



Original Research

A Study on the Effect of Acidulants on Physico-chemical and Organoleptic Qualities on Intermediate Moisture Chicken Chammanthi

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Abstract

Chammanthis are a popular indigenous ready to eat food products of South India. Study was conducted to standardize the processing technology for its preparation and to evaluate the influence of adding various acidulants on physico-chemical and sensory attributes. Four formulation viz. C_1 (without acidulent), Treatments- T_1 (2% lemon juice), T_2 (0.1% lactic acid), T_3 (3% lemon juice) and T_4 (0.2% lactic acid). The pH was significantly ($p < 0.05$) higher in control compared to treatments. Proximate composition of Intermediate moisture chicken chammanthi (IMCC) revealed a significant ($p < 0.05$) decrease in the per cent of protein and fat content in the treatments. However no significant difference was noted for moisture, dry matter, yield and water activity. The sourness value of T_4 , was significantly ($p < 0.05$) higher as compared to control. Lightness and yellowness colour characteristics of the treatments significantly ($p < 0.05$) decreased, redness value increased significantly with addition of acidulants. The overall acceptability of treatment with 3% lemon juice was significantly ($p < 0.05$) higher as compared to control and the other treatments. Based on overall activity and numerically lower water activity in third treatment, it could be concluded that the best IMCC can be prepared by incorporating 3% lemon juice.

Key words: Acidulants, Intermediate Moisture Foods, IMCC, Lactic Acid, Lemon Juice

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Introduction

In developing countries like India with the increasing urbanization, the demand for the processed food is increasing rapidly. Due to lack of cold chain facilities in developing countries, it is very much imperative to develop shelf stable meat products with good sensory attributes and better stability at ambient temperature. Intermediate moisture foods (IMF) increased shelf-life and retain soft moist texture and are stable without refrigeration. Reduction of water activity is frequently necessary to develop an IMF. The





demand for processed meat products is increasing continuously with growing consumer's response and awareness about the nutrition and quality. Poultry meat is comparatively more acceptable than other meat because of its flavour, ease of digestion, low fat content and high ratio of unsaturated fatty acids and also due to excellent source of protein (Barbut, 2012). Coconut and fish *chammanthi* are indigenous ready to eat products and are popular especially in southern part of the country. Since available literature show no work is done on meat *chammanthi*. The present study was carried out to develop and standardize *IMCC* treated with acidulants and to compare the effect of natural lemon juice and synthetic acidulant on the physico-chemical qualities and sensory attributes of the developed *IMCC*.

Materials and Methods

Raw Materials

Broiler chicken of 2.0 to 2.5 kg weight procured from the local market of Thrissur, Kerala were humanely slaughtered and dressed under hygienic conditions at Meat Technology Unit, Mannuthy, Thrissur, Kerala. The dressed carcasses were immediately chilled for around 24 hours and then made into cuts, cooked and deboned. Food grade lactic acid purchased from the Genesys Inc. Tamil Nadu and Roquette Riddhi Siddhi Pvt. Ltd. Mumbai, India was used as acidulants.

Other Ingredients

Lemon, garlic, ginger, onion, curry leaves, salt, red chilli powder, coriander powder, turmeric powder, sunflower oil, black gram, ground nut, and black pepper powder.

Analytical Methods

Physico-Chemical Characteristics

pH

The pH was determined using a combined electrode digital pH meter (μ pH system 362, Systronics, India) as per procedure of Troutt *et al.* (1992).

Cooking Yield Percent

The weights of *IMCC* before and after cooking were recorded. Product yield was expressed in per cent.

$$\text{Product yield (\%)} = \frac{\text{Weight of final product}}{\text{Weight of raw product}} \times 100$$

Proximate Analysis

The proximate composition of the *IMCC* was determined by the standard procedure of AOAC (1990).

