The Pharma Innovation Journal 2021; 10(11): 264-268

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 264-268

www.thepharmajournal.com
Received: 17-08-2021
Accepted: 30-10-2021

Harshit K Prajapati
School of Sensory Science, National Institute of Food Technology Entrepreneurship and Management, Thanjavur, Tamil Nadu, India

Chandrasekar V
School of Sensory Science, National Institute of Food Technology Entrepreneurship and Management, Thanjavur, Tamil Nadu, India

Corresponding Author:
Chandrasekar V
School of Sensory Science, National Institute of Food Technology Entrepreneurship and Management, Thanjavur, Tamil Nadu, India

Evaluation of shelf-life and quality attributes of retort processed Drumstick pulp curry

Harshit K Prajapati and Chandrasekar V

Abstract
Ready to eat (RTE) food products have attained popularity during recent decades, pawed away for this research on retort processed drumstick pulp curry. Drumstick pulp being underutilized in the case of processed food has been taken as a major criterion for the research since it possesses numerous health benefits. Fresh drumstick was purchased washes, peeled and then pulp was removed and added with spices to produce drumstick curry followed by retort processing and packaging (four-layer laminated pouch). The processing parameter such as time, temperature profile, based on heat diffusion characteristics, F_0 value and the microbiological assay was performed. The results of the thermal processing parameter, based on heat diffusion characteristics were retort processing temperature of 121 °C, heating rate index (17.3 min), process time (20 min), and F_0 value were 6. The microbial assay was performed for a period of 3 months using the serial dilution method (pour plate) and found that the retort processing had a significant reduction in microbial load (yeast and mold) at $P< 0.05$. The fact that retort processed ready-to-eat drumstick pulp curry was commercially sterile and acceptable for consumption was determined by microbial analysis. The physical and microbial analysis before and after processing for three months under ambient conditions rated the curry with excellent and good condition.

Keywords: Retort processing, Ready-To-Eat, microbial analysis, pH, drumstick pulp curry, temperature profile, and core temperature

1. Introduction
Moringa oleifera a well-known vegetable having huge health benefits conveyed by the world health organization (WHO) consists of various parts namely leaves, fruits, flowers, immature pods, and pulp possess high nutritive content. Moringa is the native of sub-Himalayan tracts of India, Pakistan, Philippines, and several countries in Asia and Africa. It had proved to have multi-system effects in the human body (Saini, Sivanesan, and Keum 2016) [7]. It has become a renowned herb in the community but it has inadequate scientific evidence to explain the mechanism and validate its efficacy in superficial uses. It is rich in simple sugar, rhamnose called glucosinolates, and isothiocyanate (Siskawardani, Winarsih, and Khawwee 2021) [9]. In that have present free radical inhibitors, like phenolic acid, flavonoid coumarin quinone, tannin, and stilbenes), nitrogen (alkaloid, amine, B- alanine), vitamin, terpenoids (carotenoid), and other one endogenous metabolite. The studies proved that and immature pods and pulp having vitamin C, protein, calcium, and potassium that act as good natural antioxidant sources. These were able to increase the self-life of fat food due to the presence of various types of antioxidants phenolic content flavonoids and carotenoids and ascorbic acid (Siskawardani, Winarsih, and Khawwee 2021) [9]. Moringa and moringa pulp gives different palatable taste and is a rich source glutamic acid. Traditionally moringa is utilized in sambhar, curries, dals, and soup as a flavoring agent. The moringa pulp can be efficiently extracted, through the machine and thermally preserved and stored. The conveniently used for direct consumption and raw material for value addition in several food products and supplements. The Demand for suitable food is growing due to changing social and economic patterns increase in urbanization, the purchasing power of consumer's awareness about healthy foods, change the meal shape and variety of desire to test new products, etc. Convenience foods can be categorized as ready-to-cook, instant use, and ready-to-eat products. The rising demand for high-quality, convenient ready-to-eat food items among the next generation of consumers has resulted in an increase in commercial production of ready-to-eat foods (Kanatt, Chander, and Sharma 2005) [3], (Karada\ug and Güne\cs 2008) [4]. Thermal processing of foods entails the use of controlled heat energy and is one of the most common methods for preserving packaged shelf-stable foods. (Gokhale and Lele 2014) [2], (Shah, Bosco, and Mir 2015) [8].

