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# Effect of Steam Cooking on Quality Characteristics of Shelf Stable Chicken Pickle

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## ABSTRACT

The present study was carried out to evaluate the effect of stream cooking (without pressure) on quality characteristics of shelf stable chicken pickle. Chicken pickle was prepared as per method, prescribed by Das et al. (2013) with slight modifications. An attempt was made to improve the quality characteristics of chicken pickle by precooking of marinated meat by steam cooking without pressure for 10, 15 and 20 minutes separately. There was a significant difference ($P<0.05$) among the treatments for all physico-chemical properties, except fat and ash content. The pH, moisture content and water activity values increased significantly ($P<0.05$) while titratable acidity and protein content decreased significantly ($P<0.05$) with increased precooking time. Among the colour and textural parameters, lightness (L*) and shear force values decreased significantly ($P<0.05$) while there were no significant difference in redness (a*) and yellowness (b*). Sensory scores were not significantly affected with respect to color and appearance, saltiness and sourness however flavour, texture, juiciness and overall acceptability scores were significantly ($P<0.05$) higher in precooking of marinated meat for 15 minutes. It can be concluded that the best quality chicken pickle could be prepared with pre-cooking of marinated chicken meat by steam cooking (without pressure) for 15 minutes in terms of juiciness, texture and tenderness.

**Keywords:** *Chicken pickle, Quality characteristics, Steam cooking, Shelf stable, Sensory evaluation*

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## INTRODUCTION

Economic growth leads to the extensive demand of "ready-to-cook" or "ready-to-serve" products, which results in the development of 'convenience' products to meet out the need of the people. Pickling is an ancient form of food preservation and there are historical evidences to suggest it was followed by the ancient Indians, Egyptians and Chinese. Pickled products are considered a delicacy and have a long shelf life. Currently, pickled fish and prawn are produced using organic acids as pickling agents along with spices. Pickling protects the food and also helps to retain its wholesomeness and nutritive value for a long time. Poultry sector in India has undergone a paradigm shift in structure and operation from a mere backyard activity into a major commercial agriculture based industry. Poultry production in India continues to exhibit spectacular growth inspite of several challenges encountered over the years. Poultry industry has been rising at the rate of around 8 percent per annum over the past three decades. Chicken meat is most widely accepted meat in India unlike beef or pork and the price of chicken meat is lower than that of mutton or goat meat hence chicken meat makes an important component in Indian non-vegetarian diet. Availability of high biological value animal protein, essential amino acids, fat, essential fatty acids, vitamins and other nutrients ensure its popularity among masses. Application of well suited technologies and value addition may further enhance its acceptability with greater demand and better financial returns. Chicken meat pickle is a shelf stable intermediate moisture type product. It is value added convenient product containing various ingredients like meat, spices, condiments, oil, vinegar and other food additives (Maiti et al. 2009). Quality characteristics of chicken pickle are dependent on characteristics of meat, formulation and processing technique as well as time/temperature evolution during cooking. Cooking and frying during pickle making denatures meat proteins and decreases water holding capacity of meat resulting in loss of water and increase its shelf life. Cooking also improves palatability of meat pickle and causes destruction of microorganisms present in meat. The heating profile affects the sequence and extent of meat protein denaturation in the cooking process and consequently improves the physical and sensory properties of the final product (Riva and Schiraldi, 1994). Pre cooking of marinated chicken meat before frying not only decrease the cooking time of pickle, even also may improve acceptability of product in terms of tenderness, juiciness and texture. Therefore, present study was planned to evaluate the effects of steam cooking (without pressure) on quality characteristics of chicken pickle.

