

DETERMINATION OF LEVEL OF DRIED CAPSICUM POWDER FOR OPTIMISATION OF SPENT BROILER BREEDER HEN CHICKEN KOFTAS

M.V. Sneha Sharada^{*1}, J. Indumathi ², G. V. Bhaskar Reddy³ and S. Shakila⁴

Department of Livestock Products Technology

College of Veterinary Science

Tirupati – 517 502, Andhra Pradesh

ABSTRACT

The present study was undertaken to evaluate the effect of different levels of dried capsicum powder on the quality characteristics of chicken koftas. The capsicum dried powder was incorporated at three different levels viz. 2, 4 and 6% in the formulation. The products were analyzed for various physicochemical and sensory attributes. The pH, emulsion stability (83.56 ± 0.011) (%), cooking yield (81.12 ± 0.011) (%), crude protein, crude fat and total ash contents of the products showed significant ($P < 0.05$) decreasing trend with increase in levels of incorporation of dried capsicum powder. However, a significant ($P < 0.05$) increase in the water holding capacity (%), moisture (67.10 ± 0.008) and crude fibre (1.56 ± 0.006) contents of the chicken koftas was observed with increasing levels of incorporation. Sensory evaluation revealed that koftas prepared with 4 per cent capsicum dried powder had superior scores ($P < 0.05$) compared to 2 and 6 per cent. Hence, incorporation of dried capsicum powder at 4 per cent level in chicken koftas was considered to be optimum. (Include some values of important findings)

Keywords: Chicken koftas, dried capsicum powder, physicochemical parameters, sensory analysis

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INTRODUCTION

Spent broiler breeder hens are heavy birds (4 to 6 kg) with satisfactory amount of

meat in the breast and thighs and they are used to produce commercial broilers with high hybrid vigour for meat production (Indumathi *et al.*, 2019). Spent broiler breeder hens are usually culled around 72 weeks of age, their economic life span. These spent hens are usually used for human consumption with lower price and used in various feed production and concentrated stock preparation (Ajuyah *et*

¹M.V.Sc Student, Corresponding author Email id: madavenkatasneha@gmail.com

²Assistant Professor and Technical Officer to Controller of Examinations

³Assistant Professor and Head

⁴Professor and Head, Department of Poultry Science

al., 1992). The disposal of layer hens is one of the main economic and environmental problems of the poultry industry (Lyons, 2001). Consumption of meat from spent broiler breeder hens is limited by its poorer sensory quality, in particular poorer tenderness due to increased collagen content and cross linkages (Grabowski, 2004 and Komiyama *et al.*, 2010). The development of comminuted meat products offers an important avenue for the profitable disposal of spent hens (Mehraj *et al.*, 2017). Commination and marination dilute the effect of toughness associated with spent broiler breeder hen meat and improve the quality of meat products by increasing the palatability, variety and result in economic utilization of the low value meat (Chetan *et al.*, 2017). The demand of spent broiler breeder hen meat can be increased by developing some novel functional poultry meat products and introducing them to consumers at reasonable prices (Fan and Wu, 2022). These products are generally produced by reformulation of meat by incorporating ingredients like green vegetable fibres, protein, polyunsaturated fatty acids, antioxidants, vitamins and minerals etc. (Parveez *et al.*, 2017).

Green bell pepper (*Capsicum annuum* L.) is an excellent source of ascorbic acid and a fair source of provitamin A carotenoids (Haytowitz and Matthews, 1984). In addition, peppers are rich in flavonoids (Lee *et al.*, 1995) and other phytochemicals (Duke, 1992). It has good antioxidant properties. It promotes cardiovascular health, speeds up metabolism and burn more calories due to presence of

capsaicin which stimulates hepatic and skeletal muscle fatty acid oxidation and also inhibits growth of fat cells. It stimulates stomach secretions and improves digestion (Mandloi and Amin, 2017). Inclusion of capsicum in new products or existing ones may solve the current fiber deficit to the consumers, and help to reduce the risk of colon cancer, obesity, cardiovascular diseases and several other disorders. So that keeping above point in view, the present study was planned to evaluate the efficacy of dried capsicum powder on chicken meat products. The quality and acceptability of the products were determined.

