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Effect of phyto-protein enrichment on organoleptic evaluation of mango Squash

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Abstract
The investigation was conducted to develop the protein fortified mango squash. Various proportions of soya protein isolate (SPI), peanut protein isolates (PPI) and rice bran protein concentrate (RBPC) were added to the mango pulp to fortify mango squash. It was observed that there was slight decrease in the sensory scores of the beverage in the initial but no change was observed in the later phase of storage The overall acceptability scores w.r.t. control were lower for protein fortified squash, however, the squash fortified with protein from different sources were not showing significant difference among themselves. Throughout the storage period, the squash prepared by replacing sucrose with fructose scored more in flavor, taste, mouth feel and overall acceptability scores. The Organoleptic scores of all the variants of protein fortified squash remained acceptable at room temperature upto 90 days of storage.

Keywords: Phyto-protein, enrichment, organoleptic, evaluation, mango, Squash

Introduction
India is the second largest producer of fruits and vegetables in the world. Fruits and vegetables are important constituents of our diet and provide significant quantity of nutrients, especially vitamins, minerals, fiber and sugars. Mango (*Mangifera indica* L.) belongs to family Anacardiaceae. It is national fruit of India, Pakistan, Philippines and Bangladesh. It is known as 'King of Indian Fruits' due to its high palatability, excellent taste and exemplary nutritive value (Nakesone, 1998) [8]. Mango is considered indigenous to eastern Asia, Myanmar and Assam State of India. It is one of the most commonly eaten fruits in tropical countries and is gaining popularity in different parts of the World due to its wide adaptability, high yield, attractive fruit colour, excellent taste and high therapeutic value. Mango is considered to be a fruit with great potential for future (Ravani and Joshi, 2013) [13]. Ripe fruit of mango are soft with a pleasant aroma and has a flavour often described as a peach-pineapple combination (Lalel *et al*., 2003) [7]. It has an excellent flavor, attractive fragrance, delicious taste and high nutritional value that have made it one of the best fruits. It is a good source of vitamin A, B and C and minerals.

Consumers of the present day are becoming increasingly conscious of the health and nutritional aspects of their food. Their tendency is to avoid chemical and synthetic food and choose therapy and nutrition through natural resources. Fruits ready to serve beverages (RTS), which are acidic and non-alcoholic in nature, have been increasingly gaining popularity throughout the world due to their nutritional, refreshing and easily digestible properties. However, these beverages are traditionally poor in protein due to inherent low protein content in fruits and the technological difficulties in its protein fortification of acidic beverages.

The majority of people in India and other developing countries suffer from the deficiency of protein intake in their diets due to scarcity and high cost of animal or dairy based sources of protein. This problem demands consumption of plant based protein with low cost and good quality. The production of a protein rich fruit juice beverage would thus improve the nutritional profile of fruit beverages and will also have a good commercial potential (Segall, 2009) [12].

The major challenge to develop a protein fortified fruit beverage is to preserve protein functional properties and to prevent its sedimentation. The flavor challenges include overcoming the bitter/brothy flavor of protein and coagulation during pasteurization. Proteins undergo denaturation and discoloration due to disruption of food systems by heating and/or blending during processing. Temperature also affects food protein deterioration, which can affect storage time, sedimentation, pH, objectionable odors and off-flavors development. The protein enriched fruit-whey beverages have been reported to suffer from the problem of astringency also (Beecher *et al.*, 2008) [1].

Reactions of amines, amino acids, peptides, and proteins with reducing sugars and vitamin C results in non-enzymatic browning, often called Maillard reactions that cause deterioration of food during storage (Friedman, 1996) [4]. Replacement of sucrose with fructose in beverages improved overall acceptability and decreases the browning during storage. Sucrose causes browning and protein cross-linking at a rate 10 times greater than fructose (Knecht *et al.*, 1992) [6]. Thus, keeping in mind the popularity of mango beverages and the need of its fortification with protein from plant sources, the present research work was undertaken

