

RETORT PROCESSED CHICKEN CURRY FROM BROILER AND *DESI* CHICKEN MEAT

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ABSTRACT

Low cost technologies for small and large scale production of meat products need to be developed to initiate and attract a large number of entrepreneurs to the processed meat industry. Retort pouches have advantages of shelf-stability, less weight, less storage space, ease of opening & preparation and storage without refrigeration. It has been shown that the use of retortable pouches for the thermo-processed foods is technical and commercially feasible. The present study was conducted to determine the suitable recipe formulation, retort processing temperature and shelf-life of the chicken curry with desi and broiler under ambient temperature (32±2°C) up to 3 months of period. Shelf-life studies included changes in microbiological, physicochemical composition and sensory characters.

Key words: Chicken meat, F₀ value, Retort Process, Storage studies

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INTRODUCTION

Thermal processing of foods is to reduce or destroy microbial activity, reduce or destroy enzyme activity and to produce physical or chemical changes to make the food meet a certain quality standard. Thermal

processing is one of the most important operations in food processing in canneries and pasteurization and processing of food, heat acts to develop taste and flavor, and in addition to lower the microbial load in order to carry out physical changes to the food (Miri *et al.*, 2008).

Retortable flexible containers are laminate structures that are thermally processed like a can and are shelf-stable and have the convenience of freezing and boiling in the bag with the products and have no food additives. Retort system uses steam or super-heated water to cook food in its own package,

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extending shelf-life and ensuring food safety. In conventional canning food must be cooked approximately twice as long as food contained in retort pouch. Reduced heat exposure thus results in improved quality and in economy packaging.

The study has been designed to standardize recipe formulation, retort pouch processing temperature and shelf-life of the ready to eat indigenous meat product of Chicken curry using *desi* and broiler meat.

MATERIALS AND METHODS

Preparation of chicken curry

Deboned meat of broiler and *desi* chicken were bought from the local market and extract release volume as per Pearson (1968) was conducted to assess the quality of the meat before preparing the products.

The recipe was standardized based on the information collected from Chef Damodharan of Tamil Nadu, India (Damodharan, 2020, Personal communication). The preliminary study (pilot scale) was conducted to standardize chicken curry recipe. Crated coconut ground to fine paste and the remaining spices were used as such during product preparation. Dry spices, onion, garlic and ginger were fried in refined oil and mixed with the precooked meat. The whole mix was fried for about 10 min. The preparation was similar for both chicken curry with *desi* and broiler meat.

Determination of retort processing temperature

Retort processing temperature was determined based on the values reported by Rajkumar *et al.* (2010) and from the experiment

conducted with laboratory model overpressure autoclave/retort. Laboratory model was supplied by M/s Lakshmi Engineering, Ambattur, Chennai, India having a capacity of 25 pouches. The product core temperature and the lethal rates (F_0 value) were obtained for chicken curry with both broiler and *desi* chicken meat. The F_0 value was calculated as per Stumbo (1973). Product core temperature was noted for every minute till the products were processed and the F_0 values was calculated by adding all the lethal rates noted every minute. Sealed pouches having 100g chicken meat (*desi*/broiler) and 50g gravy were subjected to thermal processing by maintaining the retort temperature at 121.1°C. Pressure was maintained at 20 psi throughout the process by using steam-air mixture during heating and water-air mixture during cooling. The processing time was determined based on commercial sterility test, visual observation test and sensory evaluation. The processed retort pouches were stored in ambient temperature ($32 \pm 2^\circ\text{C}$) for further studies.

Shelf-life studies/ storage studies

Total viable count, anaerobic, *Coliform*, *Staphylococcal*, *Clostridium*, yeast and mould counts of processed samples were determined by the method described by American Public Health Association (APHA, 1984). pH was determined by AOAC (1995). Thio-barbituric acid number and Tyrosine value was determined by the procedure outlined by Strange *et al.* (1977). Sensory evaluation was assessed by 9-point hedonic scale by a trained and semi-trained taste panel. The data (6 replicates) were subjected to analysis of variance statistically in SPSS

software (version 20.0) as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Retort processing

The retort temperature and the product core temperature before processing were 35°C and 40°C respectively. The product core temperature reached its first lethality rate of 0.001 when the product core temperature of chicken curry using *desi* and broiler meat were 86.3 and 84.2°C respectively. These findings were similar to the results observed by Devadason (2004), Sreenath *et al.* (2007) and Rajkumar *et al.* (2010). To reach the first lethality, come up time (CUT) for chicken curry using *desi* and broiler meat were 22 and 21 min respectively which were below the CUT values reported by Rajkumar *et al.* (2010) in Chettinad goat meat.

