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Quality attributes of hurdle technology-based shelf-stable chicken pickle fried for different durations

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ABSTRACT

The present study was carried out to evaluate the effect of frying for different durations on quality attributes of shelf stable chicken pickle. Chicken pickle was prepared as per pre- established method. An attempt was made to improve the quality characteristics of chicken pickle by precooking of marinated meat by frying in mustard oil for 10, 15 and 20 minutes separately. The pH, fat and ash content as well as redness (a^*) values increased significantly (P<0.05) whereas titrable acidity, moisture content, lightness (L^*) and shear force valuesdecreased significantly (P<0.05) with increase in frying time of marinated chickenmeat. However, there was no significant difference in yellowness (b^*) values among the treatments. Among the sensory attributes, colour and appearance scores of marinated meat fried for 5 minutes were significantly (P<0.05) higher than marinated meat fried for 10 and 15 minutes; whereas flavour, texture, juiciness, sourness and overall acceptability scores were significantly (P<0.05) higher in marinated meat fried for 10 minutes than other treatments. Therefore, it can be concluded that the best quality chicken pickle could be prepared with pre-cooking of marinated chicken meat by frying for 10 minutes in terms of flavour, texture, juiciness, sourness and overall acceptability scores.

Keywords: - Meat pickle, shelf stable, Frying, Shear force, Sensory score

Introduction

From being a small backyard activity to a significant commercial agriculture-based enterprise, India's poultry sector has seen a fundamental change in its structure and operations. India's poultry industry is still seeing remarkable development despite a number of obstacles throughout the years. Over the past three decades, the poultry sector has grown at an average rate of about 8% annually. The overall amount of meat produced in India in 2023–24 was 10.25 million tons, according to DAHD (2024). The percentages of meat produced by buffalo, cattle, sheep, goats, pigs, and poultry were 19.83%, 4.62%, 7.6%, 14.22%, 6.41%, and 47.32%, respectively. India comes in fifth place behind the US, Brazil, the EU, and China in terms of broiler meat production. According to the 20th Livestock Census, there are 851.81 Million in 2019, increased by 16.8% over previous Census. In 2016–17, India produced over 3.5 million tons of broiler meat (DAHD, 2024). As chicken meat is less expensive than mutton or goat meat and is more extensively consumed in India than beef or pork, it plays a significant role in the non-vegetarian diet of many Indians. The availability of high biological value animal protein, vital amino acids, fat, essential fatty acids, vitamins, and other nutrients helps to its reach among the general population. Value addition and the use of appropriate technology might increase its acceptability and lead to higher demand and better financial returns.

Chicken meat pickle is a product with an intermediate moisture level that is shelf stable. It is value added convenient product containing various ingredients like meat, spices, condiments, oil, vinegar and other food additives. During development of pickles, cooking and frying denature the proteins in the meat and reduces its ability to hold water, which causes the meat to lose water and improve its shelf life. Cooking also eliminates microbes found in meat and enhances the flavour of meat pickles. Chicken meat pickle has a good sensory quality, with low microbial, yeast, and mould counts. However, other factors that affect the quality of chicken pickles include the type of meat used, the recipe and processing method, and the changes in temperature and cooking time. Any component or method that results in a higher moisture content or a higher pH might ruin the pickle by encouraging the growth of microorganisms and oxidizing lipids.Such adverse changes can be prevented in terms of microbial stability and safety of traditional and novel foods like chicken pickle with the combination of several preservation factors known as hurdles.

The partial vapour pressure of the food in relation to pure water at its surface is measured by water activity, or a_w. One of the most significant and often used indicators in food processing and testing is moisture content. Water, or moisture, contributes up to 75% of the weight of meat, making it the component with the highest quantitative importance. Meat products' water-holding and water-binding capacities are closely correlated with their water content. Muscle tissue and water are linked in meat, and protein plays a key part in the process of water binding.Except in young animals, the water content of meat is negatively correlated with fat content but unaffected by protein amount (Varnam and Sutherland, 1995).

