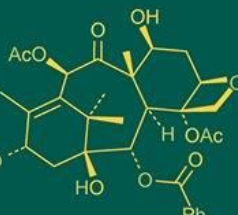
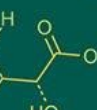
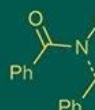


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Development and quality evaluation of shelf-stable boneless chicken pickle

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Abstract

Pickling of meat serves as an excellent and economical method for producing shelf-stable meat products. As a highly acceptable, ready-to-eat, and convenient product of Indian origin, pickle offers a valuable alternative for meat preservation. The present study aimed to develop a shelf-stable boneless chicken pickle that could be safely stored at ambient room temperature. Boneless broiler chicken meat, along with a combination of spices, salt, condiment paste, sunflower oil, and vinegar, was utilized in formulating the product. The developed chicken pickle was examined for its physicochemical properties—including cooking yield percentage, pH, and titratable acidity—along with proximate composition parameters such as moisture, protein, and fat content. Microbial quality was assessed by determining total plate count, yeast, and mould levels, and the product was also subjected to sensory evaluation. Based on the overall physicochemical, microbial, and sensory evaluation results, it is concluded that the developed chicken pickle is highly acceptable and offers substantial value addition as a shelf-stable meat product.

Keywords: Chicken pickle, shelf-stable, physico-chemical characteristics, proximate composition, sensory attributes

Introduction

India has emerged as a significant contributor to global meat production, with total output reaching 10.50 million tonnes in 2024-25, thereby ranking fourth worldwide. Over the past decade, the country has experienced a notable rise in meat production, driven primarily by the poultry sector, which accounts for 49.27% of the total national meat yield (BAHS, 2025) [6]. Among the various meat types, chicken meat holds exceptional popularity due to its affordability, wide accessibility, minimal religious constraints, ease of culinary preparation, desirable sensory characteristics, high digestibility, and low caloric value. Nutritionally, chicken meat is recognized as an excellent source of high-quality protein with low lipid content, providing all essential amino acids and beneficial unsaturated fatty acids. Rapid urbanization, rising per capita income, shifting lifestyle patterns, increased consumer awareness, and the growing involvement of women in the workforce have collectively intensified the demand for ready-to-eat (RTE) meat products. Modern consumers increasingly prioritize foods that offer high nutritional value, enhanced microbiological safety, and minimal use of synthetic preservatives. However, meat continues to be highly perishable, especially in tropical regions where high ambient temperatures and humidity accelerate spoilage and increase susceptibility to foodborne pathogens. These challenges underscore the need for developing meat products with extended shelf life suitable for storage at room temperature (Raut *et al.*, 2024) [15].

Pickling represents one of the traditional and effective preservation techniques for developing low-cost, shelf-stable meat products. Meat pickles are widely accepted RTE convenience foods of Indian origin and have gained popularity due to their distinctive sensory attributes (Gadekar *et al.*, 2010) [9]. Beyond their preservative function, pickling imparts desirable characteristics such as enhanced colour, flavour, and texture. Additionally, pickles are known to act as natural appetizers, stimulating gastric secretions and aiding digestion (Rahman *et al.*, 2025) [13]. The term “meat pickle” refers to a condiment-type preparation consisting of meat, spices, salt, vegetable oil, and optionally acetic acid (Sidhu

et al., 1995) [16]. It is an unfermented, spicy RTE product with low moisture content, which contributes to its stability for several weeks under ambient storage conditions (Maiti *et al.*, 2009) [12]. This study therefore focuses on formulating a shelf-stable boneless chicken pickle suitable for effective commercialization and on evaluating its quality attributes.

Materials and Methods

Materials

Boneless chicken meat was procured from retail chicken shops, the fat and adhering extraneous materials on the surface of chicken were removed and it was cut into small cubes of 1.0 cm³. The spices, oil and condiments were procured from super markets.

Preparation of spice mix

The spices were dried in an oven at 50 °C for 4 hours, ground using a mixer, sieved through a fine mesh, and stored in a glass jar. The spice mix formulation was presented in Table-1.

