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Effect of microwave cooking on quality attributes of shelf stable chicken meat pickle

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Abstract
The purpose of this study was to assess the effect of microwave cooking on the physico-chemical parameters, shear force value, and sensory values of shelf-stable chicken meat pickles. Chicken meat pickles were cooked using the method prescribed by Singh *et al*. (2019). An effort was made to enhance the quality attributes of chicken meat pickles by pre-cooking the marinated meat by microwave cooking for 20, 15, and 10 minutes separately. Microwave cooking of chicken meat pickles resulted in a significant ($p<0.05$) increase in ash content, pH, and redness values and significant decrease ($p<0.05$) in titrable acidity, moisture content, shear force values, lightness, and yellowness values with increased cooking time. Among the sensory attributes, colour and appearance score, flavour, texture, juiciness scores, and overall acceptability scores of microwave-cooked meat for 10 minutes were significantly ($p<0.05$) higher, hence selected as the best treatment. The above study found that the chicken pickle could be prepared with the pre-cooking of marinated chicken meat by microwave cooking for 10 minutes, which was found to be optimal in terms of overall acceptability, juiciness, flavour, and texture.

Keywords: Chicken pickles, water activity, microwave cooking, shear force value

Introduction
Pickling is an age-old traditional process for the preservation of food. Pickles are a good appetite-increasing food which stimulates the flow of gastric juices and helps in the digestion of food. Because pickling requires no refrigerated facilities and has a cheaper initial investment, it's also a better option for developing rural entrepreneurship. Foods that are perishable can be pickled in vinegar or edible oil with additional salt, spices, and condiments to develop a ready-to-eat product that keeps well at room temperature.

India's poultry industry has grown from backyard farming to a significant commercial agricultural industry, revolutionizing its structure and methods of operation. Despite various challenges faced over the years, India's poultry output has continued to rise at an astounding rate. The poultry sector has been showing a growth rate of around 8% per year over the past few decades. As per DAHD (2018) [3], India produced a total of 7.7 million metric tons of meat in 2017–18, with the contribution of buffalo, cattle, sheep, goats, pigs, and poultry at 19.83%, 4.62%, 7.6%, 14.22%, 6.41%, and 47.32%, respectively. India is the fifth-largest producer of broiler meat after the US, Brazil, the European Union, and China. According to the 19th Livestock Census, the total poultry population in India is 729.21 million. In 2016–17, India produced about 3.5 million metric tons of broiler meat. Since chicken meat is less expensive than mutton or goat meat and is more extensively consumed in India than beef or pork, chicken meat is a staple of the country's non-vegetarian diet.

Chicken meat pickles are a shelf-stable and intermediate-moisture product. It is a convenient, value-added product made up of a variety of components, including meat, oil, vinegar, spices, and other food additives. While cooking pickles, cooking and frying denatures the proteins in the meat and reduces its ability to hold water, which causes the meat to lose water and enhances its shelf life. Cooking also eliminates the bacteria found in meat and enhances the flavour of meat pickles. Pickled chicken meat exhibits good sensory quality along with reduced levels of bacteria, yeast, and mold. However, various 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 an increased moisture content or a higher pH value might spoil the pickle by encouraging the growth of microorganisms and oxidizing lipids. Such negative effects can be avoided in terms of the microbiological stability and safety of classic and innovative foods like chicken pickles, along with other preservation methods known as hurdles.

Water activity (a_w) is a measure of the partial vapor pressure of food compared to that of pure water at its surface. One of the most significant and widely used parameters in food processing and testing is moisture content. Moisture contributes up to 75% of the weight of meat, making it an important component. Meat products' water-holding and water-binding capacities are directly associated with their water content. Muscle tissue and water are linked in meat, and protein plays a vital role in the process of water binding. Except in young animals, the water content of meat is negatively associated with fat content but unaffected by protein amount (Varnam and Sutherland, 1995) [17].

The food's pH has a major effect on the lethality of the heat treatment of the food. For meat products to stay stable during storage, a pH value of less than 5.0 is considered vital (Dziezak, 1986) [5]. The product's microbial load is reduced by higher acidity, salt content, heating, frying, and low moisture levels. Therefore, the goal of acidifying meat pickles is to stop germs from growing and stabilize their shelf life at room temperature. Acidified goods may limit microbial growth or survival, depending on the kind of bacteria in the food and the sort and concentration of acid used. Food has been preserved by fermentation and the addition of organic acids to increase its acidity since the beginning of time. Organic acids work better as preservatives when they are not dissociated. When organic acids' pH in food is decreased, they function better as preservatives.

