Journal of Animal Research: v.13 n.01, p. 127-130. February 2023

**DOI:** 10.30954/2277-940X.01.2023.17

# Study on Effect of Incorporation of Potato in Chicken Meat Balls

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**Received:** 05 Dec., 2022 **Revised:** 16 Jan., 2023 **Accepted:** 19 Jan., 2023

**ABSTRACT**

The study was conducted to explore the possibilities of utilization of potato puree in the preparation of chicken meatballs. The potato puree was incorporated at various levels as 0%, 10% and 20% by replacing lean meat in the formulation. Meatball samples were cooked in a pre-heated 180°C electric oven. Crude protein, fat, ash and energy content of the chicken meatballs showed significantly ($p < .05$) decreasing trend with increasing levels of potato puree. There was a significant increase in the moisture content, cooking yield and water holding capacity in treated products than control and recorded highest for T2. Sensory attributes showed comparatively higher scores in potato puree incorporated chicken meatballs. The results conclude that potatopuree can be used in chicken meatballs at 10 percent level to enhance the palatability and to reduce the cost of formulation.

**HIGHLIGHTS**

- Incorporation of potatopuree in chicken meat balls has been discussed.
- Incorporation of Potatopuree in meat balls improved the moisture content cooking yield and water holding capacity.

**Keywords:** Potato puree, chicken meat balls

Meatballs are one of the most popular meat products in India and various types (such as chicken meatball, beef meatball, fish meatball and prawn meatball) are available. However, the most accepted and usually prepared from chicken, fish and beef. The consumption of poultry meat and poultry meat products is growing all over the world (Mielnik *et al*., 2002). Ingredients used in processing of food products are among the most important factors influencing the final product quality. Consumer demands have stimulated the development of meat products formulations with various types of extenders and binders (Gujral *et al*., 2002; Ergezere and Serdargolu, 2009). Extension of meat and meat products with vegetables could reduce production costs and improve the nutritional qualities of the products. Vegetables occupy an important role in human nutrition as they provide essential minerals, vitamins and are also known to contain large amount of dietary fibre and phytochemicals that are natural antioxidants (Xu, 2001). Vegetables could also serve as fillers, binders, fat replacers and sources of dietary fiber and natural antioxidants in a meat system (Hedrick *et al*., 1994). Numerous studies have focused on functional properties of potato flour, potato protein and potato fibre in meat products. The water-binding of potato flour in emulsion type sausages is dependent of its content in the formulation. Ikhlas *et al*. (2011) found that the addition of potato flour increased the cooking yield of meatballs.

**How to cite this article:** Sagi, R., Sahitya, M., Sudheer Babu, A., Kolli, V. and Suresh Nayak, A. (2023). Study on Effect of Incorporation of Potato in Chicken Meat Balls. *J. Anim. Res.,* **13**(01): 127-130.

**Source of Support:** None; **Conflict of Interest:** None

Nieto *et al*. (2009) have found that potato proteins at a level of 2% significantly reduced cooking losses and had a significant effect on lipid oxidation in emulsion type of sausages. In this study potato puree prepared with skinned on was selected as potential extender for meatballs. The present study was envisaged for development of potato puree incorporated chicken meatballs and for reducing the cost of production by better utilization of potato puree.

## MATERIALS AND METHODS

### Raw material

Broiler chicken (6–8 weeks) carcasses were purchased from local market Hyderabad. Trimming and deboning of the chicken meat was done. Potatoes were washed and cooked for 45 min in boiling water than mashed (skin on) by using kitchen type food processor to obtain potato puree. Potato puree, condiments, salt, refined oil, spice mix, salt and sodium tri-phosphate along with the meat were ground in the food mixer. The proportion of ingredients used was shown in Table 1. Two replications of the experiment were conducted each at separate times. For each replication five meatballs were examined for proximate composition, cooking yield and water holding capacity (WHC) and sensory properties.

### Proximate analysis

Moisture, protein, fat and ash contents were determined in accordance with standard AOAC (2019).

