Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(3): 1180-1184
Received: 03-03-2018
Accepted: 07-04-2018

Bhat Mudasir
Shere-Kashmir University of Agricultural Science and Technology, Chatha Jammu, Jammu and Kashmir, India

Bhat Anju
Shere-Kashmir University of Agricultural Science and Technology, Chatha Jammu, Jammu and Kashmir, India

Correspondence
Bhat Mudasir
Shere-Kashmir University of Agricultural Science and Technology, Chatha Jammu, Jammu and Kashmir, India

A study on the physico-chemical characteristics and storage of pumpkin-guava blended jam

Bhat Mudasir and Bhat Anju

Abstract
In the present study pumpkin pulp was blended with guava in the ratio's of 100: 00, 75: 25 and 50:50 for preparation of jam using sugar and brown sugar maintaining TSS of 68.50º Brix. At the beginning the highest acidity (0.60%), ascorbic acid (18.90 mg/100g), reducing sugars (18.74%), total sugars (62.45%) and pectin (0.97%) were recorded in T_6 (50:50:: pumpkin: guava), whereas highest dry matter (71.80%) was recorded in T_1 (100:00::pumpkin: guava). The highest β-carotene (4.41mg/100g), pH (3.66), and ash (0.60%) was recorded in T_4 (100:00: pumpkin: guava).

Keywords: jam, pumpkin, guava, physicochemical parameters

Introduction
The post-harvest loss of fresh fruits and vegetables are estimated to be 20-30%. In order to prevent the losses, there is a need to process the commodities into various value added products. India is one of the largest producers of fruits and vegetables in the world and occupies a second position after China. Pumpkin (*Cucurbita moschata*) is one of the important cucurbitaceous vegetable grown all over India. Pumpkins are extensively grown in tropical and sub-tropical countries. Pumpkin is composed of *Cucurbita moschata, Cucurbita pepo, Cucurbita maxima, Cucurbita mixta, Cucurbita facifola and Telfairia occidental* (Caili *et al.* 2006*)* [8]. *Cucurbita moschata*, *Cucurbita pepo*, *Cucurbita maxima* are the world wide commonly grown species of pumpkin (Lee *et al.* 2003). These represent economically important species and have high production (Caili *et al.* 2006*)* [8]. The annual production of pumpkin in Jammu and Kashmir and particularly in Jammu region is 4,719 metric tonnes over an area of 23 hectares (Anonymous, 2009-10) [3].
Pumpkin also called kashiphal or lal kadu occupies a prominent place among vegetables owing to its high productivity, nutritive value, good storability, long period of availability and better transport qualities. Their colors vary from green, white and blue grey or yellow, orange or red depending on the species. It is used both at mature and immature stages as a vegetable. The flesh is delicious when fried, stewed, boiled or baked. Fresh pumpkins are very perishable and sensitive to microbial spoilage, even at refrigerated conditions. It can be consumed in variety of ways such as fresh or cooked vegetable, as well as being stored frozen or canned (Figueredo *et al.* 2000) [13]. The fruits are sweetish when fully mature and can be used in preparing sweets, candy or fermented into beverages. They are rich in carotenes, minerals, vitamins, pectin and dietary fiber. The yellow-orange characteristic color of pumpkin is due to the presence of caroteniods. Its young leaves, tender stem and flowers are also cooked and consumed. Besides, being nutritionally rich the fruit also posses many medicinal properties. They are diuretic, tonic and calm thirst. Caroteniods are the primary source of vitamin A for most of the people in the developing countries (Boileu *et al*. 1999) [5] where vitamin A deficiency is still common (Chakarvarty, 2000) [9]. It is believed that β- carotene has a protective role against cancer (Halter, 1989) and coronary heart diseases (Cindy *et al*. 1992) [11]. The pulp of the fruit is considered as sedative, emollient and refrigerant (Kiritikar and Basu, 1975). In India, these are mostly consumed in fresh vegetable preparations with the exception of their use in vegetable soups where pumpkin is added as thickening agent. Pumpkin has a vast scope for diversification and can be utilized in the production of processed products like jam, pickle, beverage, candy, bakery products and confectionary.
Guava (*Psidium guajava* L.) grown successfully throughout tropical and sub-tropical regions of India, is also termed as poor man's apple because it is cheap and easily available in the plains of Northern and Central India (Aggarwal *et al.* 2002) [1]. Guava is 4th most widely grown fruit crop in India. It is highly nutritional and delicious with pleasing aroma and rich source of pectin (Bulk *et al.* 1997) [7]. The fruit is rich in minerals like phosphorous (23-