## MATERIALS AND METHODS

The experiments were conducted in the Department of Livestock Products Technology, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura. The water activity (aw), color and textural parameters were conducted at Central Institute for Research on Goats (CIRG), Makhdoom, Mathura. Live spent poultry birds were procured from Department of Poultry Science, DUVASU, Mathura. These birds were taken, given rest for 1-2 hours and then slaughtered at Meat Processing Laboratory at Department of Livestock Products Technology, College of Veterinary Sciences and Animal Husbandry, DUVASU, Mathura following the standard procedure (Halal method). The lean carcass was eviscerated and dressed carcass was kept for conditioning in a refrigerator at 4±1oC for 4–6 hours and then frozen at -18oC till further processing. All other ingredients like salt, mustard oil, vinegar, spices of Agmark grade and condiments etc required for product preparation were procured from local market of Mathura. All the chemicals used in the study were procured from Hi Media Laboratories (P) Ltd, Mumbai, India. Thermo rigid air tight PET containers were sourced from local market for packaging and were pre-sterilized by exposing to U.V. light for 30 minutes before use.

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***Preparation of Spice Mix:*** The ingredients in desired ratio were procured from local market, dried at 45±2oC for 2 hours followed by grinding in food grinder (Inalsa Mixie) and sieving through mesh. The spice mix was stored in pre sterilized low density polyethylene bags and used as per requirement. The composition of spice mix is given in Table 1.

**Table 1: Composition of Spice Mix**

| Serial No. | Ingredients | Percentage (%) |
|---|---|---|
| 1. | Coriander powder (Dhaniya) | 15 |
| 2. | Cumin seed (Jeera) | 15 |
| 3. | Caraway seed (Ajwain) | 10 |
| 4. | Fennel seeds (Soanf) | 10 |
| 5. | Black pepper (Kalimirch) | 10 |
| 6. | Red chilli powder | 08 |
| 7. | Dried Ginger powder (Soath) | 08 |
| 8. | Cinnamon (Dalchini) | 05 |
| 9. | Clove (Loang) | 05 |
| 10. | Black cardamom (Badi elaichi) | 05 |
| 11. | Mace (Javitri) | 05 |
| 12. | Nutmeg (Jaifal) | 02 |
| 13. | Green cardamom (Choti elaichi) | 02 |
| | Total | 100 % |

***Preparation of chicken pickle:*** The chicken pickle was prepared as per method followed by Das et al. (2013) with slight modifications (Singh et al. 2017). Frozen dressed meat was thawed at refrigeration temperature overnight and thawed meat was cut into smaller chunks of 1-2 inch. All the ingredients i.e. common salt, mustard oil, vinegar, turmeric powder, condiments and spice mix were weighed accurately as per the formulation (table 2). Meat chunks were mixed with 1% salt and 1% turmeric powder and kept for 30 minutes for marination. The marinated chicken meat was then pre-cooked (steam cooking without pressure) for three different times viz. 10, 15 and 20 minutes respectively and abbreviated as S1- steam cooking (without pressure) of marinated chicken meat for 10 minutes; S2- steam cooking (without pressure) of marinated chicken meat for 15 minutes and S3- steam cooking (without pressure) of marinated chicken meat for 20 minutes. Pre-cooked meat chunks were then fried at 175±5oC in pre warmed mustard oil to get golden brown colour. Condiments were prepared and fried in separate kadahi in preheated mustard oil along with mustard seeds and then spice mix and salt were added to it. Finally precooked-fried meat chunks and vinegar were added to it and cooked for 5 minutes. Thus, prepared chicken meat pickle was cooled down to room temperature and then packed in pre sterilized air tight PET container, where remaining heated mustard oil was filled in container till it's top without leaving any air space. Chicken pickle was left for next 2 days at ambient temperature for maturing and then used for further analysis.

**Table 2: Formulation used for preparation of chicken pickle**

| S.N. | Ingredients | Weight(gm) |
|---|---|---|
| 1 | Chicken meat | 1000 gm |
| 2 | Mustard oil | 500 gm |
| 3 | Salt | 30 gm |
| 4 | Dry Spice mix | 30 gm |
| 5 | Condiments | 80 gm |
| 6 | Vinegar | 100 ml |
| 7 | Turmeric powder | 10 gm |
| | Total | 100 |

