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RESEARCH PAPER

Nutritional quality of jamun-bael spread during storage

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Abstract : The present study was conducted to standardize appropriate combinations of jamun-bael blends for preparation of spread and to evaluate the changes in moisture, TSS, reducing sugars, total sugars, titratable acidity and ascorbic acid content of the developed product during storage. Spread prepared from 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100 ratio of jamun-bael pulp were analyzed for changes in chemical constituents at two months interval during storage period of six months. TSS, total sugars, reducing sugars and acidity increased while as moisture and ascorbic acid decreased in spread during storage.

Key Words : Jamun, Bael, Spread, Nutritional quality, Storage

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INTRODUCTION

Fruits and its value added products are important supplements to human diet due to presence of all the vital components required for normal growth and development of the human body. Blending of pulp from different fruits is practiced to overcome the high cost of some exotic fruits, product scarcity or seasonal availability, balancing of strong or bland flavours, high acidity, astringency and bitterness, and improving total soluble solids, colour and appearance, taste and overall acceptability. Nutritional and phytochemical properties can also be increased by blending pulps or juices, which offer to adjust sugar/acid ratios and compensate undesirable consistency. The black plum or Indian blackberry, commonly known as Jamun (*Syzygium cumini* L.) is also an important member of family Myrtaceae (Hameed *et al*., 2020). It is widely grown throughout India and other tropical and sub-tropical countries. Its fruits are oblong, ovoid and crimson black in colour at ripe stage. Jamun fruits are used in *Ayurveda* and *Unani* systems of medicine. Its fruits and leaves are used for curing stomach disorder, whereas seed powder and pure juice are used for curing diabetes (Aqil *et al*., 2012). Seeds are rich in carbohydrates, proteins and calcium and can be used as a concentrate in animal feed. Fruits are stomachic and diuretic apart from having cooling and digestive properties (Baliga *et al*., 2011). These are also used as herbal medicine from ancient age and are reported to be beneficial for diabetic persons. Jamun fruits show antioxidant property which is due to flavonoids and anthocyanins present in it (Hameed *et al*., 2020). The ripe fruits are highly perishable in nature and available only for a very short duration during June-

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July. Jamun fruits are generally consumed in fresh form. The surplus produce can be processed into value added products like jam, jelly, chutney, sauce, cheese and toffee (Shahnawaz *et al*., 2009). Jamun juice, being acidic and astringent in taste, has not been used much and is yet to pick up the impetus for being utilized extensively for processing.

Bael fruit (*Aegle Marmelos*) occupies an important place among the under-utilized fruits, is indigenous to India, belongs to family Rutaceae and commonly known as Bengal quince, Indian quince, Golden apple, Holy fruit, Bel, Belwa, Sriphal, Stone apple and Maredo in India (Gupta *et al*., 2020). This fruit bearing tree is found in dry forests, hills and plains of Myanmar, Pakistan, Bangladesh, Nepal, Vietnam Laos, Cambodia as well as Sri Lanka, Northern Malaya, Java and in Philippines and in India it is found in Uttar Pradesh, Madhya Pradesh, Orissa, Bihar, West Bengal and Tamil Nadu (Sharma *et al*., 2007). The pulp has numerous seed which are densely covered with fibrous hairs and are oblong and flat. The pulp of fruit contains many functional and bioactive compounds such as carotenoids, phenolics, alkaloids, coumarins, flavonoids, terpenoids and other antioxidants, which may protect against chronic diseases (Manandhar *et al*., 2018). The fruit is aromatic, cooling and laxative. The ripe bael fruit is a tonic, restorative, laxative and is good for heart and brain, whereas mature bael fruit is astringent, digestive, stomachic (Bhardwaj and Nandal, 2015). The fruit is used for the treatment of diarrhoea and dysentery. Bael fruit is not consumed as a table fruit due to its hard shell, mucilaginous pulp and a large number of seeds and fibres in its pulp, although, it has a great potential for processing into several products *viz.*, ready-to-serve drink, nectar, squash, preserve, candy, cheese and toffee (Manandhar *et al*., 2018). Some fruits, although, rich in nutrients but are not acceptable due to high acidity, poor taste or flavour, can be blended with other fruits to improve its acceptability and make use of available nutrients. Keeping in view the nutritional and functional attributes of jamun and bael, the research work was planned to standardize appropriate combination of jamun-bael blends for preparation of spread and to evaluate storage quality of blended product.