The packaging is a well-organized system for preparing a product for transportation, distribution, and shelf life. One such packaging that can protect the product from contamination and other sources is a retort pouch. Because it can prevent physical, chemical, and environmental pollution and contamination, the packaging function extends the shelf life and preserves the product's quality.. Retort pouches are flexible and made up of polymer laminates and aluminum foil and are resistant to the sterilization process (E Triyannanto *et al*. 2019) [10]. The advantages of retort processing were it reduces the time of heating ultimately results in the prevention of overcooking, has superior product quality, maintains the texture of solid, and has no change in nutrient content (Endy Triyannanto and Lee 2017) [11]. It has excellent product compatibility and possesses high pouch reliability and stability. Retort processed food products are more suitable for consumption than the foods packed in glass and metal containers because of the fact its more attractive and convenient end-use (Al-Baali and Farid 2007) [1], (Mohan *et al*. 2006) [5]. The objective of retort processing is to calculate the proximate value and analyze the changes of color, pH, water activity, microbial and free fatty acid during the storage period.

2. Materials and methods

2.1 Drumstick pulp and retort pouches

The detailed process flow was depicted in fig.1. Fresh drumsticks were purchased from the local market Thanjavur. The drumsticks were washed thoroughly using potable water, and the pulp was removed using a drumstick pulp separation machine. Four-ply flexible pouches containing of 12 μm polyesters (external layer), 9 μm aluminum foil and nylon (mid-layer), 70 μm polypropylene (internal cast) was purchased from M/s. Laxmi industry Pvt. Ltd. Chennai, Tamil Nadu, India and used for packaging of drumstick pulp curry. The size of the pouches was 150 × 200 mm with a filling capacity of around 250 g of curry.

2.2 Sample preparation

The separated drumstick pulp were blanched in distilled water at 65 -70 °C for 10 min and then cooled in cold running water for 1 min. The blanched pulp was and dried on filter paper and used for curry preparation. In a frying pan, 50 ml of refined gingerly and mustard seeds were taken. Mustard seeds were allowed to splutter. Then, curry leaves, chopped onion, and tomato were added and fried. Then chili powder, coriander powder, ginger, and garlic powder, black paper, garam masala, salt, cumin powder, chat masala, sauf powder, dried Kasturi methi leaf, vinegar, and drumstick pulp were added and cooked for 20 mins. The ingredients quantity is given in table 1.

Table 1: Standard recipe of Drumstick pulp curry

Ingredients	Quantity	Ingredients	Quantity
Drumstick pulp	25 gm	Coriander powder	1 gm
Oil	10mL	Sauf powder	0.5 gm
Onion	10 gm	Salt	According to taste
Tomato	10 gm	Black pepper powder	1 gm
Garam masala	1 gm	Chat masala	1 gm
Cumin powder	1 gm	Vinegar	4 mL
Turmeric powder	1 gm	Water	42 mL
Ginger powder	1 gm	Kasturi methi	1 gm

2.3 Filling and packaging

About 50 ± 5 g of drumstick pulp were packed in retort pouches. Each of the retort pouches was filled with hot curry (150 ± 10 g) and maintaining a packaged weight of about (200 ± 10 g). Precautions were taken to avoid the contamination of the sealing of the pouches. The pouch was immediately removed from the present air in the pouches, followed by sealing with a retort pouch sealing machine (Lakshmi Industries, Chennai, Tamil Nadu). The sealing temperature of the pneumatic machine was 200 °C. The detailed steps for the thermal process of "Drumstick pulp curry" in retort pouches.

