



## Shelf life of Jack Fruit Based Ready -To - Cook (RTC) Instant Mixes

### KEYWORDS

Shelf stability,moisture,microbial evaluation, sensory evaluation,PE and laminate pouches

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### ABSTRACT

Jack fruit tree is a part of almost all homesteads of Kerala. However its potentials are not utilised owing to its morphological peculiarities. The Koozha type of jackfruit was selected for this study, because of its less popularity compared to Varikka. Three popular raw jack fruit based dishes of Kerala 'namely' Avial', 'Koottu' and 'Olath' were standardized as Ready to cook products (RTC products), after preliminary treatments and dehydration. The rehydration requirements and cooking time were standardised. The 3 ready to cook curry mixes were packed in PE and laminate pouches and tested for shelf stability for 3 months. The sensory evaluation and physico chemical analyses revealed acceptable results. The sensory qualities, changes in the moisture content and microbial profile were assessed. The organoleptic evaluation showed that among the two packaging materials laminate pouches retained the quality of the products better. The moisture content was found to increase after each month. The moisture content was highest for Avial mix packed in PE and laminate pouches and lowest for Koottu mix packed in laminate and PE pouches during the storage period. The microbial evaluation of the developed RTC mixes did not show any bacterial growth during three months of storage. Yeast growth was found to be observed in Koottu mix packed in PE pouches in negligible amounts.

### INTRODUCTION

In Kerala, though jackfruit is not cultivated intentionally, it grows widely in many parts of the state and it is common knowledge that a significant portion of the production goes waste due to many reasons. Invariably the production season coincides with monsoon, making the fruits unacceptable in taste. Besides, difficulties in harvesting, extracting the edible ripe fruit making the hand sticky, attraction of flies are some of the main reasons constraining its wide scale use.

. Though a variety of products have been made from jackfruit, its consumption has decreased over the years. This is mainly due to its cumbersome handling procedures, which is making it unpopular even in rural areas. In this context, developing convenient ready to cook (RTC) products with this ethnic fruit maintaining all its sensory qualities would be of tremendous value for urban as well as rural housewives. Moreover, for the Malayalees staying away from Kerala in particular, jackfruit means nostalgia. Therefore, there is ample scope for marketing such RTC jack fruit based products to these migrated population. Such an effort would cater to the needs of such Malayalees and also to the larger population who crave for variety. Therefore, Ready to cook curry mixes were developed from raw jackfruit, which was acceptable in quality. This study envisages the shelf life study of these developed products

### MATERIALS AND METHODS

The standardized dehydrated Avial, Koottu and Olath were stored in PE and laminated pouches in ambient conditions and shelf life was assessed in periodic intervals (monthly) for 3 months. The Avial, Koottu and Olath mixes were formulated and selected on the basis of sensory evaluation by 10 members panel using a five point scale. The identified Avial mix comprised of jack fruit bulbs and seeds, green chilly, garlic, jeera, turmeric powder and curry leaves. Similarly Koottu mix comprised of jack fruit bulbs and seeds, red chilly, turmeric powder, cumin and curry leaves. Olath mixes comprised of jack fruit bulbs and seeds, crushed red chilly, onion, garlic, turmeric powder and curry leaves.

The shelf life of the three developed products were evaluated in terms of sensory attributes, moisture and microbial profile (T0, T1, T2 and T3).

### SENSORY ATTRIBUTES

Sensory quality evaluation plays an important role in acceptability of a new product. Sensory characteristics like appearance, colour, flavor, texture, taste and overall acceptability of the RTC Avial, Koottu and Olath mixes were assessed by a panel of judges using a five point scale.

### MOISTURE

Moisture content of the dehydrated food material is an important factor which affect the stability of the food. So it is necessary to control the moisture to a level where microorganisms may not be able to grow and spoil the product.

### MICROBIAL PROFILE

The stored product samples were assessed for the presence of various micro-organisms viz., bacteria, fungi and yeast at monthly intervals up to three months. The serial dilution of the samples followed by pour plating was employed to estimate the population of viable microorganisms in developed products



Avial mix



Koottu mix



Olath mix

## RESULTS AND DISCUSSION

Shelf life is the recommendation of time that products can be stored, during which the defined quality of a specified proportion of the goods remains acceptable under expected conditions of distribution, storage and display (Azanha and Faria, 2005). The factors like raw material quality, storage temperature, storage containers, procedures employed and the environment in which it is processed affects the shelf life quality (Shankar, 1993).

