

Standardization of a banana peel based ready to cook curry mix (RTC)

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The present investigation entitled, 'Development of RTC curry mix based on banana peel' was conducted at the Department of Home Science, College of Agriculture, Vellayani. The objective of the study was to develop a banana peel based ready to cook curry mix. The study intended to utilize this nutritionally significant raw material through value addition, thereby reducing its large scale wastage from the processing industry and also avoiding the related environmental pollution. Slice dimension of 1x1cm was selected based on OVQ scores-The identified Curry mix contained banana peel, crushed red chillies, garlic, cumin, turmeric powder and curry leaves, the ratio being 1000:30:50:10:20:50 In order to give hints for using the product to the consumer, reconstitution time and cooking time were also standardized. Reconstitution time of 20 min and cooking time of seven minutes was optimized from the study.

Key Words : Ready to cook curry mix, Banana peel, Dimensions, Reconstitution time, Cooking time

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INTRODUCTION

The annual production of bananas was reported to be over 145 MT in 2011. The main by-product of the banana processing industry is the peel, which represents approximately 40 per cent of the fruit. After consumption and processing, a significant amount of banana peel is discarded as waste after the inner fleshy portion is eaten. This by-product constitutes an environmental problem, because it contains large quantities of nitrogen and phosphorus. Besides, its high water content makes it susceptible to attack by micro-organisms.

Banana peels have significant nutritional qualities. They are rich sources of starch (3%), crude protein (6-

9%), crude fat (3.8-11 %), and total dietary fibre (43.2-49.7%). It is a rich source of polyunsaturated fatty acids particularly linoleic acids and alpha linolenic acid. It contains essential amino acids such as valine, phenyl alanine and theonine and also micronutrients like K, P, Ca, Mg, Fe and Zn, Zn and Fe were found in higher concentrations in peels compared to pulp. Banana peels are also good sources of lignin (6-12%), pectin (10-21%), cellulose (7.6-9.6%), hemicelluloses (6.4-9.4%) and galactouronic acid. Pectin extracted from banana peel also contains glucose, galactose, rhamnose and xylose (Emaga *et al.*, 2007).

Phenolic compounds are the secondary metabolites produced by plants. It has multiple biological effects. The total amount of phenolic compounds in banana peel ranges from 0.90 to 3.0 g/100 of gDW. Galocatechin is identified at a concentration of 160 mg/100g DW. Ripe banana peel also contains other compounds, such as the anthocyanins, delphinidins, cyanidins and catecholamines. Furthermore, carotenoids, such as beta-carotene, alpha-

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carotene and xanthophylls have been identified in banana peels in the range of 300-400 mg lutein equivalents/100g. Sterols and triterpenes, such as β -sitosterol, stigma sterol, campesterol, cycloecalenol, cycloartenol, and 24-ethylene cycloartanol are also identified in banana peel. Potassium content is found to be high in banana peel (78.10mg/g). This mineral helps in the regulation of body fluids and helps maintain normal blood pressure. It will also help to control kidney failure, heart diseases and respiratory flaw (Nguyan *et al.*, 2003).

Food processing industry is of enormous significance in India's development because of the vital linkage and synergies that it promotes between the two pillars of the economy, namely industry and Agriculture (Maheshkumar, 2009). Convenience foods or processed foods are foods which are designed for convenience to women in the kitchen. It also reduces costs due to spoilage (Liaquat *et al.*, 2009).

Fruit wastes, which are highly perishable, is a problem to the processing industries and pollution monitoring agencies. Suitable methods to utilize them for conversion into value-added products would be useful for developing healthy foods. By-product recovery from fruit wastes can also improve the overall economics of processing units. Besides this, the problem of environmental pollution also can be reduced considerably.

Despite the nutritional, economic and medicinal importance of banana peel, they still remain neglected. Not much work has been done to develop banana peel based processed foods. In this context the present investigation on 'Development of a value added product from banana peel' was selected with the objective of developing a value added product and to evaluate its organoleptic, functional, and nutritional and shelf-life quantity.

