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Research Article

EFFECT OF PUMPKIN POWDER INCORPORATION ON QUALITY CHARACTERISTICS OF CHICKEN CUTLETS

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Abstract: The present study was undertaken to determine the effect of pumpkin powder incorporation in chicken cutlets. Chicken cutlets were prepared by replacing lean meat with pumpkin powder at different levels (0%, 5%, 10%, 15%). The three treatments along with the control were evaluated for physicochemical properties and sensory characteristics. The incorporation of different levels of pumpkin powder in chicken cutlets significantly ($P<0.05$) increased cooking yield, crude fibre and ash content. Product pH, moisture, crude protein and crude fat showed a significant decrease ($P<0.05$) with increase in the level of pumpkin powder incorporation. Mean sensory scores for treatments were found to be significantly higher ($P<0.05$) for general appearance, flavour, texture and juiciness when compared to the control. The addition of pumpkin powder improved both mineral and vitamin contents and resulted in chicken cutlets with improved sensory acceptability scores. The optimum incorporation level of pumpkin powder was found to be 10% for chicken cutlets preparation.

Keywords: *Pumpkin powder, Antioxidant, Crude fibre, Physico-chemical properties, Sensory quality*

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Introduction

Meat and meat products have great nutritional importance in human food as they contain proteins of high biological value, vitamins mainly B_6 and B_{12} and minerals. Meat and meat products lack dietary fibres and their regular intake is often associated with various health problems. For this purpose, fiber enrichment is a better option to reduce the deleterious health effect of meat products. Fortification with high fibre containing fruits and vegetables can provide a good opportunity to improve the functional qualities. In addition to meat products, it is also suitable for increasing cooking yield and for advancing texture [1]. In the past, various attempts have been made to fortify fibers by natural sources in meat products, such as carrot [2], ground carrot and mashed sweet potato [3], soy protein and tomato pulp [4] and finger millet flour [5].

Processed meat industry is rapidly growing world over due to changes in lifestyle, growing urbanization, increasing per capita income and working couples. The processing of meat and meat products leads to the generation of many functional compounds beneficial to human health [6,7]. The advancement of processed meat makes fresh meat more desirable by using simple processes such as cutting, grinding and mixing. Due to the social and cultural changes in recent years, there is a rising demand for ready-to-eat and ready-to-cook convenience food items [8]. The creation of convenience and value-added goods such as chicken cutlets, chicken nuggets, chicken frankfurters, chicken meatballs and chicken burgers is a result of advances in meat processing technologies. In Indian cuisine, a cutlet refers specifically to the stuffing with a batter of mashed vegetables (potato, carrot, beans) or cooked meat (mutton, fish, chicken) fried. Meat cutlets are a flat croquette of minced meat, flour, pulse, nuts, potatoes, condiments and rusk-coated spices and are one of the most popular snack-based items, which can be served hot with or without sauce or chutney [9].

In the last decade, the consumption of meat containing high amounts of polyunsaturated fatty acids (PUFAs) has increased significantly. Though, a high degree of polyunsaturation accelerates oxidative processes that lead to the deterioration of the colour, flavour, texture and nutritional value of meat. The use of antioxidants in meat products has a greater role to prevent lipid oxidation [10].

The antioxidant incorporation in muscle foods is also important to avoid oxidative degradation during processing and storage. Many natural antioxidants have been documented to be more active than synthetic antioxidants and it is important to investigate the use of these compounds in food. Potential health issues may be caused by the use of synthetic antioxidants [11], allowing studies into the detection and integration of natural antioxidants to protect consumers and foods from various adverse effects that result from oxidation.

The rising cost of meat has necessitated improvements to current meat product processing technologies. The development of certain alternatives has become necessary which can reduce costs and maintain the colour and flavour of meat products during storage. The potential use of powders and extracts of different vegetables as preservatives and functional ingredient in meat have been studied in recent years such as carrot powder by Kumar *et al*. (2015) [12] in chicken cutlets; butterbur and broccoli extracts by Kim *et al*. (2013) [13] in ground beef patties; cabbage powder by Malav *et al*. (2015) [14] in mutton patties and dried apricot pomace in frankfurters by Adıbelli (2017) [15]. The incorporation of vegetables into processed meat products would serve as a substitute for non-meat ingredients which will bring substantial cost reduction and also improve the nutritional value. They are a rich source of natural antioxidants, dietary fibres, essential minerals and vitamins [16].

