RESEARCH PAPER — FOOD SCIENCE RESEARCH JOURNAL

e ISSN-2230-9403 ■ Visit us : *www.researchjournal.co.in*
Volume 9 | Issue 1 | April, 2018 | 79-84
DOI : 10.15740/HAS/FSRJ/9.1/79-84

Study on qualitative attributes of RTS beverage of mixed fruit using bael and orange under different storage conditions

Devendra Kumar, R.N. Shukla and Sanjeev Kumar

Experimental studies were conducted for the production of bael and orange based RTS beverage and its quality evaluation. The quality attributes comprised of acidity, pH, optical density, TSS, ascorbic acid, total plate count and sensory quality parameters on 9- point hedonic scale. Evaluation of quality parameters were done for fresh as well as stored RTS samples at 0, 15, 30, 45, and 60 days of storage under different storage conditions. The TSS and acidity of bael and orange RTS beverage increased with increase in the level of bael juice, the optical density increased with increase in the level of orange juice ratio.The pH decreased with increase in the level of bael juice. The pH values of the samples composition 60:40, 50:50, and 40:60 after 60 days of storage period were observed as 2.00, 2.00, 1.45, respectively at refrigeration conditions. The total plate count (TPC) of the RTS samples of different bael and orange juice ratio of 60:40, 50:50 and 40:60 were observed as 1.078×10^5cfu/ml, 1.068×10^5cfu/ml and 1.061×10^5cfu/ml at refrigerator temperature condition. The microbial growth increased during storage period irrespective of bael juice ratio at different storage conditions. The vitamin C (ascorbic acid) of the RTS samples were decreased during storage period. The minimum ascorbic acid of the sample of juice ratio (bael and orange) 60:40, 50:50 and 40:60 after 60 days of storage were observed as 4.70, 4.29 and 4.08, respectively at refrigeration conditions. The higher score of overall acceptability was 8.225 for the fresh samples and the minimum scored awarded for overall acceptability was 6.600 for the RTS sample bael and orange juice ratio 50:50 at refrigeration condition. However, the overall acceptability of beverage decreased with increase in storage period. It was concluded that refrigerated storage method was found to be superior over other methods of storage of bael and orange based RTS beverage followed by BOD incubator and room temperature conditions.

Key Words : Bael, Beverage, Orange, Sensory, RTS beverage

How to cite this article : Kumar, Devendra, Shukla, R.N. and Kumar, Sanjeev (2018). Study on qualitative attributes of RTS beverage of mixed fruit using bael and orange under different storage conditions. *Food Sci. Res. J.,* **9**(1): 79-84, **DOI : 10.15740/HAS/FSRJ/9.1/79-84**.

INTRODUCTION

Ready–to-serve (RTS) beverage is a fruit beverage which contains at least 10 per cent total soluble solid (TSS) and 10 per cent fruit juice besides about 0.3 per cent acid. It is not diluted before serving. Fruit beverages are easily digestible, highly refreshing, thirst-quenching, appetizing and nutritionally far superior to many synthetic and aerated drinks (Srivastava and Kumar, 2009).

The bael fruit (Aeglemarmelos Correa, family: Rutaceae), occupies an important place among the various fruit.Bael fruit has been attributed with various nutritional

MEMBERS OF RESEARCH FORUM

Author for correspondence :
Devendra Kumar, Baba Saheb Dr. B.R. Ambedkar College of Agricultural Engineering and Technology (C.S.A.U.A &T.), Etawah (U.P.) India (Email : devendrachaturvedi2008@gmail.com)