The pH of the food also significantly impacts the lethality of heat treatment of the food. For meat products to stay stable during storage, particularly pickled meat, a pH value of less than 5.0 is deemed necessary (Dziezak, 1986). The product's microbial load is decreased by higher acidity, salt content, heating, frying, and low moisture levels. Therefore, acidification of meat pickle is intended to prevent the growth of microorganisms and make the product shelf stable at room temperature. Depending on the kinds of microbes present in the meat and the kind and concentration of acid utilized, acidified items may restrict microbial growth or survival. Fermentation and addition of organic acids have been used as a preservation method since ancient times to increase acidity of foods. When organic acids are not dissociated, they function as better preservatives.

Material and methods

The experiments were conducted in the Department of Livestock Products Technology, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura. Live spent poultry birds (72-74 weeks age) were procured from the Department of Poultry Science, DUVASU, Mathura. These birds were rested for 1-2 hours before being slaughtered at Meat Processing Laboratory following the standard procedure (Halal method). The lean carcass was eviscerated and the dressed carcass was kept for conditioning in a refrigerator at 4±1°C for 4–6 hours and then frozen at -18°C 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 the 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 the local market for packaging and were pre-sterilized by exposing them to U.V. light for 30 minutes before use.

Preparation of chicken pickle: - The chicken pickle was prepared using Das et al. (2013) method with slight modifications (Singh et al., 2019). Thawed chicken meat was cut into 1-2 inch chunks, and marinated with 1% salt and 1% turmeric powder for 30 minutes. The marinated chicken meat was then fried at 210-220^{0}C in mustard oil for 10, 15 and 20 minutes separately. In a separate kadahi containing prewarmed (170^{0}C) oil, mustard seeds, condiments, spice mix and salt were added consecutively followed fried meat chucks and vinegar and cooked for 5 minutes. The pickle was cooled to room temperature and packed in a pre-sterilized air tight PET container, with the remaining heated mustard oil filled to the top without leaving any air space. Chicken pickle was left for the next 2 days at ambient temperature for maturing and then used for further analysis. The formulation used for the preparation of chicken pickle is given in Table 1.

Analysis of product: The developed chicken pickle was 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 were evaluated as per AOAC (1995). The water activity of sample was measured by Aqua LAB dew point water activity meter 4TE. The colour parameters of the samples were measured using Hunter colorimeter of ColorTech PCM+ (Color Tec Associates Inc. Clinton NJ, USA). The coin shaped lens 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). The shear force value was evaluated and measured with the help of an 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). A sensory panel (semi-

trained) 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*., colour and appearance, texture, flavour, texture, juiciness, saltiness, sourness and overall acceptability in the sensory room of department. Plain lukewarm water was given for mouth rinsing in between sensing two samples. 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. 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.

Statistical analysis: 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 and sub-class of means were compared by using Dunkan's multiple range test at 5% level (Dunkan, 1955).

Result and Discussion

Physico-chemical properties

The effects of frying of marinated chicken meat on physico-chemical propertiesof chicken meat pickle are presented in Table 2. Moisture content decreased significantly (P<0.05) however fat content increased significantly (P<0.05) with increase in frying time due to more fat pickup and moisture loss in product. Singh et al. (2015) also reported more fat retention and moisture loss in chicken meat cutlets prepared with deep fat frying. There was no significant (P<0.05) difference in protein content and $a_w$values among the treatments.The pH values increased significantly (P<0.05) while titratable acidity decreased significantly (P<0.05) with increase in cooking time, however mean pH and titratable acidity of F2 were comparable to F1 and F3.

Colour and textural parameters

The effects of frying of marinated chicken meat on colourand shear force values of chicken meat pickle are presented inTable 3.Lightness (L^*) values decreased significantly (P<0.05) whereas redness (a^*) values increased significantly (P<0.05) with increase in frying time of marinated chicken meat.However, there was no significant difference in yellowness (b^*) values among the treatments.Lower L^* and higher a^* values with increased frying time might be due tocaramelization and browning of product. As per Szczeniak (1963), high temperature and low moisture content in surface layer may cause caramelization of sugars andoxidation of fatty acids to aldehydes, alcohols, lactones, ketones and esters which may cause a deeper brown colour of product. Shear force values of F2 were significantly (P<0.05) lower than F1 and F3 due to optimum cooking, which provided tenderness and softness to the product.

