Development of Ambient Stable Retort Pouch Processed Ramasseri Idli

Krishnaprabha, K.P. Sudheer, N. Ranasalva, S. Rajani, P.R. Rohitha

Abstract: Development retort pouch packaged Ramasseri idli was undertaken with specific objectives of standardisation of thermal process in retort pouch package, shelf life study and quality evaluation. The Ramasseri idli, an indigenous cereal-legume based food of south India, was procured and packaged in retort pouches with one idli in each pouch. The idlis were pasteurized at different time temperature combinations to achieve desired F_0 values ($110^\bullet C$ for $F_0=3$ min, $110^\bullet C$ for $F_0=6$ min $100^\bullet C$ for $F_0=3$ min, $110^\bullet C$ for $F_0=6$ min). After thermal processing the pouches were stored for shelf life studies under ambient storage ($28^\bullet C$) and refrigerated storage ($7^\bullet C$). The processed product was analysed for microbial and physico-chemical qualities viz; moisture content, pH, water activity, colour and texture using standard procedure at regular intervals. Based on physico-chemical characteristics and sensory evaluation, the thermal processed Ramasseri idli at $100^\bullet C$ for $F_0=6$ min and stored under refrigeration showed best results up to three week of storage among the four treatments. The microbial analysis also showed that the product was safe up to 3 weeks of storage.

Keywords: *Ramasseri idli, chutney powder, Retort pouch processing, F_0 value, D value, RTE foods*

I. INTRODUCTION

Cultural and traditional food shows greater variations in their ingredients and method of preparation and connect to past of a particular region [8]. The Ramasseri idli is a traditional breakfast cuisine available exclusively on Ramasseri village of Palakkad, Kerala. It is a fermented steamed food that is rich source of carbohydrates and proteins (rice and urad dhal being major constituents). The Ramasseri idli has a soft, moist texture having salty taste with a hint of sourness. These idlis were steamed cakes made in stakes of idli plates. The peculiarity of Ramasseri idli over common idlis available in different parts of south India are its shape and soft texture and

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the traditional method of preparation using steam cooking in unglazed clay pots. The idli can be served together with side dishes *viz., chutney* and *sambar* to enhance its taste or with the chutney powder which have its own epic taste.Several issues like obesity, diabetes, high cholesterol, heart problems *etc*. had been attributed to the increased consumption of fast food and ready to eat fried food items. This caught the attention of people towards traditional RTE foods that could be both nutritious and time saving. Fresh Ramasseri idli have a shelf life of one day, due to highly perishable nature which necessitate the need for an adequate technology to convert it as a ready to eat product having increased shelf life that make it suitable for marketing and exporting.Thermal processing is one of the preservation techniques extensively used in food processing industries to extend shelf-life of perishable foods by subjecting them to extreme temperature of 121° C to kill microorganisms present in food [6]. Retort pouch processing is recent and advanced commercial thermal processing technique where food sample are kept in flexible retort pouches subjecting to higher temperature and pressure in a closed chamber. Retort pouch packaging system is a flexible, multilayered and laminated package made as an alternative to metal cans that can withstand high processing temperatures for producing thermally processed shelf stable foods [7].Thermal processing involves treatment of food products at higher temperature (121° C) by application of extreme heat through steam or water at higher pressure (15 lbs). Food when subjected to higher temperature and pressure can kill all micro organisms including spore formers but, will result in nutritional and sensory losses. The procured fresh Ramasseri idli can be packaged with one or two idli with in a pouch together with chutney powder filled in LDPE pouches. Retort pouch processed Ramasseri idli will provide an ethnic RTE food that can be revived into its fresh form by just steaming the product for less than a minute. Owing to immense marketing and exporting potential with in the country, a study on 'Development of retort pouch processed Ramasseri idli' will provide a new dimension for food processing and packaging industries over India.

II. MATERIALS AND METHODS

A. Sample preparation

Prepared Ramasseri idli were procured from Ramasseri village, near Palakkad, India. It was brought as fresh and packaged manually in retort pouches with dimension 15 cm × 20 cm with one idli and 5 g LDPE packaged chutney powder in a single retort pouch.

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The sealing of pouches were done using hydraulic sealing machine at a pressure of 100 KPa and voltage of 38 V with sealing and cooling time set as 6 s and 15 s respectively. After loading into retort chamber, one of the pouches was fixed with thermocouple sensor for recording core temperature and the other probe to measure retort temperature.