2.4 Flow chart

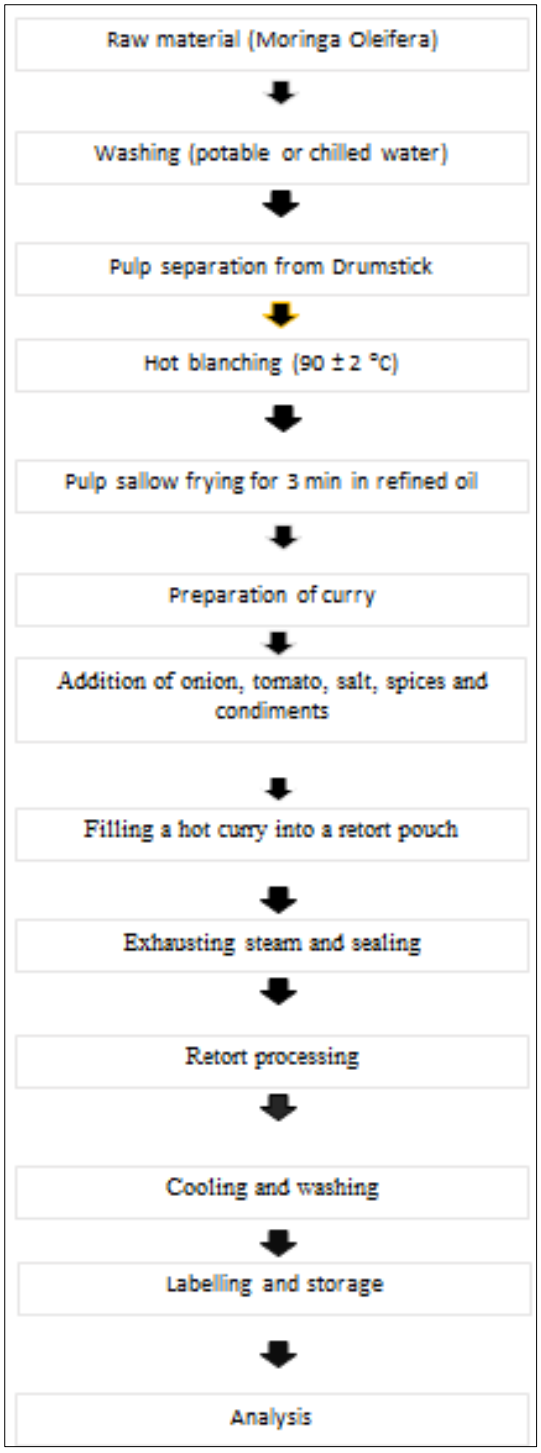

Fig 1: Process flow of drumstick pulp curry preparation

2.5 Preparation of curry
The drumstick pulp curry was prepared following steps, and ingredients have used for curry preparation are given in table 1. And the curry was prepared by the following steps. Fresh onion, tomato were chopped and fried in oil for 6 min at 100 to 150 °C. The fried onion grinds in mixture as well as tomato, grind onion fried in oil for 15 min at 100 to 150 °C and assorted with chili powder, coriander powder, ginger and garlic powder, black paper, garam masala, salt, cumin powder, chat masala, sauf powder, dried Kasturi methi leaf, vinegar and drumstick pulp.

2.6 Proximate analysis
The moisture, crude protein and fat, and ash content of the drumstick pulp and curry sample were determined using standard method. The carbohydrate content was estimated by subtracting the proportions of moisture, crude protein and fat, and total from 100.

2.7 pH
pH of the drumstick pulp were determined by adding 50 mL of distilled water into 10 g of sample dissolve into distilled water and homogenization for 60 s. The pH value of, measurement using a digital pH meter (HI11310, 0 to 13 pH meter, HANNA i123456789nstrument, Romania), and calibration of pH meter using a pH buffer 4 to 7. The determination of the pH gravy sample, electrode were placed directly in the gravy sample.

2.8 Colour
The colour analysis of "drumstick pulp curry sample" were analysed by hunter lab Colorimeter (model A60-1012-312, department of food engineering, IIFPT, Thanjavur) and L* represent lightness, a* present redness, and (yellowness b*) represent yellowness of the sample.