Material and Method

The squash recipe was standardized using 40% pulp, adjusting 50% TSS and 1.0 to 1.5% acidity. For development of plant protein fortified beverages, following treatments were tried: Soya, peanut protein isolates and rice bran protein concentrates @ 2, 3 and 4% were added to the mango beverage. These protein isolates were mixed properly in water before adding in the beverages. The pH of the beverage was adjusted to 4.5 with 1 N NaOH before addition of protein source. The beverages prepared from various concentrations of protein sources were organoleptically evaluated to obtain the most acceptable treatment. In the best blend above obtained, to prevent browning during pasteurization and storage, the cane sugar (sucrose) was replaced with 0, 50 and 100% keto group sugar fructose. The beverage blend with various proportions of fructose was then analyzed to obtain best treatment showing maximum organoleptic acceptability and minimum browning during storage upto 90 days at room temperature. The best combination of above prepared beverages with isolate and replacement of sugar with or without fructose were separately bottled in 200 ml bottles, pasteurized, capped and stored at room temperature (35±5°C) for further analysis and compared with control. For preparing beverages, total soluble solids and acidity were first analyzed in mango pulp. On the basis of this analysis, requisite quantities of sugar and citric acid dissolved in water by heating were added to pulp for the adjustment of TSS and acidity in beverages (w/w basis). The beverages were homogenized in colloid mill, strained, filled in pre-sterilized glass bottles (200 ml capacity) leaving 2.5 cm headspace and sealed with crown corks. The sealed bottles were processed in boiling water for 20 minutes. The bottles were then cooled in air, labelled and stored at room temperature for analysis during storage. The squash prepared were evaluated organoleptically at the regular monthly interval during three months storage. The organoleptic evaluation was done by a panel of ten semi trained judges following the hedonic rating scale as described by Ranganna (2003). The products were evaluated for colour and appearance, flavour, taste, mouth feel and overall acceptability.

Result and Discussion

The organoleptic evaluation of squash was conducted for the attributes colour and appearance, taste, aroma, mouthfeel and overall acceptability after its 3 time dilution to obtain RTS drink. The 9-point hedonic scale was used for evaluation of scores.

Colour and appearance

The colour and appearance score of treatments of squash and changes in it during storage are presented in Table 1. There was a progressive and significant decrease in colour and appearance scores of squash with increasing storage period. The average colour and appearance score of squash at 0-day was 8.4 which decreased to 7.3 by 90 days of storage. Among the various treatments, no significant differences w.r.t. control were observed for colour and appearance scores of protein fortified squash and its variants where sucrose was replaced by fructose. The interaction between treatments and storage was found to be non-significant. In squash, colour and appearance score decreased with the time due to degradation of carotenoids, increased sedimentation and NEB, as observed also by Dutta *et al*., (2005) [3]. The decrease in colour and appearance scores of squash during storage has been reported by other workers also (Sirohi *et al*., 2010; Hussain *et al.*, 2008) [13, 5].

Table 1: Effect of different treatments and storage period on colour and appearance scores (9-point hedonic scale) of PPI fortified mango squash

Treatments	Storage period (days)				
	0	30	60	90	Mean
T_0	8.5	7.7	7.4	7.1	7.7
T_1	8.8	8.2	7.7	7.4	8.0
T_2	7.9	7.6	7.4	7.3	7.6
T_3	8.5	8.3	7.3	7.2	7.8
Mean	8.4	8.0	7.5	7.3	
CD at 5% Treatment = NS; Storage = 0.32; Treatment × Storage = NS					

T_0 (Control with Sucrose); T_1 (Control with Fructose); T_3= T0+PPI; T_4=T_1+PPI;PPI= Peanut protein isolate; NS= Non-significant

Taste

The tastes score of treatments of squash and changes in it during storage are presented in Table 2. There was a significant decrease in taste score of squash with increasing storage period. The average taste score of squash at 0-day was 8.0, which decreased to 7.3 by 90 days of storage. Among the various treatments, no significant difference w.r.t. control were observed in taste score of PPI fortified squash. However, there was slight improvement in the taste scores of variants of squash where sucrose was replaced by fructose. The interaction between treatments and storage was found to be significant. Usha and Shikha (2015) [14] reported that the sugar replacement with sucrolose improved the overall acceptability of RTS mango drink.

Table 2: Effect of different treatments and storage period on taste scores (9-point hedonic scale) of PPI fortified mango Squash

Treatments	Storage period (days)				
	0	30	60	90	Mean
T_0	7.9	7.5	7.4	7.2	7.5
T_1	8.0	8.1	7.5	7.4	7.8
T_2	7.8	7.5	7.3	7.1	7.4
T_3	8.1	7.8	7.6	7.4	7.7
Mean	8.0	7.7	7.5	7.3	
CD at 5% Treatment = 0.24; Storage = 0.24; Treatment × Storage = 0.45					

T_0 (Control with Sucrose); T_1 (Control with Fructose); T_3= T0+PPI; T_4=T_1+PPI;PPI= Peanut protein isolate.