Pumpkin is a member of the family Cucurbitaceae. It is grown under a wide range of agro-climatic conditions in India. The family comprises about 25 species of which the economic importance is Cucurbita maxima, Cucurbita moschata and Cucurbita pepo. Pumpkin is grown in all tropical and subtropical countries [17]. The fruit is variable in size, round or oval in shape, bluntly ribbed and brownish-yellow or colour varied [18]. Pumpkin is abundant in carotene, lutein, pectin, vitamins (A, B1, B2 and C), minerals (Fe, Ca, Na, K, Mg and P), dietary fibers and other health-saving substances [19]. Pumpkin seeds are rich in protein sources (24.00 to 36.50%) and highly unsaturated fat (31.50 to 51.00%) [20]. The fruit is sweet with yellow or orange flesh and a valuable source of ascorbic acid and carotenoids, with high antioxidant properties.

Pumpkin has a vast scope for diversification and can be utilized in the production of processed products like jam, pickles, beverages, candy and bakery products. Pumpkin can be processed into flour which has a longer shelf-life and also a highly-desirable flavour and sweetness with deep yellow-orange colour. There have been a few studies regarding the incorporation of raw or pumpkin pulp [21,22] in meat products but less research has been carried out on the direct incorporation of dried pumpkin sources. Only some researchers have addressed pumpkin powder in the production of meat products [23,24,25].

This research aimed to investigate the effect of different levels of pumpkin powder incorporation on the quality attributes of chicken cutlets.

Material and Methods

Chicken meat

The boneless chicken meat was procured from the local market of Anand and kept at refrigeration (4±1ºC) overnight which was then subsequently used for product formulation.

Packaging Material

Low-density polyethylene film pouches were procured from a market of Anand.

Additives

Salt, sugar and vegetable oil were purchased from the local market.

Condiment mixture

The condiment paste was prepared from onion, ginger and garlic. The outer covering of condiments was removed and cut into small pieces. The fine paste was made by blending onion, garlic and ginger in a proportion of 3:1:1 in a grinder.

Spice mix

Ingredients of the spice mix were procured from a local market of Anand. The extraneous matter was removed and dried in a hot air oven at 60°C for 1 hr. The ingredients were grounded separately in the grinder to prepare a fine mesh. The powders were mixed in suitable proportions to prepare spice mix by using the proportion of each ingredient as mentioned in [Table-1]. The spice mix was stored in a plastic air-tight container till further use.

Table-1 *Composition of the spice mixture*

Ingredients	Percent (%)
Coriander seeds (*Coriander cyminum*)	16
Cumin seed (*Cuminum cyminum*)	11
Caraway seed (*Carum carvi*)	10
Black pepper (*Piper nigrum*)	10
Turmeric (*Curcuma longa*)	10
Aniseed (*Pimpinella anisum*)	10
Red chilli (*Capsicum frustescence*)	7
Cardamom (*Elettaria cardamomum*)	5
Cinnamon (*Cinamomum zeylanicum*)	5
Cloves (*Syzygium aromaticum*)	3
Mace (*Myristica fragrans*)	1
Nutmeg (*Myristica fragrans*)	1
Bay leaves (*Laurus nobilis*)	1

Pumpkin

Pumpkin required for the experiment was procured from the local market of Anand and it was incorporated in powder form at different levels in chicken cutlets formulation.

Methodology for preparation of chicken cutlets

Minced chicken was used for the preparation of chicken cutlets. Chicken cutlets were prepared by slight modified method of Singh *et al*. (2014) [9]. Pumpkin powder was incorporated by replacing lean meat at 5%, 10% and 15% levels for the formulation of chicken cutlets as per mentioned in [Table-2].

Analytical procedures - pH

The pH of the cooked chicken cutlets was determined by following the procedure of Troutt *et al*. (1992) [26].

Table-2 *Formulations of chicken cutlets with the incorporation of different levels of pumpkin powder*

Ingredients	Treatments			
	T1	T2	T3	T4
Chicken meat %	76	71	66	61
Pumpkin powder %	0	5	10	15
Cooked shredded potato %	10	10	10	10
Condiments %	10	10	10	10
Spices %	2	2	2	2
Salt %	1.75	1.75	1.75	1.75
Sugar %	0.25	0.25	0.25	0.25
Sodium nitrite %	150 ppm	150 ppm	150 ppm	150 ppm

Cooking yield

Percentage of cooking yield was determined by calculating differences in the weight of the chicken cutlets before and after cooking as per the method suggested by Murphy *et al*. (1975) [27].

Cooking yield (%) = [Weight of cooked chicken meat cutlet/ Weight of raw chicken cutlets] X 100

Proximate composition

Moisture, crude protein, crude fat, crude fiber and ash content of chicken meat cutlets were determined by the standard procedure of Association of Office Chemist (AOAC, 1995) [28].