Material and Methods

The present investigation was carried out in Division of Food Science and Technology, SKUAST-Jammu, during 2018-2020. The unripe, injured and defective jamun and bael fruits were sorted out manually and the fully matured ripened underutilized fruits were washed with water and then separated into inedible (peel) and edible (pulp) portions. Seeds were manually removed and discarded. The jamun and bael pulp were blended in different ratio of 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100, respectively.

For preparing spread, I kg of blended pulp, 800 g sugar and 2 g citric acid were mixed to develop jamun-bael blended spread. Two per-cent pectin was also added for proper setting of fruit spread. The mixture of blended pulp, sugar and citric acid was cooked with constant stirring to obtain desired consistency. Pectin dissolved in lukewarm water was added to the cooking mass and it was concentrated upto 68 ºBrix. Prepared spread was filled hot in 250 g capacity sterilized glass jars, screw capped properly, cooled in air, labeled and stored at room temperature for six months.

Jamun-bael spread was analyzed for changes in chemical constituents at two month interval for six months. The moisture content was determined by using an electronic moisture analyser at 105 ºC by spreading a weighed sample of 2 g in an aluminum sample holder and evaporative moisture losses were automatically expressed as per cent moisture content. Total soluble solids (TSS) was measured by using hand refractometer (Erma, Japan). The results were expressed as Brix (°B) according to the standard procedure as given by Ranganna (2014). Total and reducing sugars were estimated by the method of Rangana (2014). Acidity was analyzed by titration against 0.1N sodium hydroxide (AOAC, 2012). Ascorbic acid was analyzed by AOAC (2012). The treatments were replicated thrice and the data were analyzed statistically using Completely Randomized Design.

Results and Discussion

Treatment T_1 (100 : 0:: Jamun : Bael) recorded the highest moisture content of 36.79 per cent followed by T_2 (90 : 10:: Jamun : Bael) with moisture content of 35.74 per cent whereas the lowest moisture content of 31.52 per cent was observed in T_{11} (0 : 100:: Jamun : Bael) at initial month of storage. However, the lowest and highest moisture content of 25.27 abd 30.04 per cent was found in T_{11} (0 : 100:: Jamun : Bael) and treatment T_1 (100 : 0:: Jamun : Bael), respectively after six months of storage. The moisture per cent (Table 1) decreased during storage period of six months. The decrease in moisture content

of spread during storage might be due to evaporation of moisture from the samples and utilization of free water in converting polysaccharides into mono and disaccharides. Similar results were also reported by Tarafdar *et al*. (2018) in wood apple and date blended fruit jam and Pinandiyo and Mansar (2020) in papaya jam fortified with soy protein.

The TSS of all treatments at initial was adjusted to 68.00 ºBrix. However, the TSS increased significantly with increase in the amount of bael pulp. The statistically higher TSS of 72.23 ºBrix observed in treatment T_{11} (0 : 100:: Jamun : Bael) and the lowest of 71.02 ºBrix was recorded in T_1 (100 : 0:: Jamun : Bael) after six months of storage period. The treatment showed significant effect of blending on TSS. The total soluble solids (Table 2) of blended spread increased significantly during six months of storage period. This might be due to reduction in moisture content of the product, solidification of pulp constituents during storage and conversion of polysaccharides like pectic substances and starch into soluble sugars by acid hydrolysis. The results were also in line with the findings of Shah *et al*. (2015) who reported an increase in the total soluble solids of apple and olive fruit blended jam during storage period of three months.

At 0 month of storage, the treatment T_1 (100 : 0:: Jamun : Bael) recorded the lowest value of 57.89 and 27.43 per cent while as the statistically higher total and reducing sugar content of 68.45 and 32.06 per cent was registered in treatment T_{11} (0 : 100:: Jamun : Bael). After

Table 1: Effect of treatment and storage period on moisture (%) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	36.79	34.89	32.90	30.04	33.65
T_2 (90 : 10:: Jamun : Bael)	35.74	33.84	31.76	29.63	32.74
T_3 (80 : 20:: Jamun : Bael)	35.02	33.07	31.59	29.15	32.21
T_4 (70 : 30:: Jamun : Bael)	34.84	32.52	30.68	28.60	31.66
T_5 (60 : 40:: Jamun : Bael)	34.12	32.26	30.11	28.39	31.22
T_6 (50 : 50:: Jamun : Bael)	33.77	31.93	29.41	27.81	30.73
T_7 (40 : 60:: Jamun : Bael)	33.26	31.57	29.20	27.25	30.32
T_8 (30 : 70:: Jamun : Bael)	32.89	30.94	28.45	26.79	29.77
T_9 (20 : 80:: Jamun : Bael)	32.31	30.11	28.36	26. 03	29.20
T_{10} (10 : 90:: Jamun : Bael)	31.91	29.75	27.74	25.86	28.81
T_{11} (0 : 100:: Jamun : Bael)	31.52	29.48	27.38	25.27	28.41
Mean (Storage)	33.83	31.85	29.78	27.71	