Aroma

The aroma score of treatments of squash and change in it during storage are presented in Table 3. There was slight decrease in aroma score of squash upto 30 days of storage but was not significantly affected on further storage. The average aroma score of squash at 0-day was 8.3, which decreased to 7.6 by 90 days of storage. Among the various treatments, slight but significantly lower aroma scores were recorded for PPI fortified squash. There was improvement in the aroma scores of variants of squash where sucrose was replaced by fructose. The interaction between treatments and storage was found to be significant.

Table 3: Effect of different treatments and storage period on aroma scores (9-point hedonic scale) of PPI fortified mango Squash

Treatments	Storage period (days)				
	0	30	60	90	Mean
T_0	8.4	7.9	7.6	7.3	7.8
T_1	8.5	8.1	8.3	8.3	8.3
T_2	7.9	7.5	7.3	7.2	7.5
T_3	8.3	7.9	7.8	7.5	7.9
Mean	8.3	7.9	7.8	7.6	
CD at 5% Treatment = 0.24; Storage = 0.28; Treatment × Storage = 0.58					

T_0 (Control with Sucrose); T_1 (Control with Fructose); T_3= T0+PPI; $T_4=T_1$+PPI;PPI= Peanut protein isolate,.

Mouthfeel

The mouthfeel score of treatments of squash and change in it during storage are presented in Table 4. There was slight decrease in mouthfeel score of squash upto 30 days of storage but was not significantly affected on further storage. The average mouthfeel score of squash at 0-day was 8.1, which decreased to 7.1 by 90 days of storage. Among the various treatments, slight but significantly lower mouthfeel scores were recorded for PPI fortified squash. There was improvement in the mouthfeel scores of variants of squash where sucrose was replaced by fructose. The interaction between treatments and storage was found to be significant.

Table 4: Effect of different treatments and storage period on mouthfeel scores (9-point hedonic scale) of plant protein fortified mango Squash

Treatments	Storage period (days)				
	0	30	60	90	Mean
T_0	8.3	7.9	7.6	7.3	7.8
T_1	8.5	8.3	8.0	7.8	8.2
T_2	7.5	7.4	7.3	7.1	7.3
T_3	8.2	8.0	7.9	7.6	7.9
Mean	8.1	7.9	7.7	7.5	
CD at 5% Treatment = 0.25; Storage = 0.25; Treatment × Storage = 0.52					

T_0 (Control with Sucrose); T_1 (Control with Fructose); T_3= T0+PPI; $T_4=T_1$+PPI;PPI= Peanut protein isolate

Overall acceptability

The overall acceptability score of treatments of squash and change in it during storage are presented in Table 5. There was slight decrease in overall acceptability of squash upto 30 days of storage but was not significantly affected on further storage. The overall acceptability score of squash at 0-day was 8.2, which decreased to 7.4 by 90 days of storage. Among the various treatments, slight but significantly lower overall acceptability scores were recorded for PPI fortified squash. There was improvement in the overall acceptability of variants of squash where sucrose was replaced by fructose. The PPI fortified RTS and its variant obtained by replacing sucrose by fructose remained acceptable upto studied storage period of 90 days. The interaction between treatments and storage was found to be significant. Similar lower acceptability has been reported by other workers for mango beverage fortified with soya protein isolate (Chauhan and Joshi, 1998) [2] and soya milk (Sakhale *et al.*, 2012) [11].

Table 5: Effect of different treatments and storage period on overall acceptability scores (9-point hedonic scale) of plant protein fortified mango Squash

Treatments	Storage period (days)				
	0	30	60	90	Mean
T_0	8.3	7.8	7.5	7.2	7.7
T_1	8.5	8.2	7.9	7.7	8.1
T_2	7.8	7.5	7.3	7.2	7.4
T_3	8.3	8.0	7.7	7.4	7.8
Mean	8.2	7.9	7.6	7.4	
CD at 5% Treatment = 0.32; Storage = 0.32; Treatment × Storage = 0.62					

T_0 (Control with Sucrose); T_1 (Control with Fructose); T_3= T0+PPI; $T_4=T_1$+PPI;PPI= Peanut protein isolate.

