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Evaluation of microbial load and organoleptic quality of banana pseudostem core candy cv. Rajapuri

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Abstract
Osmotic dehydration of banana pseudostem core cubes to prepare a flavoured candy appears to be a convenient way to harness the nutrients from pseudostem. An experiment was carried out during 2019-2020 to standardize the protocol for preparation of flavoured candy from pseudostem core of banana cv. Rajapuri. Candies were prepared and subjected for organoleptic evaluation by semi-trained panel to analyse the quality attributes like colour and appearance, taste, texture and overall acceptability using 9 point hedonic scale and they are evaluated for microbial load by serial dilution technique during storage period of 3 months under ambient conditions. The experiment was carried out in Completely Randomized Design (CRD) with nine treatments and three replications. Among various treatments, the candy prepared by blanching for 2.5 minutes and steeping in 40-60°Brix sugar syrup with 1 per cent citric acid and 5 per cent pineapple juice as a natural flavor (T_4) obtained highest mean organoleptic score with respect to colour and appearance (8.16), taste and flavour (8.25), texture (8.31) and overall acceptability (8.24). Total bacterial population was recorded minimum (0.46 x 10^5 cfu/g) in T_5 (Blanching for 2.5 min. + steeping in 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice) and total fungal count was recorded minimum (0.51 x 10^3 cfu/g) in T_9 (Blanching for 5 min. + 40 - 60°Brix syrup + 1% citric acid + 10% Pineapple juice) after the storage period of 90 days at ambient condition.

Keywords: Pseudostem, pineapple, ambient, flavoured candy, organoleptic score

Introduction
Banana is one the most prominent tropical fruits eaten by people of all ages worldwide. Approximately 25–30 t / ha of banana pseudostem waste is produced after bunch harvest, which is common for making compost, vermi-compost, and vermi-wash. Only negligible contributions were made to diet. The waste can be used to manufacture paper, paper boards, stationery items, briquettes etc. Most of them, however, are wasted which also creates major problems with agro-waste and environmental nuisance (Shiva *et al*., 2018) [1].
The pseudostem contains rich quantities of calcium, potassium, sodium, iron, magnesium and chlorides. All these are essential to maintain the balance of body fluids and electrolytes. Central cores have been reported to be effective against liver and kidney parasites and central core is traditional remedy against kidney stone. Among the various banana varieties grown in India, the Rajapuri cultivar belonging to the AAB group is popular local variety among North Karnataka growers and consumers. It is a hardy crop with thick pseudostem and can withstand to strong winds. The fruits are medium in size, with an extremely sweet flavour with a sweet and acid mix.
Osmotic dehydration is an important technique of food preservation and processing in which foods *viz*. fruits and vegetables are immersed in the osmotic solution containing concentrated salt and sugar. The osmotic agent used may be fructose, corn syrup, glucose, sodium chloride or sucrose. Cell membrane of fruits and vegetables works as semi permeable membrane which permits water to move from low concentrated fruits and vegetables to high concentrated osmotic solution. Comparing to other conventional methods, osmotic dehydration treatment is a simple procedure which requires no mechanical aid and involves decreased cost of energy. It is easy to perform at room temperature, which ensures the retention of colour, texture and nutrients. In this context exploitation of banana pseudostem for the preparation of flavoured candy is planned in the present study (Hasannuzzaman *et al.*, 2014) [2].

Materials and Methods
An experiment was carried out during 2019-20 in the Department of Post harvest Technology,

KRC College of Horticulture, Arabhavi (UHS, Bagalkote), Karnataka. The banana pseudostems of cv. Rajapuri were procured from AICRP on Tropical fruits, immediately after harvesting of bunch. Pseudostems from healthy banana plants and free from damage were selected.

Banana pseudostems were washed thoroughly with tap water to remove the dirt and adhering soil. The pseudostems were split by sharp stainless steel knife and the cores were taken out. The cores are cut horizontally into wheels and fibrous outer skin was removed using stainless steel knife, further the core wheels were cut horizontally and vertically and made into small cubes. These core cubes were immersed in 0.2 per cent potassium Meta bi-sulphate for an hour to reduce browning. Cubes were taken out and blanched in boiling water for specific period of time (2.5 and 5 minutes) as per the treatment details and immediately after blanching dipped in cold water to avoid over cooking. Blanched banana cubes were pricked and steeped in sugar syrup (40ºB) and citric acid (0.5 and 1%) as per the treatments. After 24 hours of steeping in syrup, banana pseudostem core cubes were strained out of syrup and degree brix of sugar syrup was raised to 50ºB and pineapple juice (5 and 10%) was added as flavor as per the treatments. After 24 hours of steeping in syrup, banana pseudostem core cubes were strained out of syrup and degree brix of sugar syrup was raised to 60ºB. After 24 hours cubes were strained out of sugar syrup using strainer and slightly washed with filtered water to remove the excess syrup to avoid stickiness during drying, cubes were again given shape using small knives to remove unattractive part, then the cubes were dried at 60ºC using electric tray drier. Dried cubes were packed in LDPE pouches with label. Packed candies were stored in ambient condition for further storage studies.