MATERIALS AND METHODS

Six trials were conducted initially to determine the optimum level of inclusion of dried capsicum powder. Spent broiler breeder birds (females) of 72 weeks age were purchased from local market, transported and slaughtered at the Department of Livestock Products Technology, College of Veterinary Science, Tirupati. Slaughter and dressing was performed as per the standard procedure. After marinating with salt and phosphates overnight in a chiller, the carcasses were hand-deboned and the meat was kept in freezer ($-18\pm 1^{\circ}\text{C}$) until further use. Fresh capsicums were procured from the local market of Tirupati. The capsicums were washed to remove adhering dirt, after draining off excess liquid vegetables were sliced, then dried in hot air oven at $60\pm 5^{\circ}\text{C}$ until brittle. The dried slices were grounded to fine powder and sieved and were added to the emulsion.

Preparation of Chicken Koftas

Preliminary trials were conducted to optimize the basic formulation and processing conditions for the preparation of chicken koftas. The deboned meat was thoroughly screened for removing excess fat, tendon, etc. After adequate thawing in room temperature, meat was weighed, cut into small chunks and placed in the meat mincer. Meat mincing was done by 6 mm diameter plate and subsequently by 4 mm diameter plate (Sirman TC12E). In minced meat, required amount of salt, polyphosphate and sucrose were added and chopped for 2 to 3 min in a bowl chopper (Schadfen 58452 written). After addition of ice flakes, it was chopped again for 2 min. Thereafter, vegetable oil was added with continuous chopping followed by incorporation of condiment, dried capsicum powder, refined corn flour and spice mix. Chopping ended after formation of uniform batter mix. After preparing emulsions, small koftas weighing approximately 20 g were prepared and were deep fat fried till the desired brown color and an internal temperature of 72°C was attained. Formulations of control and different treatments are presented in Table 1.

Estimation of pH, Cooking Yield and Proximate Analysis

The pH of cooked chicken koftas was determined by the method of Trout *et al.* (1992) using digital pH meter (Systronics pH system 361, Model: 7856, Type 361). The cooking yield of the product was calculated on the basis of Weight of cooked koftas and emulsion. Moisture, crude protein, crude

fibre, crude fat and total ash contents in both treatment samples and control were determined by using standard procedures prescribed by AOAC (2002).

Emulsion stability and Water-Holding Capacity (WHC)

Emulsion stability of meat emulsion was determined as per procedure described by Townsend *et al.* (1968). Water-holding capacity (WHC) was determined according to Wardlaw *et al.* (1973).

Sensory Evaluation

The koftas samples were then arranged on a white porcelain dish and immediately subjected to sensory evaluation carried out on a 8 point hedonic scale by a semi trained five members taste panel (Keeton 1983).

Statistical Analysis

Experiment was carried out thrice in duplicates (n=6) and data were analyzed using SPSS-16.0 software package (SPSS Inc. Chicago, IL, USA) as per standard procedures (Snedecor and Cochran, 1995) for analysis of variance using Duncan's Multiple Range Tests and Homogeneity tests to test the significance of difference between means at 5% level ($P < 0.05$).

RESULTS AND DISCUSSION

The mean values of various physicochemical parameters namely pH, cooking yield, emulsion stability, water holding capacity and proximate composition of chicken koftas incorporated with 2, 4 and 6 per cent levels of capsicum dried powder are presented in Table 2 and 3.

Table 1. Formulations of spent broiler breeder hen chicken koftas fortified with dried capsicum powder at different levels

Ingredients	Control	Spent broiler breeder hen chicken koftas fortified with dried capsicum powder		
		T1	T2	T3
Spent broiler breeder hen chicken meat	90	90	90	90
Dried capsicum powder	-	2	4	6
Vegetable fat	10	10	10	10
Salt	2	2	2	2
Sugar	1	1	1	1
Poly phosphate	0.3	0.3	0.3	0.3
Dry spice mix	2	2	2	2
Wet condiment mix*	3	3	3	3
Binder (corn flour)	3	3	3	3
Ice flakes	10	10	10	10