Table 1: Formulation of IMCC

Ingredients	C (%)
Minced chicken	100
Sunflower oil	13.5
Ground nut	3.3
Garlic	3
Ginger	3
Small onion	3
Black gram	2
Salt	1.2
Black pepper	1.2
Curry leaves	0.5
Dried red chilli	0.2
Coriander powder	0.2
Turmeric powder	0.2
Potassium sorbate	0.15

	T ₁	T ₂	T ₃	T ₄
Lemon juice	2	—	3	—
Lactic acid		0.1	—	0.2

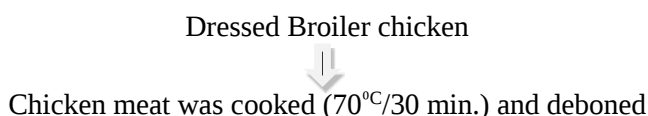
*above the quantity of the formulation added over and above treatment (control) IMCC. Control-(Without acidulants)

Colour Characteristics

Surface colour (L^* , a^* , b^*) of the IMCC was determined objectively as per Page *et al.* (2001) using Hunter Lab Mini Scan XE Plus Spectrophotometer (Hunter Lab, Virginia, USA) with diffuse illumination. The instrument was standardized to measure L^* , a^* and b^* using illuminant 45/0 and 10° standard observer with an aperture size of 2.54 cm. It was calibrated using black and white tiles. Colorimeter score was recorded where 'L' of black equalled 0 and 'L' of white equalled 100, 'a' of lower numbers indicated more green (less red) and higher numbers indicated more red (less green), and 'b' of lower numbers indicated more blue (less yellow) and higher numbers indicated yellow (less blue). The colour co-ordinates L^* (lightness), a^* (redness) and b^* (yellowness) of the samples were measured four times and mean values were taken. (Navneet and Shitiji, 2011).

Flow Chart for Development of IMCC

The control and standardized IMCC were prepared as per the formulation in Table 1.



Debonned meat aerobically packed(HDPE) bags and kept frozen until used

Deboned chicken meat pieces thawed, chopped in a bowl chopper

Dry fried in open pan (till turns slightly brownish)

The spice and condiments fried separately using refined sunflower oil

Fried chicken meat added into the fried spice and condiments mix and fried further to reduce the moisture content and then acidulent was added and packed in laminated pouch.

Organoleptic Evaluation

Sensory attributes of the *IMCC* were assessed organoleptically (AMSA, 1983) using 8 point Hedonic scale, where 8= excellent; 1= extremely poor. The sensory panel consisted of 10 semi-trained taste panelists drawn from the Department of Livestock Products Technology, CVAS, Mannuthy, Thrissur. The product was served to the panellist with code numbers to the samples. The average of the individual scores was taken as the score for the particular attribute.

Statistical Analysis

The experiment was replicated six times and the data obtained for physico-chemical and sensory evaluations of different products were statistically analyzed as per Snedecor and Cochran (1994) using SPSS software version 24.

Result and Discussion

Physico-Chemical Properties

The physico-chemical properties and proximate composition of *IMCC* are shown in the Table 2. The pH value of the treatments were significantly ($p<0.05$) lower as compared to the control, which might be due to higher pH of added acidulents and it agrees with the result reported by Hedrick *et al.* (1993) in salami type products added with lactic acid. Protein per cent of T_2 and T_3 are significantly ($p<0.05$) lower than control and fat per cent of T_3 is significantly ($p<0.05$) lower than control. This result supported the finding of Barbut (2006), who reported that addition of acidulent like lactic acid causes separation of fats and resulted in lower fat and protein values in salami. However, no significant difference was noted for moisture, total ash and dry matter contents. No significant difference was noted for water activity among the samples and for all the samples the water activity was within the range of IMF (0.65-0.90) (Multon *et al.*, 1978).

Table 2: Physico-chemical properties of IMCC

Parameters	C ₁	T ₁	T ₂	T ₃	T ₄
pH	5.85±0.01 ^a	5.51±0.01 ^b	5.34±0.03 ^b	5.25±0.05 ^c	5.13±0.36 ^d
a _w	0.69±0.00	0.68±0.01	0.70±0.00	0.67±0.02	0.69±0.00
Protein (%)	35.01±0.08 ^c	34.25±0.15 ^{bc}	32.50±0.62 ^a	33.33±0.35 ^{ab}	33.99±0.44 ^{bc}
Fat (%)	25.85±0.34 ^b	25.26±0.41 ^b	25.32±0.35 ^b	24.23±0.19 ^a	25.18±0.08 ^{ab}
Moisture (%)	10.33±0.33	9.76±0.39	10.48±0.58	10.28±0.34	10.36±0.44
Total Ash (%)	3.23±0.07	3.27±0.15	3.26±0.11	3.23±0.07	3.31±0.08
DM (%)	89.74±0.33	90.21±0.38	89.41±0.63	89.67±0.33	89.46±0.49
Yield (%)	47.54±0.98	48.64±0.78	47.87±0.86	48.45±0.85	48.87±0.85

Mean ± SE with same superscripts in a row does not differ significantly ($p < 0.05$). C₁=control, T₁=2.0% lemon juice, T₂=0.1% lactic acid, T₃=3.0% lemon juice and T₄= 0.2% lactic acid.