Table 1: Formulation of spice mix

Ingredients	Level of ingredients (%)
Red chilli powder	64.5%
Coriander	16.0%
Turmeric	7.5%
Cloves	3.5%
Cinnamon	3.5%
Black pepper	3.5%
Fenugreek	1.5%

Preparation of chicken pickle

The chicken was cut into cubes of 1.0 cm³ and washed thoroughly. The chicken cubes were deep-fried in heated sunflower oil until a golden-brown colour developed and were kept aside. The fresh sunflower oil was then heated to prepare the gravy; the condiment paste was added into the oil followed by salt, commercial chicken masala, and the prepared spice mix. All the ingredients were boiled in the oil, after which the fried chicken pieces were added into the gravy, cooked for 2 minutes, and cooled. After cooling, vinegar was added to the pickle, mixed thoroughly, and packed in polyethylene terephthalate (PET) 250 g bottles. The product was stored at ambient room temperature (32±2 °C) for a maturation period of 2 days. The formulation of boneless chicken pickle was presented in Table-2.

Table 2: Formulation of boneless chicken pickle

Ingredients	Level of ingredients (%)
Fried chicken	40%
Sunflower oil	40%
Spice mix	6%
Commercial chicken masala	3%
Salt	4%
Condiment paste (Ginger:Garlic-1:1)	5%
Vinegar	2%

Physico-chemical characteristics analysis

The weight of the pickle samples was recorded before and after processing, and the yield was determined (product yield = weight of pickles/weight of raw materials × 100) and expressed as a percentage. The pH of the chicken pickle was measured using a digital pH meter. Titratable acidity (% acetic acid) was assessed following the procedure outlined

by APHA (1984) [5]. The proximate composition, including moisture, protein, and fat percentages, was estimated according to the methods prescribed by AOAC (2000) [4]. Total plate count and yeast and mold counts of the chicken pickle samples were analyzed following the standard procedures described by APHA (1984) [5]. Ready-to-use media (Hi-Media Laboratory Pvt. Ltd., Mumbai, India) were employed for microbial enumeration. The mean colony counts for each group of organisms were expressed as log₁₀ CFU/g of sample.

Sensory evaluation was carried out using semi-trained panelists. The chicken pickle samples were presented to the panel, and sensory traits such as appearance, flavour, juiciness, tenderness, saltiness, sourness, and overall acceptability were assessed using a 9-point descriptive scale (where 1 indicates extremely undesirable and 9 denotes extremely desirable) as per the method of Keeton (1983) [11]. Statistical analysis of the data was performed using Microsoft Excel.

Results and Discussion

The physico-chemical characteristics, proximate composition, microbiological profile and sensory evaluation of the boneless chicken pickle were presented in table-3.

Table 3: Physico-chemical characteristics, Proximate composition, Microbial Profile, Sensory evaluation of chicken pickle

Physico-chemical characteristics	
Product yield (%)	96.3±0.71 %
pH	4.67±0.21
Titrateable acidity (% acetic acid)	0.43±0.26 % acetic acid
Proximate Composition	
Moisture (%)	27.78±0.91%
Protein (%)	20.51±0.27 %
Fat (%)	48.31±0.32%
Microbial profile	
Total plate count	0.87±0.18 log ₁₀ CFU/g
Yeast and mould count	Not Detected
Sensory evaluation	
Appearance	8.7±0.12
Flavour	8.5±0.18
Juiciness	7.6±0.10
Tenderness	8.1±0.18
Saltiness	8.3±0.15
Sourness	8.2±0.17
Overall acceptability	8.4±0.12

The average product yield of the developed boneless chicken pickle was 96.3%. Product yield is a critical parameter for commercialization, as a higher yield directly contributes to improved profitability for manufacturers. The yield of chicken pickle is influenced by the method of cooking employed, such as boiling, pressure cooking, or deep-fat frying, as well as by the composition and levels of ingredients used in the formulation. Anandh *et al.*, (2019) [3] reported a product yield of 108.16% for chicken gizzard pickle, which is comparable with the findings of the present study. The slightly lower yield observed in the prepared boneless chicken pickle may be attributed to moisture loss from the chicken meat and condiment paste during cooking in the pickle gravy. In contrast to the present results, Dey *et al.*, (2021) [7] documented a substantially lower cooking yield of 57.2% for chicken pickle.