Material and Methods

The trials were carried out at the Department of LPT, Co.V.Sc. and A.H., DUVASU, Mathura. At the CIRG, Makhdoom, Mathura, tests were done on the colour values, water activity (a_w), and texture criteria. Live broiler birds were procured from the Department of Poultry Science, Co.V.Sc. and A.H., DUVASU, Mathura. After being collected, these birds were given rest for one to two hours before being slaughtered at the meat processing laboratory using the Halal method. After being dissected and dressed, the lean carcass was refrigerated at 4±1 °C for 4-6 hours to condition it before being frozen at -18 °C till further processing. The remaining elements needed to prepare the product, such as salt, mustard oil, vinegar, Agmark-grade spices, and condiments, were purchased from the local market in Mathura. All the chemicals used in the experiments were purchased from Hi Media Laboratories (P) Ltd., Mumbai, India. Thermo-rigid airtight PET containers were purchased for packaging from a nearby market and were UV-sterilized for 30 minutes before usage.

Preparation of Spice Mix

The spices, purchased from the local market, were mixed in the desired ratio, dried for two hours at 45 °C, ground in a grinder (Inalsa Mixie) and sieved. The spice mixture was kept in LDPE bags that had been previously sterilized and used as needed. The composition of the spice mix is given in Table 1.

Preparation of chicken pickles

The chicken meat pickles were prepared using Singh *et al*. 2019 [15] (a slight modification of Das *et al*. 2013 method). Thawed meats were cut into 1-2-inch chunks and marinated with turmeric powder @ 1% and salt @ 1% for 30 minutes. The marinated meat was steam-cooked (without pressure) for 15 minutes at 175±5 °C and then fried in heated mustard oil to get a golden-brown colour. In a separate kadahi containing prewarmed oil, mustard seeds, condiments, spice mix, and salt were added consecutively, followed by the adding fried meat chucks and vinegar, and cooked for 5 minutes. Once the pickle reached room temperature, it was put into an airtight PET container that had been previously sanitized. The heated mustard oil was poured into the container until it reached the top, leaving no room for air. After ripening for the next two days at room temperature, the chicken pickle was used for additional examination. The composition used for the preparation of chicken pickles are given in Table 2.

Analysis of the product

The developed chicken meat pickle underwent standard methodologies to examine its physico-chemical and other properties. The Trout *et al*. (1992) [16] method was used to measure the pH of the pickled chicken meat. The Fisher and Peters (1968) [7] method was used to determine titrable acidity. Proximate composition was assessed according to AOAC (1995) [1], which includes moisture, fat, protein, and ash percentage. The Aqua LAB dew point water activity meter 4TE was used to measure the a_w (water activity) of the sample. Using a Hunter colorimeter from ColorTech PCM+ (ColourTec Associates Inc., Clinton, NJ, USA), the colour characteristics of the samples were measured. Six randomly selected places on the exterior layer of the chicken meat pickle were touched with a coin-shaped piece of instrument attached to software (Hunter and Harold, 1987) [10]. Using an texture profile analyzer (TA. HD Plus Texture Analyzer), the shear force value (a measure of the texture profile) was measured in accordance with Bourne (1978) [2]. An eight-point hedonic scale, where 8 represents extremely desirable and 1 represents extremely unsatisfactory, was used to conduct the sensory evaluation (Keeton, 1983) [11]. A semi-trained panel of 7 judges, selected from the post-graduate students and faculty of the Veterinary College at DUVASU, Mathura, India, was asked to assess the product in the department's sensory room for various quality attributes, including colour and appearance, texture, flavour, juiciness, sourness, saltiness, and overall acceptability. When 2 samples were sensed, consequently, lukewarm water for mouth rinsing was given. After ageing, the chicken meat pickles were used for sensory assessment at room temperature in the late afternoon, around 4:00 p.m. A total of 3 replications were conducted, with each analysis conducted in duplicate (n = 6), except for the sensory investigations, where 7 panelists performed three sensory evaluations and 21 observations were recorded for each sensory attribute.

Statistical analysis

The data obtained from various experiments were collected and analyzed by the statistical method of one-way ANOVA

and mean ± S.E. using the SPSS-16.0 software package, and sub-classes of means were compared using Dunkan's multiple range test at the 5% level (Dunkan, 1955) [6].

Results and Discussion

Physico-chemical properties

The effects of microwave cooking on the physico-chemical parameters of chicken meat pickles are showed in Table 3. The pH and ash content increased significantly ($p<0.05$), while moisture content and titrable acidity decreased significantly ($p<0.05$) with increased microwave cooking at 540 MHz, which might be due to more moisture loss with an increase in cooking time. Oz *et al*. (2016) [12] also observed a significant ($p<0.05$) increase in pH values of beef steaks with an increase in microwave cooking time. As per Girard (1992) [9], the increased pH values in cooked meat from microwave cooking could be due to the cleavage of bonds involving sulfhydryl, hydroxyl groups, and imidazole. Ruyack and Paul (1972) [14] also reported more cooking loss during the heating of beef by microwave cooking than other conventional methods due to less moisture retention and a higher percentage of moisture loss. There was no significant ($p<0.05$) difference in fat, protein content and a_w values among the treatments.

