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Effect of Incorporation of Potato on the Quality of Chicken Cutlets

Pant Chetana*, Kumar Yogesh, Anita, Bharti SK, Tanwar VK.
Dept.Of livestock products Technology, G.B.P.U.Agri&Tech., Pantnagar, US Nagar, Uttarakhand, India. PIN-263145.

Abstract:*A study was carried out to assess the effect of addition of different levels of potato (25% and 50%) and compared with control (C) on the basis of physicochemical, proximate and sensory attributes of chicken cutlets. Results for physico-chemical analysis indicated that pH values of both treatments were higher than C and differences were highly significant (P<0.05). Cooking losses and Shrinkage values of T_{25} and T_{50} were significantly (P<0.05) lower than that of C. Highly significant (P<0.01) differences were observed in WHC values of treatments and C. Moisture retention of T_{25} and T_{50} were highly significant (P<0.01) than C. Fat retention was significantly (P<0.05) higher for both treatments than C however protein content of T_{25}, T_{50} and C did not differ significantly. Moisture content of T_{25} and T_{50} were significantly (P<0.05) higher than C. However, no significant differences were observed in ash content of all samples. Sensory evaluation revealed that highly significant (P<0.01) scores for colour & appearance, juiciness and overall acceptability were observed for T_{25}. However, no significant differences were observed for texture and flavour values. It can be concluded that potato incorporation at 25% level improves quality and also decreases cost of production of chicken cutlets.*

Keywords*: chicken cutlets, potato, physicochemical analysis, proximate, sensory attributes*

I. Introduction

With rapid increase in poultry production in the country, disposal of spent birds meat becomes a challenge. About 30% of the poultry slaughtered in India are aged stocks after passing their productive life resulting in meat which is tough, less juicy with poor functional properties. This coarse textured meat needs to be subjected to special processing and cooking methods to improve tenderness (Hedrick, Aberle, Judge and Merkel, 1994; Lawrie, 1985). Meat processors can benefit from the development of efficient and economical technology for processing under-valued tough meat into value added products that are palatable and reasonable in cost. The preparation of value-added meat products enables incorporation of various binders/extenders. These processes not only bring down the cost of production but also improve palatability and yield of products. Various reports on addition of non-meat extenders and binders such as egg albumen and refined wheat flour (Padda et al, 1987), soy protein isolate (Singh and Verma, 2000), porridge flour (Pathak, 2009), milk co precipitate (Patil and Sanyal, 2001). In countries with low purchasing power like India production cost can be reduced high amounts of cheap extenders/fillers (e.g. flours, starches, potato, bread crumbs) to meat products. Cheap fillers like potato (*Solanum tuberosum)* can reduce cost of the product by 10-30%. Majority of the consumers prefer slight to medium extended meat products compared to full-meat products. Fillers like starches, flours and potato increases the juiciness of the product due to their high water absorption capacity particularly at the temperature between 50^0C -70^0C (FAO). Keeping these points in view, the present study was undertaken to evaluate the effects of incorporation of potato at 25% and 50% levels on physic-chemical, nutritive and organoleptic qualities of chicken cutlets and their storage stability.

Further enrobing of meat products provides advantages such as preserving the nutritive value, preventing moisture and weight loss, improving tenderness and juiciness. These improvements are brought about by coating ingredients which act as sealants and also prevent high oil uptake during frying of product (Cunningham, 1989). Breading on the fried product enhances texture, flavour and appearance of the product (Rao& Delaney, 1995).

II. Materials And Methods

Spent and culled broiler breeders were slaughtered hygienically in the semi-automatic poultry processing plant in the Department of Livestock Products Technology, GBPUA&T, Pantnagar. Dressed carcasses were chilled for 4-5 hrs. and deboned manually; deboned meat was packed in polythene bags and stored in freezer till further use .Partially thawed meat was minced by passing first through 6mm. and then 4mm. plate in an electric meat mincer. In experimental trials boiled mashed potato was incorporated at 0%, 25% and 50% levels proportionately. Other ingredients were salt (1.7%), dry spice mix (2.5%) and green curry stuff (onion, garlic and ginger paste; 5:3:1).

Meat mince was divided into three parts. No potato was added to CONTROL, 25% was added to second part (T_{25}) and 50% to the third part (T_{50}). Meat batter was prepared by hand mixing of all the ingredients in the above mentioned proportion. The batter was moulded into the shape of cutlets. The moulded cutlets were coated with white refined flour paste and enrobed with bread crumbs. Cutlets were deep fried to golden brown in sunflower refined oil till an internal temperature of 80^0 C was reached and turned repeatedly to avoid charring.

