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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(7): 254-259

www.thepharmajournal.com
Received: 06-05-2017
Accepted: 23-06-2017

Pukhraj Meena
Centre of Food Science and Technology, Banaras Hindu University, Varanasi 221005, India.

Indra Raj
Centre of Food Science and Technology, Banaras Hindu University, Varanasi 221005, India.

Correspondence
Pukhraj Meena
Centre of Food Science and Technology, Banaras Hindu University, Varanasi 221005, India.

Sensory evaluation and estimate the cost of production of Guava based Papaya Fruit Cheese

Pukhraj Meena and Indra Raj

Abstract
Fruit cheese made with locally grown fruit can be sold at premium prices. They are often purchased as gifts because they have a relatively long shelf life and are brightly colored. Fruit cheese, fruit butter, jam are acid foods. However, it is still important to follow recommended times in the boiling water canner for each specific fruit and its product type (U.S. FDA Code of Federal Regulations. 21CFR150). In this study, sensory evaluation was on 9 point hedonic scale with parameters i.e. flavor & taste, body & texture, color & appearance and treatments were T_0, T_1, T_2 & T_3. Flavor & taste score was recorded in the fruit cheese sample of T_2 (8.04) followed by T_0 (7.60), T_1 (7.56) and T_3 (7.36). In case of body and texture, fruit cheese sample of T_2 (8.04) followed by T_0 (7.88), T_1 (7.88) and T_3 (7.36). Colour & appearance score recorded in the fruit cheese of T_0 (7.80), T_1 (7.76), T_2 (7.76) and T_3 (7.12). It was noted the highest cost (Rs./kg.) was recorded in the fruit cheese sample of T_3 (90.44), T_2(87.44), T_1 (84.44), followed by T_0 (81.44). The significant difference thus obtained was further analyzed statistically to find out the C.D between and within the different treatment combinations.

Keywords: Shelf life, sensory evaluation, product type & treatment combinations.

1. Introduction
Traditional fruit cheese containing more than the usual amount of fruit, so people are turning away from the usual high-fat products like butter and cream cheese to spread on bread or a muffin in the morning. The fact is, all fruit cheese, spread, jams and jellies have no fat and are relatively low in calories. Summer and fall are the seasons for making jams and preserves at home. But cooks today are more likely to prepare a small amount of intensely fruity, less sweet preserves than to spend all day peeling and pitting quarts of fruit and wrestling with dripping jelly bags.

A certain amount of sugar and acidity also prevents the growth of dangerous microorganisms. Although it is successfully grown all over India, the most important guava growing states are Uttar Pradesh, Bihar, Karnataka and Maharashtra. Bihar is, by far, the most important guava producing state in India Allahabad District has the reputation of growing the best quality of guava in Uttar Pradesh.

The shelf life of papaya can be extended further by controlled atmosphere storage of 1 to 1.5% oxygen. Papaya has been described as an excellent source of pro vitamin A and ascorbic acid. Because of its year-round availability, papayas are an important source of vitamin C in the diet of the rural population of tropical Latin America and Asia [3].

WHO attributed approximately 14% of gastrointestinal cancer deaths, 11 % of heart disease death, and 9 % stroke deaths to insufficient consumption of fruit and vegetables. Papaya is considered one of the most beneficial fruits as a good source of nutrients, fiber, and proteolytic enzymes. Its consumption has been attributed to aid digestion. Previous researchers focused their study on papain activity from the latex of the unripe fruit or other parts of the plant, and also in the quantification of papain present in the pulp [26].

Generally pasteurization results in minimal changes to the nutritional and sensory characteristics of the food. However, pasteurization of fruit juices which are heat sensitive can cause loss of volatile compounds, thus a reduction of sensory quality [2].

Papaya is highly perishable and thus has a limited shelf life and distribution channel. During transportation of fresh fruit, papaya is susceptible to chill injury, bruising, wrinkling, and softening, all of which affect the acceptability of this fruit [25].

It is reported that the apple purée is a largely consumed preserve in many households and beside apple juice or cider is one of the most important apple products in the market. Papaya fruit is a good source of papain and chymopapain. Both are digestive proteolytic enzymes that

that digest protein and used as meat tenderizer, as digestive medicine, in pharmaceutical, brewing and tanning industries and in manufacture of chewing gum.

2. Materials and methods

2.1 Materials

The chemicals were procured from Hi-Media Laboratories Pvt. Ltd., Mumbai, India; Fisher Scientific, Mumbai, India; Merck Specialties Pvt. Ltd., Mumbai, India. All chemicals used in this study were of analytical grade.