The shelf life quality of the developed RTC mixes were analysed by assessing the sensory parameters, moisture content and microbial profile for three months at monthly intervals.

### SENSORY EVALUATION OF DEVELOPED RTC MIXES

Organoleptic evaluation plays an important role in determining the acceptability and shelf stability of food products. Table 1&2. shows the sensory evaluation of developed RTC mixes before packing and after three months of packaging.

### APPEARANCE OF MIXES

In the initial analysis of the two types packaging the mean rank values for appearance were found to be on par.

After one month the scores were higher for laminate pouches 21.55,21.60 and 21.55 for Avial, Koottu and Olath mixes respectively. The scores for mixes were however on par among the mixes. Similar trends were seen after two months. The

scores for mixes in PE pouches were lower (19.45,19.10 and 19.20 for Avial, Koottu and Olath mixes respectively).

After three months the scores were again higher for mixes packed in laminate pouches but there was no significant difference among the mixes among the treatments (CV = 10.24).

### COLOUR OF THE RTC MIXES

Initially the scores for colour in the two types of packagings were found to be on par, as evident in the table 1&2 After a month the scores were higher for mixes in laminate pouches. When the mean rank value of Avial mix in laminate pouches was 22.50, the value was 20.50 for the mix in PE pouches. However this difference was not marked in Koottu and Olath mixes. After second month the difference in scores for colour were markedly higher for mixes packed in laminate pouches, being 21.40, 21.30 and 21.20 for Avial, Koottu and Olath mixes respectively. After the third month, the scores remained higher for RTC mixes in laminate pouches. When the mean rank value for the Avial mix was 20.60, it was only 17.60 for those packed in PE pouches. For Koottu mix, mean rank value was 20.55 for laminated packed mixes while it was 17.80 for those in PE pouches. Similarly for Olath mix, the mean rank values were 20.65 and 17.90 respectively for mixes in laminate and PE pouches.

### TEXTURE OF THE RTC MIXES

Change in texture through out the storage period was observed at monthly interval in the two types of packagings. Initial mean rank values were on par in both types of packagings for all the three types of mixes. However the scores were high after one month of storage for mixes in laminate pouches 22.10, 22.10 and 22.40 for Avial, Koottu and Olath mixes respectively. Similar was the case after two months and three months. The difference in scores increased by three months. However the values were on par among the mixes.

### FLAVOUR OF THE RTC MIXES

Flavour changes along the storage period were analysed. The values were on par initially in both treatments. But higher values were found for mixes in laminate pouches after one month. This difference continued in the second and third months analyses. When the mean rank values for Avial mix after third month was 20.80 (in laminate pouches) it was found to be 18.30 for those in PE pouches. For Koottu mix the respective values were 20.90 and 18.40 respectively, while for Olath mixes, the values were 20.70 and 18.50 respectively.

### TASTE OF THE RTC MIXES

Taste of the mixes were also evaluated after cooking in periodic intervals. This parameter too showed similar trends. The values did not vary initially among the treatments, but started varying from the first month. The difference in mean rank values increased over time. For instance, the difference in values among

Table 1. Sensory evaluation of developed RTC mixes packed in Laminated pouches

Products	Mean Rank Values											
	Appearance				Colour				Texture			
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Avial mix	22.50	21.55	21.95	20.35	22.50	22.50	21.40	20.60	22.55	22.10	21.95	20.55
Koottu mix	22.40	21.60	21.80	20.00	22.60	20.50	21.30	20.55	22.55	22.10	21.80	20.40
Olath mix	22.50	21.55	21.90	20.10	22.50	20.55	21.20	20.65	22.50	20.40	21.90	20.40
CV	10.24											
T <sub>0</sub> – Initial month, T <sub>1</sub> - First month, T <sub>2</sub> – Second month and T <sub>3</sub> – Third month												

Products	Mean Rank Values											
	Flavour				Taste				Overall acceptability			
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Avial mix	22.5	22.25	21.90	20.80	22.50	22.10	21.60	20.90	22.50	22.20	21.40	20.40
Koottu mix	22.0	22.00	21.80	20.90	22.50	22.12	21.50	20.85	22.45	22.15	21.10	20.35
Olath mix	22.0	22.10	21.90	20.70	22.45	22.10	21.55	20.95	22.50	22.15	21.20	20.30
CV	10.24											
T <sub>0</sub> – Initial month, T <sub>1</sub> - First month, T <sub>2</sub> – Second month and T <sub>3</sub> – Third month												