### Cooking yield

Cooking yield was determined by measuring the difference in the sample weight before and after cooking and was calculated according to Murphy *et al*. (1975).

$$\text{Product yields} = \frac{\text{Weight of cooked meat ball}}{\text{Weight of raw meat ball}} \times 100$$

### pH

The pH of cooked chicken meatball was measured with a glass electrode with digital pH meter following method of Trout *et al*. (1992).

**Table 1:** Formulation of chicken meatballs prepared by incorporating potato puree

| Sl. No. | Ingredients | Control %(C) | Treatment % (T1) | Treatment % (T2) |
|---|---|---|---|---|
| 1 | Meat | 75 | 65 | 55 |
| 2 | Ice | 10 | 10 | 10 |
| 3 | Refined vegetable oil | 8 | 8 | 8 |
| 4 | Condiments | 3 | 3 | 3 |
| 5 | Salt | 2 | 2 | 2 |
| 6 | Sodium tripolyphosphate | 0.3 | 0.3 | 0.3 |
| 7 | Spice mix | 1.7 | 1.7 | 1.7 |
| 8 | Potato puree | 0 | 10 | 20 |

Control : without potato puree; T1: replacement of meat with 10% potato puree; T2: replacement of meat with 20% potato puree; Sodium nitrite at the level of 120 ppm was also added in the formulation. a: Condiment = Onion + Garlic + Ginger (3: 2 : 1). b Spices mix. = Caraway seeds, black pepper, capsicum, cumin seed, coriander, aniseed, green cardamom, black cardamom, dried ginger, cinnamon, cloves, bay leaves, fenugreek powder, nutmeg and mace.

### Water holding capacity measurement

A filter press technique was used to determine water holding capacity (WHC) of cooked meatballs (Zayas and Lin, 1998). Lower values indicate better water holding capacity.

### Sensory analysis

A panel of six experienced judges consisting of teachers and postgraduate students of College of Veterinary Science, Rajendranagar evaluated the samples for the attributes of appearance and colour, odour, juiciness,texture, tenderness, flavour and overall acceptability using 8-point descriptive scale (Keeton, 1983), where 8 = extremely desirable and 1 = extremely undesirable. Sensory panellists were selected on the basis of availability, sensitivity, willingness and health status. Semi-trained panellists were given trial sessions for the product and their sensory attributes prior to final sensory analysis for obtaining better result. The test samples were presented to the panellists after assigning suitable codes. Three sittings (n = 18) were conducted for each replicate and at each storage time samples were warmed in a microwave oven for 20 sec before serving.

Potable water was available for rinsing the oral cavity before and after sample evaluation.

## STATISTICAL ANALYSIS

Means and standard errors were calculated for different parameters. Data obtained in the study were analysed statistically using 'SPSS-16.0' software package as per standard methods (Snedecor and Cochran, 1994). Duplicate samples were drawn for each parameter and the experiment was replicated thrice (n = 6). Sensory evaluation was performed by a panel of six-member judges three times; thus, total observations were 18 (n = 18). Data were subjected to one way analysis of variance. The statistical significance was expressed at $p < 0.05$.

## RESULTS AND DISCUSSION

### Proximate composition

Proximate composition of the potato puree incorporated chicken meatballs has been tabulated in Table 2. Moisture content ranged from 55.72 to 64.09%, fat content ranged from 16.36 to 13.38% and protein content ranged from 19.63 to 15.96%. Control samples had the highest fat content (16.36%) and T2 samples had the highest moisture (64.09%) content. Adding extenders resulted decrease in fat content, the lowest fat content (13.38%) was recorded for meatballs extended with 20% potato puree. The mean values of Moisture, protein, fat and ash decreased significantly ($p < 0.05$) with increasing level of potato puree incorporation.