2.2 Determination of sensory quality

Sensory quality attributes viz. were evaluated using 9 point Hedonic rating test method. This test measures the consumer's acceptability. A semi trained panel consisting of 6 judges of different age groups having different eating habits was constituted to evaluate the quality. The judgments were quantified by appropriate analysis for determining the significance of variation of average scores and the contribution of the individual quality characteristics to the overall quality. Samples were served to the panelists and they were asked to rate the acceptability of the product through sense organs. Different attributes viz. flavor, body and texture, colour and appearance, overall acceptability were rated on the basis of 9 point hedonic scale ranging from 1 to 9. A scorecard was supplied to each panel member at the time of evaluation.

3. Results and discussion

3.1 Sensory evaluation of guava based papaya Fruit Cheese

3.1.1 Flavor and taste score in Fruit Cheese

The data regarding Flavor score in fruit cheese sample of different treatments are presented in table 1 and 2.

Table 1: Flavor & taste score for control and experimental fruit cheese

Replication		Treatments			
		T_0	T_1	T_2	T_3
R_1		7.4	7.6	7.6	7.0
R_2		7.2	7.0	8	7.4
R_3		7.6	8.0	8.2	7.0
R_4		8.0	7.4	8	7.6
R_5		7.8	8.4	7.6	7.8
	Mean	7.60	7.56	8.04	7.36
Range	Minimum	7.2	7.0	7.6	7.0
	Maximum	8.0	8.4	8.2	7.8
F- test		S			
S. Ed. (±)		0.18			
C. D. (p = 0.05)		0.39			

1. From the perusal of data on Flavor score in fruit cheese samples of different treatments and control the highest mean Flavor& taste score was recorded in the fruit cheese sample of T_2(8.04) followed by T_0 (7.60), T_1 (7.56) and T_3 (7.36).

Table 2: ANOVA for Flavor& taste score for control and experimental fruit cheese of different treatments

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Replication	4	1.30	0.347	4.39	3.25	S
Treatment	3	1.23	0.410	5.20	3.49	S
Error	12	0.95	0.080	-	-	-
TOTAL	19	3.48	-			-

*Significant

2. As evident from the result of ANOVA given in Table 2. the F (Cal) value (5.20) was greater than the table value of F (3.49) at 5% level of significance. Therefore; the difference was significant, indicating significant effect of treatments on Flavor score& taste.
3. The significant difference thus obtained was further analyzed statistically to find out the C.D between and within the different treatment combinations. Results of C.D are presented in Table 3.

Table 3: Critical difference in flavor& taste score for control and experimental fruit cheese of different treatments

Treatments		Average	T_0	T_1	T_2	T_3
			7.60	7.56	8.04	7.36
T_0		7.60		0.04	-0.44	-0.24
T_1		7.56			-0.48	0.20
T_2		8.04				0.68
T_3		7.36				
C.D.=	0.39					

The following observations were made:

The difference between the mean values of T_0-T_1 (0.04) was less than the C.D. value, 0.39.Therefore, the difference was non-significant.

The difference between the mean values of T_0-T_2 (0.44) was greater than the C.D. value, 0.39.Therefore, the difference was significant.

The difference between the mean values of T_0-T_3 (0.24) was less than the C.D. value, 0.39.Therefore, the difference was non-significant.

The difference between the mean values of T_1-T_2 (0.48) was greater than the C.D. value, 0.39.Therefore, the difference was significant.

The difference between the mean values of T_1-T_3 (0.20) was less than the C.D. value, 0.39.Therefore, the difference was non-significant.

The difference between the mean values of T_2-T_3 (0.68) was greater than the C.D. value, 0.39. Therefore, the difference was significant.

It is therefore concluded that there was significant difference b/w T_0-T_1, T_0-T_3, & T_1-T_3 non-significant difference b/w the all other treatments which may be ascribed to addition of different level of papaya and guava in the experimental treatments of fruit cheese.

