46.24	38.53	30.13	31.02	32.85	38.33	33.08	7.00	6.00	5.73	5.40	6.03
T5	32.19	35.48	38.25	44.21	37.53	31.52	32.43	33.92	38.70	34.14	7.66	6.66	6.40	6.06	6.69
T6	35.30	39.49	41.98	48.09	41.21	34.31	35.50	37.36	42.22	37.34	8.00	7.00	6.76	6.42	7.04
T7	34.77	38.69	40.96	47.81	40.56	32.89	33.42	35.03	40.79	35.53	8.00	7.00	6.71	6.38	7.02
T8	35.47	38.16	40.30	49.11	40.76	33.31	33.73	35.57	41.56	36.04	6.33	5.33	5.22	4.89	5.44
T9	37.17	41.21	43.29	50.44	43.02	36.24	37.48	39.42	43.29	39.10	8.66	8.00	7.78	7.44	7.97
F-test	S	S	S	S		S	S	S	S		S	S	S	S	
S.Ed (±)	0.966	1.042	0.920	1.036		1.146	1.023	1.703	1.665		0.444	0.567	0.553	0.545	
C.D.at 5%	2.045	2.206	1.949	2.194		2.427	2.166	3.605	3.526		0.941	1.200	1.171	1.154	

meta bisulphite treatment. It may be due to prevention of the involvement of reducing sugars in carbonyl amino reaction by potassium metabisulphite as well as in non-enzymatic browning. Similar findings were reported in cheese and toffee of guava blends (Reena *et al.*, 2007) and intermediate moisture guava slices (Harsimrat and Dhawan, 2002).

Reducing Sugar (%)

A significant increase was observed in reducing sugar during storage. The highest mean value was observed in T_9 (43.02) while minimum was recorded in T5 (37.53). According to Wedzicha (1984) sulphur dioxide is supposed to block the carbonyl group of the reducing sugars involved in carbonyl amino reaction, which is responsible for non- enzymatic browning and thereby prevents the degradation of reducing sugars. Similar results were reported in dried chilli (Take, 2012) and guava leather (Jain and Mandal, 2007).

Non-Reducing sugar (%)

A significant increase was observed in non-reducing sugar during total period of storage. The highest mean value was observed in T_9 (39.10) while minimum was recorded in T_4 (33.08).

Overall acceptability

As far as interaction is concerned in overall acceptability of guava candy during storage, the data were found statistically significant at 0, 30, 60 and 90 days of storage. At initial day the maximum overall acceptability (8.66) was observed under treatment T9. The minimum value was recorded under T8 (6.33). At 30 day the maximum overall acceptability (8.00) was observed under treatment T9. The minimum value was recorded under T8 (5.33). At 60 day the maximum overall acceptability (7.78) was observed under treatment T9. The minimum value was recorded under T9 (5.22). At 90 day the maximum overall acceptability (7.44) was observed under treatment T9. The minimum value was recorded under T8 (4.89).

CONCLUSION

In the present investigation the treatment T9 (stepping in 65º B syrup + blanching in 0.2% KMS solution+ 1% citric acid) was found most suitable treatment in terms of physico-chemical properties and organoleptic evaluation of guava candy. Storage

study showed that guava candies can be stored safely for 3 months at ambient temperature without significant changes in sensory attributes.

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