Colour Characteristics of IMCC

The colour characteristics of control and treatment of IMCC were measured in terms of L*, a* and b* values (Table 3). The lightness (L*) value of the product is basically a surface characteristics and it depends on the presence of the materials that reflect or absorb light. The Hunter L* value of the treatments significantly ($p < 0.05$) decreased with inclusion of acidulants. The addition of natural acidulant (T₁ and T₃) significantly ($p < 0.05$) improved the redness (a*) value. The yellowness (b*) value of treatments exhibited a significantly ($p < 0.05$) lower values than control samples. Similar results with an increase in a* value and decrease in b* value was observed with decrease of pH in cooked meat by Papadopoulos *et al.* (1991) and in beef top rounds by Maca *et al.* (1997) with addition of 2% lactic acid.

Table 3: Colour characteristics (Hunter L* a* b* values) of IMCC

Parameters	C ₁	T ₁	T ₂	T ₃	T ₄
L*	34.92±0.20 ^a	32.39±0.19 ^b	33.74±0.18 ^b	32.00±0.20 ^b	31.16±0.19 ^b
a*	11.37±0.08 ^a	12.45±0.13 ^b	11.46±0.40 ^{ab}	12.06±0.43 ^b	10.09±0.49 ^a
b*	36.82±0.28 ^a	34.46±0.10 ^b	34.28±0.22 ^b	34.56±0.21 ^b	35.40±0.22 ^b

Mean ± SE with same superscripts in a row does not differ significantly ($p < 0.05$). C₁=control, T₁= 2.0% lemon juice, T₂= 0.1% lactic acid, T₃=3.0% lemon juice and T₄= 0.2% lactic acid.

Organoleptic Evaluation

The organoleptic qualities of the IMCC were presented in Table 4. The sourness of treatment T₄ was the highest and T₂ was the lowest. Overall acceptability score of treatment T₃ was significantly higher than the control and the other treatments, values ranged from 7.57±0.15 to 6.00±0.15. This may be due to the inclusion of acidulants. Similar results was observed by Thomas *et al.* (2008) using lactic acid and GDL which increased the soreness and quality attributes like texture and overall acceptability in pork sausage.

**Table 4:** Organoleptic evaluation of IMCC

Parameters	C ₁	T ₁	T ₂	T ₃	T ₄
Appearance & Colour	6.53±0.12	6.63±0.14	6.61±0.14	6.83±0.10	6.76±0.16
Flavour	6.23±0.19	6.30±0.19	6.11±0.22	6.21±0.17	6.14±0.19
Juiciness	4.13±0.32	4.63±0.37	4.46±0.38	4.61±0.32	4.36±0.34
Sourness	5.87±0.25 ^{ab}	5.85±0.30 ^{ab}	5.36±0.28 ^a	6.00±0.27 ^b	6.11±0.33 ^a
Mouth coating	6.20±0.27	6.07±0.32	6.11±0.29	6.36±0.29	5.79±0.36
Texture	5.67±0.26	5.89±0.25	5.75±0.28	6.11±0.25	6.14±0.21
Overall acceptability	6.00±0.15 ^b	6.52±0.18 ^b	6.04±0.21 ^b	7.57±0.15 ^a	6.25±0.21 ^b

Mean ± SE with same superscripts in a row does not differ significantly ($p < 0.05$). C₁=control, T₁= 2.0% lemon juice, T₂= 0.1% lactic acid, T₃=3.0% lemon juice and T₄= 0.2% lactic acid.

Conclusion

Based on overall activity and numerically lower water activity in third treatment, IMCC prepared in the present study was acceptable sensorily. Treatment with three per cent lemon juice was found to be superior with respect to its sensory quality characteristics compared to the other formulations. Therefore addition of acidulant improved the overall acceptability.

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