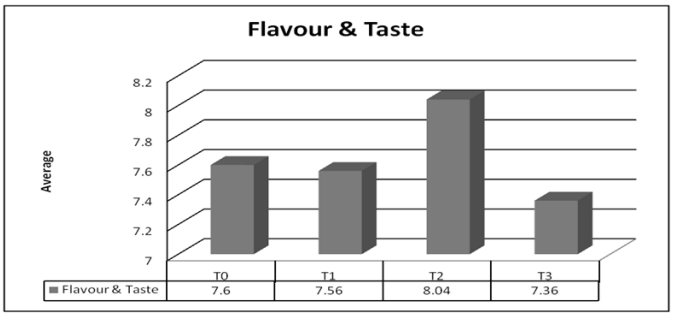

Fig 1: Flavor and taste score for control and experimental fruit cheese of different treatments

There: T_0 – Guava 100%, T_1 – Guava 90% and 10% Papaya, T_2 – Guava 80% and 20% Papaya & T_3 – Guava 70% and 30% Papaya.

3,1.2 Body & texture score in fruit cheese

The data regarding body and texture score in fruit cheese sample of different treatments are presented in table 4 and figure 2.

Table 4: Body and texture score for control and experimental fruit cheese

Replication		Treatments				
		T_0	T_1	T_2	T_3	
R_1		7.6	7.8	7.4	6.6	
R_2		7.6	7.8	8.0	7.2	
R_3		7.8	7.8	8.2	6.8	
R_4		7.6	7.8	7.6	8.0	
R_5		8.8	8.2	8.6	8.2	
	Mean	7.88	7.88	8.04	7.36	
Range	Minimum	7.6	7.8	7.4	7.2	
	Maximum	8.8	8.2	8.6	8.2	
F- test		S				
S. Ed. (±)		0.25				
C. D. (p = 0.05)		0.54				

1. From the perusal of data on body and texture score in fruit cheese samples of different treatments and control the highest mean body and texture score was recorded in the fruit cheese sample of T_2(8.04) followed by T_0 (7.88), T_1 (7.88) and T_3 (7.36).

Table 5: ANOVA for Body and texture score for control and experimental fruit cheese

ANOVA:						
Source	**d. f.**	**S.S.**	**M.S.S.**	**F. Cal.**	**F. Tab. 5%**	**Result**
Replication	4	2.60	0.65	4.17	3.25	S
Treatment	3	1.32	0.44	2.82	3.49	NS
Error	12	1.87	0.16	-	-	-
TOTAL	24	7.7589	-			-

*Non-Significant

2. As evident from the result of ANOVA given in Table 5. The F (Cal) value (2.82) was smaller than the table value of F (3.49) at 5% level of significance. Therefore; the difference was non-significant, indicating no significant effect of treatments on body and texture score, which may be ascribed to addition of different level of papaya and guava in the experimental treatments of fruit cheese.

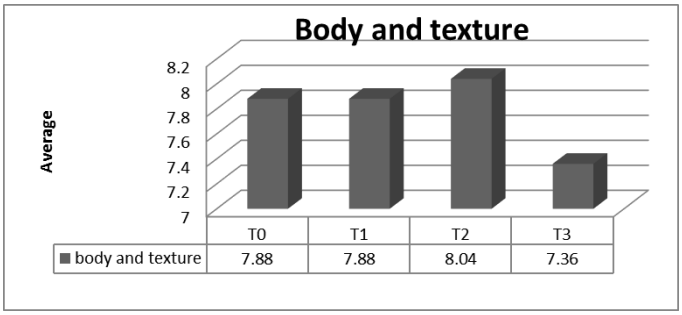

Fig 2: Body and texture score for control and experimental fruit cheese of different treatments

There: T_0 – Guava 100%, T_1 – Guava 90% and 10% Papaya, T_2 – Guava 80% and 20% Papaya & T_3 – Guava 70% and 30% Papaya

3.1.3 Colour & appearance in fruit cheese

The data regarding color& appearance score in fruit cheese sample of different treatments are presented in table 6 and figure 3.

Table 6: The average colour and appearance of control and experimental Fruit Cheese

Replication		**Treatments**			
		T_0	**T_1**	**T_2**	**T_3**
R_1		7.6	7.6	7.2	6.6
R_2		7.2	7.6	8.0	7.0
R_3		8.2	8.2	8.0	6.6
R_4		7.6	7.2	7.8	7.8
R_5		8.4	8.2	7.8	7.6
	Mean	7.80	7.76	7.76	7.12
Range	Minimum	7.2	7.2	7.2	6.6
	Maximum	8.4	8.2	8.0	7.8
F- test		NS			
S. Ed. (±)		0.26			
C. D. (p = 0.05)		0.57			

1. From the perusal of data on colour & appearance score in fruit cheese samples of different treatments and control the highest mean colour & appearance score recorded in the fruit cheese of T_0(7.80), T_1 (7.76), T_2 (7.76) and T_3 (7.12).