METHODOLOGY

Standardization of ready to cook curry mix (RTC):

Standardization of dimensions of slices :

Selection of appropriate dimensions of slices of vegetables to be dried is essential in processing, thicker slices will dry at a slower rate or may not dry fully and it may subsequently deteriorate after packing than thinner pieces. But in the case of very thin pieces there is a tendency for the pieces to stick on to the drying trays which will be difficult to remove. So the length and breadth of the banana peels were standardized. The banana peels

were sliced into groups of various dimensions. The best of these variations were identified by evaluating the overall visual quality (OVQ) of the dehydrated material by a panel of semi trained judges. The variations in dimensions that were evaluated are given in Table A.

Sr. No	Treatments	Dimension (cm)
1.	T ₁	0.5 x 0.5
2.	T ₂	1x1
3.	T ₃	1.5 x1
4.	T ₄	1.5x1.5
5.	T ₅	1.5x2
6.	T ₆	2x2

Standardization of pre-treatment media :

Pre treating fruits and vegetables is an important step for preserving the produce. It helps the food product to maintain its natural colour and destroy enzymes that can cause food spoilage (Joseph *et al.*, 2001).

Sr. No	Treatments	Particulars
1.	T ₁	Citric acid (0.1%) +salt (1%)
2.	T ₂	Citric acid (0.2%) +salt (1.5%)
3.	T ₃	Citric acid (0.3%) +salt (2%)
4.	T ₄	Citric acid (0.4%) +salt (2.5%)
5.	T ₅	Citric acid (0.5%) +salt (3%)

Hundred grams of blanched slices were immersed in one litre water with the various additives for 15mts. The best of these variations were again identified by analyzing the scores of overall visual quality (OVQ) of the drained and dried product as rated by the sensory panel.

Standardization of immersion time :

Banana peels were immersed in the selected media for various durations of time. The optimum immersion time in the selected media for retaining maximum sensory qualities was identified, on the basis of scores obtained

Sr. No	Treatments	Time (min)
1.	T ₁	5
2.	T ₂	10
3.	T ₃	15
4.	T ₄	20
5.	T ₅	25

Sr. No.	Treatments	Ingredients	Proportion of ingredients(g)
1.	S ₁	Banana peel+Crushed Red Chilli+Garlic+cumin+ Turmeric+Curry leaves	1000:30:50:10:20:50
2.	S ₂	Banana peel+ Red chilli powder+Garlic+cumin+Turmeric powder+Curry leaves	1000:30:50:10:20:50
3.	S ₃	Banana peel+ Green chilli+ Garlic+ cumin+ Turmeric powder+ curry leaves	1000:30:50:10:20:50
4.	S ₄	Banana peel+ pepper+ Garlic+cumin+ Turmeric powder+ Curry leaves	1000:30:50:10:20:50
5.	S ₅	BananaPeel+Pepper+Turmeric powder+Curry leaves	1000:15:15:50:10:20:50

on a hedonic scale, for overall visual quality (OVQ), the best treatment was identified.

Formulations of ready to cook (RTC) curry mixes from banana peel :

The ingredients in the RTC product were sliced green chillies, crushed red chilli, red chilli powder, pepper, garlic, turmeric, cumin and curry leaves, they were mixed in different combinations and proportions (g) as given in Table D.

All the formulations were mixed thoroughly and dehydrated at 65°C till crisp. These dehydrated formulations were rehydrated for various durations of time, cooked and subjected to organoleptic evaluation.

Optimization of reconstitution time of RTC products:

The dehydrated RTC mixes were reconstituted in different time durations. For this the formulated Ready to cook mixes were soaked in cold water and evaluated for overall visual quality (OVQ) of the product.