### Cooking yield

Mean values of cooking yield of potato puree incorporated chicken meatballs has been presented in the Table 2. The cooking yield values increased significantly ($p < 0.05$) as the incorporation of the potato puree percentage increased in chicken meatball. The highest cooking yield was recorded in the T2 group, which might be due to increased moisture binding by the added potato puree and swelling properties of dietary fiber and starch in potatoes. Similar results were reported (Ulu, 2006; Yilmaz and Daglioglu, 2003). Ulu (2004) reported cooking yield of 41.3-49.32% for meatballs extended with wheat flour. Moisture retention in ground meat products is an important cooking parameter, since retained moisture in the product affects eating quality.

**Table 2:** Proximate composition, cooking yield, pH and water holding capacity of cooked chicken meatballs incorporated with Potato Puree

| Parameter | Control %(C) | Treatment % (T1) | Treatment % (T2) |
|---|---|---|---|
| Moisture% | $55.72^{c} \pm 0.18$ | $60.32^{b} \pm 1.67$ | $64.09^{a} \pm 0.28$ |
| Protein% | $19.63^{a} \pm 0.26$ | $17.58^{b} \pm 0.18$ | $15.96^{c} \pm 0.23$ |
| Fat% | $16.36^{a} \pm 0.19$ | $14.82^{b} \pm 0.21$ | $13.38^{c} \pm 0.20$ |
| Ash% | $2.51^{a} \pm 0.02$ | $2.48^{b} \pm 0.01$ | $2.28^{c} \pm 0.03$ |
| Cooking Yield | $75.82^{c} \pm 0.43$ | $80.53^{b} \pm 0.80$ | $85.54^{a} \pm 0.53$ |
| pH | $6.13 \pm 0.02$ | $6.17 \pm 0.01$ | $6.21 \pm 0.03$ |
| WHC | $43.20^{c} \pm 0.56$ | $47.12^{b} \pm 0.43$ | $51.36^{a} \pm 0.21$ |

$^{abc}$Mean with different superscripts within a row differ significantly ($p < 0.05$); *Control :without Potato puree; $T_1$ :replacement of meat with 10% Potato puree; $T_2$: replacement of meat with 20% Potato puree.

### pH

As shown in Table 2, the pH of various treatments ranged from 6.13 to 6.21 and differed non significantly ($P>0.05$). The influence of addition of potato on pH values of chicken meat balls was clearly observed in this study. As the level of potato was increased the corresponding values for pH also increased gradually (Yilmaz and Daglioglu, 2003). Studies with respect to water holding capacity (WHC) meat balls have shown that incorporation of potato puree significantly increased water holding capacity from 43.22 to 51.62 and the differences were highly significant ($P<0.05$). This might be due to higher moisture absorbance capacity of boiled potato in meat emulsion. Boiled potato can absorb large quantity of water without increased product viscosity.

### Sensory properties

Sensory properties are among the major concerns for the utilization of plant proteins in foods. Potato puree addition increased juiciness and flavour scores of meatballs. Lower texture scores attributed to extensively softening in meatball texture. However, these higher values for texture (hardness) do not necessarily mean better quality. 10%

potato puree was received with overall acceptability. This acceptance was due to the suitability of potato puree at a level of 10% in flavour and texture.

**Table 3:** Sensory Properties of meat balls incorporated with different percent levels of potato puree

| Parameter | Control %(C) | Treatment % (T1) | Treatment % (T2) |
|---|---|---|---|
| Appearance | 6.32±0.12 | 6.19±0.14 | 6.11±0.17 |
| Texture | 6.01±0.15 | 5.92±0.12 | 5.76±0.13 |
| Juiciness | 6.33±0.13 | 6.52±0.16 | 6.12±0.11 |
| Flavour | 6.39±0.09 | 7.33±0.12 | 6.97±0.10 |
| Overall Acceptability | 6.22±0.15 | 7.16±0.14 | 6.44±0.17 |

[abc]Mean with different superscripts within a row differ significantly ($p < 0.05$); *Control :without Potato puree; $T_1$ :replacement of meat with 10% Potato puree; $T_2$: replacement of meat with 20% Potato puree.

## CONCLUSION

The research suggested that addition of potato puree at 10% level significantly improved cooking properties and sensory properties of the meat balls.

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