Sensory evaluation

The effects of frying of marinated chicken meat on sensory values of chicken meat pickle are presented in Table 4. Colour and appearance scores decreased significantly (P<0.05) with an increase in cooking time as frying provided dark brown colour to the product. Flavour and texture scores of F2 were significantly (P<0.05) higher followed by F2 than F1.Lower scores of F1 and F3 might be due to under and over frying of product resulting in hard texture and toughness of pickle. The changes that took place in the fried chicken pickle might be due to the induction of water loss, the stimulation of thermo-oxidation reactions, the change of the color to brown, and modification of the fatty acid profile (depending on the type of fat and oil used) (Ramirez et al., 2004). There was no significant difference in saltiness scores, however juiciness, sourness and overall acceptability scores of F2 were significantly (P<0.05) higher than F1 and F3 due to optimum cooking, appropriate flavour and texture of product.

Conclusion

Frying of marinated chicken meat resulted in significant (P<0.05) increase in pH, fat and ash content as well as redness (a^*) values whereas titrable acidity, moisture content, lightness (L^*) and shear force values decreased significantly (P<0.05) with an increase in cooking time. Among the sensory attributes, colour and appearance scores of marinated meat fried for 5 minutes were significantly (P<0.05) higher than other treatments; whereas flavour, texture, juiciness, sourness and overall acceptability scores were significantly (P<0.05) higher in marinated meat fried for 10 minutes than other treatments. Therefore, it can be concluded that the best quality chicken pickle could be prepared with pre-cooking of marinated chicken meat by frying for 15 minutes in terms of flavour, texture, juiciness, sourness and overall acceptability scores.

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Table 1. Formulation used for preparation of chicken meat pickle

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

Table 2. Physico-chemical properties (Mean±SE) of hurdle technology based shelf stable chicken meat pickle

Parameters	F1	F2	F3	Treatment Mean
pH	5.06^{b}±0.04	5.14^{ab}±0.03	5.23^{a}±0.03	5.14±0.02
Titrable acidity	0.81^{a}±0.01	0.78^{ab}±0.01	0.75^{b}±0.01	0.78±0.01
Moisture (%)	41.37^{a}±0.03	40.25^{b}±0.04	39.42^{c}±0.08	40.34±0.02
Protein (%)	19.48±0.03	19.60±0.04	19.50±0.02	19.52±0.02
Fat (%)	29.86^{c}±0.02	30.24^{b}±0.04	31.28^{a}±0.15	30.46±0.15
Ash (%)	6.31^{c}±0.05	6.55^{b}±0.02	6.83^{a}±0.05	6.56±0.05
Water activity (a_w)	0.947±0.03	0.945±0.01	0.941±0.02	0.944±0.01

F1- Frying of marinated chicken meat for 10 minutes
F2- Frying of marinated chicken meat for 15 minutes
F3- Frying of marinated chicken meat for 20 minutes
Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly (P<0.05)

Table 3. Colour and textural parameters (Mean±SE) of hurdle technology based shelf stable chicken meat pickle

Parameters	F1	F2	F3	Treatment Mean
Lightness (*L)**	31.16^{a}±0.69	29.92^{b}±0.63	26.95^{c}±0.73	29.35±0.45
Redness (*a)**	5.01^{c}±0.26	6.19^{b}±0.39	6.79^{a}±0.24	5.99±0.25
Yellowness (*b)**	5.45±0.50	5.01±0.63	4.42±0.94	4.96±0.44
Shear force (N/cm^2)	67.16^{a}±0.30	63.73^{c}±0.21	65.34^{b}±0.28	65.41±0.24