2.9 Free fatty acid (FFA) content
The Free fatty acid analysis of drumstick pulp curry sample were analysed using method described by of A known quantity of extracted fat sample from "drumstick pulp curry sample" were taken in to conical flask of 100 mL. And hot neutralized alcohol 50 mL (99%), were added, and 1-2 ml of phenolphalein indicator also added on the reagent mixture. To dissolve the fat content, the flask were continuously shaken, and the solution was titrated against a 0.25 N NaOH solution. The value of FFA was determined using a formula.

$$\text{FFA (\%oleic acid)} = \frac{\text{alkali valume (mL)} \times \text{alkali normality} \times 28.2}{\text{weight of fat (g)}}$$

2.10 Total plate count
Total plate count (TPC) is estimated using the spread plate method, as approved by the International Commission on Microbial Specification of Foods.10 g of drumstick pulp curry and 90 mL of distilled water homogenise through the homogenizer. Serial dilution prepare as per the standard, and duplicated plate count agar and incubate at 35 to 37 °C for 24 to 48 h. Using acidified potato dextrose agar (PDA), determine the presence of yeast and mould, and then incubate for 3 to 5 days at 27 °C. The average number of microbial colonies from sample were counted and expressed as log10 CFU/g of the sample.

2.11 Statistical analysis
All the data analysed were analysed with Minitab statistical one-way ANOVA software. The determination of analysis variance effect of colour, pH, and microbial load during the storage period (Minitab version 17). compression variance among the group using turkey several range test. Significantly at $p < .05$)

3. Result and Discussion
The estimated composition of drumstick pulp curry shown Table no. 2. Proximate composition includes such as moisture, protein, fat, ash, and carbohydrate content were 87, 5.45, 4.60, 2.25, and 0.7 for drumstick pulp and 84.2, 4.50, 8.20, 2.2, and 0.9 For gravy, respectively. Similar results were found by (Sunooj and Radhakrishna 2013) [19] for the proximate composition since the attributes involved in the process of cooking were water, oil and spices which was the reason behind the same.

Table 2: The estimated composition of standard drumstick pulp curry (100 g)

Sample	Moisture	Protein	Fat	Ash	Carbohydrate
Drumstick pulp	87±0.3	5.45±0.3	4.60±0.3	2.25±0.8	0.7±0.1
Gravy or curry	84.2±0.4	4.50±0.3	8.20±0.2	2.2±0.2	0.9±0.2

3.1 Thermal processing of the sample utilized
The retort was functioned in the static, water spray mode for processing runs. Thermal processing of drumstick curry at 121° C for 20 minutes at 17 psi to reach value of F_0-6. Retort processing and core temperature profile showed in fig. 1 and table 3. All retort pouches were stored at ambient temperature for self-life analysis.

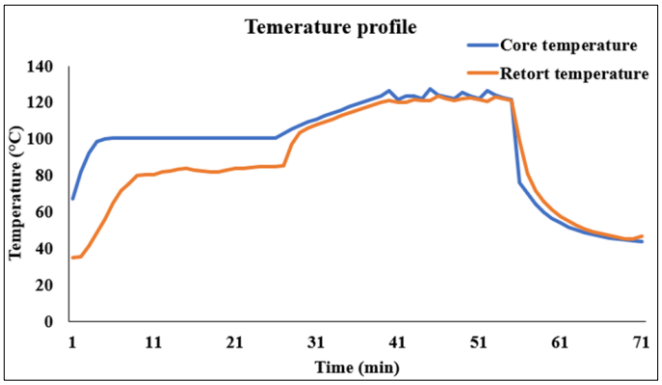

Fig 2: Characteristic of retort temperature and core temperature profile

Table 3: Heat penetration profile of drumstick pulp curry during the retort processing

S. No.	Parameter	Value
1	heating rate index (min),	17.3
2	Retort temperature,	121 °C
3	Retort process time, min	71
4	F_0 value	6

3.2 pH
The pH of drumstick pulp curry is shown table.4. The reduction of pH value during the storage period retort processed drumstick pulp curry significantly decreased from 4.96 to 4.153 respectably without processed from 4.3467 to 3.7533 and decrease inF_0 0 to 3 months. Retort processed all

sample significantly decrease with storage time. Jang and Lee (2012) [13], Jin, Kim, and Hah (2002) [17], Liu *et al*. (2009) [15] studied that by product lipids components, glucose, carbohydrate might be responsible for oxidation reduction and pH reduction as well as meat product curry.