37mg/100g), calcium (14-30 mg/100g), iron (0.6-1.4 mg/100g) as well as vitamins like niacin, panthotenic acid, thiamine, riboflavin, vitamin A and C (Bose *et al*. 1999) [6]. Guava fruits have a relatively short storage life because they have a rapid rate of metabolism and are sensitive to low temperature. The wastage of guava fruits after harvest is very serious. Hence guava fruits are required to be utilized for the development of value added products like jam, jelly, nectar, preserves, candies, marmalades etc. So an effort was made to blend guava with pumpkin for the preparation of jam

Material and methods

1. Fruit size

The fruit size was measured with help of Vernier's calliper and the average fruit size (length and diameter) was calculated and expressed in centimetres (cm).

2. Weight

Fruits were selected at random and weighed on top pan balance individually and fruit weight was calculated and expressed in kg.

3. Total soluble solids

Total soluble solids (TSS) were determined using a hand/Abbe refractometer and readings were expressed as degree Brix at 20 ^{o}C using reference table (Ranganna, 1986) [19].

4. Titratable acidity

Titratable acidity was determined by titrating a known quantity of sample (10 ml) against standard solution of 0.1 N sodium hydroxide to a faint pink colour using phenolphthalein as indicator. The results were expressed as percent citric acid (Ranganna, 1986) [19].

$$\% \text{ Titratable acidity} = \frac{\text{Titre x Normality of alkali x Equivalent weight of acid x 100}}{\text{Volume of aliquot taken x Weight of sample taken x 1000}}$$

5. Sugars

A. Reducing sugars

Sugars were estimated according to Lane and Eynon,s volumetric method given by Ranganna (1986) [19]. Measured quantity of sample (20g) was taken in 250 ml volumetric flask to which about 100 ml distilled water was added and neutralized with 40 per cent sodium hydroxide using phenolphthaline as indicator and clarified with 2 ml of 45 per cent neutral lead acetate for about 10 minutes. Excess of lead was removed by adding 5 ml of 22 per cent potassium oxalate. The volume was made to 250 ml and filtered through whatman No. 4 filter paper. 100 ml of the filtrate was taken and hydrolysed by adding 5 ml of concentrated HCl and kept overnight for estimation of total sugars. Boiling mixture containing five ml each of Fehling A and Fehling B was titrated against aliquot using methylene blue as indicator. The end point was marked by the appearance of brick red colour. Volume of aliquot was noted and the reducing sugars were calculated as per the procedures described in AOAC. (1995).

B. Total sugars

For estimation of total sugars the excess of HCl in aliquot was neutralized by adding NaOH. Boiling mixture containing 5 ml each of Fehling A and Fehling B was titrated against hydrolysed aliquot, using methylene blue as indicator. The end point was marked by the appearance of brick red colour. Total volume of aliquot used was noted and the total sugars were calculated by the procedure described in AOAC. (1995).

$$\text{a) \% reducing sugars} = \frac{\text{Factor x Dilution x 100}}{\text{Titre x Weight of sample}}$$

$$\text{b) \% Total sugars} = \frac{\text{Factor x Dilution x Dilution x100}}{\text{Titre x Weight of filtrate x Weight of sample}}$$

6. Ascorbic acid

Ascorbic acid content was determined as per AOAC (1995) using 2, 6-dichlorophenol indophenol dye. The sample was extracted in 3 per cent metaphosphoric acid (HPO_3) solution and titrated with the standard dye to pink colour persisting for 15 seconds. The results were expressed as mg/100g of sample.

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre x Dye factor x Volume made up x 100}}{\text{Aliquot of extract taken x Weight of sample}}$$

7. Ph

The pH was measured with ELTOP-3030 pH meter using standardization with buffer solutions of PH 4.0, 7.0 and 9.0.