Total lethality (F_0) received for the chicken curry for both *desi* and broiler meat was 7.5 (Fig. 1 & 2). Rajkumar *et al.* (2010) optimized the F_0 value of 12.1 for the retort processed Chettinad style goat meat and also observed a shelf-life of one year at ambient temperature whereas in the present study the F_0 value of chicken curry 7.5 for both *desi* and broiler meat. Processing of the product to a F_0 value of 8.43 was found to be ideal from the point of desired texture sensory characteristics and sterility of the Kerala style fish curry according to Gopal *et al.* (2001). Bindu *et al.* (2007) optimized F_0 value of 9 for processing clam meat in retortable pouch for a period of 12 months at room temperature. The result was not in accordance with the above results suggesting that the chicken meat based products required lesser processing time.

Bindu *et al.* (2010) had optimized the F_0 value of 7 to get a commercially sterile fish *peera*, with good sensory characteristics; Dhanapal *et al.* (2010) found that the thermally processed ready-to-eat South Indian type tilapia fish curry enriched with PUFA and packed in retort pouch is acceptable for consumption even after one year at ambient temperature when processed at a F_0 value of 7.

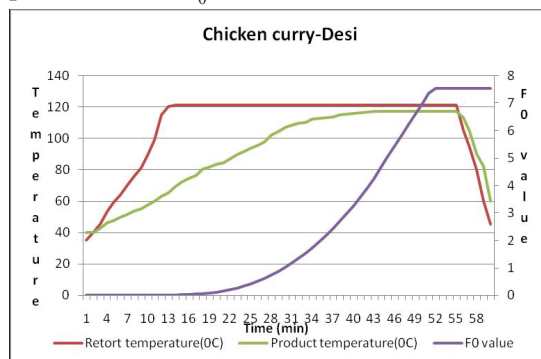


Fig. 1. Retort processing data of curry of *desi* chicken meat

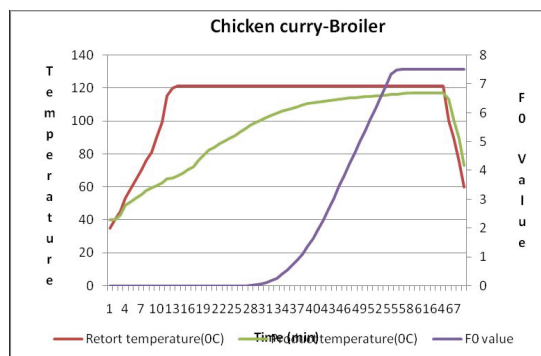


Fig. 2. Retort processing data of curry of broiler chicken meat

Commercial sterility test

Chicken curry using *desi* and broiler meat processed to the F_0 value of 7.5 were found to be commercially sterile (absence

of microbes and spores) indicated by the absence of turbidity in the thioglycollate tubes inoculated with the samples. Foods so processed generally continue to be commercially sterile, since recontamination was prevented by air tight sealing of pouches (Kumar, 2005).

Visual observation test

Bulging of the packets was observed daily up to one month and found that no packet was found bulged.

Storage stability of chicken curry using *desi* and broiler meat

Microbial count

In the microbial study (Table 1) anaerobic, *Staphylococcal*, *Coliform*, *Clostridium*, *Salmonella* and yeast and mould were absent on entire storage days and found that the total viable count was 0.44 ± 0.02 in *desi* and 1.42 ± 0.01 in broiler which increased significantly on 90th day to 0.46 ± 0.02 and

1.70 ± 0.01 log cfu in *desi* and broiler meat respectively. Mukherji and Qvist (1981) and Silla and Simonsen (1985) opined that the shelf-life of vacuum-packed meat products is not necessarily related to the aerobic plate count. The standard recommended by Public Health Laboratories (PHLS), UK, for aerobic plate count is $<10^3$, *E.coli* count is <100 and *Salmonella* should not be detected. The results of the present study are less than the recommended value, this indicates that the products are hygienically prepared, adequate thermal processing was done and may also be due to herbals, spices, condiments like cloves, fennel, garlic, ginger and turmeric in the product which have antibacterial property. Clove oil contains eugenol, which strongly inhibits the growth of *Listeria monocytogenes*, *Salmonella enteritidis*, *Escherichia coli* and *Staphylococcus sp.* in various agar media around 0.5 to 1.0% (Cressy *et al.*, 2003; Menon and Garg, 2001; Mytle *et al.*, 2006).