Associate Authors' :
R.N. Shukla and Sanjeev Kumar, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.) India (Email : sk085347@gmail.com)

and therapeutic properties such as in the cure of chronic diarrhea and certain other gastrointestinal disorders (Singh and Nath, 2004). Bael is used for the treatment of Asthama, High Blood Pressure, Typhoid and Diarrhea. Bael beverages RTS drink, nectar and squash were evaluated for changes in their chemical constituents and organoleptic quality during storage. Overall acceptability of bael beverages decreased during storage period and organoleptic score of all the three bael beverages remained above acceptable level (Verma and Gehlot, 2006a). Bael RTS drink prepared with 10% bael pulp, 14% total soluble solids and 0.28% acidity was found most acceptable among all the treatments (Verma and Gehlot, 2006b). Bael-Guava ready to serve beverage and squash were analyzed for chemical composition at 2 month storage period. Total sugars, reducing sugars, acidity and browning increased while pH, ascorbic acid and total phenols decreased in both beverages with the increase in storage duration (Nidhi *et al.*, 2007).

The Orange is a citrus cultivar of mandarin (*Citrus reticulata* Blanco) followed by sweet orange (*Citrus sinensis* Osbeck) and acid lime (*Citrus aurantifolia* Swingle). Its fresh and uniquely delicate flavor is due to complex combinations of several odour components that have interdependent quantitative relationships. Volatile flavor components are the compounds which are biosynthesized during the normal metabolic process in plants (Orav and Kann, 2001). The major volatile components that impart flavor to orange juices are: Esters, Aldehydes, Alcohols, Terpenes, Terpenols and Ketones (Selli *et al*., 2004). Orange juice is beneficial for health. It is also used for the treatment of the cancer, heart disease. Vitamin C, Vitamin $B_{6,}$ Potassium and Magnesium are found in orange. Kinnow mandarin juice and ginger juice were blended to prepare squash. Among the blended squash the ratio of 25:5 scored the highest in terms of sensory attributes (Nath *et al.*, 2005). Guava and Aonla juice were blended to prepare RTS beverage. The little changes in quality parameters *viz.*, TSS, titrable acidity, pH and optical density were observed during storage (Mall and Tandon, 2005). Guava and pineapple juice were used to prepare RTS and nectar beverage. The TSS and total sugar increased continuously during storage period of 120 days, while ascorbic acid and non-reducing sugar decreased during storage (Singh *et al.*, 2005).

Sensory qualities attributes of wine samples (kinnow/kinnow-cane/cane-wines) were analyzed as per 9-point hedonic scale. The wine produced from blend of kinnow and cane juice in ratio of 80:20 was found to score highest (Khandelwal *et al.*, 2006). Organoleptic and storage stability of mausambi RTS beverage were analyzed and observed negligible changes in samples stored at refrigeration temperature with preservative. Overall acceptability of mausambi RTS beverage decreased during 30 days at all storages conditions (Kumar *et al.*, 2008). Fruit based beverages are becoming popular in comparison to synthetic or aerated drink flavour and nutritional characteristics. It has great scope for preparation of fruit juice and other fruit based beverages (Dubey *et al.*, 2010). Organoleptic and qualitative character of fresh fruit, prepared pulp and mixed pulp of papaya and guava were analyzed and blending of the pulp in various ratios influenced the organoleptic as well as qualitative characters of blended pulp (Jain *et al.*, 2011). Visual and instrumental evaluation of orange juice color were analyzed and a significant preference ($P<0.05$) was observed for the OJs with intermediate-hue and lightness values (valencia midnight) (Fernandez-Vazquez *et al.*, 2011). Whey based pineapple mint beverage was developed with incorporation of mentha arvensis extract. Acidity and TSS content increased while pH decreased during storage. Overall acceptability of the beverage was acceptable for the period of 45 days (Shukla and Kumar, 2016). Osmotic dehydration in hot air drying of pineapple cubes by using sucrose solution in able to improve the quality like colour, aroma, texture, appearance as well as overall acceptability. Osmotic and infrared dryings were reduced the water activity which prevents the microbial growth. Drying rates and drying time of pineapple slices were affected by the blanching temperature-time combinations. Drying time was increased by increasing the blanching temperature-time combination. Regression equation was used to predict optimum condition for weight reduction, minimal solid gain, maximum water loss and physical properties of dehydrated pineapple cubes. The logarithmic model sufficiently described the drying behaviour of blanched pineapple slices. The fick's diffusion model was suitable for the experiment results which enabled the determination of the effective moisture diffusivity (Kumar and Shukla, 2017a). The preservation of food is very difficult for sustaining the global food supply but it could be improved through various production and processing technologies. These technologies are