Sensory evaluation

Chicken cutlets were evaluated organoleptically for general appearance, flavour, texture, juiciness and overall acceptability using 8-point hedonic scale (where, 8 is extremely desirable and 1 is extremely poor) as per the procedure described by Keeton, (1983) [29]. Semi-trained panelists comprising faculty and students were used as a panel for evaluation of the product. The panelists explained the nature of the experiment without revealing the identity of the treatment and were asked to record their preferences.

Statistical analysis

Data obtained in the present study were analyzed using one way analysis of variance (ANOVA) by SPSS software as per standard methods [30]. The level of significance was estimated at 5% level ($P<0.05$).

Results and Discussion

Physicochemical characteristics

The mean values of the physicochemical parameters of chicken cutlets incorporated with different levels of pumpkin powder are presented in [Table-3].

pH

The pH of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly ($P<0.05$) lower than that of control and chicken cutlets incorporated with 5% and 10% pumpkin powder (T1, T2, T3). The possible reason for a decrease in the pH might be attributed to the acidic nature of pumpkin. Similarly, Zargar *et al*. (2014) [22] reported a significant decrease trend in the pH of chicken sausages incorporated with pumpkin. Contrarily, Hartmann *et al*. (2020) [24] reported increase pH value of bovine burger with incorporation of pumpkin peel flour.

Cooking yield

The cooking yield of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly higher ($P<0.05$) than that of control and chicken cutlets incorporated with 5% and 10% pumpkin powder (T1, T2, T3). This result was broadly in agreement with the observations of Kumar *et al*. (2015) [12], who reported increase in the cooking yield of chicken cutlets with incorporation of dried carrot powder in chicken cutlets. Increase in cooking yield with increasing level of pumpkin powder incorporation might be attributed to the characteristic property of non-meat additives to bind the water.

Table-3 Effect of different levels of pumpkin powder on physicochemical parameters of chicken cutlets

Parameter	T1	T2	T3	T4
pH	6.24 ^{a}±0.00	6.22^{ab}±0.00	6.21^{b}±0.00	6.18^{c}±0.01
Cooking yield (%)	86.19^{a}±0.07	86.57^{ab}±0.23	87.21^{b}±0.12	89.41^{c}±0.25
Moisture (%)	52.98^{a}±0.28	49.79^{b}±0.56	46.07^{c}±0.50	45.33^{c}±0.41
Crude Protein (%)	21.63^{a}±0.24	19.56^{b}±0.27	17.31^{c}±0.50	16.38^{c}±0.31
Crude Fat (%)	15.04^{a}±0.10	14.13^{b}±0.05	13.26^{c}±0.15	12.55^{d}±0.25
Ash (%)	2.75^{a}±0.04	2.8^{ab}±0.02	2.90^{bc}±0.02	2.95^{c}±0.03
Crude Fibre(%)	0.80^{a}±0.01	1.16^{b}±0.06	1.55^{c}±0.03	1.88^{d}±0.04

Table-4 Effect of different levels of pumpkin powder on the sensory characteristics of chicken cutlets

Sensory Attributes	T1	T2	T3	T4
General appearance	7.58^{a}±0.095	7.43^{a}±0.095	6.79^{b}±0.119	6.36^{c}±0.092
Flavour	6.86^{b}±0.133	7.40^{a}±0.094	7.61^{a}±0.094	7.33^{a}±0.090
Texture	7.40^{b}±0.094	7.11^{c}±0.094	7.68^{a}±0.090	6.72^{d}±0.101
Juiciness	6.68^{b}±0.116	6.83^{b}±0.116	7.18^{a}±0.103	7.43^{a}±0.095
Overall acceptability	6.83^{b}±0.127	6.89^{ab}±0.129	7.21^{a}±0.107	6.39^{c}±0.107

Mean ± S.E. with different superscripts in a row differ significantly (P<0.05), T1-Control, T2-Chicken cutlets with 5% pumpkin powder, T3-Chicken cutlets with 10% pumpkin powder, T4-Chicken cutlets with 15% pumpkin powder

Moisture

The moisture of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly lower (P<0.05) than that of control and other treatments (T1, T2, T3). In accordance with the present findings Serdaroğlu *et al*. (2018) [25] reported that incorporation of dried pumpkin pulp and seed mixture significantly (P<0.05) decrease the moisture content of beef patties. Decrease trend in moisture content with increased pumpkin powder incorporation in chicken cutlets might be due to the reduced moisture content in dried pumpkin as compare to raw pumpkin.

Crude protein

Protein content in pumpkin powder incorporated chicken cutlets (T2, T3, T4) was significantly lower (P<0.05) than that of control chicken cutlets (T1). Verma *et al*. (2013) [31] also observed a decrease in the protein content of sheep meat nuggets with incorporation of guava powder. The probable reasons for the decreased protein content may be attributed to the comparatively lower protein content of pumpkin.