8. β-Carotene

Five gram of sample was taken, crushed in 10-15 ml of acetone with the help of pestle and mortar and few crystals of anhydrous sodium sulphate were added. The supernatant was decanted into a beaker. The process was repeated twice and combined supernatant was transferred to a separating funnel, then 10-15 ml of petroleum ether was added and mixed thoroughly. Two layers separated out on standing. The lower layer was discarded and upper layer was collected in 100 ml volumetric flask. The volume was made to 100 ml with petroleum ether and optical density was recorded at 452 nm using petroleum ether as blank (Srivastava and Kumar, 2002). The β–carotene was calculated using the following formula:

$$\beta \text{ - Carotene (mg/100g)} = \frac{\text{Optical density of sample x 13.9 x } 10^4 \text{ x 100}}{\text{Weight of sample x 560 x 1000}}$$

9. Moisture

Moisture content was estimated as per AOAC (1995). 10 g sample was dried in hot air oven at 130 ^{0}C ± 1 ^{0}C in pre-weighed dishes till constant weight. The dish with dried sample was transferred to a dessicator and cooled to room temperature. The dish was then weighed and moisture content in per cent was calculated from loss in weight.

$$\text{Per cent moisture} = \frac{\text{Loss in weight x 100}}{\text{Weight of sample}}$$

10. Ash

A known quantity of ground sample was taken in a pre-weighed silica crucible and charred over the heater to make it smoke free. The crucible along with the sample was ignited at 600^{o}C for 3 hrs in muffle furnace. When muffle furnace was slightly cooled, the crucible with ash was taken out, kept in desiccators to cool down, and weighed to a constant weight. The difference between the weight of silica crucible as empty

and with ash was the amount of total ash. The per cent ash was calculated from the following formula.

$$\text{Percent ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

11. Carbohydrates (AOAC, 1995)
Amount of carbohydrates was calculated from the sum of moisture, crude protein, crude fat, ash and crude fibre and lastly subtracting it from 100.

12. Crude protein
Crude protein was estimated by using Micro-kjeldahl method, AOAC (1995), using the factor 6.25 for converting nitrogen content into crude protein.

Procedure
Weighed sample (1.0g) was digested with concentrated sulphuric acid (20ml) and digestion mixture (10.0g) in Kjeldahl digestion flask. The contents were cooled and transferred to 250 ml volumetric flask. The volume was made up to the mark with distilled water and mixed. Measured aliquot (5ml) was poured in distillation flask followed by 40 per cent sodium hydroxide and ammonium borate was collected through a condenser in a flask containing 10 ml of 4.0 per cent boric acid solution. The distillate was titrated with 0.1N sulphuric acid. A blank sample was also run along with the samples.

$$\text{Per cent Nitrogen} = \frac{\text{Titre value } \times 0.0014 \times \text{Volume made}}{\text{Aliquot taken (g)} \times \text{Weight of sample(g)}} \times 100$$

Crude protein (%) = % Nitrogen x 6.25

13. Pectin content
Pectin was determined by "Gravimetric method" (Sadasivam, 1996). Twenty five gram of homogenized sample was boiled in 300 ml of 0.03 N HCl for 30 minutes in 1L beaker and residue was washed with hot water and filtrate was collected. To the residue 100 ml of 0.05N HCl was added and boiled for 20 minutes and residue was washed with hot water and filtrate was collected. Again to the residue 100 ml of 0.3 N HCl was added and boiled for 10 minutes and filtrate was collected. Filtrates were pooled, cooled and volume was made up to 500 ml. 100 to 200 ml aliquot was pipetted into 1 L beakers. 250 ml water was added and acid was neutralized with 1N NaOH using Phenolphthalein indicator. Excess of 10 ml of 1N NaOH with constant stirring was added and allowed it to stand overnight. Then 50 ml of 1N acetic acid was added and after 5 minutes, 25 ml of 1N Calcium chloride was added while stirring. After allowing it to stand for 1-2 minutes, the solution was filtered through oven dried Whatman filter paper no. 4 grade. The precipitate was washed with boiling distilled water until free from chloride. The filtrate was tested with 1% silver nitrate for chloride. The filter paper containing the precipitate was dried at 100 ^{0}C, cooled in a dessicator and weighed. The results were expressed in percent calcium pectate on oven dry basis.

