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Development and quality evaluation of meat balls from turkey meat

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A study was conducted to develop and assess the quality and acceptability of meat balls from turkey meat (*Meleagris gallopavo*). Meat balls prepared from broiler chicken meat were used as control. Significantly ($P<0.05$) higher pH, product yield (%), moisture retention (%), moisture (%), protein (%) and fat (%) were observed in turkey meat balls. The product shrinkage (%) was non-significantly higher in broiler chicken meat balls as compared to turkey meat balls. No significant differences were observed in microbial counts between the broiler chicken meat and turkey meat balls. Physico-chemical parameters of turkey meat balls were comparable with broiler chicken meat balls. Sensory evaluation scores results indicated that meat balls prepared from turkey were rated "very palatable" and were comparable with meat balls prepared from broiler chicken meat. Therefore, it can be concluded that, turkey meat can be successfully used for preparation of meat balls of acceptable quality.

Key Words : Turkey, Broiler, Chicken, Meat, Balls, Quality, Acceptability

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INTRODUCTION

Commercial turkey (*Meleagris gallopavo*) farming is becoming popular in India and farmers started to show interest in rearing turkey birds. Recently, the consumption of turkey meat is increasing worldwide and a similar trend is also emerging in India (Anna Anandh, 2018). Turkey meat has tremendous commercial viability because of its low fat and cholesterol content in comparison to red meat and other poultry meat (Castro *et al.*, 2000). Popularization of turkey meat and meat products through efficient utilization process is necessary to upgrade this back yard activity to a commercial business (Anna Anandh *et al.*, 2019). Heavier size of turkey carcass make its effective utilization in value added meat product manufacture is a difficult task. Development of further processed products from the turkey meat would be the most profitable way of utilization turkey meat (Anna Anandh, 2018). Hence, there is a need to develop more convenience products from the meat of turkey. In this perspective, it is necessary to evolve appropriate technology to convert the turkey meat in to convenient, attractive and more acceptable ready to eat meat products. Hence, a study was undertaken to develop and evaluate the acceptability of meat balls from turkey meat and were compared with meat balls prepared from broiler chicken meat.

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METHODOLOGY

Turkey meat:

Beltsville small white turkey (*Meleagris gallopavo*) were procured from Instructional Livestock farm

Complex and individually weighed after overnight fasting (except for water) and then slaughtered. The turkeys were killed by cutting the jugular vein and carotid artery on one side of the neck near atlanto occipital joint. After bleeding the carcasses were scalded at 58 ± 2°C for 2 min, handpicked and manually eviscerated. The meat separated from the turkey carcass and meat cut into small cubes and then minced through meat mincer. The minced turkey meat was used for preparation of turkey meat balls.

Broiler chicken meat:

Boneless broiler meat was purchased from local broiler meat processor. The broiler meat cut in to small cubes and then minced through meat mincer. The minced broiler chicken meat was used for preparation of chicken meat balls.

Product formulation:

Meat ball formulation consisted of 100 per cent minced broiler chicken meat / minced turkey meat, 2.5 per cent salt, 0.5 per cent sodium tripolyphosphate, 3.5 per cent spice mix (aniseed – 10, black pepper – 10, caraway seed – 10, capsicum – 8, cardamam – 5, cinnamon – 4, clove – 1, coriander – 20, cumin seed – 22, turmeric 10 percentage/weight), 5.0 per cent refined vegetable oil, 4.0 per cent refined wheat flour, 6.0 per cent condiments mix (onion, garlic and ginger in the ratio of 10:2:1), 10 per cent cooked mashed potato and 10 per cent ice flakes.

Product preparation:

The broiler chicken meat / turkey meat was manually cut into meat chunks and then minced through a meat mincer. Weighed quantity of minced turkey / chicken meat samples were mixed in meat mixer for 2 min with salt (2.5%) and sodium tri polyphosphate (0.5%), vegetable oil (5.0%), spice mix (3.5%), condiments mix (6.0%), refined wheat flour (4.0%), cooked mashed potato (10%) and ice flakes (10%) were added to mixer and mixing was further continued for 3 min so as to obtain the homogenous mixture. Then about 20 g of meat mix was manually made in to round shape. The raw balls were cooked in pre heated water upto an internal temperature of 82 $\pm$ 1ºC and maintained at this temperature for about 10 min. The internal temperature was recorded using probe thermometer. After cooking, the cooked meat balls were allowed to cool down and were evaluated for various physico – chemical and sensory attributes.