*Onion: garlic paste (3:1); T1-2% dried capsicum powder, T2-4% dried capsicum powder, T3 -6% dried capsicum powder

Table 2. Effect of incorporation of different levels of dried capsicum powder on the Physico - chemical properties of spent broiler breeder hen chicken koftas

Parameters	Control	Spent broiler breeder hen chicken koftas incorporated with dried capsicum powder		
		T1	T2	T3
pH	6.00±0.006 ^c	5.86±0.010 ^b	5.84±0.011 ^b	5.76±0.011 ^a
Cooking Yield (%)	87.57±0.010 ^d	85.43±0.013 ^c	83.15±0.011 ^b	81.12±0.011 ^a
Emulsion Stability (%)	87.76±0.012 ^d	85.92±0.008 ^c	84.65±0.012 ^b	83.56±0.011 ^a
WHC (%)	49.64±0.011 ^a	52.66±0.010 ^b	53.84±0.011 ^c	54.94±0.008 ^d

(P<0.05); Means bearing at least one common superscript in the same row do not differ significantly.

T1-2% dried capsicum powder, T2-4% dried capsicum powder, T3 -6% dried capsicum powder

Table 3. Effect of incorporation of different levels of dried capsicum powder on the proximate composition of spent broiler breeder hen chicken koftas

Parameters	Control	Spent broiler breeder hen chicken koftas incorporated with dried capsicum powder		
		T1	T2	T3
Moisture (%)	64.65±0.047 ^a	65.64±0.008 ^b	66.26±0.006 ^c	67.10±0.008 ^d
Crude Protein (%)	20.86±0.043 ^d	20.16±0.012 ^c	19.14±0.006 ^b	18.31±0.013 ^a
Crude Fibre (%)	0.64±0.013 ^a	0.86±0.006 ^b	1.27±0.008 ^c	1.56±0.006 ^d
Crude Fat (%)	11.01±0.022 ^b	12.21±0.006 ^d	11.61±0.006 ^c	10.73±0.009 ^a
Total Ash (%)	2.23±0.032 ^c	2.34±0.008 ^d	1.80±0.006 ^b	1.53±0.006 ^a

(P<0.05); Means bearing at least one common superscript in the same row do not differ significantly.

T1-2% dried capsicum powder, T2-4% dried capsicum powder, T3 -6% dried capsicum powder

The pH, Cooking Yield, Emulsion Stability and Water Holding Capacity

Chicken koftas added with dried capsicum powder at 6 per cent level recorded lower pH values. A significant (P<0.05) decrease in pH was observed in the products with increase in the level of incorporation of dried capsicum powder. This gradual reduction in pH might be due to acidic nature of dried capsicum powder (Parveez *et al.*, 2017). Similar decrease in pH was reported by Zargar *et al.* (2016) and Parveez *et al.* (2017) in chicken sausages due to incorporation of kohlrabi and capsicum in the formulations.

The per cent cooking yield and emulsion stability followed a significant (P<0.05) decreasing trend with increasing levels of dried capsicum powder in the formulation in comparison to control. Among

treatments, T1 koftas recorded significantly (P<0.05) higher values compared to other two treatments. This might be due to formation of comparatively less stable emulsion in the formulations containing dried capsicum powder. Decrease in the emulsion stability with increase in the levels of capsicum may also act as a contributing factor for decreasing the cooking yield (Parveez *et al.*, 2017). These results are in agreement with Verma *et al.* (2013) in mutton nuggets incorporated with guava powder, Parveez *et al.* (2017) in chicken sausages incorporated with capsicum paste and Zargar *et al.* (2017) in chicken sausages added with carrot.

Water holding capacity values were significantly (P<0.05) influenced by the formulations and T3 koftas recorded significantly (P<0.05) higher values compared to others. This might be due to the formation

of more stable gel matrix which leads to a lower release of water and fat, thus improving binding properties of meat emulsions (Syuhairah *et al.*, 2016). These results are in accordance with Syuhairah *et al.* (2016) in chicken sausages and Kim *et al.* (2019) in low-fat frankfurter-type sausages.