Table 1. Effect of storage on microbial quality of chicken curry (n=6)

| Microbial count | <i>Desi</i> | | | | | F value | Broiler | | | | | F value |
|-----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------|
| | Storage period (in days) | | | | | | Storage period (in days) | | | | | |
| | 0 | 15 | 30 | 60 | 90 | | 0 | 15 | 30 | 60 | 90 | |
| Total viable count | 0.44 ^c ±0.2 | 0.49 ^c ±0.02 | 0.48 ^c ±0.01 | 0.47 ^c ±0.01 | 0.46 ^c ±0.02 | 36.00** | 1.42 ^a ±0.01 | 1.44 ^a ±0.01 | 1.58 ^b ±0.01 | 1.63 ^c ±0.01 | 1.70 ^d ±0.01 | 63.69** |
| Anaerobic count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |
| <i>Staphylococcal</i> count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |
| <i>Coliform</i> count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |
| <i>Salmonella</i> count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |
| <i>Clostridium</i> count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |
| Yeast & mould count | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | - |

**Significant (P<0.01)

^{a-d}Mean values within a row bearing same superscript do not differ significantly (P<0.01)

Physicochemical

Physicochemical values on storage studies are presented in Table 2. The pH of chicken curry using *desi* and broiler meat on 0th day was 5.08±0.06 and 5.14±0.05 which showed a decreasing trend but not significantly during storage period. pH of *desi* and broiler meat on 90th day was 5.00±0.06 and 5.07±0.05 respectively. Results are in accordance with Mohan (2004) who has reported a slight reduction in the pH of shrimp kuruma upon storage in both retort pouch and aluminium cans. Normal fresh poultry pH is 6.6 whereas the product pH was 5.4 in chicken curry using *desi* meat and 5.44 in chicken curry using broiler meat which is towards the acidic side, the acidic nature of the product can be attributed to the cooking and also may be due to tomato which has acidic pH of 4.0-4.6.

TBA number of chicken curry using *desi* and broiler meat on '0' day were 0.44±0.01 and 0.42±0.03 respectively which increased up to 15th day and gradually decreased during

the storage period. TBA number of chicken curry using *desi* and broiler meat on 90th day were 0.46±0.01 and 0.45±0.03 respectively. The results of the present study are similar with Park *et al.* (1993) who found that a rapid decrease in TBA value with increased storage period of beef snack food up to 15 days at 37°C. Aubourg *et al.* (1995) found that this decrease in TBA value might be due to two reasons; one, due to the loss of the secondary oxidation products from the muscle into the curry medium and the second, being the fact TBA can react with other reactive compounds like amino groups, resulting in its reduction.

Tyrosine value of chicken curry prepared from *desi* and broiler meat on '0' day was 6.09±0.04 and 6.12±0.04 respectively. The increase in tyrosine value was significant (P<0.05) during storage period and the values on 90th day was 6.91±0.05 and 6.89±0.03 respectively; however, the values were under the maximum permissible level so the products are acceptable up to 90th day.

Table 2. Physicochemical values (n=6)

| Storage period (in days) | pH | | TBA | | TV | |
|--------------------------|--------------------|--------------------|--------------------------|--------------------------|-------------------------|--------------------------|
| | <i>Desi</i> | Broiler | <i>Desi</i> | Broiler | <i>Desi</i> | Broiler |
| 0 | 5.08±0.06 | 5.14±0.05 | 0.44 ^a ±0.01 | 0.42 ^a ±0.03 | 6.09 ^a ±0.04 | 6.12 ^a ±0.04 |
| 15 | 5.05±0.06 | 5.11±0.05 | 0.49 ^d ±0.01 | 0.48 ^d ±0.03 | 6.25 ^b ±0.04 | 6.29 ^{ab} ±0.03 |
| 30 | 5.04±0.06 | 5.09±0.05 | 0.48 ^{cd} ±0.01 | 0.47 ^{cd} ±0.03 | 6.38 ^c ±0.08 | 6.40 ^{ab} ±0.09 |
| 60 | 5.02±0.06 | 5.08±0.05 | 0.47 ^{bc} ±0.01 | 0.46 ^{bc} ±0.03 | 6.72 ^d ±0.07 | 6.55 ^b ±0.51 |
| 90 | 5.00±0.06 | 5.07±0.05 | 0.46 ^b ±0.01 | 0.45 ^b ±0.03 | 6.91 ^e ±0.05 | 6.89 ^c ±0.03 |
| F value | 0.26 ^{NS} | 0.31 ^{NS} | 11.26 ^{**} | 12.11 ^{**} | 185.06 ^{**} | 9.51 ^{**} |