Table 2: Effect of treatment and storage period on total soluble solids (ºBrix) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	68.00	69.10	70.22	71.02	69.58
T_2 (90 : 10:: Jamun : Bael)	68.00	69.16	70.29	71.15	69.65
T_3 (80 : 20:: Jamun : Bael)	68.00	69.23	70.36	71.28	69.63
T_4 (70 : 30:: Jamun : Bael)	68.00	69.29	70.43	71.36	69.77
T_5 (60 : 40:: Jamun : Bael)	68.00	69.34	70.54	71.49	69.84
T_6 (50 : 50:: Jamun : Bael)	68.00	69.40	70.62	71.57	69.90
T_7 (40 : 60:: Jamun : Bael)	68.00	69.57	70.74	71.72	70.00
T_8 (30 : 70:: Jamun : Bael)	68.00	69.64	70.86	71.81	70.08
T_9 (20 : 80:: Jamun : Bael)	68.00	69.72	70.98	71.95	70.16
T_{10} (10 : 90:: Jamun : Bael)	68.00	69.89	71.12	72.10	70.28
T_{11} (0 : 100:: Jamun : Bael)	68.00	69.76	71.26	72.23	70.31
Mean (Storage)	68.00	69.46	70.67	71.58	

six months of storage period, the highest total and reducing sugar content of 71.22 and 35.89 per cent observed in treatment T_{11} (0 : 100:: Jamun : Bael) and lowest total and reducing sugar content of 61.46 and 31.92 per cent was recorded in T_1 (100 : 0:: Jamun : Bael). A gradual and significant increase in total and reducing sugars was observed in jamun-bael spread with the advancement in storage period (Table 3 and 4). This increase in sugars may be due to hydrolysis of polysachharides into their constituent sugars and inversion of sugars. Similar findings have been cited by Chaurasiya *et al*. (2014) in palmyra palm spread and Asghar *et al*. (2015) in bael-apple jam.

At initial month of storage, the statistically higher acidity of 0.85 per cent recorded in T_1 (100 : 0:: Jamun : Bael) which increased to 0.90, 0.96 and 1.03 after two, four and six months of storage. The lowest acidity value of 0.11 per cent was recorded in T_{11} (0 : 100:: Jamun : Bael). After six months of storage, the highest acidity of 1.03 found in treatment T_1 (100 : 0:: Jamun : Bael) followed by T_2 (90 : 10:: Jamun : Bael) with values as 0.97 per cent whereas the lowest acidity value of 0.32 per cent was noted in T_{11} (0 : 100:: Jamun : Bael). There was a significant increase in acidity (Table 5) and significant decrease in ascorbic acid content (Table 6) of jamun-bael blended spread during six months of storage period. The hydrolysis of carbohydrates into organic acid and degradation of insoluble pectic substances into soluble

Table 3: Effect of treatment and storage period on total sugars (%) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	57.89	59.00	60.11	61.46	59.61
T_2 (90 : 10:: Jamun : Bael)	58.97	60.24	61.26	62.38	60.71
T_3 (80 : 20:: Jamun : Bael)	60.01	61.27	62.31	63.60	61.80
T_4 (70 : 30:: Jamun : Bael)	61.23	62.65	63.44	64.73	63.01
T_5 (60 : 40:: Jamun : Bael)	62.48	63.50	64.76	65.39	64.03
T_6 (50 : 50:: Jamun : Bael)	63.57	64.37	65.65	66.54	65.03
T_7 (40 : 60:: Jamun : Bael)	64.72	65.48	66.47	67.13	65.95
T_8 (30 : 70:: Jamun : Bael)	65.80	66.37	67.62	68.25	67.01
T_9 (20 : 80:: Jamun : Bael)	66.92	67.91	68.49	69.74	68.26
T_{10} (10 : 90:: Jamun : Bael)	67.97	68.55	69.73	70.62	69.22
T_{11} (0 : 100:: Jamun : Bael)	68.45	68.72	70.06	71.22	69.61
Mean (Storage)	63.45	64.37	65.44	66.46	