The pH of the developed chicken pickle was recorded as 4.67. The observed lower pH may be attributed to the

addition of acetic acid and its subsequent diffusion into the muscle tissue through capillary action, driven by pressure gradients resulting from internal deformation of the meat (Gault, 1985)^[10]. A pH below 5.0 is considered critical for ensuring the storage stability and safety of pickled meat products (Dziezak, 1986)^[8]. The present findings are in agreement with reports by Rahman *et al.*, (2025)^[13], Dey *et al.*, (2021)^[7] and Rajbanshi *et al.*, (2016)^[14] who observed pH values of 4.79, 4.67 and 4.65 respectively, in chicken pickle. The titratable acidity of the developed boneless chicken pickle was found to be 0.43% acetic acid. These results are in close agreement with the findings of Anandh (2020)^[1, 2], who reported a titratable acidity of 0.70% acetic acid. In contrast to the present study, Rahman *et al.*, (2025)^[13] recorded a comparatively higher titratable acidity of 1.37% acetic acid in chicken pickle.

The mean proximate composition of the boneless chicken pickle revealed moisture, protein, and fat contents of 27.78%, 20.51%, and 48.31%, respectively. Thermal processing during cooking leads to denaturation of meat proteins, resulting in a reduction in the water-holding capacity of muscle tissues and subsequent loss of moisture. Additionally, frying further contributes to moisture depletion due to the removal of water from the meat matrix. Similar findings were reported by Rajbanshi *et al.*, (2016)^[14], who observed moisture, protein, and fat contents of 24.87%, 20.91%, and 50.03%, respectively, in chicken pickle. The moisture content of the developed chicken pickle falls within the desirable range for classification as an intermediate-moisture meat product, thereby supporting its suitability as a shelf-stable commodity.

The total plate count (TPC) was determined to assess the microbial quality, shelf stability, and safety of the developed product. The chicken pickle exhibited a markedly low TPC of 0.87 log₁₀ CFU/g, which may be attributed to the effective destruction of microorganisms during cooking by deep-fat frying, along with the maintenance of hygienic conditions during processing. Anandh *et al.*, (2019)^[3] reported a comparable total plate count of 0.74 log₁₀ CFU/g in chicken gizzard pickle. Similarly, Wani and Majeed (2014)^[17] observed a low TPC of less than 1.0 log₁₀ CFU/g in chicken gizzard pickle during a storage period of up to 90 days. In contrast, higher total plate counts of 2.42 and 3.46 log₁₀ CFU/g in chicken pickle were reported by Dey *et al.*, (2021)^[7] and Rahman *et al.*, (2025)^[13], respectively.

Yeast and mould counts were not detected in the developed chicken pickle, indicating good microbiological stability. Similar observations were reported by Dey *et al.*, (2021)^[7], Anandh and Narayanan (2020)^[1, 2], and Rahman *et al.*, (2025)^[13]. However, the presence of yeast and mould in chicken pickle has been reported in some studies, wherein Rajbanshi *et al.*, (2016)^[14] and Anandh (2020)^[1, 2] recorded counts of 0.8 and 1.2 log₁₀ CFU/g, respectively.

The sensory evaluation scores of the developed chicken pickle for appearance, flavour, juiciness, tenderness, saltiness, sourness, and overall acceptability were 8.7, 8.5, 7.6, 8.1, 8.3, 8.2, and 8.4, respectively. All sensory attributes received high scores, indicating strong acceptance of the product by the sensory evaluation panel. The flavour of the pickle was highly pronounced, which may be attributed to the characteristic aroma imparted by dried spices and condiments used in the formulation. The relatively lower score for juiciness compared to other sensory attributes could be ascribed to reduced moisture content in the chicken

meat as a result of the frying process. The sensory scores obtained in the present study are comparable with those reported for chicken pickle by Anandh *et al.*, (2019)^[3], Anandh (2020)^[1, 2], and Dey *et al.*, (2021)^[7].

Conclusion

Based on the overall physicochemical, proximate, microbial, and sensory evaluation results, it is concluded that the developed chicken pickle is highly acceptable and offers substantial value addition as a shelf-stable meat product. The preparation method is simple, quick, and requires minimal technical expertise, making it feasible to adopt at the household or small-scale processing level. Owing to its ease of preparation and low initial investment requirements, the product holds strong potential for commercialization, particularly as a livelihood opportunity for working women and unemployed youth.

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