B. Retort pouch processing

Retort pouch processing was done in the lab scale steam water spray retort machine in the food processing lab of FAPE department under centre of Excellence in post harvest technology (KCAET, Tavanur). The different F value-temperature combinations selected for the standardization of Ramasseri idli are shown in Table 1. The current temperatures were taken as 100°C and 110°C and measured during processing using copper constantan thermo couples, one inserted at geometric centre of the retort pouch filled with the food product and other to measure the retort temperature. The optimization of suitable time temperature combination was determined using Valsuite software (Ellab, Denmark) which is used for calculating F_0 value. After thermal processing in retort chamber, the hermetically sealed pouches were surface dried and stored for shelf life studies at ambient temperature as well as refrigerated conditions.

C. Estimation of Physico-chemical characteristics

a. Moisture content

The moisture content of raw and processed Ramasseri idli was determined by using hot air oven method [9] - [11].

b. Water activity

Water activity refers to the unbound water, which can support the growth of microorganism. The water activity of sample was measured by using water activity meter (M/s. Aqua Lab, U.S.A; model: Series 3TE).

c. pH

pH of raw and processed food samples was measured using Systronic digital pH meter during product development and shelf life study [12].

d. Colour characteristics

Hunter Lab color flex meter was used for the measurement of colour. The system provides reading in terms of L*, a*, and b* values.

e. Texture profile analysis (TPA)

Textural properties (firmness) of the samples were analysed by using textural analyser (stable micro systems texture analyser (UK)), which had a microprocessor regulated texture analysis system connected to a personal computer. Textural analyser provides a three - dimensional product analysis by measuring force, distance and time. The analysis was conducted by placing a piece of Ramasseri idli in a flat platform of textual analyser and was subjected to compression by the probe having 5 mm diameter. The test was conducted at the pretest speed of 0.5 ms^{-1}, test speed of 1 ms^{-1} and post test speed of 10 ms^{-1} [9], [10].

D. Microbiological Analysis

Microbiological analysis was done to analyse the presence of microbes which may cause deterioration of the product during storage. It involves detection of bacteria, yeast and fungi *etc*. Microbiological analysis was performed for the quantification and identification of microorganisms. Standard Plate Count Method was performed by using Nutrient agar as media for microbial analysis of bacterial culture [5].

E. Sensory Analysis

5-point Hedonic sensory scale was used for sensory evaluation of Ramasseri idli stored at ambient and refrigerated condition. The sensory evaluation was conducted among semi trained panelists of sample size 30 after training sessions to make them familiar with quality attributes and scaling procedures.

F. Storage Studies

The thermally processed Ramasseri idli in retort pouches were stored for three weeks and shelf life studies were conducted. The pouches were stored in ambient condition (37°C) and in refrigerated condition (7°C). The idli was tested in every one week for moisture content, water activity, pH, firmness, colour, microbiological analysis and sensory evaluation up to three weeks. Final analysis was done after three weeks of storage.

G. Statistical Analysis

The statistical analysis of the results was performed using SPSS software version 20 (SPSS Inc., Chicago, USA). ANOVA was performed to analyze the data and means were separated by applying Duncan's multiple range test with 5% level of significance (95 % confidence level). The results are collected and analyzed for triplicates and expressed as mean with standard deviations [8]- [14].

III. RESULT AND DISCUSSION

The results of experiments conducted to optimise thermally processed Ramasseri idli and storage studies of processed Ramasseri idli stored at refrigerated and ambient conditions were discussed in the following headings.

A. Optimization of thermal processing

The time required for thermal processing of retort pouched Ramasseri idli at pasteurization temperature of 100°C and 110°C for F_0 value 3 and 6 was determined. Based on the Ball's formula and heat penetration curve, the total process time for pasteurization at 100°C to reach F_0 Value 3 and 6 were 41 min and 55 min, respectively. Similarly the total process time for pasteurization at 110°C to reach F_0 value 1 and 2 were 55 min and 63 min, respectively. The come up time for pasteurization temperature of 100°C and 110°C for F_0 value 3 and 6 were approximately 10 min were as holding time varied according to desired F_0 values. The heat penetration curve thus obtained comprising of time temperature data at 100°C for F_0 value= 3 min was plotted in a semi log paper as shown in Fig 1.