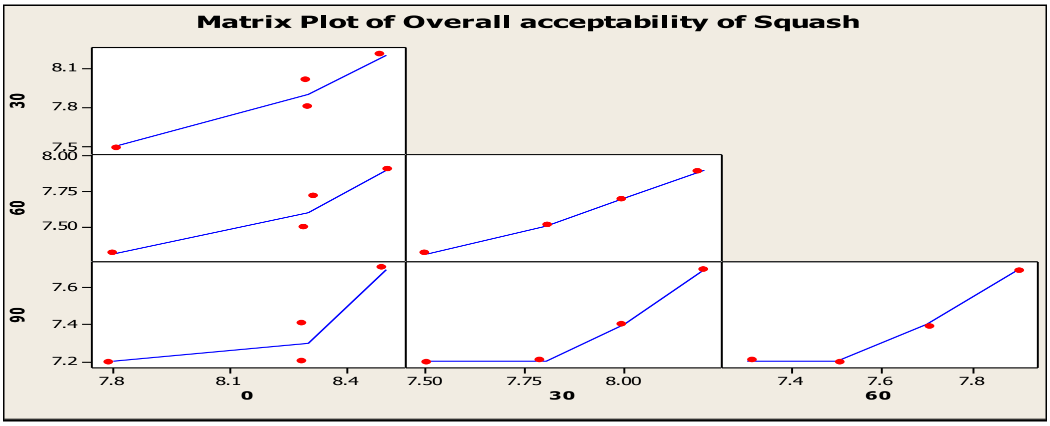

Fig 1: Matrix plot of Overall acceptability

Conclusion

From the present study it can be concluded that acceptable quality protein fortified mango squash can be prepared with 40% pulp, 2% PPI, 50% TSS, 1.20% acidity, 0.1% carrageenan, 0.1% maltodextrin, 0.1% mango essence and 1g/l sodium benzoate. The squash prepared with 100% substitution of sucrose with fructose were found more acceptable. The developed protein fortified beverages remained acceptable upto 90 days of storage at room temperature. Further research work and study need to be conducted to: further enhance the level of fortification of plant proteins in fruit beverages. The other protein sources along with newer additives, non-thermal techniques, enzyme solubilisation of proteins, etc. can also be explored.

References

1. Beecher JW, Drake MA, Luck PJ, Foegeding EA. Factors Regulating Astringency of whey beverages. Journal of Dairy Science 2008;91(7):2553-2560.
2. Chauhan SK, Joshi VK. Development of a protein rich mango beverage. Journal of Food Science and Technology 1998;35(6):521-523.
3. Dutta D, Chaudhuri UP, Chakraborty R. Structure, health benefits, antioxidant property and processing and storage of carotenoids. African Journal of Biotechnology 2005;4(13):1510-1520.
4. Friedman M. Food browning and its prevention: an overview. Journal Agricultural and Food Chemistry 1996;44(3):631-653.
5. Hussain I, Zeb A, Shakir I, Shah AS. Combined effect of potassium sorbate and sodium benzoate on individual and blended juices of apricot and apple fruits grown in Azad Jammu and Kashmir. *Pakistan* Journal of Nutrition 2008;7(1):181-185.
6. Knecht KJ, Feather MS, Baynes JW. Detection of 3-deoxyfructose and 3-deoxyglucosone in human urine and plasma: evidence for intermediate stages of the Maillard reaction *in vivo*. Archive of Biochemistry & Biophysics 1992;294:130-137.
7. Lalel HJD, Singh Z, Tan SC. Aroma volatiles production during fruit ripening of ‘Kensington Pride’ mango. Postharvest Biology and Technology 2003;27:323-336.
8. Nakesone HY. Tropical Fruits. 1998, 208-238. University of Hawaii at Manoa, Honolulu, HI, USA.
9. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw Hills Publishing Co. Ltd., New Delhi 1998.
10. Ravani A, Joshi DC. Mango and it’s by product utilization–a review. Trends In Post Harvest Technology 2013;1(1): 55-67.
11. Sakhale BK, Pawar VN, Ranveer RC. Studies on the development and storage of whey based rts beverage from mango cv. Kesar. Journal of Food Process Technology 2012;3(3):148-152.
12. Segall K. Protein fortification of acidic beverages: a clear opportunity. Food and Beverage Asia. 2009, 31-33.
13. Sirohi D, Patel S, Choudhary PL, Sahu C. Studies on preparation and storage of whey-based mango herbal *Pudina* (*Mentha arvensis*) beverage. Beverage and Food World 2010;37(4):44-46.
14. Usha B, Shikha M. Quality characteristics of no added sugar ready to drink milk supplemented with mango pulp. Journal of Food Science and Technology 2015;52(4):21122120.