Analytical procedures:

The pH was determined by using a digital pH meter according to the procedure explained by Trout *et al*. (1992) by dipping the combined glass electrode of a digital pH meter in the slurry of meat balls with distilled water. Product yield was expressed as a percentage after recording the weights of raw and cooked meat balls. Shrinkage of the products was calculated using the formula given by El-Magoli *et al.* (1996) with suitable modification. Moisture (%) of the cooked sample was used to calculate moisture retention (%) which represent the amount of moisture retained in the cooked per 100 gm of the raw sample. The value was calculated by using the formula:

$$\text{Moisture retention (\%)} = \frac{(\text{\% cooking yield} \times \text{\% moisture in cooked product})}{100}$$

and as described by El-Magoli *et al.* (1996). Moisture (Oven drying), protein (Kjeldahal) and fat (Soxhlet ether extract) contents of the products were determined as per AOAC (1995).

Microbial analysis:

Total plate, coliform and yeast and mold counts of meat ball samples were determined by the methods described by APHA (1984). Readymade media (Hi-media Laboratory Pvt. Ltd., Mumbai, India) was used for microbial count. Preparation of samples and serial dilutions were done near the flame in a horizontal laminar flow cabinet which was pre sterilized by ultraviolet irradiation observing all possible aseptic precautions. Tenfold dilution of each samples were prepared aseptically by blending 10 g of sample with 90 ml of 0.1 per cent sterile peptone water with a pre sterilized blender. Plating medium was prepared and autoclaved at 15 lb pressure for 15 min before plating. The plates were incubated at 30 ± 1°C for 48 h for total plate count (TPC). Coliform count was done using double layer violet red bile agar and plates were incubated at 37 ± 1°C for 48 h. Acidified potato dextrose agar (pH 3.5) was used for enumeration of yeast and mold with incubation at 25 ± 1°C for 5 days. After incubation, the plates showing 30 – 300 colonies were counted. The average number of colonies for each species was expressed as log10 cfu / g sample.

Sensory evaluation:

The broiler chicken meat and turkey meat balls were served to an experienced panel. The sensory attributes appearance, flavour, juiciness, texture, binding and overall acceptability was evaluated on eight point descriptive scale as suggested by Keeton (1983). The sensory score of 9 was extremely desirable, whereas a score of 1 was extremely undesirable.

Statistical analysis:

The experiment was repeated four times. The data generated from each experiment were analyzed statistically by following standard procedures (Snedecor and Cochran, 1989) for analysis of variance (ANOVA) comparing the means and to determine the effect of treatment by using SPSS-16 (SPSS Inc., Chicago, IL., USA). The level of significant effects, least significant differences were calculated at appropriate level of significance (P<0.05).

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physico–chemical characteristics:

Physico-chemical parameters of broiler chicken and turkey meat balls are presented in Table 1. The mean pH values were 6.13 ± 0.12 and 6.65 ± 0.10 for broiler chicken meat and turkey meat balls, respectively. The mean pH of turkey meat balls were significantly (P<0.05) higher compared to the broiler chicken meat balls. This result is in agreement with the findings of Chettri *et al.* (2011). The mean product yields were 80.80 ± 0.16 and

Table 1: Physico-chemical characteristics broiler chicken and turkey meat balls **(Mean ± S.E)**

Physico-chemical parameters*	Broiler chicken meat balls	Turkey meat balls
pH	6.13 ± 0.12^{a}	6.65 ± 0.10^{b}
Product yield (%)	80.80 ± 0.16^{a}	84.25 ± 0.18^{b}
Product shrinkage (%)	4.76 ± 0.25	4.12 ± 0.22
Moisture retention (%)	50.72 ± 0.10^{a}	55.54 ± 0.10^{b}
Moisture (%)	62.78 ± 0.20^{a}	65.92 ± 0.18^{b}
Protein (%)	21.60 ± 0.16^{a}	23.88 ± 0.18^{b}
Fat (%)	7.23 ± 0.20^{a}	9.88 ± 0.18^{b}