$$\% \text{ Pectin Content} = \frac{\text{Weight of calcium pectate} \times 500}{\text{mL of filtrate taken} \times \text{Weight of sample taken for estimation}} \times 100.$$

Physico-chemical composition of fresh fruits of pumpkin and guava

Parameters	Pumpkin	Guava
Pulp yield (%)	60.68	56.38
Residue (%)	39.32	43.61
Fruit weight (kg)	7.91	0.13
Fruit size		
(A) Fruit length (cm)	32.20	6.27
TSS (^{o} Brix)	6.25	9.30
Titratable acidity (%)	0.08	0.40
TSS-Acid ratio	79.11	23.25
Ascorbic acid (mg/100g)	16.50	168.70
Reducing sugars (%)	1.8	4.35
Total sugars (%)	4.55	6.42

Jam Preparation
Jam was prepared from different blends/ratios as per procedure given by Srivastava and Kumar (2002). Mixed fruit pulp was cooked along with sugar/ brown (raw) sugar and citric acid with constant stirring. It was boiled at a uniform flame till TSS of 68.5^o Brix and poured at once into hot, sterilized bottles. Then the bottles were sealed and stored.

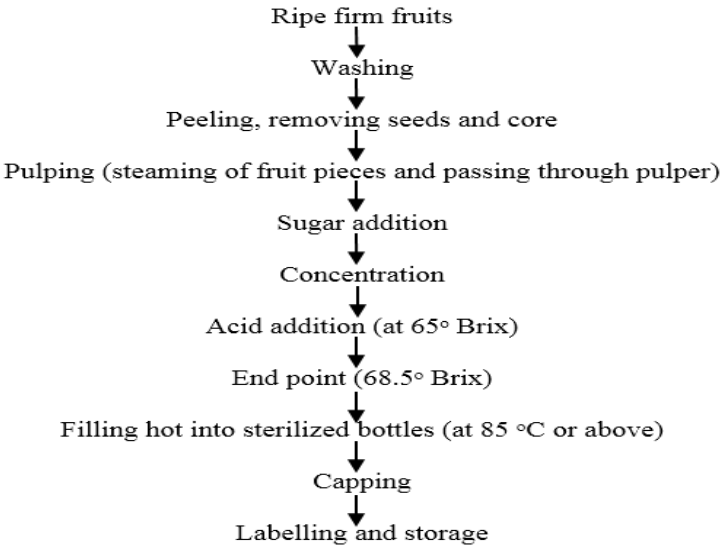

Fig 1: Flow chart for preparation of jam

Results and Discussion

Physico-chemical composition of pumpkin-guava blended jam.

Jam prepared by using different ratios of pumpkin and guava blends revealed that TSS level did not vary with the treatments due to retention of optimum level of TSS and acidity initially at the time of preparation. However, there was a significant increase in TSS irrespective of treatments during six months of storage period which might due to the conversion of starch and other insoluble carbohydrates into sugars. Similar increase in TSS was also recorded by Kannan and Thirumaran (2001) [15] in jamun jam, Vidhya and Narain (2011) [25] in wood apple jam, Muhammad *et al*. (2008) [18] in diet jam, Saravanan *et al*. (2004) in apricot jam, Koli (2004) in Sapota jam, Riaz *et al*. (1999) [20] in strawberry jam and Singh *et al*. (2005) in beal/blended beal jam. Significant increase in total and reducing sugars was observed after six months of storage. The increase in reducing sugar during storage might be due to inversion of sucrose to glucose and fructose and hydrolysis of sugars with increase in acidity and decrease in pH. The increase in total sugars may be attributed to the breakdown insoluble polysaccharides into simple sugars**.** Similar observations have been reported by Riaz *et al*. (1999) [20] in strawberry jam, Anjum *et al*. (2000) [2] in apricot dite jam, Ehsan *et al*. (2003) [12] in grape fruit apple marmalade**,** Vidhya and Narain (2011) [25] in wood apple jam, Pota *et al*. (1987), Joshi *et al*. (1996) [14] in apple pomace sauce and Chopra *et al*. (2003) [10] in wood apple jelly

It was observed that during storage titratable acidity increased significantly with corresponding decrease in pH in all treatments which might be as a result of ascorbic acid degradation or hydrolysis of pectin as reported by Muhammad *et al.* (2008) [18] in diet apple jam, Shakir *et al.* (2007) [22] in apple and pear mixed fruit jam, Chopra *et al.* (2003) [10] in wood apple jelly and Gowda *et al*. (2005) in guava fruit bar.