Proximate composition

A significant ($P<0.05$) increase in moisture and crude fibre per cent was recorded with increase in each level of dried capsicum powder. Among the treatments T3 koftas recorded higher values and it differed significantly ($P<0.05$) with all other levels of incorporation. It might be attributed to the absorption of added water and higher fiber content in the dried powder (Grigelmo-Miguel *et al.*, 1999 and Esayas *et al.*, 2011). These results are in agreement with Verma *et al.* (2016) in functional pork loaves incorporated with inulin powder, Parveez *et al.* (2017) in chicken sausages incorporated with capsicum paste and Hajrawathi *et al.* (2022) in chicken meat balls incorporated with purple sweet potato flour.

The crude protein, crude fat and total ash contents of chicken koftas decreased significantly ($P<0.05$) with increase in levels of dried capsicum powder. Among the treatments T1 koftas recorded higher values compared to others. This might be due to relative dilution of the solid contents with the increase in the moisture content which occurred due to dried capsicum powder incorporation (Verma *et al.*, 2015). The results obtained in this study are in accordance with Verma *et al.* (2016) in

functional pork loaves and Zargar *et al.* (2016) in chicken sausages containing inulin and kohlrabi respectively.

Sensory attributes

The mean values of various sensory parameters namely appearance, flavour, juiciness, texture and overall acceptability of chicken koftas incorporated with 2, 4 and 6 per cent levels of dried capsicum powder are presented in Table 4.

The mean sensory scores for all sensory attributes of spent broiler breeder hen chicken koftas significantly ($P<0.05$) differed between treatments and control. Among treatments, T2 koftas recorded higher scores for all sensory attributes compared to other treatments. Decline in sensory scores could be attributed to dilution of meat pigment, meaty flavour, (Bhat and Pathak, 2011) and more moisture retention (Binti *et al.*, 2021) due to the addition of dried capsicum powder. The results obtained in this study are in accordance with Zargar *et al.* (2016) in chicken sausages formulated with kohlrabi.

CONCLUSION

The results of this study revealed that spent broiler breeder hen chicken koftas incorporated with 4% capsicum dried powder had better sensory scores and acceptability (what about physico-chemical and other parameters?) than other treatments. However, chicken koftas incorporated with 6% level dried capsicum powder scored significantly ($P<0.05$) higher values for different physico-

Table 4. Effect of incorporation of different levels of dried capsicum powder on the sensory evaluation of spent broiler breeder hen chicken koftas

Parameters	Control	Spent broiler breeder hen chicken koftas incorporated with dried capsicum powder		
		T1	T2	T3
Appearance	7.14±0.008 ^c	6.86±0.010 ^b	6.84±0.008 ^b	6.12±0.009 ^a
Flavour	6.83±0.011 ^b	6.92±0.010 ^c	7.09±0.031 ^d	6.52±0.011 ^a
Juiciness	7.00±0.004 ^d	6.57±0.009 ^b	6.66±0.009 ^c	6.45±0.009 ^a
Texture	7.00±0.024 ^c	6.95±0.008 ^b	6.98±0.008 ^c	6.31±0.013 ^a
Overall Acceptability	7.07±0.030 ^d	6.73±0.013 ^b	6.93±0.013 ^c	6.24±0.012 ^a

(P<0.05); Means bearing at least one common superscript in the same row do not differ significantly. T1-2% dried capsicum powder, T2-4% dried capsicum powder, T3 -6% dried capsicum powder

chemical parameters like per cent cooking yield, emulsion stability, water holding capacity, moisture and crude fiber than other two levels of incorporation. Spent broiler breeder hen chicken koftas incorporated with 2% level dried capsicum powder recorded significantly (P<0.05) higher values of per cent crude protein, crude fat and total ash than other levels of incorporation. But they (2 and 6% level of incorporation) failed to get better sensory scores. Hence incorporation of capsicum dried powder at 4 percent level in chicken koftas was considered to be optimum for all the desired qualities of a value-added meat product. Incorporation of capsicum had a potential to increase the dietary fibres and biochemically active compounds such as beta-carotene and carotenoids.

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