Crude fat / Ether extract

A gradual decline in fat content was observed as the incorporation of pumpkin powder level increased. The fat of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly lower (P<0.05) than that of control and chicken cutlets incorporated with 5% and 10% pumpkin powder (T1, T2, T3). Similar findings were reported by Reddy *et al*. (2018) [2] in carrot-incorporated turkey meat sausages. Choi *et al*. (2012) [23] also reported a decrease in fat content with increased concentration of pumpkin fibre in chicken frankfurters.

Crude fibre

The fibre content of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly higher (P<0.05) than that of control and chicken cutlets incorporated with 5% and 10 % pumpkin powder (T1, T2, T3). In accordance to the present findings, Malav *et al*. (2015) [14] reported increase level of fiber with increased incorporation of cabbage powder in mutton patties. This increased level of crude fibre might be due to high fibre concentration of pumpkin as compared to chicken.

Ash

The ash content of the chicken cutlets incorporated with 15% pumpkin powder (T4) was significantly higher (P<0.05) than that of control and it is at par with chicken cutlets incorporated with 10% pumpkin powder (T3). The ash content of the chicken cutlets incorporated with 10% pumpkin powder (T3) was significantly not differ (P<0.05) than that of chicken cutlets incorporated with 5% pumpkin powder (T2). In accordance to the present findings, Chetana *et al*. (2014) [32] reported increase in ash content with incorporation of potato in chicken cutlets. In contrast to the present findings, Verma *et al*. (2010) [33] reported decrease in ash content in low fat chicken nuggets prepared by the incorporation of apple pulp. There was a gradual increase in ash content with increasing level of pumpkin powder, which might be due to the higher mineral content of pumpkin powder.

Sensory Characteristics

The mean sensory scores of chicken cutlets incorporated with different levels of pumpkin powder are presented in [Table-4]. Statistical analysis of data revealed that there was a significant difference (P<0.05) in the general appearance, flavour, texture, juiciness and overall acceptability scores amongst control chicken cutlets as well as those incorporated with different levels of pumpkin powder. The score of general appearance of the control treatment (T1) and chicken cutlets incorporated with 5% pumpkin powder (T2) were significantly higher (P<0.05) than that of chicken cutlets incorporated with 10% and 15% pumpkin powder (T3 and T4). In accordance to the present findings decreased score for appearance was recorded by Verma *et al*. (2015) [21] in chicken nuggets developed through incorporation of chickpea hull flour.

Flavour of chicken cutlets incorporated with pumpkin powder showed a marginal increase. Flavour score for the control treatment (T1) was significantly (P<0.05) lower than pumpkin powder incorporated treatments (T2, T3, T4). Similarly, Zargar *et al*. (2014) [22] found increased level of flavour score for pumpkin treated chicken sausages as compared to control chicken sausages. The score for texture of the chicken cutlets incorporated with 10% pumpkin powder (T3) was significantly higher (P<0.05) than that of control (T1) and chicken cutlets incorporated with 5% and 15% pumpkin powder (T2 and T4). In contrast to the present findings decreased score for texture was recorded by Gamit *et al*. (2020) [5].

Juiciness scores of chicken cutlets incorporated with 10% and 15% pumpkin powder were significantly higher than control and chicken cutlets incorporated with 5% pumpkin powder.

In accordance to the present findings Mendiratta *et al*. (2013) [34], observed increase juiciness score for capsicum incorporated treatment as compared to control treatment. A marginal increase was observed in overall acceptability of chicken cutlets incorporated with pumpkin powder. The score of overall acceptability of the chicken cutlets incorporated with 10% pumpkin powder (T3) was significantly higher (P<0.05) than that of control and chicken cutlets incorporated with 15% pumpkin powder (T1 and T4). But, T3 and T2 were not significantly differ from each other. Choi *et al*. (2012) [23] also reported increase in overall acceptability for pumpkin incorporated treatment as compare to control.

Conclusion

The present study showed successful utilization of pumpkin powder in the preparation of chicken cutlets. The incorporation of pumpkin powder in chicken cutlets increased cooking yield, crude fibre and ash content; whereas, decrease moisture, crude protein and crude fat content was revealed. Based on the research findings the incorporation of pumpkin powder at a concentration of 10% was found to be the most acceptable for the development of chicken cutlets.

Application of research: This study will be beneficial to understand role of dietary fibre and antioxidant rich meat products on the health aspect

Research Category: Veterinary Science and Animal Husbandry

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Breed name: Chicken

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