helpful to improve the quality, quantity and public health standards of food products while preserving the environment and fulfilling consumer expectations (Kumar and Shukla, 2017b). Therefore, the study was undertaken to analyze the quality attributes of RTS beverage of mixed fruit using bael and orange under different storage conditions.

METHODOLOGY

Fresh, uniform sizes and fully ripened bael and orange were used in the experiment. Bael and Orange free from diseases and insects infections were selected for the investigation. Bael and orange were washed with potable water and removal of the dust, dirty particles and some bacteria's is done. Peeling was done manually. Juice of orange was extracted by Electric Juicer mixer and strained through muslin cloth. Bael juice was extracted by hand driven screw press.The RTS beverage is prepared from the extracted bael and orange juice, adjusting its total soluble solid and acidity as per FPO specification for RTS beverage by mixing the juice with required quantity of sugar syrup prepared from sugar, citric acid, preservative (KMS) and mixed water. The beverage is filled in the bottle, crown corked and processed in water for 4 to 6 minute at 85^0 C for pasteurization and then air cooled. After pasteurization bottles were cooled under the running tap water and then stored under refrigerator till further use. Ready-to-serve beverages consist essentially of an amount of 10 to 15 % fruit juice. They are sweetened at least 10^o Brix with a maximum acidity of 0.3%. Experiments were conducted using three compositions *viz.*, 60:40, 50:50, 60:40 of bael and orange juice. The digital pH meter was used to determine the pH of the samples. Refractometer is instrument that is used to measure substances dissolved in water and certain oils. The refractometer works using the principle of light refraction through liquids. Digital spectrophotometer a compact instrument was used for the analysis of optical density of solution. Digital Colony Counter is designed for quick and accurate counting of bacterial and mould colonies in petri dishes. Weighing of sample for analysis of moisture content, fat content, ash content, acidity etc. was carried out with help of electronic balance. Sample were served to the panelist and they were asked to rate the acceptability of the product through the sense of organs. Different attributes *viz.*, colour, flavour, texture and taste were rated on the basis of hedonic scale, ranging from 1 (extremely dislike/ most undesirable) to 9 (extremely like/ most desirable), (Rangana, 2001).

OBSERVATIONS AND ASSESSMENT

The study was undertaken to develop RTS beverages using bael and orange juice and its qualitative analysis was done during storage period at different temperature. For the evaluation of quality of RTS of bael and orange (60:40, 50:50, 40:60), several physico-chemical parameters *viz.*, TSS, pH, acidity, optical density, ascorbic acid, microbial studies (TPC) and sensory parameters were selected. Evaluation of quality parameters was carried out for fresh as well stored samples after 0, 15, 30, 45 and 60 days under the different storage conditions *viz.*, Refrigerator (5^0 C), BOD incubator (25^0C) and Room temperature (30-35^0C).

The TSS of the sample having bael and orange juice ratio 60:40, 50:50, and 40:60 were measured as 12.00, 12.20, and 12.10 ^{0}Brix, respectively in the fresh samples. The TSS values of the sample after 60 days of storage were observed as 13.90, 13.30 and 13.00 ^{0}Brix under refrigeration condition and 13.90, 14.00 and 14.60 ^{0}Brix at room temperature for orange and bael juice ratio 60:40,

Table 1 : Change in overall acceptability of bael and orange based RTS beverage at different storage conditions