*Number of observations = 4. Means bearing same superscripts (lowercase letters) row-wise do not differ significantly (P< 0.05)

Table 2: Microbial profile of broiler chicken and turkey meat balls **(Mean ± S.E)**

Microbial profile (log_{10} cfu/g)**	Broiler chicken meat balls	Turkey meat balls
Total plate count	1.50± 0.18	1.62± 0.16
Coliform count	ND	ND
Yeast and mould count	ND	ND

**Number of observations: = 4 Means bearing same superscripts row- wise do not differ significantly (P < 0.05).

Table 3: Sensory acceptability of broiler chicken and turkey meat balls **(Mean ± S.E)**

Sensory attributes***	Broiler chicken meat balls	Turkey meat balls
Appearance	8.2 ± 0.14^{a}	8.0 ± 0.12^{b}
Flavour	8.5 ± 0.10^{a}	8.0 ± 0.10^{b}
Juiciness	8.5 ± 0.10^{a}	8.0 ± 0.10^{b}
Texture	8.4 ± 0.16^{a}	8.0 ± 0.18^{b}
Binding	8.5 ± 0.12^{a}	8.2 ± 0.14^{b}
Overall acceptability	8.4 ± 0.12^{a}	8.0 ± 0.12^{b}

***Number of observations = 32.
Sensory attributes of meat balls were evaluated on an 9-point descriptive scale (wherein, 1 = extremely undesirable; 9 = extremely desirable).
Means bearing same superscripts (lowercase letters) row-wise do not differ significantly (P< 0.05).

84.25 ± 0.18 for broiler chicken meat and turkey meat balls, respectively. The product yield was significantly (P<0.05) higher for turkey meat balls as compared to broiler chicken meat balls. The product yield of meat balls in this study is comparable to those reported by Chettri *et al.* (2011). Increased protein extractability, which resulted in greater solubilisation of muscle proteins, might have caused the increased product yield (Xargayo and Lagares, 1992). Serdaroglu (2006), reported that higher cooking yield may be attributed to the water holding and fat binding capacity of protein. The mean product shrinkage values were 4.76 ± 0.25 and 4.12 ± 0.22 for broiler chicken meat and turkey meat balls, respectively. The product shrinkage value was significantly (P<0.05) higher for broiler chicken meat balls as compared to turkey meat balls. More coagulation of muscle proteins resulted in thermal shrinkage which subsequently expressed water from the muscle tissue and it might have contributed to increased product shrinkage value in broiler chicken meat balls. The mean moisture retention values were 50.72 ± 0.10 and 55.54 ± 0.10 for broiler chicken meat and turkey meat balls, respectively. Moisture retention values were significantly (P<0.05) higher for turkey meat balls as compared to broiler chicken meat balls. More coagulation and thermal shrinkage of connective tissue might have contributed to decreased moisture retention value in broiler chicken meat balls.

The mean moisture, protein and fat content values were 62.78 ± 0.20 and 65.92 ± 0.18, 21.60 ± 0.16 and 23.88 ± 0.18 and 7.23 ± 0.20 and 9.88 ± 0.18 for broiler chicken meat and turkey meat balls, respectively. Moisture, protein and fat contents of broiler chicken meat and turkey meat balls differ significantly (P<0.05). The moisture content of meat balls in this study is comparable to those reported by Huda *et al.* (2007), whereby balls in the market chicken contained 60.14 – 72.81 per cent of moisture. The present result of proximate composition of chicken meat balls and turkey meat balls are in agreement with the findings of Halini *et al.* (2018) and Chettri *et al.* (2011).