Table 4: pH value of retort processed and without processed drumstick pulp curry

Storage time (Month)	Retort processed	Without processed
	pH	
0	4.96±0.658*a	4.3467±0.1007*a
2	4.583±0.257*a	3.8133±0.0643*b
3	4.153±0.340*a	3.7533±0.1007*b

3.3 Colour: The retort processed drumstick pulp curry during the storage period changes in colour (L*a*b*) are given in table 4. The observed that during the storage period of L* vale increase with storage time. However, it decreased with decreased F_0 value in 20 min. The reduction of L* value might be increase of F_0 value and longer exposure time in high temperature. Muhlisin *et al*. (2013) [17] studied that retort processed chuncheon dakgadli (korean dish), lightness L* value decrease with inbcrease cooking time. The meat chunk of the (redness a*) value increased with starage time, respectibly dcreased in garvy. Addition of red chilli in gravy, may be resion of higher value of a*. Bindu *et al*. (2010) [12] studied that both meat and gravy increase with storage time, and b* value significantly had no changes in b* value.

Table 5: Colour value of retort process and without process during the storage period of drumstick pulp curry

Storage time (Month)	Retort processed			Without processed		
	Colour					
	L*	a*	b*	L*	a*	b*
0	26.88±0.884*b	10.59±0.123*a	15.93±0.832*b	29.70±1.180*a	13.30±1.47*a	17.60±0.90*a
2	28.97±0.613*a	14.15±0.361*a	18.697±1.00*a	30.88±0.305*a	12.52±0.44*a	17.89±0.74*a
3	28.75±0.732*ab	14.40±2.35*b	17.02±1.261*ab	31.10±0.903*a	14.78±0.66*a	16.97±2.38*a

3.4 Free fatty acid value

Table no. 6 lists the free fatty acids found in retort processed drumstick pulp curry the fatty acid that is produced when lipids are degraded by enzymes, microbial, and various processing techniques. Since temperature increases were utilized in this analysis to inactivate the whole cell wall and sterilized the product. Free fatty acid generates by higher temperature alone, and the free fatty acid value increase with increase in processing time drumstick pulp curry. The higher free fatty acid value curry than drumsticks pulp Also, the Free fatty acid significantly increases with storage time and the highest value recorded in longer storage time. Reported to another journal similar trends was retort process Chettinad chicken (Rajan, Kulkarni, and Chandirasekaran 2014) [18]

Table 6: Free fatty acid value during the storage period of drumstick pulp curry

Storage time (Month)	Retort processed	Without processed
	Free fatty acid (FFA)	
0	0.46±0.02*a	0.39±0.03*a
2	0.51±0.03*a	0.46±0.01*a
3	0.67±0.01*ab	0.58±0.04*a

3.5 Total plate count

The total plate count of retort processed drumstick pulp curry sample was determined. The result indicates that the bacterial colonies, yeast and mold colonies of "retort processed drumstick pulp curry" were <10 CFU/mL observed. Jang and Lee, (2012) [13] During the storage period, the microbiological count (bacterial colonies, yeat, and mould) for ready to eat ginseng chicken porrige was determined to be 1.0 log CFU/cm^2. Rajan, Kulkarni, and Chandirasekaran (2014) [18]. According to studies, no microbial growth was observed in retort processed chettinad chicken during a 3-month storage period.

4. Conclusion

The demand of the ready to eat foods day by day emerging specially in retort processed because of the various advantages. Drumstick pulp curry was developed and retort processed for a 3-month storage period in retort pouches. The product was given an F0 value, which was then used to evaluate various quality characteristics. All sample showed the positive result after storage such as free fatty acid (FFA), pH, and colour value. The all sample were microbiological safe for a 3-month period. The present studied result showed that retort processed drumstick pulp curry acceptable for long term period at room temperature and with all expected quality parameter desirable. Retort process drumstick pulp curry is convenient for ready to eat.