**Significant (P<0.01)

*Significant (P<0.05)

^{NS}Not significant (P≥0.05)

Sensory Scores

Sensory scores (Table 3) decreased when storage period increased from '0' to 90 days. However it was within the acceptable limits. There was significant difference in sensory attributes between *desi* and broiler

meat during the storage studies. *Desi* meat had more acceptability when compared to broiler meat, the reason given by panellist was more flavour and meat fibres are intact in *desi* but in broiler meat fibres are not intact during storage period.

Table 3. Effect of storage on sensory score of chicken curry (n=6)

| Sensory score | <i>Desi</i> | | | | | F value | Broiler | | | | | F value |
|-----------------------|----------------------------|-----------------------------|------------------------------|-----------------------------|----------------------------|---------|----------------------------|-----------------------------|------------------------------|-----------------------------|----------------------------|---------|
| | Storage period (in days) | | | | | | Storage period (in days) | | | | | |
| | 0 | 15 | 30 | 60 | 90 | | 0 | 15 | 30 | 60 | 90 | |
| Appearance | 8.32 ^d ±0.07 | 8.20 ^{cd} ±0.07 | 8.12 ^{bc} ±0.05 | 7.97 ^b ±0.04 | 7.73 ^a ±0.06 | 15.19** | 7.90 ^d ±0.06 | 7.72 ^{cd} ±0.08 | 7.57 ^{bc} ±0.09 | 7.40 ^{ab} ±0.09 | 7.23 ^a ±0.08 | 10.27** |
| Flavour | 8.13 ^d ±0.10 | 8.02 ^{bc} ±0.10 | 7.88 ^{abc} ±0.12 | 7.70 ^{ab} ±0.13 | 7.60 ^a ±0.11 | 3.87* | 7.72 ^c ±0.11 | 7.60 ^{bc} ±0.09 | 7.48 ^{abc} ±0.09 | 7.37 ^{ab} ±0.09 | 7.20 ^a ±0.10 | 4.18* |
| Juiciness | 8.22 ^d ±0.09 | 8.08 ^{cd} ±0.07 | 7.92 ^{bc} ±0.06 | 7.7 ^{ab} ±0.06 | 7.62 ^a ±0.06 | 12.22** | 7.90 ^c ±0.11 | 7.68 ^{bc} ±0.13 | 7.50 ^{ab} ±0.12 | 7.37 ^{ab} ±0.12 | 7.20 ^a ±0.13 | 5.10** |
| Tenderness | 8.42 ^d ±0.05 | 8.33 ^{cd} ±0.06 | 8.23 ^c ±0.06 | 8.08 ^b ±0.06 | 7.88 ^a ±0.03 | 21.56** | 8.08 ^d ±0.03 | 7.88 ^{cd} ±0.06 | 7.72 ^{bc} ±0.09 | 7.50 ^{ab} ±0.10 | 7.28 ^a ±0.08 | 16.93** |
| Overall acceptability | 8.82 ^d ±0.07 | 8.67 ^{cd} ±0.06 | 8.50 ^c ±0.06 | 8.32 ^b ±0.07 | 8.13 ^a ±0.06 | 18.98** | 7.78 ^c ±0.10 | 7.62 ^{bc} ±0.12 | 7.50 ^{abc} ±0.10 | 7.40 ^{ab} ±0.07 | 7.23 ^a ±0.06 | 5.08* |

**Significant (P<0.01)

*Significant (P<0.05)

CONCLUSION

Results of the present study revealed that the values of physico chemical parameters like, pH, TBA number and Tyrosine value and the microbial quality were within the limits during the entire storage period for both chicken curry prepared from *desi* and broiler meat. The taste panel study with semi-trained panellist was of the opinion that the texture was slightly affected after 90 days of storage in chicken curry using broiler meat. Between

broiler and *desi* birds, it was found that the *desi* birds were more suited for preparing retort processed chicken products. The cost of production from *desi* meat and broiler meat was in the affordable range of Rs.84 and 48 per pouch (250g). Hence as the low cost technology retort process technique can be useful in popularizing traditional products like chicken curry as well as to attract more entrepreneurs to the meat processing industry which does not require refrigeration for storage.

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