Microbial characteristics:

Microbial profiles of broiler chicken meat and turkey meat balls are presented in Table 2. Coliform counts and yeast and mould count were not detected in both broiler chicken meat and turkey meat balls. The mean total plate counts were 1.50 ± 0.18 and 1.62 ± 0.16 for broiler chicken meat and turkey meat balls, respectively. There was no significant difference between broiler chicken meat and turkey meat balls and the microbial counts were within the standard stipulated for cooked meat products (Jay *et al*., 2005).

Sensory characteristics:

Sensory attributes of broiler chicken meat and turkey meat balls are presented in Table 3. The mean appearance, flavour, juiciness, texture, binding and overall acceptability scores were significantly (P<0.05) higher in broiler chicken meat balls as compared to turkey meat balls. Sensory evaluation scores of turkey meat balls were comparable with broiler chicken meat balls. Sensory evaluation scores results indicated that meat balls prepared from turkey and chicken meat rated "very palatable".

Conclusion:

Physico-chemical parameters of turkey meat balls were comparable with broiler chicken meat balls. Sensory evaluation results indicated that meat balls prepared from turkey and chicken meat rated "very palatable". Thus, it can be concluded that, turkey meat can be successfully used for preparation of meat balls of acceptable quality.

LITERATURE CITED

Anna Anandh, M. (2018). Quality and acceptability of turkey (*Meleagris gallopavo*) meat cutlets. *Asian J. Anim. Sci.*, **13** : 54 – 58.

Anna Anandh, M., Sutha, M. and Sobana, A.S. (2019). Quality and acceptability of pickle from chicken and turkey gizzards. *Asian J. Dairy Food Res.*, **38** : 155 -158.

AOAC (1995) *Official methods of analysis* (16th Ed.). Association of Official Analytical Chemists. Washington, D.C., U.S.A.

APHA (1984). In M. L. Speck (Ed.): *Compendium of methods for the microbiological examination of foods* (2nd Ed.). American Public Health Association, Washington, D.C., U.S.A.

Castro , F.M.M., Morgano, M.A., Nascimento de Queiroza, S.C. and Mantovani, D.M.B. (2000). Relationships of the minerals and fatty acid contents in processed turkey meat products. *J. Food Chem.*, **69** : 259-265.

Chettri, A., Kulkari, R.C., Mahapatra, C.M. and Kumar, P. (2011). Effect of different cooking methods on the quality of soya incorporated turkey meat balls. *Indian J. Poult.*

Sci., **46** : 361 - 364.

El-Magoli, S.B., Laroia, S. and Hansen, P.M.T. (1996). Flavour and texture characteristics of low fat ground beef patties formulated with whey protein concentrate. *Meat Sci.,***42**: 179 –193.

Halini, N., Aripin, M. and Huda, N. (2018). Quality characteristics of meat balls prepared from different ratio of chicken and duck meat. *Asia Pacific J. Sust. Agric. Food & Ener.,***6**: 6- 9.

Huda, N., Ismail, N., Shen, Y. H. and Huey, Y. L. (2007). *Chemical composition, colour and textural properties of commercial chicken balls*. 12th Asian Chemical Congress, Kuala Lumpur 23-25 August 2007.

Jay, J.M., Loessner, M.J. and Golden, D.A. (2005). *Modern food microbiology*. 7 th Edition. Springer, Inc, United State of America.

Keeton, J.C. (1983). Effect of fat and Nacl/phosphate levels on the chemical and sensory properties of pork patties. *J. Food Sci.,* **48** : 878–881.

Serdaroglu, M. (2006). Improving low fat meatball characteristics by adding whey powder. *J. Meat Sci.,***72** : 155-163.

Snedecor, G.W. and Cochran, W.G. (1989). *Statistical methods.* 8th Edn. Oxford and IBH Publ. Co, Calcutta, W.B. (India).

Trout, E.S., Hunt, M.C., Johnson, D.E., Claus, J.R., Kastner, C.L. and Kropf, D.H. (1992). Characteristics in low-fat ground beef containing texture modifying ingredients. *J. Food Sci.,* **57**: 19–24.

Xargayo, M. and Lagares, J. (1992). Computerized massaging of meat. *Fleishwirtschaft*, **4** : 2.

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