Storage period (Days)	Overall acceptability								
	B_{60}:O_{40}			B_{50}:O_{50}			B_{40}:O_{60}		
	5^0C	25^0C	30-35^0C	5^0C	25^0C	30-35^0C	5^0C	25^0C	30-35^0C
0	8.20	7.375	7.475	7.70	7.45	7.325	8.225	7.75	7.45
15	7.975	7.125	7.175	7.475	7.225	7.00	7.925	7.55	7.20
30	7.675	6.95	6.90	7.20	6.90	6.775	7.70	7.225	6.95
45	7.35	6.525	6.60	6.90	6.60	6.475	7.425	6.875	6.60
60	7.10	6.175	6.225	6.60	6.275	6.175	6.710	6.475	6.175

where,
B_{60}:O_{40} : bael juice 60% + orange juice 40%
B_{50}:O_{50} : bael juice 50% + orange juice 50%
B_{40}:O_{60} : bael juice 40% + orange juice 60%

50:50, and 40:60, respectively. The TSS content of RTS beverage showed an increasing trend under all the treatments with increasing period upto 60 days. Baramanray *et al.* (1995) observed that the increase in TSS value of RTS beverages during storage were probably due to conversion of polysaccharides in to soluble sugars.

The acidity of the samples having bael and orange juice ratio 60:40, 50:50, and 40:60 were measured as 0.126, 0.128 and 0.125, respectively in the fresh sample. The acidity of bael and orange RTS beverage showed an increasing trend under all the treatments with increasing periods upto 60 days. The increase in the value of acidity was observed with either increase in the ratio of bael juice or decrease in the ratio of orange juice in the developed RTS. The increase in acidity in RTS beverage may be due to formation of organic acid by ascorbic acid degradation as well as progressive decrease in protein content. The decrease in the value of pH was observed with either increase in the ratio of bael juice or decrease in the ratio of orange juice in developed RTS. The lowest pH (1.45) of the sample ratio 40:60 was observed in refrigeration temperature storage after 60 days. The pH decrease may be due to the fact that pH has inverse relationship with acidity.

The optical density of bael and orange juice ratio 60:40, 50:50, and 40:60 were measured as 0.055, 0.047 and 0.036, respectively in the fresh sample. The optical density values of sample composition 60:40, 50:50, and 40:60 after 60 days of storage were observed as 0.081, 0.078 and 0.065 under refrigeration condition and 0.089, 0.083 and 0.071 at room temperature, respectively. Optical density of all the samples was increased with storage periods. This increase in optical density may be attributed to non-enzymatic browning which would have taken place during storage.

It was observed that ascorbic acid of all the samples was decreased during increase of storage days. The lowest ascorbic acid content (3.83) of the sample having 40:60 ratio was observed in BOD temperature after storage of 60 days. The decrease in ascorbic acid of the RTS samples during the storage might be due to oxidation

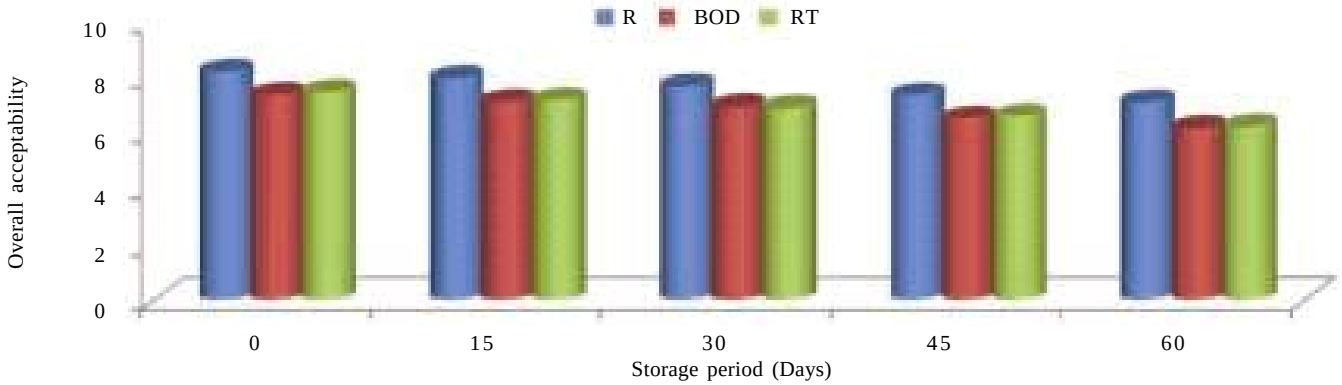

Fig. 1 : Change in overall score of samples 60:40 in RTS beverage during different temperature condition