***Analysis of product:*** Developed chicken meat pickles were evaluated for various physico-chemical properties as per standard procedures. The pH of chicken meat pickle was determined as per Trout et al. (1992) method. Titrable acidity was determined as per Fisher and Peters (1968). Proximate composition such as moisture, fat, protein and ash percentage was evaluated as per AOAC (1995). Water activity of sample was measured by Aqua LAB dew point water activity meter 4TE. The color parameters of the samples were measured using Hunter colorimeter of ColorTech PCM+ (Color Tec Associates Inc. Clinton NJ, USA). The coin shaped lence of instrument attached to software was directly put on the surface of chicken meat pickle at randomly chosen six different points (Hunter and Harold, 1987). Textural profile analysis, i.e. shear force value, was evaluated and measured with the help of instrumental texture profile analyzer (TA HD Plus Texture Analyser) as per Bourne (1978). Sensory evaluation was carried out using eight-point hedonic scale with 8 = extremely desirable and 1 = extremely poor (Keeton, 1983). An experienced sensory panel of seven judges drawn from post-graduate students and faculty of Veterinary College, DUVASU, Mathura, India, were requested to evaluate the product for different quality attributes viz., color and appearance, texture, flavor, texture, juiciness, saltiness, sourness and overall acceptability in sensory room of department. The freshly prepared chicken meat pickles after ageing were given for sensory evaluation at normal room temperature in late afternoon around 4:00 p.m.

***Statistical analysis:*** A total of three replications were carried out, with each analysis done in duplicate (n = 6), except sensory studies where seven sensory panelists did sensory evaluation three times and n = 21 observations were recorded for each sensory attribute. The data generated from various trials under each experiment were pooled and analyzed by statistical method of one way-ANOVA and mean±S.E using SPSS-16.0 software package developed as per the procedure of Snedecor and Cochram (1995), and means were compared by using Dunkan's multiple range test at 5% level (Dunkan, 1995).

**Table 3: Effect of steam cooking (without pressure) on physico-chemical properties (Mean±SE) of chicken pickle (n=6)**

| Parameters | S1 | S2 | S3 | Treatment Mean |
|---|---|---|---|---|
| pH | $5.34^{b}$±0.02 | $5.42^{ab}$±0.03 | $5.51^{a}$±0.04 | 5.42±0.02 |
| Titrable acidity | $0.79^{a}$±0.05 | $0.77^{ab}$±0.04 | $0.73^{b}$±0.05 | 0.76±0.03 |
| Moisture (%) | $42.80^{c}$±0.04 | $43.76^{b}$±0.02 | $45.14^{a}$±0.03 | 43.90±0.23 |
| Protein (%) | $19.20^{a}$±0.07 | $18.51^{b}$±0.03 | $17.15^{c}$±0.03 | 18.29±0.20 |
| Fat (%) | 28.87±0.07 | 28.78±0.05 | 28.69±0.09 | 28.78±0.06 |
| Ash (%) | 6.55±0.03 | 6.74±0.06 | 6.88±0.04 | 6.72±0.09 |
| Water activity (aw) | $0.941^{b}$±0.09 | $0.942^{ab}$±0.05 | $0.949^{a}$±0.07 | 0.944±0.06 |

S1- steam cooking (without pressure) of marinated chicken meat for 10 minutes

S2- steam cooking (without pressure) of marinated chicken meat for 15 minutes

S3- steam cooking (without pressure) of marinated chicken meat for 20 minutes

Mean±SE with different superscripts in a row differ significantly (P<0.05)

***Instrumental colour and shear force value:*** The effects of steam cooking without pressure of marinated chicken meat on colour and shear force values of chicken meat pickle are presented in Table 4. Lightness (L*) values decreased significantly (P<0.05) with increase in cooking time, however there was no significant difference in redness (a*) and yellowness (b*) values among the treatments. Tanuja et al (2014) and Khanam (2017) also observed no significant difference in colour values of steam cooked mince fish meat incorporated chicken momos and chicken spread respectively. Shear force values of S1 was significantly (P<0.05) higher than S3, however values of S2 was comparable to S1 and S3. Higher shear force values in S1 might be due to less cooking of product, which provided more toughness and chewiness to the product, as also reported by sensory panellists.