Table 2. Sensory evaluation of developed RTC mixes packed in PE pouches

Products	Mean Rank Values											
	Appearance				Colour				Texture			
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Avial mix	22.50	20.10	19.45	18.10	22.50	20.50	19.30	17.60	22.50	19.95	19.10	18.95
K o o t t u	22.40	20.20	19.10	18.20	22.60	20.40	19.35	17.80	22.50	20.10	19.00	17.95
Olath mix	22.50	20.16	19.20	18.35	22.50	20.35	19.30	17.90	22.50	19.90	19.15	17.90
CV	10.24											
T <sub>0</sub> – Initial month, T <sub>1</sub> - First month, T <sub>2</sub> – Second month and T <sub>3</sub> – Third month												

Products	Mean Rank Values											
	Flavour				Taste				Overall acceptability			
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Avial mix	22.30	20.15	18.95	18.30	22.50	20.20	18.70	17.50	22.50	20.00	19.20	18.45
Koottu mix	22.30	20.10	19.00	18.40	22.50	20.35	18.65	17.50	22.45	20.10	19.15	18.65
Olath mix	22.40	20.10	19.20	18.50	22.45	20.25	18.60	17.55	22.50	20.20	19.20	18.40
CV	10.24											
T <sub>0</sub> – Initial month, T <sub>1</sub> - First month, T <sub>2</sub> – Second month and T <sub>3</sub> – Third month												

treatments for Avial mix was 2.8 in PE pouches, while it was only 1.6 in laminate pouches by third month. Similar was the trend in other mixes also.

#### OVERALL ACCEPTABILITY OF THE RTC MIXES

As for the major parameters namely overall acceptability, the values were on par among treatments initially, but the difference increased in favour of laminate pouches by the third month. The difference in values more marked in PE packing than laminate pouches. For Koottu mix the difference in values were 2.10 in laminate packing, while it was 2.80 in PE packing. The same difference was noted in the other mixes also.

#### MOISTURE CONTENT OF STORED PRODUCTS

Moisture content is one of the most commonly measured properties of food materials. Knowledge of the moisture content is often necessary to predict the behaviour of foods during processing. The moisture content of the developed products packed in laminate and PE pouches were analysed. The comparison of products from both types of packaging were conducted periodically for three months and the data is shown in Table 3.

The data reveals that initially the moisture content of developed products packed in PE pouches varied from 5.44 – 6.08 per cent. The highest moisture content was recorded for Avial mix (6.08 per cent) and the lowest was observed for Koottu mix (5.28 per cent) packed in PE pouches, whereas the moisture content of the developed RTC mixes packed in laminate pouches ranged from 5.38 – 6.18 per cent during the initial period of storage. The highest moisture content was observed for Avial mix (6.18 per cent) and the lowest was recorded for

Koottu mix (5.38 per cent). Initially the moisture content of developed RTC mixes packed in PE pouches were on par with RTC mixes packed in laminate pouches.

Table 3 further indicates the moisture content of developed RTC mixes during storage periods. At the end of first month the moisture content of developed RTC mixes packed in PE pouches and stored at ambient condition ranged from 5.41 – 6.22 per cent. The highest moisture content was noted for Avial mix (6.22 per cent) and lowest was noted for Koottu mix (5.41 per cent). The moisture content of developed RTC mixes packed in laminate pouches varied from 5.40 – 6.20 per cent. Avial mix recorded highest moisture content (6.20 per cent) followed by Olath mix (5.56 per cent) and the lowest was noted for Koottu mix (5.40 per cent). Higher moisture content was recorded in the RTC mixes packed in PE pouches.

During the end of second month in PE packaging the moisture content ranged from 5.46 – 6.24 per cent. The highest moisture content was observed in Avial mix (6.24 per cent) and lowest was recorded for Koottu mix (5.46 per cent) packed in PE pouches. The RTC mixes packed in laminate pouches varied from 5.41 – 6.22 per cent. The lower moisture content was recorded in RTC mixes packed in laminate pouches.