Table 4: Effect of treatment and storage period on reducing sugars (%) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	27.43	28.68	30.24	31.92	29.57
T_2 (90 : 10:: Jamun : Bael)	27.77	29.05	30.48	32.13	29.86
T_3 (80 : 20:: Jamun : Bael)	28.15	29.37	31.02	32.55	30.27
T_4 (70 : 30:: Jamun : Bael)	28.54	30.07	31.61	33.16	30.84
T_5 (60 : 40:: Jamun : Bael)	29.01	30.46	31.98	33.59	31.26
T_6 (50 : 50:: Jamun : Bael)	29.70	30.82	32.08	33.90	31.62
T_7 (40 : 60:: Jamun : Bael)	30.11	31.21	32.46	34.01	31.95
T_8 (30 : 70:: Jamun : Bael)	30.47	31.69	33.07	34.42	32.41
T_9 (20 : 80:: Jamun : Bael)	31.01	32.33	33.58	34.87	32.95
T_{10} (10 : 90:: Jamun : Bael)	31.54	32.75	34.10	35.51	33.47
T_{11} (0 : 100:: Jamun : Bael)	32.06	33.43	34.87	35.89	34.06
Mean (Storage)	29.62	30.90	32.32	33.81	

Table 5: Effect of treatment and storage period on titratable acidity (%) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	0.85	0.90	0.96	1.03	0.93
T_2 (90 : 10:: Jamun : Bael)	0.79	0.86	0.92	0.97	0.88
T_3 (80 : 20:: Jamun : Bael)	0.70	0.77	0.82	0.91	0.80
T_4 (70 : 30:: Jamun : Bael)	0.64	0.70	0.76	0.83	0.73
T_5 (60 : 40:: Jamun : Bael)	0.56	0.62	0.69	0.75	0.65
T_6 (50 : 50:: Jamun : Bael)	0.48	0.55	0.62	0.69	0.58
T_7 (40 : 60:: Jamun : Bael)	0.40	0.47	0.54	0.60	0.50
T_8 (30 : 70:: Jamun : Bael)	0.34	0.42	0.48	0.55	0.45
T_9 (20 : 80:: Jamun : Bael)	0.27	0.35	0.41	0.48	0.38
T_{10} (10 : 90:: Jamun : Bael)	0.21	0.29	0.35	0.40	0.31
T_{11} (0 : 100:: Jamun : Bael)	0.11	0.20	0.27	0.32	0.22
Mean (Storage)	0.49	0.56	0.62	0.68	

Table 6: Effect of treatment and storage period on ascorbic acid (mg/100 g) of jamun-bael blended spread

Treatments	Storage period (months)				
	0	2	4	6	Mean (Treatment)
T_1 (100 : 0:: Jamun : Bael)	10.67	9.42	8.90	7.15	9.03
T_2 (90 : 10:: Jamun : Bael)	9.82	8.75	7.37	6.08	8.00
T_3 (80 : 20:: Jamun : Bael)	8.96	7.60	6.81	5.45	7.20
T_4 (70 : 30:: Jamun : Bael)	8.37	7.31	6.36	5.00	6.76
T_5 (60 : 40:: Jamun : Bael)	7.82	6.85	5.98	4.71	6.34
T_6 (50 : 50:: Jamun : Bael)	7.20	6.47	5.35	4.23	5.81
T_7 (40 : 60:: Jamun : Bael)	6.73	5.79	4.67	3.82	5.25
T_8 (30 : 70:: Jamun : Bael)	6.13	5.10	4.39	3.54	4.79
T_9 (20 : 80:: Jamun : Bael)	5.58	4.23	3.79	2.24	3.96
T_{10} (10 : 90:: Jamun : Bael)	4.87	3.76	2.57	1.87	3.27
T_{11} (0 : 100:: Jamun : Bael)	4.32	3.00	2.16	1.48	2.74
Mean (Storage)	7.31	6.21	5.30	4.14	

pectate might also have contributed towards an increase in acidity while as decrease in the ascorbic acid content of blended spread during storage might be due to the oxidation of L-ascorbic acid to dehydro-ascorbic acid with the passage of time and further to 2,3-diketogulonic acid which is physiologically inactive. The results are in conformity with those of Mckee *et al*. (2002) in red raspberry fruit spread and Chakraborty *et al*. (2010) in jack-passion fruit spread.