**Table 4: Effect of steam cooking (without pressure) on physico-chemical properties (Mean±SE) of chicken pickle (n=6)**

| Parameters | S1 | S2 | S3 | Treatment Mean |
|---|---|---|---|---|
| Lightness (L*) | 30.74$^{a}$±1.27 | 28.96$^{ab}$±1.79 | 24.99$^{b}$±1.39 | 28.23±1.00 |
| Redness (a*) | 3.93±0.88 | 4.28±0.90 | 5.46±0.86 | 4.55±0.83 |
| Yellowness (b*) | 6.37±0.32 | 5.17±0.70 | 4.03±0.80 | 5.19±0.42 |
| Shear force (N/cm2) | 66.41$^{a}$±1.37 | 63.55$^{ab}$±0.27 | 60.00$^{b}$±1.42 | 63.32±0.89 |

S1- steam cooking (without pressure) of marinated chicken meat for 10 minutes
S2- steam cooking (without pressure) of marinated chicken meat for 15 minutes
S3- steam cooking (without pressure) of marinated chicken meat for 20 minutes
Mean±SE with different superscripts in a row differ significantly (P<0.05)

***Sensory evaluation:*** The effects of steam cooking without pressure of marinated chicken meat on sensory attributes of chicken meat pickle are presented in Table 5.

**Table 5: Effect of steam cooking (without pressure) on sensory attributes (Mean±SE) of chicken pickle (N=21)**

| Attributes | S1 | S2 | S3 | Treatment Mean |
|---|---|---|---|---|
| Colour and appearance | 7.28±0.01 | 7.33±0.02 | 7.34±0.01 | 7.31±0.01 |
| Flavour | 7.35$^{b}$±0.01 | 7.45$^{a}$±0.02 | 7.41$^{ab}$±0.02 | 7.40±0.01 |
| Texture | 7.41$^{b}$±0.01 | 7.48$^{a}$±0.02 | 7.45$^{ab}$±0.01 | 7.44±0.01 |
| Juiciness | 7.30$^{c}$±0.01 | 7.45$^{a}$±0.01 | 7.36$^{b}$±0.04 | 7.37±0.02 |
| Saltiness | 7.25±0.05 | 7.30±0.09 | 7.25±0.07 | 7.26±0.04 |
| Sourness | 7.25±0.01 | 7.30±0.01 | 7.27±0.02 | 7.27±0.01 |
| Overall acceptability | 7.28$^{c}$±0.03 | 7.50$^{a}$±0.01 | 7.37$^{b}$±0.02 | 7.38±0.01 |

S1- steam cooking (without pressure) of marinated chicken meat for 10 minutes
S2- steam cooking (without pressure) of marinated chicken meat for 15 minutes
S3- steam cooking (without pressure) of marinated chicken meat for 20 minutes
Mean±SE with different superscripts in a row differ significantly (P<0.05)

There was no significant difference in colour and appearance, saltiness and sourness scores with increase in cooking time. Flavour and texture scores of S2 were significantly (P<0.05) higher than S1 due to optimum cooking and tenderness of product, however S3 had comparable scores with S1 and S2. Juiciness and overall acceptability scores of scores of S2 were significantly (P<0.05) higher than other treatments. Choi et al. (2016) also observed significantly (P<0.05) higher scores of Marinated Chicken Steak treated with superheated steam than chicken steaks treated with other cooking methods. Lower scores of S1 and S3 might be due to under and over cooking of chicken pickle respectively whereas higher scores of S2 were due to optimum cooking providing appropriate flavour and texture to the product.

## CONCLUSIONS

For steam cooking without pressure resulted into significant (P<0.05) increase in pH, moisture content and water activity (aw) values whereas titrable acidity, protein content, lightness (L*) and shear force values decreased significantly (P<0.05) with increase in cooking time. Among the sensory attributes, flavour, texture, juiciness and overall acceptability scores were significantly (P<0.05) higher at steam cooking for 15 minutes. Therefore, steam cooking (without pressure) of marinated chicken meat for 15 minutes was found optimum as pre-cooking methods for preparation of chicken meat pickle.

**COMPETING INTERESTS:**
No

**ETHICS STATEMENT :** Not applicable

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