Microbial analysis (cfu g $^{-1}$)

The total microbial load in banana pseudostem core candy was taken at monthly intervals of storage as per the method of Harrigan and Mccance (1996) [3]. Samples were prepared by taking 10 gm of representative sample from three replications in each treatment. 10 gm of samples are mixed with 90 ml of sterilized water in a conical flask and serial dilution technique was carried out to estimate fungal and bacterial load in banana pseudostem core candy. The dilution 10^{-3} was used for fungi and 10^{-5} was used for bacterial counting. One ml of aliquot from respective dilution was transferred to petri plates in duplication and sterilized lukewarm molten potato dextrose agar and nutrient agar were poured to the respective plates for isolation of fungi and bacteria respectively. After solidification, the plates were incubated at 37 ± 1 ºC for three days and the colony counts were recorded and expressed as cfu/g of sample.

Sensory Evaluation

The pulp was evaluated for sensory attributes *viz*., colour and appearance, taste, texture, flavor and overall acceptability by a panel of 15 trained judges consisting of teachers and postgraduate students of KRC College of Horticulture, Arabhavi. They evaluated pulp samples during 90 days of storage at room temperature. Each panellist assessed every sample over 30 days interval at sensory evaluation laboratory of the post-harvest technology department by using individual booths with daylight and ambient room temperature. Each consumer evaluated the samples using nine-point hedonic scale (Table 1) as described by Ranganna (2003) [4] where 1 represents extremely disliked and 9 represent extremely liked.

Table 1: Hedonic scale

Hedonic scale	Colour and appearance	Texture	Taste	Overall acceptability
Like Extremely	9	9	9	9
Like very much	8	8	8	8
Like moderately	7	7	7	7
Like slightly	6	6	6	6
Neither like nor dislike	5	5	5	5
Dislike slightly	4	4	4	4
Dislike moderately	3	3	3	3
Dislike very much	2	2	2	2
Dislike extremely	1	1	1	1

Statistical analysis

The data recorded on the organoleptic characteristics and total microbial counts were subjected to statistical analysis in completely randomized block design. Analysis was done using Web Agri. Stat. Package 2 developed by ICAR research complex, Goa. Examination of the data was determined in accordance with Panse and Sukhatme (1985) [5].

Treatment details

T$_1$: Control (without blanching, citric acid and flavour)
T$_2$: Blanching for 2.5 min. + steeping in 40-60ºBrix syrup + 0.5% citric acid + 5% Pineapple juice
T$_3$: Blanching for 2.5 min.+ steeping in 40-60ºBrix syrup + 0.5% citric acid + 10% Pineapple juice
T$_4$: Blanching for 2.5 min. + steeping in 40-60ºBrix syrup + 1% citric acid + 5% Pineapple juice
T$_5$: Blanching for 2.5 min. + steeping in 40-60ºBrix syrup + 1% citric acid + 10% Pineapple juice
T$_6$: Blanching for 5 min. + steeping in 40-60ºBrix syrup + 0.5% citric acid + 5% Pineapple juice
T$_7$: Blanching for 5 min. + steeping in 40-60ºBrix syrup + 0.5% citric acid + 10% Pineapple juice
T$_8$: Blanching for 5 min. + steeping in 40-60ºBrix syrup +1% citric acid + 5% Pineapple juice
T$_9$: Blanching for 5 min. + steeping in 40-60ºBrix syrup + 1% citric acid + 10% Pineapple juice

Organoleptic evaluation of banana pseudostem core candy was done at initial and monthly intervals up to three months of storage. It was carried out by semi-trained panel of judges consisting of teachers and Post-graduate students of KRC College of Horticulture, Arabhavi. The organoleptic characteristics like Colour and appearance, texture, taste, and overall acceptability were evaluated on a nine-point hedonic scale using the score card (Ranganna, 2003) [4].