Instrumental colour and shear force values

Table 4 shows the effect of microwave cooking on the colour and shear force values of the chicken meat pickles. Lightness (*L**) and yellowness (*b**) values decreased significantly ($p<0.05$); however, redness (*a**) values increased significantly ($p<0.05$) with increased time of microwave cooking, which might be due to proper cooking and non-enzymatic browning of the product. Yang and Chen (1993) [18] also observed increased redness and decreased lightness and yellowness in chicken meat cooked by microwave cooking as compared to raw meat. Parang *et al.* (2011) [13] also observed similar findings in microwave cooking of *Longissimus dorsi* veal meat. It might be explained by pigment oxidation (heme group) after cooking having less brightness (Garcia *et al*., 2007) [8]. The shear force values throughout the treatments did not differ significantly; however, values declined slightly with increased cooking time due to the softness and tenderness of the product.

Sensory evaluation

Table 5 shows the effect of microwave cooking on the sensory attributes of the chicken meat pickles. The colour and appearance scores of M1 (microwave cooking for 10 minutes) and M2 (microwave cooking for 15 minutes) were significantly higher than those of M3 due to the higher rate of maillard reaction and browning of meat with increased time in M3 (microwave cooking for 20 minutes). There was no significant difference in sourness and saltiness scores; however, overall acceptability, flavour, juiciness, and texture scores of M1 were significantly ($p<0.05$) higher than other treatments due to optimum cooking, which provided appropriate tenderness, palatability, and flavour to the product.

Table 1: Composition of Spice Mix

Ingredients	Percentage (%)
Coriander powder (Dhaniya)	15
Cumin seed (Jeera)	15
Caraway seed (Ajwain)	10
Fennel seeds (Soanf)	10
Black pepper (Kalimirch)	10
Red chilli powder	08
Dried Ginger powder (Soath)	08
Cinnamon (Dalchini)	05
Clove (Loang)	05
Black cardamom (Badi elaichi)	05
Mace (Javitri)	05
Nutmeg (Jaifal)	02
Green cardamom (Choti elaichi)	02
Total	100%

Table 2: Formulation used for preparation of chicken pickle

Ingredients	Weight(gm)
Chicken meat	1000 gm
Mustard oil	500 gm
Salt	30 gm
Dry Spice mix	30 gm
Condiments	80 gm
Vinegar	100 ml
Turmeric powder	10 gm

Table 3: Effect of microwave cooking on physico-chemical properties (Mean±SE) of chicken meat pickle

Parameters	M1	M2	M3	Treatment Mean
pH	5.11^{b}±0.06	5.19^{ab}±0.03	5.32^{a}±0.03	5.21±0.03
Titrable acidity	0.79^{a}±0.02	0.77^{ab}±0.04	0.74^{b}±0.06	0.76±0.03
Moisture (%)	44.16^{a}±0.15	43.13^{b}±0.13	38.50^{c}±0.12	41.93±0.09
Protein (%)	18.01±0.02	17.89±0.06	17.92±0.02	17.94±0.18
Fat (%)	29.20±0.53	29.95±0.61	30.40±0.48	29.85±0.43
Ash (%)	5.76^{b}±0.03	5.81^{ab}±0.02	5.92^{a}±0.02	5.83±0.02
Water activity (a_w)	0.949±0.01	0.941±0.01	0.946±0.01	0.945±0.02

Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly ($p<0.05$)
(M1-microwave cooking for 10 minutes, M2- microwave cooking for 15 minutes, M3-microwave cooking for 20 minutes)

Table 4: Effect of microwave cooking on colour and textural parameters (Mean±SE) of chicken meat pickle

Parameters	M1	M2	M3	Treatment Mean
Lightness (*L**)	30.53^{a}±0.81	30.06^{a}±0.60	25.69^{b}±0.47	28.76±0.23
Redness (*a**)	4.83^{c}±0.59	5.61^{b}±0.65	5.80^{a}±0.71	5.41±0.51
Yellowness (*b**)	5.63^{a}±0.88	5.32^{a}±1.08	4.41^{b}±0.90	5.12±0.65
Shear force (N/cm^2)	66.18±0.88	65.61±0.78	63.75±0.91	65.18±0.85

Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly ($p<0.05$)
(M1-microwave cooking for 10 minutes, M2- microwave cooking for 15 minutes, M3-microwave cooking for 20 minutes)