Table- 1: Standardisation of time-temperature combinations for thermal processing of Ramasseri idli

Sample	Treatment	Total processing time (min)
T-1	Pasteurized at 100°C for F_0 3 stored at refrigerated condition	41
T-2	Pasteurized at 100°C for F_0 6 stored at ambient condition	55

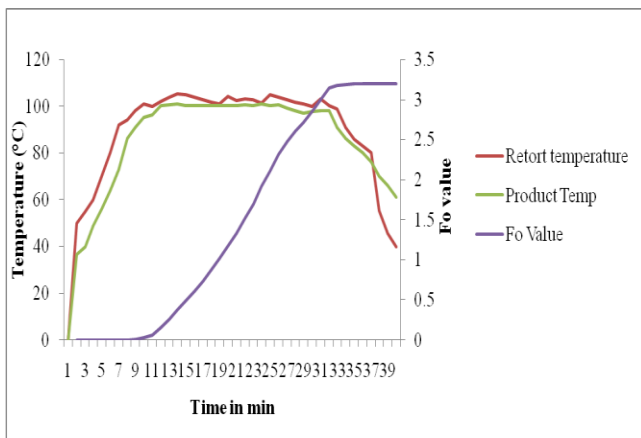| T-3	Pasteurized at 110°C for F_0 3 stored at refrigerated condition	51
T-4	Pasteurized at 110°C for F_0 6 stored at ambient condition	63

Fig. 1. Heat penetration characteristics for pasteurization (100^{0}C F value= 3 min)

B. Physico- chemical characteristics

The moisture content of all four treatments of retort packaged Ramasseri idli does not varied significantly after thermal processing even though a slight reduction of moisture content was observed during storage for all treatments which was not varying significantly from initial readings.There was a significant reduction in pH of Ramasseri idli during storage period. The reduction in pH was more pronounced in ambient storage than in refrigerated storage condition. The values obtained after four weeks of storage in refrigerated and ambient conditions for following treatments T1, T2, T3, and T4 were in the range from 4.7 to 4.3. The pH of food product has a direct relationship with temperature as the pH was found to reduce with increase in temperature of during thermal processing. Similar results were also observed during storage of retort processed meat products. The higher temperature results in increased rate of protein break down that resulted in liberation of free amino acid during storage thereby reducing pH of the food product [4], [13], [8].

The water activity of the food sample reduced from 0.8725 to 0.667 after thermal processing. The water activity of processed Ramasseri idli showed an increasing trend with storage period. The result was more pronounced in ambient sample than refrigerated sample.

Table- 2. Physico-chemical properties of unprocessed and thermally processed Ramasseri idli

Physico-chemical characteristics		Results	
		Unprocessed	**Processed**
Chemical characteristics			
Moisture%(wb)		69.9±0.02	68.9±0.05
pH		5.03±0.01	4.9±0.03
Water activity		0.8725±0.06	0.667±0.09
Physical characteristics			
Colour	L^*	76.183±0.04	77.183±0.03
	a^*	0.077±0.01	0.167±0.01
	b^*	11.12±0.06	12.12±0.02

Texture	Firmness(N)	1.175±0.09	1.075±0.07
Microbiological analysis			
Microbiological load ($x10^3$cfu/ml)		6±0.03	Nil

Thermal processing and pH affects the colour properties of food. It was observed that the L* value of the samples increased significantly with storage period. It could be seen that with a drop in pH value below 4.5, the L* value of the sample got increased. This significant change can be a result of protein denaturation and coagulation during thermal processing and higher acidity. Similar results on lightness index were reported by [3], [1], [2]. It was observed that storage of the samples resulted in slight increase of the redness. The increase in a* value was higher at ambient storage than at refrigerated storage for all treatments. It was observed that there was an increase in b* value for both ambient and refrigerated stored Ramasseri idli during storage which was not significantly varying from initial readings. The firmness values of Ramasseri idli showed a significant difference before and after processing. The firmness values also varied within treatments. Higher processing temperature and time resulted in significant reduction in firmness value. During storage studies, Refrigerated sample showed more pronounced increase as compared to the ambient sample though there was only negligible increase in firmness. Retort processed Ramasseri idli was examined for its microbiological load at regular intervals of one week and it was observed that no total plate counts (colony forming units) were found except for T1 (Ramasseri idli processed for 100 C for F= 3 min) which had colony growth beyond permissible limit after four weeks of storage. The results revealed that all the thermally processed samples under ambient and refrigerated storage were microbiologically safe for a storage period of three weeks.