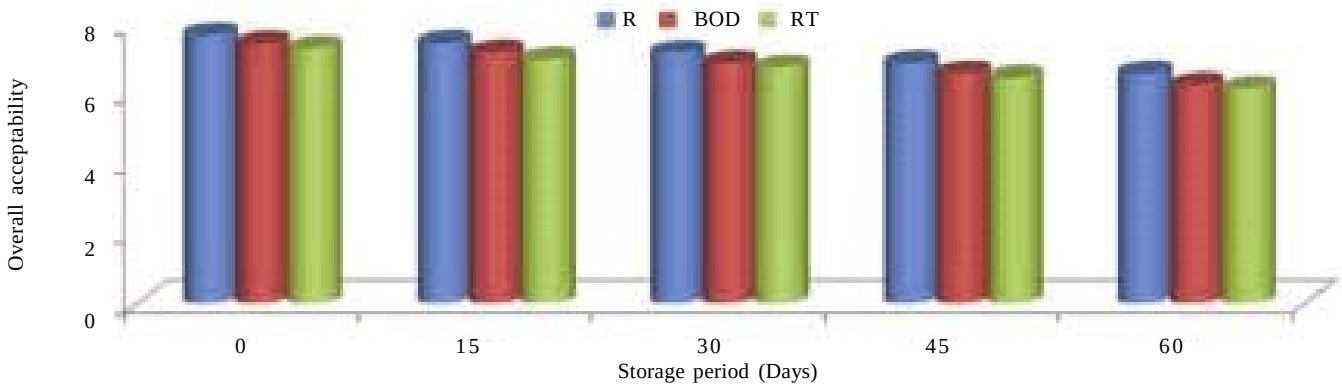

Fig. 2 : Change in overall score of samples 50:50 in RTS beverage during different temperature condition

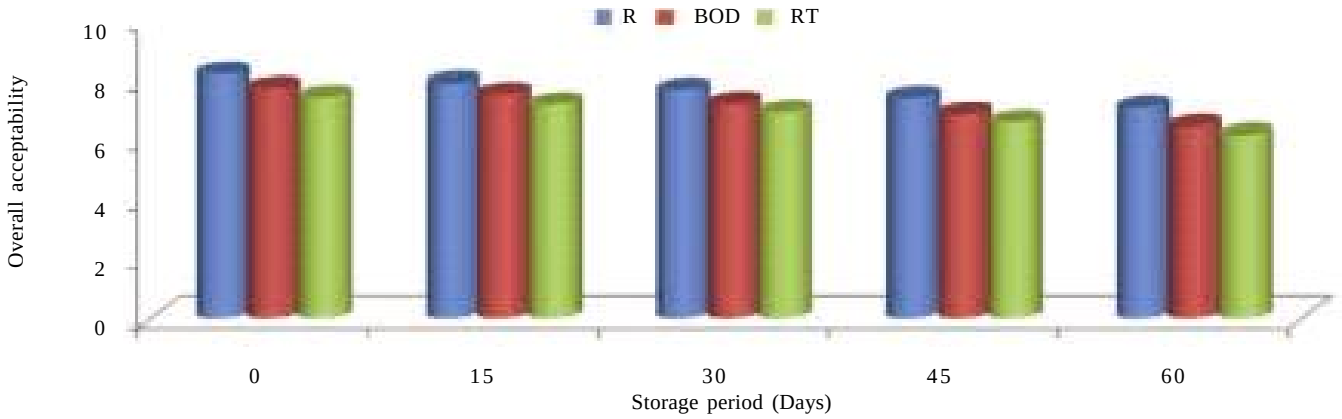

Fig. 3 : Change in overall score of samples 40:60 in RTS beverage during different temperature condition