Sr. No.	Treatments	Time (min)
1.	T ₁	10
2.	T ₂	15
3.	T ₃	20
4.	T ₄	25
5.	T ₅	30

Optimization of cooking time :

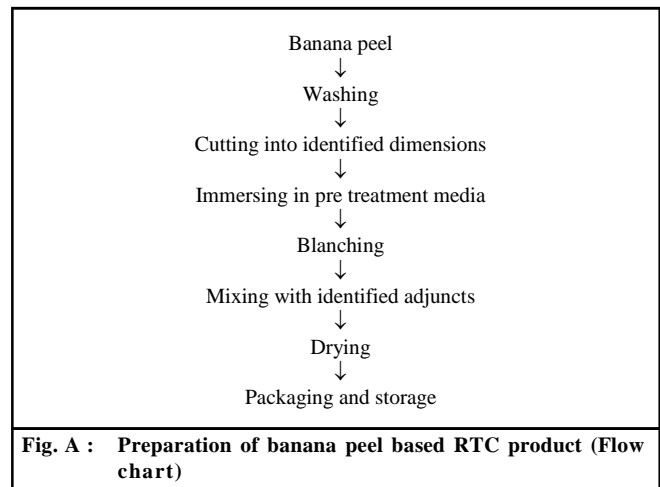
The reconstituted mix was subjected to cooking. Cooking time was evaluated for the mix by members of the sensory panel.

Sr. No.	Treatments	Time (min)
1.	T ₁	5
2.	T ₂	7
3.	T ₃	9
4.	T ₄	11

Grated coconut and coconut oil are essential ingredients in Kerala cuisine. Since they are perishable ingredients they were not included in the RTC mixes. So the amount of coconut and oil to be added at the consumer level was evaluated. Hundred gm grated coconut and 15 g coconut oil were added into RTC mix and subjected to organoleptic evaluation. The cooked weight of the product was noted.

Shelf-life study :

The shelf-life of the developed product was evaluated at monthly intervals upto 3 months in terms of moisture, microbial profile and sensory attributes.



OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Standardization of dimension of slices :

Cutting the vegetables into uniform slices will improve its appearance and consumption. It is important that all of the pieces are about the same size, so that they will dry at the same rate.

The mean rank values of scores allotted by the panel members for overall visual quality was evaluated. The six dimensions were dehydrated and rated by panel members. Overall visual quality (OVQ) scores for dimension of slices of raw material revealed that T₂ scored the highest mean rank value (51.8) and T₆ scored the lowest mean rank value (13.7). Thus T₂ was selected as the best dimensions of raw material (Table 1). The values were found to be significantly different as revealed by the CD value.

Table 1 : Overall visual quality (OVQ) of dimensions of raw material

Sr. No.	Treatments	OVQ Scores
1.	T ₁ (0.5 x 0.5cm)	17.1
2.	T ₂ (1 x 1 cm)	51.8
3.	T ₃ (1.5 x 1.0 cm)	45.3
4.	T ₄ (1.5 x 1.5 cm)	32.2
5.	T ₅ (1.5 x 2 cm)	22.8
6.	T ₆ (2 x 2 cm)	13.7
	C.D. (P=0.05)	22.02

OVQ Scores indicate mean rank values

Standardization of pre –treatment media :

In order to prevent browning and to preserve colour of the banana peel different pre-treatment media comprising of citric acid and salt and their combinations were used before dehydration.

On analyzing the OVQ scores, the treatment T₅ with citric acid and salt was observed to have the highest mean rank score (42.2) from amongst the 5 treatments. This was followed by T₄ with citric acid and salt (31.0). The treatment T₁ (12.2) and T₂ (15.1) recorded the lowest scores, which were also found to be at par (CD=18.07 at 5% level of significance). Hence, T₅ was selected from amongst the 5 treatments as best pre-treatment media for raw material. In other words T₅ retained the colour and appearance of the raw material to the maximum (Table 2).

Table 2 : Overall visual quality (OVQ) of pre treated raw material

Sr. No.	Particulars	OVQ scores
1.	T ₁ (Citric acid 0.1%) +salt (1%)	12.2
2.	T ₂ (Citric acid 0.2%) +salt (1.5%)	15.1
3.	T ₃ (Citric acid 0.3%) +salt (2%)	26.0
4.	T ₄ (Citric acid 0.4%) +salt (2.5%)	31.0
5.	T ₅ (Citric acid 0.5%) +salt (3%)	42.2
	C.D. (P=0.05)	18.07

OVQ scores indicate mean rank values

Standardization of immersion time :

Dipping or briefly soaking produce in salt water solution will help to create appropriate conditions for the growth of micro-organisms that form acids, which will in turn preserve the produce and also improve the colour, odour and taste.