Results and Discussion

Microbial population (cfu/ml)

The quality of the product tends to deteriorate during storage, due to many reasons. At initial, when banana pseudostem core candy was fresh no microbial growth was observed but there was a slight increase in microbial population after 1, 2 and 3 months after storage.

Irrespective of treatments the mean total bacterial count increased from 0.45 to 0.69 x 10^5 cfu/g and mean total fungal count increased from 0.57 to 0.85 x 10^3 cfu/g during storage. Total bacterial population was recorded maximum (1.37 x 10^5 cfu/g) in T_1- Control (without blanching, citric acid and flavour) and minimum was (0.46 x 10^5 cfu/g) in T_5 (Blanching for 2.5 min. + steeping in 40-60ºBrix syrup + 1% citric acid + 10% Pineapple juice) and total fungal count was recorded

maximum (2.07 x 10^3 cfu/g) in T_1- Control (without blanching, citric acid and flavour) and minimum (0.51 x 10^3 cfu/g) in T_9 (Blanching for 5 min. + 40 - 60°Brix syrup + 1% citric acid + 10% Pineapple juice) after 3 months of storage (Table 2). Similar results were noticed in pumpkin candy as reported by Harshitha (2018) [6] and also by Muzzaffar (2006) [7] in pumpkin candy. Candies were safe to consume even after three months of storage. This is because of the presence of high sugar content and citric acid in the candies, which prevented the spoilage of the product, thereby increasing the storage stability of candies.

Table 2: Effect of treatments and storage period on Microbial count of banana pseudostem core candy

Treatments	Total bacterial count (x 10^5 cfu/g)			Total fungal count (x 10^3 cfu/g)		
	Months after storage					
	1	2	3	1	2	3
T_1	1.10	1.26	1.37	1.34	1.78	2.07
T_2	0.46	0.58	0.71	0.65	0.78	0.92
T_3	0.37	0.46	0.61	0.58	0.70	0.81
T_4	0.39	0.48	0.57	0.51	0.62	0.73
T_5	0.23	0.37	0.46	0.46	0.60	0.69
T_6	0.52	0.71	0.85	0.42	0.53	0.66
T_7	0.42	0.56	0.68	0.48	0.59	0.71
T_8	0.33	0.44	0.52	0.38	0.49	0.57
T_9	0.26	0.39	0.47	0.35	0.46	0.51
Mean	0.45	0.58	0.69	0.57	0.73	0.85
S.Em±	0.02	0.03	0.03	0.03	0.05	0.03
C.D. @ 1%	0.15	0.18	0.20	0.18	0.17	0.14

T_1: Control (without blanching, citric acid and flavour)
T_2: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice
T_3: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T_4: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 5% Pineapple juice
T_5: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice
T_6: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice
T_7: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T_8: Blanching (5 min.) + 40-60°Brix syrup +1% citric acid + 5% Pineapple juice
T_9: Blanching (5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice

Organoleptic evaluation

Organoleptic evaluation of products is a chief means for determining the consumer acceptability. Human element plays a significant role in assessment of sensory quality of a product. The marketability of the product is determined by the colour, flavour and organoleptic taste of the product. Organoleptic quality like colour and appearance, texture, and flavour of the product generally reduces with the increase in storage period (Table 3 and 4).

In the present experiment, gradual decrease in colour and appearance, texture, taste and overall acceptability of banana pseudostem core candy during the storage were observed. Reduction in the mean value for colour and appearance was initially from 7.72 to 7.35 at the end of storage. Maximum score (8.16) was found in the treatment T_4 - Blanching (2.5 min.) + 40 - 60°Brix syrup + 1% citric acid + 5% Pineapple juice followed by T_5 (7.96) and minimum score (6.45) was recorded in T_1- Control (without blanching, citric acid and flavour). This change may be due to deterioration of pigments because of enzymatic and non-enzymatic oxidation process (Sagar and Kumar, 2009) [8].

Significant decrease was recorded in organoleptic score with respect to the texture of the candy. The mean value for texture was also decreased throughout the storage period, but the maximum score (8.37) was recorded by the treatment T_5- Blanching (2.5 min.) + 40 - 60°Brix syrup + 1% citric acid + 10% Pineapple juice followed by T_4 (8.31) and minimum scores (7.51) was documented in T_9- Blanching (5 min.) + 40 - 60°Brix syrup + 1% citric acid + 10% Pineapple juice. Change in texture after storage may be attributed to degradation of pectic substances and moisture absorption by polyethylene pouches (Sharma *et al.*, 2004) [9].