or irreversible conversion of L-ascorbic acid in to dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (*Ascorbinase*) caused by trapped or residual oxygen in the glass bottles was reported by Baramanray *et al.* (1995). ANOVA were generated for all physico-chemical parameters which were significant at 5% level.

The study revealed that as microbial growth increases with increase of storage period irrespective of storage conditions. The highest microbial growth was observed as 1.110×10^5cfu/ml in case of sample having bael and orange juice ratio 50:50 at room temperature condition after 60 days of storage which is safe for consumption as reported by Kumar and Manimeglai (2002).

It was observed that, in general no definite trends of sensory score for individual attributes were observed for fresh samples. The highest score awarded for colour was 8.4 to the sample having fruit juice composition 60:40 at refrigeration temperature. Where as, the lowest score 5.8 of the sample 60:40 at 25^0 C temperature. Except one sample 60:40, all other samples were rated between "Like extremely" and "Like slightly". Best score of flavour was 8.3 in the sample having fruit juice composition 60:40 at refrigeration temperature and the lowest score 6.2 of the sample 60:40 at room temperature. The highest score awarded for taste was 8.6 of the sample having juice ratio 60:40 at refrigeration condition and the lowest score 6.3 of the sample at room temperature.The highest score awarded for texture was 7.8 of the sample 60:40 at refrigeration temperature and the lowest score 5.7 of the sample 60:40 at room temperature. All other samples were rated between "Like extremely" and "Neither like nor dislike". In general, decline in sensory score were observed in samples after 0, 15, 30, 45, and 60 days of storage period. Table 1 shows that after the storage of 60 days all the samples were in good conditions. Overall sensory score after 60 days of storage was lowest 6.60 (Like moderately) and highest 8.20 (Like extremely). Fig. 1 to 3 shows overall score of samples 60:40, 50:50, and 40:60 in RTS beverage during storage conditions at room temperature, BOD incubator temperature and refrigeration temperature.

Conclusion :

The bael and orange based RTS beverage 60:40, 50:50 and 40:60 at room temperature, B.O.D incubator, and refrigerator storage conditions were acceptable upto 60 days. The acidity of bael and orange based RTS beverage increased either with increase in the ratio of orange juice or decrease in the ratio of bael juice in developed RTS. During storage, acidity of samples increased with increase in the storage period. The pH of bael and orange RTS beverage decreased during storage period. TSS of bael and orange based RTS beverage increased slightly with increase in orange juice ratio as well as with increase in the storage period. The increase in optical density was observed with increase in bael juice ratio in RTS samples during storage period.The vitamin-C (ascorbic acid) of the RTS samples were decreased during storage period.The microbial growth increased during storage period irrespective of bael juice ratio at different storage conditions. It was concluded that best sample containing 60:40 ratio of bael and orange juice as taste, colour, flavour and texture points of view at refrigeration conditions.

LITERATURE CITED

Baramanray, A., Gupta, O.P. and Dhawan, S.S. (1995). Evaluation of guava hybrids for making nectar. *Haryana J. Hort. Sci.,* **24** (2): 102-109.

Dubey, Sanket, Banafar, R.N.S. and Sahu, G.D. (2010). Recipe standardization for preparation of guava nector and RTS beverage. *Processed Food Industry*, 61-62.

Fernandez-Vazquez, R., Stinco, C.M., Melendez-Martinez, A.J., Heredia, F.J. and Vicario, I.M. (2011). Visual and instrumental evaluation of orange juice colour: a consumers' preference study. *J. Sensory Studies*. **26** (6) : 436-444.