The immersion time of raw material in pre-treated media was set in different time durations such as 5min, 10min, 15min, 20min and 25min. The products were then dehydrated in uniform conditions. On evaluation of OVQ scores, T₂ (10 min) got the highest mean rank score (42.7) and T₅ (25min) got the lowest mean rank score. Values of T₄ and T₅ were found to be par (CD=18.07 at 5% level of significance). Hence T₂ was selected as the optimum time duration for the immersion of raw material (Table 3).

Table 3 : Standardization of immersion time

Sr. No.	Treatments	OVQ Scores
1.	T ₁ (5 mts)	33.6
2.	T ₂ (10 mts)	42.7
3.	T ₃ (15 mts)	23.8
4.	T ₄ (20 mts)	15.1
5.	T ₅ (25 mts)	12.2
	C.D. (P=0.05)	18.07

OVQ Scores indicate mean rank values

Formulations of Ready to cook (RTC) dehydrated product from banana peel :

Ready to cook products are primarily targeted for persons having busy life styles, and those who are convenience seekers and also mobile women. The newly emerging era of fast foods, convenient foods and instant foods are becoming increasingly popular among Indian households (Rajpur, 2007). There is an urgent need to develop low cost ready to cook mixes to improve the nutritional status of our population along with saving time (Solanki, 2000).

In the present study, different combinations of dehydrated RTC products were formulated keeping the banana peel as the major ingredient and varying the amounts and proportions of adjuncts used. A Sensory panel evaluated the various formulations with respect to the five parameters namely, appearance, colour, texture, flavour, taste and overall acceptability. The analysed data is presented in the Table 4.

Appearance :

The appearance parameter increases the appeal of

Table 4 : Sensory quality of the RTC mix

Treatments	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
S ₁	40.1	40.5	39.7	38.0	37.8	38.4
S ₂	24.0	23.0	27.7	25.5	26.7	25.5
S ₃	21.8	23.0	20.5	23.0	22.4	23.5
S ₄	21.8	25.5	22.9	20.5	22.3	19.0
S ₅	19.7	18.7	16.7	20.5	20.3	21.2
K value	24.83	22.61	24.22	20.82	16.39	17.50
C.D. (P=0.05)				18.07		

Scores indicated are mean rank values

a product. Among the RTC curry mixes the formulation S₁ obtained significantly higher mean rank value (40.1) for appearance. This formulation comprised of banana peel, crushed red chilly, garlic, Tumeric powder and curry leaves. While formulation S₅ got the lowest mean rank value (19.7). Hence, the combination S₁ was selected as the best. The mean rank values obtained were found to be significantly different.

Colour :

Colour is another important parameter for the consumer acceptance of any food product. If the colour is unattractive, a potential consumer may not be impressed by any other attributes. Among the formulations S₁ recorded the highest mean rank score of 40.5 while S₅ recorded the least mean rank score 18.7⁰. There existed significant difference between S₁ and S₅. But the difference between S₂, S₃ and S₄ were at par.

Texture :

Texture is an overall assessment of the sensations of the mouth and hand or it is the sense of touch by hand and mouth, S₁ got the highest mean rank value (38.0) for this attribute and S₅ got the lowest mean rank value (20.5). The difference in these scores were found to be significant. The scores obtained by S₂ and S₃ were on par with regard to this parameter.

Flavour :

Flavour distinguishes one food from another, therefore it is considered an important parameter in the acceptance of any food product. The maximum mean rank value for flavour was noted for S₁ (39.7) while least mean rank value (16.7) was obtained for S₅. Data on the mean rank score obtained for flavour of different treatment revealed a significant difference.

Taste :

Consumers generally value food for its taste. In this case mean values revealed that there was a significant difference in the taste of the formulated RTC curry mix. The obtained mean rank values ranged from 20.3-37.8. S₁ gained the highest mean rank value (37.8) and S₅ got the lowest mean rank values (20.3) for this attribute. The scores obtained for S₃ and S₄ and were at par with each other.