5. Reference

1. Al-Baali AG, Abdul Ghani, Mohammed Farid M. Sterilization of Food in Retort Pouches. Springer Science \& Business Media, 2007.
2. Gokhale SV, Lele SS. "Retort Process Modelling for Indian Traditional Foods." Journal of Food Science and Technology 2014;51(11):3134-43.
3. Kanatt, Sweetie R, Ramesh Chander, Arun Sharma. "Effect of Radiation Processing on the Quality of Chilled Meat Products." Meat Science 2005;69(2):269-75.
4. Karada\ug, Ay\cse, and Gürbüz Güne\cs. "The Effects of Gamma Irradiation on the Quality of Ready-to-Cook Meatballs." Turkish Journal of Veterinary and Animal Sciences 2008;32(4):269-74.
5. Mohan CO, Ravishankar CN, Bindu J, Geethalakshmi V, Srinivasa Gopal TK. "Effect of Thermal Process Time on Quality of 'Shrimp Kuruma' in Retortable Pouches and Aluminum Cans." Journal of Food Science 2006;71(6):S496-S500.
6. Syarif R, Halid H. Teknologi Penyimpanan Pangan (Jakarta: Penerbit Arcan. Kerjasama dengan Pusat Antar Universitas Pangan Dan Gizi IPB), 1993.
7. Saini, Ramesh Kumar, Iyyakkannu Sivanesan, Young-Soo Keum. "Phytochemicals of Moringa Oleifera: A Review of Their Nutritional, Therapeutic and Industrial Significance." 3 Biotech 2016;6(2):1-14.
8. Shah, Manzoor Ahmad, Sowriappan John Don Bosco, Shabir Ahmad Mir. "Effect of Moringa Oleifera Leaf Extract on the Physicochemical Properties of Modified Atmosphere Packaged Raw Beef." Food Packaging and Shelf Life 2015;3:31-38.
9. Siskawardani, Devi Dwi, Sri Winarsih, Khwunta Khawwee. "The Antioxidant Activity of Kelor (Moringa

Oleifera Lam.) Leaves Based on Drying Method." Jordan Journal of Biological Sciences 2021, 14(2).
10. Triyannanto E, Fauziah S, Rahmatulloh S, I Diqna H, D Putra TI. Others "Application of Conventional, Vacuum, and Retort Packaging on the Physicochemical and Sensory Evaluation of Ready-to-Eat (RTE) Ayam Kalasan at Ambient Temperature during Two Weeks." In IOP Conference Series: Earth and Environmental Science 2019;387:12087.
11. Triyannanto Endy, Keun Taik Lee. "Effect of Sucrose Stearate on the Sensory-Related Quality of the Broth and Porridge of Ready-To-Eat Ginseng Chicken Soup Samgyetang." Korean Journal for Food Science of Animal Resources 2017;37(6):855.
12. Bindu J, Ravishankar CN, Srinivasa Gopal TK, Mallick AK. "Investigation of shelf life and heat penetration attributes of ready-to-eat 'fish peera' from anchovy (stolephorous commersoni) in retort pouches." Journal of Food Processing and Preservation 2010;34:207-22.
13. Jang, Dong Hyun, Keun Taik Lee. "Quality Changes of Ready-to-Eat Ginseng Chicken Porridge during Storage at 25 C." Meat Science 2012;92(4):469-73.
14. Jin Sang-Keun, Il-Suk Kim, Kyung-Hee Hah. "Changes of PH, Drip Loss and Microbes for Vacuum Packaged Exportation Pork during Cold Storage." korean journal for food science of animal resources 2002, 2(3).
15. Liu, Deng-Cheng, Ruei-Tsz Tsau, Yen-Chih Lin, Shyh-Shyan Jan, Fa-Jui Tan. "Effect of Various Levels of Rosemary or Chinese Mahogany on the Quality of Fresh Chicken Sausage during Refrigerated Storage." Food Chemistry 2009;117(1):106-13.
16. FDA). Bacteriological analytical manual for foods. Washington, USA: US Government Printing Office, 2013.
17. Muhlisin Muhlisin, Dong Soo Kim, Yeong Rae Song, Young Jae Cho, Cheon-Jei Kim, Byoung-Ki An *et al*. "Effect of Cooking Time and Storage Temperature on the Quality of Home-Made Retort Pouch Packed Chuncheon Dakgalbi." Food Science of Animal Resources 2013;33(6):737-43.
18. Rajan S, Kulkarni VV, Chandirasekaran V. "Preparation and Storage Stability of Retort Processed Chettinad Chicken." Journal of Food Science and Technology 2014;51(1):173-77.
19. Sunooj Kappat Valiyapeediyekkal, Kolpe Radhakrishna. "Physico-Chemical Changes in Ready to Eat Pineapple Chicken Curry during Frozen Storage, 2013.