b. Sensory Evaluation

After four weeks of storage, sensory evaluation of various parameters such as colour, taste, texture and overall acceptability were conducted. From the observations, the sensory scores for all the treatments were found to be unacceptable for consumption after four weeks of storage. Fig 6 depicts the results of sensory evaluation of retort processed Ramasseri idli after three weeks of storage. From the Fig 2, it was understood that the treatment T2 pasteurised at 100°C for F value of 3 min and stored at refrigerated condition was the best among all treatments.

IV. CONCLUSION

Based on above results it is concluded that the retort pouch processing is an ideal method of preserving Ramasseri idli for long period of storage. It is found from the experiment that the product can be stored for 3 weeks without microbial contamination and deterioration in product quality in terms of physico-chemical characteristics. The best thermal processing method for retort pouched product is found to be 100^{0}C for F value of 6 min at refrigerated storage (RS), since the values obtained from physico-chemical, microbiological and sensory analysis of the above sample were not significantly varying from the control sample.
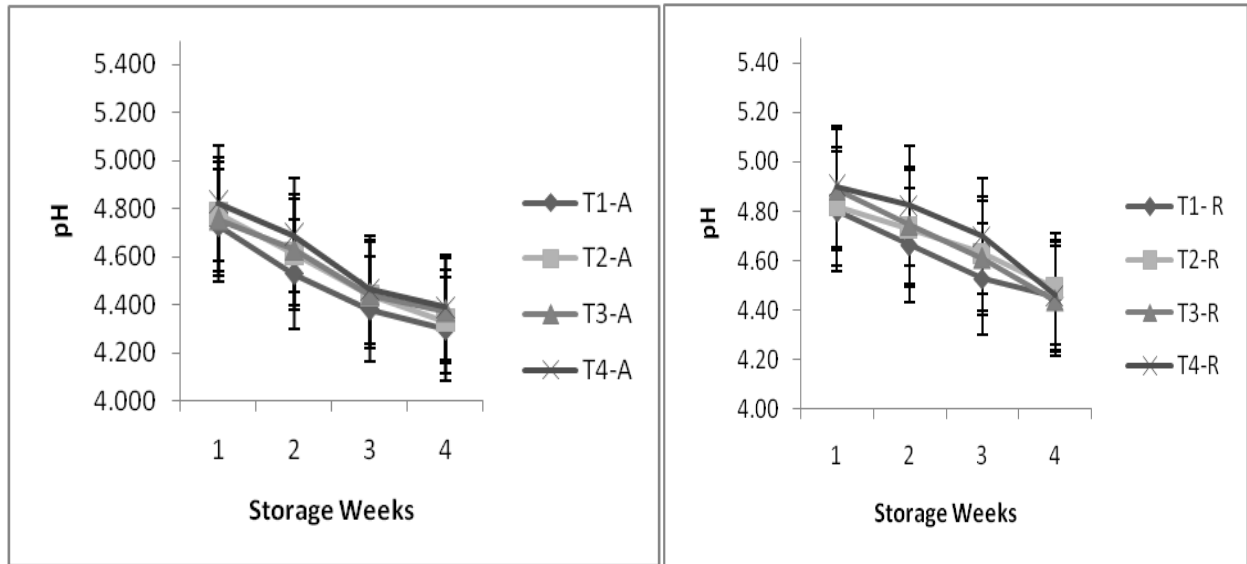
Fig 2. Effect of storage period and thermal processing on pH of Ramasseri idli (A- Ambient; R- Refrigerated)
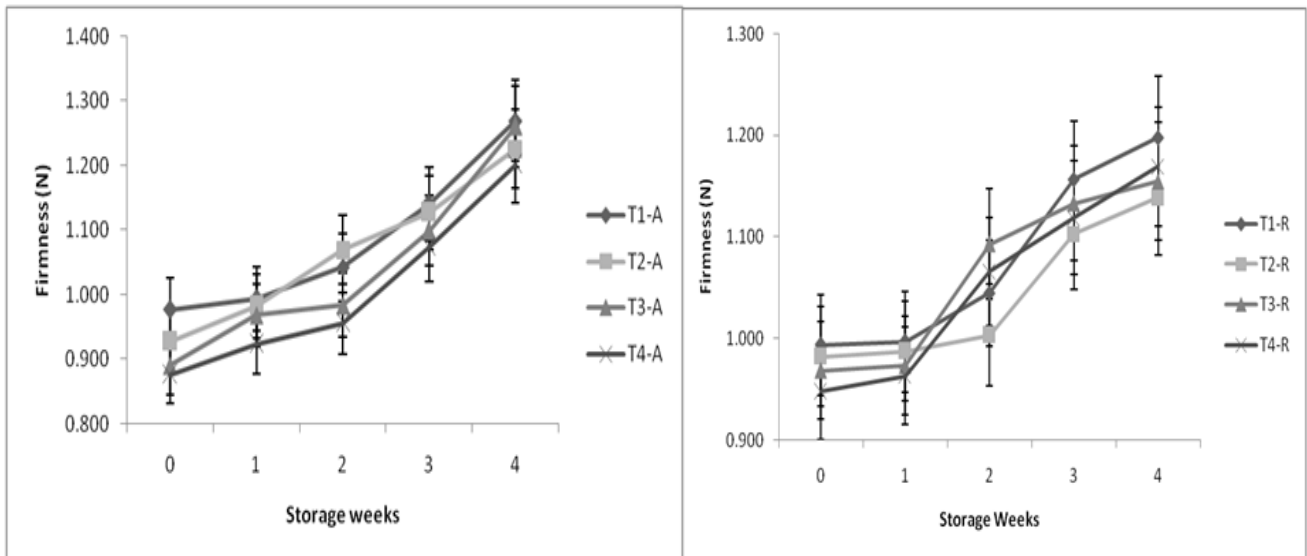