At the end of the third month the moisture content ranged between 5.53 – 6.44 per cent packed in PE pouches. Highest moisture content was noted for Avial mix (6.44 per cent) and lowest was recorded for Koottu mix (5.53 per cent). The moisture content of RTC mixes packed in laminate pouches ranged from 5.45 – 6.25 per cent.

When the mixes packed in PE pouches were analysed, the moisture content of Avial mix was 6.08 per cent at the time of packing and increased up to 6.44 per cent after three months. In the case of laminate pouches the moisture content of Avial

increased from 6.18-6.25 per cent within a period of 3 months. In the case of Koottu mix packed in PE pouches the moisture content increased from 5.28 to 5.53 per cent. While in Koottu mix packed in laminate pouches the moisture content increased from 5.38-5.45 per cent.

As for Olath mix, the moisture content increased from 5.44-5.67 per cent packed in PE pouches and for Olath mix packed in laminate pouches ranged from 5.54-5.63 per cent. The data shows that the moisture content was higher in RTC mixes packed in PE pouches as compared to laminate pouches, although the difference was not statistically significant.

**Table3. Moisture content (%) of RTC mixes packed in laminate and PE pouches**

RTC mixes	PE package				Laminate pouches			
	Initial	First month	Second month	Third month	Initial	First month	Second month	Third month
Avial	6.08	6.22	6.24	6.44	6.18	6.20	6.22	6.25
Koottu	5.28	5.41	5.46	5.53	5.38	5.40	5.41	5.45
Olath	5.44	5.57	5.61	5.67	5.54	5.56	5.57	5.63
SE	0.020	0.024	0.025	0.098	0.020	0.021	0.023	0.019
CD (0.05)	0.062	0.074	0.078	0.303	0.062	0.065	0.072	0.061

### MICROBIAL PROFILE OF RTC MIXES

Analysis of microbial population in developed food products is important as it determines the quality and safety of food products. The microbiological safety of food is achieved by ensuring the absence of pathogenic microorganisms and as far as possible through preventing their multiplication by all possible means (Beckers, 1988). Microbial analyses of stored products were done to ascertain the shelf life of the products. The products were stored in ambient conditions for three months. The microbial evaluation was done initially and at 30 days intervals up to 3 months. The growth of bacteria, fungi, actinomycetes and E-coli were determined using Nutrient Agar (NA), Potato Dextrose Agar with Rose Bengal (PDARB), Ken Knight's Agar (KEN) and Eosin Methylene Blue (EMB). The evaluation was done by serial dilution of the samples followed by pour plating techniques suggested by Johnson and Curl (1972).

During the storage period no bacterial colonies were found to appear in the developed RTC mixes packed in PE and laminated pouches. But Yeast colonies were seen in negligible amounts in PE packaging. Even though yeast was detected in Koottu mix packed in PE pouches during third month, it was within permissible limits (FSSAI limit for dehydrated products is not more than 40,000 cfu/g). No other pathogenic organisms could be detected in the developed products.

Thus all the products were found to be acceptable in storage stability with respect to change in moisture levels, microbial profile and sensory parameters. This indicates its scope for further scaling up for commercialisation

### CONCLUSION

There is scope for marketing these RTC products to keralites living outside India, as well as to residents in the state when the fruit is out of season

### FUTURE SCOPE

A scaling up to mechanise the production can make the commercialisation more viable

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### REFERENCES

1. Azanha, A.B. and Faria, M. (2005) Use of mathematical models for estimating the shelf life cornflakes in flexible packaging. *J. Packaging Technol. Sci.* 18(4): 161-222
2. Beckers, H. J. (1988) Microbiology and food hygiene in mass catering. *Cater Health.* 10(1): 3-5 Johnson, L. F. and Curl, E.A. (1972) *Methods for Research on the Ecology of Soil Borne Plant Pathogens.* Burgess publishing company, New York, 133p
4. Shankar, C. (1993) Microbial standard of processed foods and rapid methods of microbial quality assurance. *Proceedings of the third international food convention.* 20-23.
5. Shankar, G. (2000) Role of moisture, temperature and humidity during storage of food grains... In: Gopal, G., Seth, P., and Rathore, J. S. (ed.), *Proceeding of the Third International Food Convention, 20-23 October 2000, Central Food Technology Research Institute, Mysore.* pp11-16.