F1- Frying of marinated chicken meat for 10 minutes
F2- Frying of marinated chicken meat for 15 minutes
F3- Frying of marinated chicken meat for 20 minutes
Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly (P<0.05)

Table 4. Sensory attributes (Mean±SE) of hurdle technology based shelf stable chicken meat pickle

Attributes	F1	F2	F3	Treatment Mean
Colour and appearance	7.26^{a}±0.03	7.15^{b}±0.01	7.05^{c}±0.01	7.15±0.01
Flavour	7.15^{c}±0.01	7.30^{a}±0.01	7.25^{b}±0.01	7.23±0.01
Texture	7.10^{c}±0.01	7.25^{a}±0.01	7.18^{b}±0.01	7.17±0.01
Juiciness	7.05^{b}±0.02	7.20^{a}±0.01	7.08^{b}±0.01	7.11±0.01
Saltiness	7.00±0.05	7.11±0.01	7.02±0.04	7.04±0.02
Sourness	7.00^{b}±0.03	7.15^{a}±0.01	7.09^{b}±0.03	7.08±0.01
Overall acceptability	7.19^{b}±0.02	7.30^{a}±0.01	7.21^{b}±0.01	7.23±0.01

F1- Frying of marinated chicken meat for 10 minutes
F2- Frying of marinated chicken meat for 15 minutes
F3- Frying of marinated chicken meat for 20 minutes
Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly (P<0.05)

Hurdle Technology Based Shelf Stable Chicken Meat Pickle

References

AOAC. (1995). Official Methods of Analysis (17th edition). Association of Official Analytical Chemists, Washington, D.C, USA.

Bourne, M.C. (1978). Texture Profile Analysis. Food Technology. **32**:62-66,72.

DAHD (2024). https://dahd.gov.in/sites/default/files/2024-11/BAHS-2024.pdf

Das, A.K., Nath, D.R., Hazarika, M. and Laskar, S.K. (2013). Studies on certain quality attributes of meat pickle prepared from spent chicken. Veterinary World. **6(3)**:156-158.

Dunkan, D.B. (1955). Multiple range and multiple opening "F test". Biometrics. **1**:1-8.

Dziezak D. (1986). Antioxidants and antimicrobial agents Food Technology, 40:94-111.

Fisher, R.B. and Peters, D.G. (1968). Theory and practice of qualitative chemical analysis. 3. Philadelphia: W.B. Saunders, Co.

Hunter, R.S. and Harold, R.W. (1987). The Measurement of appearance, (2nd edition).

Keeton, J.T. (1983). Effect of fat and sodium chloride/phosphate levels on the chemical and sensory properties of pork patties. Journal of Food Science. **48(3)**:878-881.

Leistner, L. (2000). Basic aspects of food preservation by hurdle technology. International Journal of Food Microbiology. **55**:181-186.

Ramirez MR, Morcuende D, Estevez M, Cava R. 2004. Effects of the type of frying with culinary fat and refrigerated storage on lipid oxidation and color of fried pork loin chops. Food Chemistry, 88:85–94.

Szczesniak AS. (1963). Classification of texture characteristics. Journal of Food Science. 28:385-389.

Singh T, Chatli MK, Malav OP, Kumar P and Metha N. (2015). Quality characteristics of spent henmeat cutlets incorporated with meat emulsion as binder. Indian Journal of Poultry Science, 50: 175-179.

Singh, S., Goswami, M., Pathak, V., Verma, A.K. and Rajkumar, V. (2019). Effect of steam cooking on quality characteristics of shelf stable chicken pickle. Journal of Meat Science. **14(1&2):** 12-15.

Trout, E.S., Hunt, N.C., Johnson, D.E., Claus, J.R., Kastner, C.L., Kropf, D.H. and Stroda, S. (1992). Chemical, physical, and sensory characterization of ground beef containing 5 to 30 percent fat. Journal of Food Science. **57**:25–29.

Varnam AH, Sutherland JP. (1995). The water of meat in Meat and Meat Products.Chapman & Hall, New York, pp. 24–26.