With the blending of pumpkin with guava the ascorbic acid content increased among the treatments, as guava being an excellent source ascorbic acid. Results revealed that ascorbic acid content declined during six months of storage. The fall in ascorbic acid content might be due to oxidation of ascorbic acid to dehydro-ascorbic acid (DHA) or furfural or hydroxymethyl furfural in jam. Similar results were reported by Torezan (2002) in mango jam during storage and Riaz *et al*. (1999) [20] in strawberry jam. Gupta (2000) also observed a decrease in ascorbic acid content during storage of sweet papaya chutney.

By increasing the proportion of guava in the jam**,** β-carotene decreased. There was a decrease in β-carotene content during the storage period of six months as they are extremely unstable and susceptible to oxidation and isomerization, the latter being catalyzed by light and heat (Simpson, 1985). Similar results were observed by Kowsalya and Chandrasekhar (2003) [16] and Saravanan *et al.* (2004) in papaya jam.

The treatments containing the brown sugar showed higher ash content compared to rest of the treatments due to the presence of molasses (rich in minerals) in it. The ash content decreased during storage. The decrease in ash content is due to increased activities of microorganism utilizing the minerals for growth (Ashaye *et al*. 2006). Similar observations were focused by Saini and Jain (1995) during the storage of pear juice concentrate, Narayana and Maini (1989) during the storage of turnip pickle.

Increasing the ratio of guava, the pectin content was enhanced among the treatments as guava being a rich source of pectin**.** There was a decrease in pectin content during six months due to the conversion of insoluble pectin into soluble fractions (Tripathi *et al.* 1988) [24]. These findings are in conformity with the findings of Joshi *et al*. (1996) [14] in apple pomace sauce. The pectin content of papaya fruit bar decreased in a non-significant manner as the period of storage increased (Miklos *et al.* 2005).

There was no definite pattern in dry matter content of the various treatment combinations of jam. However, fluctuations were observed during the six month storage period. Fluctuations in the dry matter content may be due to the activity of microorganisms and catabolic enzymes produced by them (Ashaye *et al*. 2006).

Effect of storage on physic-chemical characteristics of pumpkin-guava blended jam during storage period

Jam with addition of sugar				
Treatment	**TSS (%)**	**Acidity (%)**	**Ascorbic acid**	**Reducing sugars (%)**
T1	69.05	0.63	14.10	26.35
T2	69.20	0.63	14.20	27.16
T3	69.35	0.63	14.60	27.96
Jam with addition of brown sugar				
T4	69.45	0.62	13.30	26.44
T5	69.57	0.63	15.10	26.52
T6	69.75	0.65	15.70	28.40

Jam with addition of sugar						
Treatment	**Total sugars (%)**	**PH**	**b-carotene**	**Ash (%)**	**Pectin (%)**	**Dry matter (%)**
T1	62.32	3.61	3.40	0.59	0.67	72.94
T2	62.79	3.61	3.08	0.56	0.86	71.11
T3	63.06	3.58	2.26	0.55	0.92	70.60
Jam with addition of brown sugar						
T4	63.35	3.64	3.58	0.55	0.64	70.09
T5	63.53	3.60	3.37	0.52	0.85	69.81
T6	63.97	3.59	1.33	0.51	0.95	68.93