Conclusion :

The study revealed that with increase in storage period, an increase in TSS, acidity, total and reducing sugars occurred, while as decrease was observed in moisture and ascorbic acid content in all the blends. Thus, jamun and bael fruits can be blended in appropriate ratio to formulate fruit spread with improved nutritional quality. Therefore, by preparing jamun-bael blended value added products the processing industry can fulfil the dual purpose of better use of these perishable fruits having therapeutic value, thus lowering post harvest losses and will also give good returns to the growers.

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REFERENCES

AOAC (2012). *Official methods of analysis*. 19th Ed. Association of Official Analytical Chemists, Washington, D.

C., U.S.A.

Aqil, F., Gupta, A., Munagala, R., Jeyabalan, J., Kausar, H., Sharma, R. J., Singh, I. P. and Gupta, R. C. (2012). Antioxidant and antiproliferative activities of anthocyanin/ellagitannin-enriched extracts from *Syzygium cumini* L. (Jamun, the Indian Blackberry). *Nutrition Cancer*, **64** (3): 428-438.

Asghar, N., Imran, M., Mushtaq, Z., Ahmad, R. S., Khan, M. K., Ahmad, N. and Ahmad, U. (2015). Characterization and functional product development from bael (*Aegle marmelos* L. Correa) fruit pulp. *J. Food Processing & Preservation*, **40** (4) : 770-779.

Baliga, M. S., Bhat, H. P., Baliga, B. R. V., Wilson, R. and Palatty, P. L. (2011). Phytochemistry, traditional uses and pharmacology of *Eugenia jambolana* Lam. (black plum): A review. *Food Research International*, **44**: 1776–1789.

Bhardwaj, R.L. and Nandal, U. (2015). Nutritional and therapeutic potential of bael (*Aegle marmelos* Corr.) fruit juice: a review. *Nutrition & Food Science,* **45**(6): 895-919.

Chakraborty, I., Chaurasiya, A. K. and Saha, J. (2010). Quality of diversified value addition from some minor fruits. *J. Food Science & Technology*, **48** (6): 750-754.

Chaurasiya, A. K., Chakraborty, I. and Saha, J. (2014). Value addition of palmyra palm and studies on the storage life. *J. Food Science & Technology*, **51**(4):768–773.

Hameed, F., Gupta, N., Rahman, R., Anjum, N. and Nayik, G. A. (2020). Jamun. In: Nayik, G. A. and Gull, A. (eds). *Antioxidants in fruits: Properties and health benefits,* Springer, Singapore.

Gupta, N., Sood, M. and Trilokia, M. (2020). Preparation of bael preserve and its quality evaluation during storage. *Annals of Plant & Soil Research*, **22**(1): 70-74.

Manandhar, B., Paudel, K. R., Sharma, B. and Karki, R. (2018). Phytochemical profile and pharmacological activity of *Aegle marmelos* Linn. *J. Integrative Medicine,* **16**(3): 153–163.

Mckee, L. H., Whitehead, C. G. and Remmenga, M. (2002). Quality characteristics of red raspberry fruit spread made with four sweeteners. *Plant Foods for Human Nutrition,* **57**: 343-352.

Pinandoyo, D. B. and Mansar, A. (2020). Changes in chemical constituents and overall acceptability of papaya jam fortified with soy protein during storage. *E-Journal Menara Perkebunan*, **88**(1) : 35-43.

Rangana, S. (2014). *Handbook of analysis and quality control for fruit and vegetable products* (2nd Ed.). Tata McGraw Hill Publishing Co. Ltd., New Delhi, India.

Shah, W., Khan, A., Zeb, A., Khan, M. A., Shah, F. N., Amin, N., Ayub, M., Wahab, S., Muhammad, A. and Khan, S.H. (2015). Quality evaluation and preparation of apple and olive fruit blended jam. *Global J. Medical Research: Nutrition & Food Science*, **15**(1):15-21.

Shahnawaz, M., Sheikh, S. A. and Nizamani, S.M. (2009). Determination of nutritive value of jamun fruit (*Eugenia jambolana*) products. *Pakistan J. Nutrition*, **8**(8): 1275-1280.

Sharma, P. K., Bhatia, V., Bansal, N. and Sharma, A. (2007). A review on bael tree. *Natural Product Radiance*, **6** (2):171-178.

Tarafdar, M., Saravanan, S. and Navitha, D. (2018). Standardization of blended fruit jam of wood apple and date. *The Pharma Innovation*, **7**(8): 301-304.