Scores for taste showed analogous decreasing trend as colour and appearance, here treatment T_4 - Blanching (2.5 min.) + 40 - 60°Brix syrup + 1% citric acid + 5% Pineapple juice recorded highest score (8.25) followed by T_3 (8.15) and minimum value (7.38) was recorded in T_1- Control (without blanching, citric acid and flavour). A gradual decrease in flavour during storage might be due to heat treatment applied during processing.

The mean score for overall acceptability of banana pseudostem core candy varies from 8.04 in fresh to 7.74 at the end of 3 months of storage period signifying reduction in performance over the time. The highest score (8.24) was recorded in T_4 (Blanching (2.5 min.) + 40 - 60°Brix syrup + 1% citric acid + 5% Pineapple juice) followed by T_5 (8.14) at the end of storage period whereas least score (7.15) was documented in T_1- Control (without blanching, citric acid and flavour). The results were in accordance with Ankita *et al.* (2014) [10] in osmotic dehydration of papaya cubes and Sra *et al.* (2014) [11] in dried carrot slices.

However, there was a significant decrease in organoleptic mean score for colour and appearance, texture, taste, flavour and overall acceptability during storage. The sensory mean score for each trait was uppermost on the day of preparation, which decreased with increasing period of storage. There are many extrinsic factors which determine the storage stability of products and temperature plays an important role among them.

Table 3: Effect of treatments and storage period on colour and appearance and taste of banana pseudostem core candy

Treatments	Colour and appearance				Taste			
	Months after storage							
	0	1	2	3	0	1	2	3
T_1	7.18	6.76	6.58	6.45	7.88	7.66	7.50	7.38
T_2	7.68	7.56	7.42	7.30	8.19	8.08	7.99	7.90
T_3	7.82	7.70	7.61	7.53	8.44	8.35	8.22	8.15
T_4	8.46	8.38	8.27	8.16	8.51	8.43	8.32	8.25
T_5	8.29	8.18	8.07	7.96	8.37	8.29	8.16	8.09
T_6	7.79	7.62	7.51	7.42	8.09	8.01	7.93	8.00
T_7	7.47	7.39	7.24	7.13	8.27	8.19	8.07	8.00
T_8	7.26	7.17	7.03	6.92	7.99	7.87	7.81	7.73
T_9	7.52	7.41	7.32	7.24	7.82	7.74	7.60	7.51
Mean	7.72	7.57	7.45	7.35	8.17	8.07	7.96	7.89
S. Em ±	0.02	0.05	0.04	0.03	0.04	0.04	0.05	0.03
C. D. (0.01)	0.16	0.14	0.12	0.22	0.13	0.22	0.19	0.21

T_1: Control (without blanching, citric acid and flavour)
T_2: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice

T3: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T4: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 5% Pineapple juice
T5: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice
T6: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice
T7: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T8: Blanching (5 min.) + 40-60°Brix syrup +1% citric acid + 5% Pineapple juice
T9: Blanching (5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice

Table 4: Effect of treatments and storage period on Texture and Overall acceptability of banana pseudostem core candy

Treatments	Texture				Overall acceptability			
	Months after storage							
	0	1	2	3	0	1	2	3
T_1	7.81	7.73	7.65	7.59	7.62	7.38	7.24	7.15
T_2	8.47	8.39	8.30	8.24	8.11	8.01	7.9	7.81
T_3	8.41	8.34	8.27	8.20	8.22	8.13	8.03	7.96
T_4	8.53	8.48	8.39	8.31	8.50	8.43	8.33	8.24
T_5	8.59	8.50	8.43	8.37	8.42	8.32	8.22	8.14
T_6	8.18	8.13	8.04	7.97	8.02	7.92	7.83	7.80
T_7	8.25	8.27	8.09	8.01	7.99	7.95	7.8	7.71
T_8	7.99	7.87	7.81	7.73	7.75	7.64	7.55	7.46
T_9	7.82	7.74	7.63	7.51	7.72	7.63	7.52	7.42
Mean	8.23	8.16	8.07	7.99	8.04	7.93	7.82	7.74
S. Em ±	0.03	0.04	0.04	0.05	0.05	0.04	0.05	0.03
C. D. (0.01)	0.13	0.15	0.14	0.17	0.16	0.20	0.20	0.18