Overall acceptability :

Statistical analysis revealed that there was significant difference in this parameter between the formulations developed (between S₁ and S₃). It is noted that S₁ obtained the highest mean rank value (38.4) in overall acceptability than other formulations, second position was of values, S₁ was selected for the further study.

Optimization of reconstitution time of RTC curry mix :

The formulated RTC mix were reconstituted by various treatments. A measured quantity of mix (116g) was soaked in cold water for 10 min, 15min, 20min, 25min and 30min. The reconstitution time was evaluated with respect to OVQ scores of the product for appearance. When the scores of the product for appearance. When

Table 5 : Overall visual quality (OVQ) of reconstituted RTC Curry mix

Sr. No.	Treatments	OVQ Scores
1.	T ₁ (10 mts)	12.9
2.	T ₂ (15 mts)	25.8
3.	T ₃ (20 mts)	43.0
4.	T ₄ (25 mts)	27.9
5.	T ₅ (30 mts)	17.8
	C.D. (P=0.05)	18.07

OVQ scores-indicate mean rank values

the scores of OVQ were analysed, treatment T₃ was found to be get the highest mean rank value (43.0) and T₁ got lowest mean rank score (12.9). The difference among the scores were found to be significant. It ranged from 12.9-43.0. Therefore T₃ was selected as the optimum time duration for the reconstitution of RTC curry mix (Table 5).

Optimization of cooking time of dehydrated RTC mix :

Optimization of cooking time of dehydrated mix is also an important information to be conveyed at the consumer level. Formulation 1 comprising of banana peel, crushed red chilly, garlic, cumin, turmeric powder and curry leaves were cooked at various durations of time (5 min -11 min). The product was evaluated on the basis of OVQ scores of the 10 panel members.

The mean rank values ranged from 10.2-32.2. T₂ was found to be give the highest mean rank value (32.2) and T₁ got lowest mean rank value (10.2). These scores were found to be significantly different (CD=13.79 at 5% level of significance). Thus for different treatments, T₂ was found to be the optimum cooking time for RTC curry mix.

Moisture content of the stored product :

The initial moisture content of the product was 5.4 per cent and at the end of the first month, it became 5.6%; at the end of second month moisture content did not show any difference, but at the end of third month, there was a slight increase to 5.8% (CD =0.16 at 5% level of significance)

Sensory qualities during storage :

Results indicated that the highest mean rank score of overall acceptability of curry mix was found for the fresh product(29.6), followed by the first and second month(27.7 and 25.4, respectively).Lowest mean rank score was obtained in the third month (24.2) (CD=13.79 at 55 level of significance)

Microbial profile of the stored product :

During the period of storage no bacterial colonies were found to appear in the packed RTC curry mixes

Conclusion :

The Ready to cook curry mix was adjudged to be with good sensory quality and shelf-life. The present technology can be imparted to self help groups after scaling up. This would be a major breakthrough to harness the potentials of banana peel.

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LITERATURE CITED

- Emaga, T., Robert, C., Ronkart, S.N., Wathelet, B. and Paquot, M. (2007).** Dietary fibre components and pectin chemical features of peels during ripening in banana and plantain varieties. *J. Biotech.*, **99** : 4346-4354.
- Joseph, G., Angersbach, A. and Knorr, D. (2001).** Effects of pretreatments on the diffusion kinetics and some quality parameters of osmotically dehydrated apple slices. *J. Agric. Food Chem.*, **49**: 2804-2811.
- Liaqat, P., Khan, M.N. and Mohammad, F. (2009).** Consumer acceptance of standardized mixed/composite foods for optimal accuracy in nutrient estimation. *Pakistan J. Nutr.*, **8**(8):1301-1303.
- Nguyen, T., Keta, S. and Vandoorn, W.G. (2003).** Relationship between browning and the activities of polyphenol oxidize and phenyl alaine ammonialase in banana peel during low temperature storing. *J. Food Technol.*, **30**(2):187-193.
- Rajpur, R. (2007).** Vegetable and disease prevention. *J. Clin. Nutr.*, **10**:145-149.
- Solanki, S. (2000).** Formulation and shelf-life study of malted ready to eat mixes. *Indian J.Nutr. Dietet.*, **23** : 35-39.

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