Table 5: Effect of microwave cooking on sensory attributes (Mean±SE) of chicken meat pickle

Attributes	M1	M2	M3	Treatment Mean
Colour and appearance	7.26^{a}±0.01	7.32^{a}±0.01	7.10^{b}±0.04	7.22±0.01
Flavour	7.38^{a}±0.01	7.35^{b}±0.01	7.25^{b}±0.01	7.32±0.01
Texture	7.42^{a}±0.01	7.37^{b}±0.01	7.30^{c}±0.01	7.30±0.01
Juiciness	7.35^{a}±0.01	7.25^{b}±0.01	7.12^{c}±0.03	7.24±0.01
Saltiness	7.20±0.34	7.10±0.22	7.00±0.25	7.10±0.18
Sourness	7.21±0.09	7.15±0.08	7.18±0.06	7.12±0.05
Overall acceptability	7.40^{a}±0.01	7.33^{b}±0.02	7.25^{c}±0.01	7.32±0.01

Overall means bearing different superscripts in a row (a, b, c, d.....) differ significantly (p<0.05)
(M1-microwave cooking for 10 minutes, M2- microwave cooking for 15 minutes, M3-microwave cooking for 20 minutes)

Conclusion

Microwave cooking of marinated chicken meat for meat pickle preparation showed significant (p<0.05) increase in pH, ash content, and redness values and significant decreased in titrable acidity, moisture content, lightness, yellowness, and textural values (p<0.05) with increased microwave cooking time. Between the sensory attributes, overall acceptability, colour and appearance, texture, juiciness, and flavour scores were significantly (p<0.05) higher at microwave cooking of marinated chicken for 10 minutes. Therefore, microwave cooking of marinated chicken at 540 MHz for 10 minutes was found to be optimal as a pre-cooking method for the preparation of chicken meat pickles.

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References

1. AOAC. Official Methods of Analysis. 17th edition. Association of Official Analytical Chemists, Washington, D.C; c1995.
2. Bourne MC. Texture Profile Analysis. Food Technol. 1978;32:62-66, 72.
3. DAHD. 2018. Statistical database [Online] Available at: http://dahd.nic.in/about-us/divisions/statistics
4. Das AK, Nath DR, Hazarika M, Laskar SK. Studies on certain quality attributes of meat pickle prepared from spent chicken. Vet. World. 2013;6(3):156-158.
5. Dziezak D. Antioxidants and antimicrobial agents. Food Technology. 1986;40:94-111.
6. Dunkan DB. Multiple range and multiple F test". Biometrics. 1995;1:1-8.
7. Fisher RB, Peters DG. Theory and practice of qualitative chemical analysis. 3rd ed. Philadelphia: W.B. Saunders, Co; c1968.
8. Garcia SP, Andres BA, Martinez-monzo J. Effect of cooking method on mechanical properties, colour and structure of beef muscle (*M. pectoralis*). Journal of Food Engineering. 2007;80:813-821.
9. Girard JP. Technology of Meat and Meat Products. Ellis Horword Ltd., Chichester, U.K; c1992.
10. Hunter RS, Harold RW. The Measurement of Appearance, 2nd edition; c1987.
11. Keeton JT. Effect of fat and sodium chloride/phosphate levels on the chemical and sensory properties of pork patties. J Food Sci. 1983;48(3):878-881.
12. Oz F, Aksu MI, Turan M. The effects of different cooking methods on some quality criteria and mineral composition of beef steaks. Journal of Food Processing and Preservation; c2016. p. 1745-4549.
13. Parang N, Yarmand S, Emamjomeh Z. Effect of cooking methods on chemical composition, quality and cook loss of camel muscle (*Longissimus dorsi*) in comparison with veal. African Journal of Biotechnology. 2011;10(51):10478-10483.
14. Ruyack DF, Paul PC. Conventional and microwave heating of veal: use of plastic wrap. Family and Consumer Sciences research Journal. 1972;1:98.
15. Singh S, Goswami M, Pathak V, Verma AK, Rajkumar V. Effect of steam cooking on quality characteristics of shelf stable chicken pickle. Journal of Meat Science. 2019;14(1&2):12-15.
16. Trout ES, Hunt NC, Johnson DE, Claus JR, Kastner CL, Kropf DH, Stroda S. Chemical, physical, and sensory characterization of ground beef containing 5 to 30 percent fat. J. Food Sci. 1992;57:25-29.
17. Varnam AH, Sutherland JP. The water of meat in Meat and Meat Products. Chapman & Hall, New York, pp. 1995;24-26.
18. Yang C, Chen T. Effects of refrigerated storage, pH adjustment, and marinade on colour of raw and microwave-cooked chicken meat. Poultry Science. 1993;72(2):355-362.