Table 7: ANOVA for colour and appearance of control and experimental fruit cheese

Source	**d. f.**	**S.S.**	**M.S.S.**	**F. Cal.**	**F. Tab. 5%**	**Result**
Replication	4	1.30	0.32	1.88	3.25	NS
Treatment	3	1.61	0.54	3.08	3.49	NS
Error	12	0.17	0.17	-	-	-
Total	19	3.08	-			-

**Non significant

2. As evident from the result of ANOVA given in Table 7. the F (Cal) value (3.08) was smaller than the table value of F (3.49) at 5% level of significance. Therefore; the difference was non-significant, indicating no significant effect of treatments on color and appearance score, which may be ascribed to addition of different level of papaya and guava in the experimental treatments of fruit cheese.

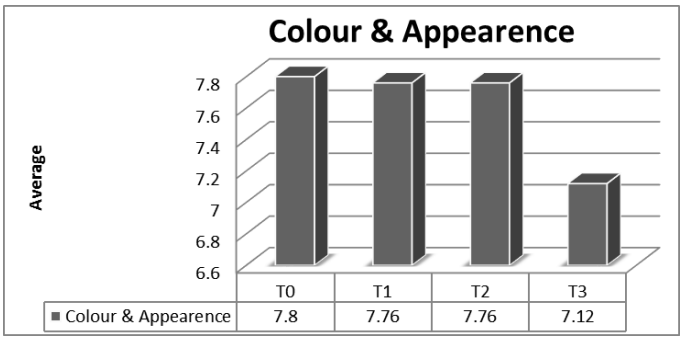

Fig 3: Colour and appearance score for control and experimental fruit cheese of different treatments

Where: T_0 – Guava 100%, T_1 – Guava 90% and 10% Papaya, T_2 – Guava 80% and 20% Papaya & T_3 – Guava 70% and 30% Papaya.

3.1.4 Overall acceptability score in Fruit Cheese

The data regarding Overall acceptability score in fruit cheese sample of different treatments are presented in table 8 and 9.

Table 8: Overall acceptability score for control and experimental fruit cheese

Replication		Treatments			
		T_0	**T_1**	**T_2**	**T_3**
R_1		7.6	7.8	7.6	6.8
R_2		7.2	7.4	8.0	7.4
R_3		8.0	7.8	8.4	7.0
R_4		7.8	7.4	8.0	7.6
R_5		8.4	8.6	8.4	7.8
	Mean	7.80	7.80	8.08	7.32
Range	Minimum	7.2	7.4	7.6	6.8
	Maximum	8.4	8.6	8.4	7.8
F- test		S			
S. Ed. (±)		0.19			
C. D. (p = 0.05)		0.41			

1. From the perusal of data on Overall acceptability score in fruit cheese samples of different treatments and control the highest mean Overall acceptability score was recorded in the fruit cheese sample of T_2 (8.08) followed by T_0 (7.80), T_1 (7.80) and T_3 (7.32).

Table 9: ANOVA for Overall acceptability score for control and experimental fruit cheese of different treatments

ANOVA :						
Source	**d. f.**	**S.S.**	**M.S.S.**	**F. Cal.**	**F. Tab. 5%**	**Result**
Replication	4	1.84	0.46	5.22	3.25	S
Treatment	3	1.49	0.50	5.66	3.49	S
Error	12	1.06	0.09	-	-	-
TOTAL	19		-			-

*Significant

2. As evident from the result of ANOVA given in Table 4.2.4.b. the F (Cal) value (5.66) was greater than the table value of F (3.49) at 5% level of significance. Therefore; the difference was significant, indicating significant effect of treatments on Overall acceptability score.
3. The significant difference thus obtained was further analyzed statistically to find out the C.D between and within the different treatment combinations. Results of C.D are presented in Table 10.

Table 10: Critical difference in Overall acceptability score for control and experimental fruit cheese of different treatments

Treatments		**Average**	**T_0**	**T_1**	**T_2**	**T_3**
			7.80	**7.80**	**8.08**	**7.32**
T_0		7.80		0.00	-0.28	0.48
T_1		7.80			-0.28	0.48
T_2		8.08				0.76
T_3		7.32				
C.D.=	0.41					

The following observations were made

The difference between the mean values of T_0-T_1 (0.00) was less than the C.D. value, 0.41.Therefore, the difference was non-significant.