Fig 3. Effect of storage period and thermal processing on texture property (firmness) of Ramasseri idli (A- Ambient; R- Refrigerated)
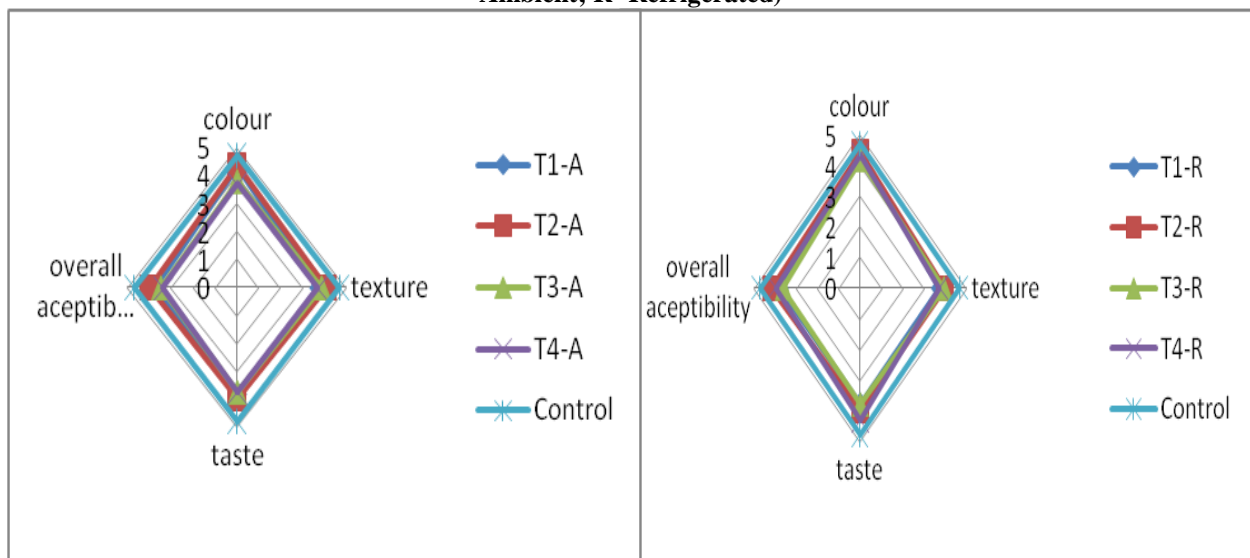

Fig 3. Sensory score values of thermally processed Ramasseri idli during Ambient and Refrigerated storage

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