Jain, P.K., Jain, Priyanka and Nema, K. Prabhat (2011). Quality of Guava and Papaya fruit pulp as influenced by blending ratio and storage period. *American J. Food Technol.,* **6**(6): 507-512.

Khandelwal, Prathima, Kumar, Vijay, Das, Niranjan and Tyagi, S.M. (2006). Development of a process for preparation of pure and blended kinnow wine without debittering kinnow mendarin juice. *Internat. J. Food Safety,* **8** : 24-29.

Kumar, K., Sharma, A. and Barmenray, A. (2008). Storage stability of mausambi (citrus sinensis) RTS beverage in different storage conditions. *Beverage & Food World*, **35** (2): 47-48.

Kumar, Sanjeev and Shukla, R.N. (2017a). Different pre-treatments and storage stability of dehydrated pineapple slices. *Internat. J. Agric. Sci. & Res.,* **7** (2): 12.

Kumar, Sanjeev and Shukla, R.N. (2017b). Osmotic drying of pineapple : A review. *Internat. J. Agric. Engg.,* **10** (1): 215-221.

Kumar, Saravana and Manimeglai, G. (2002). Storage stability of soy milk whey based jack fruit blended RTS beverage. Research Institute Tamilnadu Agricultural University, Madurai. *Processed Food Industry*, 33-34.

Mall, P. and Tandon, D.K. (2005). Development of guava-aonla blended beverage. International Guava symposium march, ISHS *Act Hort*., **1** : 735.

Nath, A., Yadav, D.S., Sharma, Pranabjyoti and Dey, B. (2005). Standardization of ginger and kinnow squash and its storage. *J. Food Sci. Technol.,* **42** (6): 520-522.

Nidhi, Gehlot, Rakesh, Singh R., Siddiqui, S. and Rana, M.K. (2007). Changes in chemical composition of bael-guava blends ready to serve beverage and squash during storage. *Haryana J. Hort. Sci.,* **36**: (1/2), 46-48.

Orav, A. and Kann, J. (2001). Determination of peppermint and orange aroma compounds in food and beverages. *Procee. Estonian Academy Sci. Chem.,* **50**: 217-225.

Ranganna, S. (2001). Handbook of analysis and quality control for fruit and vegetables products. Tata Mcgraw Hill publishing Co. Ltd. New Delhi.

Selli S, Cabaroglu T. and Canbas, A. (2004). Volatile flavor components of orange juice obtained from the cv. Kozan of Turkey. *J. Food Composition & Analysis,* **17** : 789-796.

Shukla, R.N. and Kumar, Devendra (2016). Study of qualitative attributes of whey based herbal beverage. Proceeding of 4th National Symposium on Transforming Indian Agriculture towards food and nutritional security, IGFRI, Jhansi, U.P. Feb. 20-21, 2016.

Singh, A.K. and Nath, Nirankar (2004). Development and evaluation of whey protein enriched bael fruit (Aegle marmelos) beverage. *J. Food Sci. & Technol. (Mysore)*, **41** (4) : 432-436.

Singh, Jashkaran, Singh, A.K. and Singh, A.K. (2005). Preparation and preservation of pomegranate (*Purnica granatum* L.) RTS. *Beverage & Food World*, **32** (12): 45-46.

Srivastava and Kumar, S. (2009). Fruit and vegetable preservation (Principle and Practices).*International books distributing company. Charbagh*, Lucknow.

Verma, Sunil and Gehlot, Rakesh (2006a). Development and evaluation of bael beverages. *Haryana J. Hort. Sci.,* **35** (3/4) : 245-248.

Verma, Sunil and Gehlot, Rakesh (2006b). Studies on development and evaluation of ready to serve (RTS) drink from bael (*Aelgle marmelos* Correa). *Res. Crops,* **8** (3): 745-748.

Received : *21.09.2017;* **Revised:** *03.02.2018;* **Accepted :** *21.02.2018*