The difference between the mean values of T_0-T_2 (0.28) was less than the C.D. value, 0.41.Therefore, the difference was non-significant.

The difference between the mean values of T_0-T_3 (0.48) was greater than the C.D. value, 0.39.Therefore, the difference was significant.

The difference between the mean values of T_1-T_2 (0.28) was less than the C.D. value, 0.41.Therefore, the difference was non-significant.

The difference between the mean values of T_1-T_3 (0.48) was greater than the C.D. value, 0.41.Therefore, the difference was significant.

The difference between the mean values of T_2-T_3 (0.76) was greater than the C.D. value, 0.41. Therefore, the difference was significant.

It is therefore concluded that there was significant difference b/w T_0-T_1, T_0-T_2, & T_1-T_2 non-significant difference b/w the all other treatments which may be ascribed to addition of different level of papaya and guava in the experimental treatments of fruit cheese.

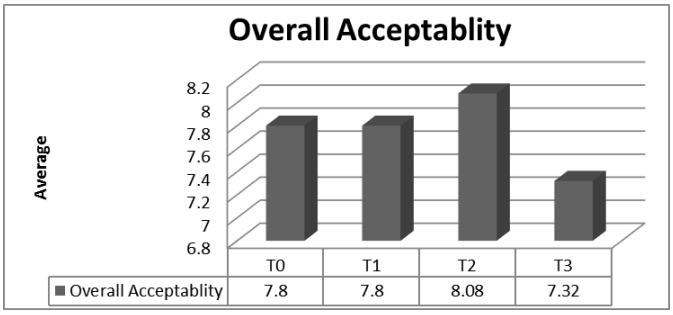

Fig 4: Overall acceptability scores for control and experimental fruit cheese of different treatments

Where: T_0 – Guava 100%**,** T_1 – Guava 90% and 10% Papaya, T_2 – Guava 80% and 20% Papaya & T_3 – Guava 70% and 30% Papaya.

3.2 Cost analysis of Guava based papaya fruit cheese (Rs. /kg.)

The data regarding cost (Rs) of fruit cheese, fruit cheese and therapeutic value of fruit cheese products sample of different treatments are presented in table 11.

From the perusal of data of cost (Rs.) in fruit cheese samples of different treatments and control furnished in table 11, it was noted the highest cost(Rs./kg.) was recorded in the fruit cheese sample of T_3 (90.44), T_2(87.44), T_1 (84.44), followed by T_0 (81.44).

Table 11: Cost analysis for control and experimental fruit cheese

Ingredients	Amount required for each replication (in grams)				Rate(Rs./kg)	Cost in (Rs./kg.)			
	T_0	T_1	T_2	T_3		T_0	T_1	T_2	T_3
Guava	1000	900	800	700	30	30	27	24	21
Papaya	0.00	100	200	300	60	0.00	6	12	18
Sugar	900	900	900	900	36	32.40	32.40	32.40	32.40
Butter	50	50	50	50	350	17.50	17.50	17.50	17.50
Citric acid	3	3	3	3	516	1.54	1.54	1.54	1.54
	Grand total					81.44	84.44	87.44	90.44

4. Conclusion

The shelf life of papaya can be extended further by controlled atmosphere storage of 1 to 1.5% oxygen. Papaya has been described as an excellent source of pro vitamin A and ascorbic acid. In contrast to traditional apple purée preparation, high pressure processing or mild thermal treatments could imply new opportunities for the apple processing industry in developing more fresh-like, value-added apple products with reasonable shelf life. Papaya is one example of fruit with a poor ability to withstand thermal processes. According to previous studies, traditional pasteurization methods develop cooked flavor in papaya juice; this is one of the reasons why papaya juice is often mixed with other fruits to mask the off flavors. In case of body and texture, fruit cheese sample of T_2 (8.04) followed by T_0 (7.88), T_1 (7.88) and T_3 (7.36). Colour & appearance score recorded in the fruit cheese of T_0 (7.80), T_1 (7.76), T_2 (7.76) and T_3 (7.12). The significant difference thus obtained was further analyzed statistically to find out the C.D between and within the different treatment combinations. It was noted the highest cost (Rs./kg.) was recorded in the fruit cheese sample of T_3 (90.44), T_2(87.44), T_1 (84.44), followed by T_0 (81.44). All results were found more significant ($p<0.05$) as represent in ANOVA.

5. Acknowledgments

The authors gratefully acknowledge to Centre of Food Science and Technology, Banaras Hindu University, Varanasi (India) for providing laboratory facilities for research study.

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