T1: Control (without blanching, citric acid and flavour)
T2: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice
T3: Blanching (2.5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T4: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 5% Pineapple juice
T5: Blanching (2.5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice
T6: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 5% Pineapple juice
T7: Blanching (5 min.) + 40-60°Brix syrup + 0.5% citric acid + 10% Pineapple juice
T8: Blanching (5 min.) + 40-60°Brix syrup +1% citric acid + 5% Pineapple juice
T9: Blanching (5 min.) + 40-60°Brix syrup + 1% citric acid + 10% Pineapple juice

Biochemical changes occurring during the storage might have led to the formation of undesirable colours, texture and taste, which might have affected the poor acceptability of the products which can further lead to a reduction of the organoleptic score of the product (Dwivedi *et al.*, 2000) [12]. Similar results were also reported by Pereira *et al.* (2010) [13] in osmotic dehydration of guava slices, Kumar (2013) [14] in osmotic dehydration of plum, Khan *et al.* (2014) [15] in strawberry osmotic dehydration, Ankita *et al.* (2014) [10] in osmotic dehydration of papaya cubes and Sra *et al.* (2014) [11] in dried carrot slices.

Conclusion

Among the treatments, treatment T_4 - Blanching (2.5 min.) + 40 - 60°Brix syrup + 1% citric acid + 5% pineapple juice was better organoleptically. Total bacterial population was recorded minimum (0.46 x 10^5 cfu/g) in T_5 and maximum (1.37 x 10^5 cfu/g) was in T_1- Control and total fungal count was recorded maximum (2.07 x 10^3 cfu/g) in T_1 and minimum (0.51 x 10^3 cfu/g) in T_9 after 3 months of storage.

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References

1. Shiva KN, Adiyaman P, Naik R, Marimuthu N. Development and standardisation of banana pseudostem based novel functional blended ready to drink (rtd) beverages and studies nutritional changes during storage. International journal of life sciences. 2018;7(3):151-158.
2. Hasannuzzaman M, Kamruzzaman M, Islam MM, Khanom SAA, Rahman MM, Lisa LA *et al.* A study on tomato candy prepared by dehydration technique using different sugar solutions. Food and Nutrition Sciences. 2014;5:1261-1271.
3. Harrigan WF, Mccance ME. Laboratory methods in microbiology. Academic press, London, 1996, 4-16p.
4. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw Hills Publishing Co. Ltd., New Delhi, 2003.
5. Panse VS, Sukhatme PV. Statistical method for agriculture workers. Indian Council of Agriculture Research. New Delhi, India, 1985.
6. Harshitha SB. Standardization of protocol for the preparation of pumpkin (*Cucurbita moschata* d.) candy and biscuits, M.Sc. (Hort.) Thesis, Univ. Hort. Sci., Bagalkot (India), 2016.
7. Muzaffar S. Utilization of pumpkin (*Cucurbita moschata*) for the preparation of value added products. M.Sc. Thesis, Dr. Y. S. Parmar Uni. Hort. and For. Nauni, HP (India), 2006.
8. Sagar VR, Kumar PS. Involvement of some process variables in mass transfer kinetics of osmotic dehydration of mango slices and storage stability. Journal of Scientific and Industrial Research. 2009;68:1043-1048.
9. Sharma KD, Kumar R, Kaushal BBL. Mass transfer characteristics, yield and quality of five varieties of osmotically dehydrated apricot. Journal of Food Science and Technology. 2004;41(3):264-275.
10. Ankita, Singh R, Nayansi. Effect of hurdle Technology on the quality and stability of minimally processed papaya. International Journal of Scientific Research. 2014;3(8):173-176.
11. Sra SK, Sandhu KS, Ahluwalia P. Effect of treatments and packaging on the quality of dried carrot slices during storage. Journal of Food Science and Technology. 2014;51(4):645-654.
12. Dwivedi AK, Mitra SK. Performance of litchi (*Litchi chinensis* sonn.) cultivars for processing into squash. Haryana J. Hort. Sci. 2000;29(3 & 4):176-177.
13. Pereira LM, Sandra MC, Valeria CA, Cristhiane CF, Miriam DH. Calcium lactate effect on the shelf life of

osmo dehydrated guavas. Journal of Food Science. 2010;75(9):12-16.
14. Kumar N. Optimization of method for the preparation of osmo-dried plum (*Prunus salicina* L.). M.Sc. Thesis, Dr. Y. S. Parmar Uni. Hort. and For. Nauni, HP (India), 2013.
15. Khan MR. Osmotic dehydration technique for fruits preservation. Pakistan Journal of food sciences. 2014;22(2):71-85.