References

1. Aggarwal R, Parihar P, Mandhyan BL, Jain DK. Physico-chemical change during ripening of guava fruit (*Psidium gujava* L.). Journal of Food Science and Technology. 2002; 39:94-95
2. Anjum FM, Maqam-ud-Din Ijaz AI, Pasha RA. Preparation and evaluation of dried apricot diet jam. Pakistan Journal of Food Science. 2000; 10(3):21-23.
3. Anonymous. Annual area production report. Department of Horticulture, Jammu, 2009-10.
4. Ashaye AO, Babalola OS, Aina OJ, Fasoyiro BS. Chemical and Organoleptic Characterization of pawpaw and guava leathers. World Journal of Agricultural Sciences. 2005; 1(1):50-51.
5. Boileau TWM, Moore AC, Erdnman JW. Caroteniods and Vitamin A. In: Papas AM. (Eds.). Antioxidant status, diet, nutrition and health. CRC Press, FL, 1999, 133-138.
6. Bose TK, Mitra KS, Farooqui AA, Sandhu KM. *Tropical Horticultural.* Nava Prakash Publication, Kolkata, 1999, 297.
7. Bulk ELRE, Balsiker EFE, Tinay AH. Changes in chemical composition of guava fruits during development and ripening. Food Chemistry. 1997; 59: 395-399.
8. Caili FU, Huan S, Ouanlong LI. A review on pharmacological activities and utilization technologies of pumpkin. Plant Food Human Nutrition. 2006; 61:73-80.
9. Chakravarty I. Food based strategies to control vitamin A deficiency. Food Nutrition Bulletein. 2000; 21:135-143
10. Chopra CS, Singh P, Singh RP. Studies on preparation of jelly from wood apple (*Limonia acidissima*) fruit. Beverage Food World. 2003; 30(3):13-14.
11. Cindy JF, Harold F, Adrianne B, Roberts P, Daphne AR. Effect of β-carotene supplementation on photo-suppression of delayed type hypersensitivity in normal young men. American Journal of Clinical Nutrition. 1992; 56:684-690.
12. Ehsan EB, Naeem PZ, Javed A, Nazir A. Development, standardization and storage studies on grape fruit apple marmalade. Pakistan Journal of Food Science. 2003; 13(3 & 4):11-15.
13. Figueredo E, Minguez A, Vidarte L. Allergy to pumpkin and cross-reactivity to other cucurbitaceous fruits. Journal of Allergy Clinical Immunology. 2000; 106:402-403.
14. Joshi KV, Kaushal KN, Thakur SN. Apple pomace sauce- development and quality of fresh and stored products. Journal of Food Science and Technology. 1996; 33(5):414-417.
15. Kannan S, Thirumaran AS. Studies on storage life of jamun products. Indian Food Products. 2001; 55(6):125-127.
16. Kowsalya S, Chandrasekhar U. Total caroteniods and beta-carotene contents of selected stored plant food. Indian Journal of Food Science and Nutrition. 2003; 40(4):122-128
17. Lee YK, Chung WI, Ezura H. Efficient plant regeneration via organogenesis in winter squash (C*ucurbita maxima).* Plant Science. 2003; 164:413-418.
18. Muhammad A, Durrani Y, Zeb A, Ayub M, Ullah J. Development of diet jam from apple grown in swat (NWFP). Sarhad Journal of Agriculture. 2008; 24(3):461-467.
19. Ranganna S. Manual of analysis of fruits and vegetable products. Tata Mcgraw Hill Publishing Company Ltd. New Delhi, 1986.
20. Riaz MN, Mohyuddin G, Al Haq MI. Physical, chemical and sensory characteristics of jams made from fresh and frozen strawberries. Pakistan Journal of Arid Agriculture. 1999; 2(1):51-60.
21. Sadasivam S, Manicham A. Biochemical method. New Age International (P) Ltd. New Delhi, 1996, 136.
22. Shakir I, Durrani Y, Hussainm I, Qazi MI, Zeb A. Physicochemical analysis of apple and pear mixed fruit jam prepared from varieties grown in Azad Jammu and Kashmir. International Journal of Food Safety. 2007; 9:22-24.
23. Torezan GAP. Comparison between mango jam with no sugar addition obtained by a continuous process and conventional jam processed in open vats. Department of Food Technology, University of Campinas, Brazil, 2001.
24. Tripathi VK, Singh MB, Singh S. Studies on comparative compositional changes in different preserved products of amla (*Emblica officinalis*) var. Banarsi. Indian Food Packer. 1988; 42(4):60-66.
25. Vidhya R, Narain A. Development of preserved products using under exploited fruit, wood apple (*Limonia acidissima*). American Journal of Food Technology. 2011; 6(4):279-288