Table 1: Composition for formulation of chicken cutlets using boiled mashed potatoes as binder

INGREDIENTS(gm.)	CONTROL	T_{25}	T_{50}
CHICKEN MEAT	500	375	250
POTATO	-	125	250
SALT (1.7%)	8.5	8.5	8.5
DRY SPICES MIX (2.5%)			
GREEN CURRY STUFF (5%)			
ONION PASTE	13.88	13.88	13.88
GARLIC PASTE	8.33	8.33	8.33
GINGER PASTE	2.77	2.77	2.77
WHITE REFINED FLOUR PASTE	COATING	COATING	COATING
BREAD CRUMBS	ENROBBING	ENROBBING	ENROBBING

The pH of the sample (raw batter) was recorded, immediately after preparing batter, by homogenizing 5gm of batter in 45ml. of distilled water, using digital pH meter (Trout *et al*. 1992). Weight of raw and cooked cutlets was recorded to calculate cooking losses (%). Length, breadth and thickness (in cm.) of raw and cooked cutlets were recorded to determine shrinkage (%) by formula given by El-Magoli, Laroia and Hansen (1996).

$$\text{Shrinkage (\%)} = \frac{(\text{raw thickness} - \text{cooked thickness}) + (\text{raw diameter} - \text{cooked diameter})}{(\text{Raw thickness} + \text{raw diameter})} \times 100$$

Water holding capacity (%) was calculated by mixing 20gm of meat batter with 30ml. Of 0.6M NaOH in polycarbonate centrifuge tube and was stirred for 1 minute.The tube was then kept at refrigerated temperature (4 ± 1^0C) for 15 min, stirred again and centrifuged at 500rpm for 10 min. The supernatant was measured and amount of water retained by samples was expressed as WHC in percentage.

The moisture content was determined by hot air oven drying, fatby Soxhlet extraction with petroleum ether, protein by automatic Kjeldahl method and total ash contents of the chicken cutlets were estimated by muffle furnace as per AOAC.

Moisture (%) of the cooked and raw 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 according to the following equation as described by El-Magoli *et al.* (1996).

Moisture retention (%) = (%cooking yield X % moisture in cooked product)/ 100

A semi-trained panel comprising of faculty and PG students of the college were used for sensory evaluation of the product viz. , colour and appearance, flavour, texture, juiciness and overall acceptability using 8 point hedonic scale (Keeton ,1983) where 8- extremely good and 1-extremely poor. Pooled data from three trials were statistically analysed (Snedecor & Cochran, 1989) by analysis of variance.

III. Results And Discussion

Physico-chemical characteristics:

The results of various physico-chemical characteristics influenced by different levels of potato were presented in Table 2. Cooking loss is the important parameter to predict the behaviour 0f various additives like binders and non-meat ingredients during cooking. In the present investigation cooking losses of T_{25} and T_{50} were significantly ($P>0.05$) lower than CONTROL. CONTROL cutlets had the highest cooking losses, while the T_{25} and T_{50} differed non-significantly. Thus; incorporation of potato increased the moisture retention in the products during cooking (Keeton, 1994), as a result lowering the cooking losses, thereby increasing the cooking yield. Similar, results were recorded by Sharma *et al.* (1998) and Pathak *et al.* (2009).

The influence of addition of potato on pH values of chicken cutlets 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) of raw cutlets have shown that incorporation of potato significantly increased water holding capacity from 46.66 to 56.22 and the differences were highly significant ($P<0.01$). This might be due to higher moisture absorbance capacity of boiled potato in meat emulsion. Boiled potato can absorb large quantity of water without increase product viscosity. Shrinkage values of T_{25} and T_{50} were significantly ($P<0.05$) lower than that of CONTROL. Moisture retention of potato added cutlets showed highly significant ($P<0.01$) values than that of CONTROL. This is due to high moisture

absorption capacity of potato added cutlets. Fat retention capacity was significantly (P<0.05) higher for treatment compared to CONTROL.

Table 2: Effect of incorporation of boiled potato on Physico-chemical characteristics of chicken cutlets

PARAMETERS	CONTROL	T_{25}	T_{50}
COOKING LOSS	14.5600 ±0.4313[b]	12.7666 ± 0.1666[a]	13.2400 ± 0.1258[a]
pH	6.1300 ± 0.0116[b]	6.0500 ± 0.02085[a]	6.2166 ± 0.0202[c]
WATER HOLDING CAPACITY	44.6633 ± 0.3838[a]	56.2166 ± 0.4344[b]	56.2200 ± 0.2197[b]
SHRINKAGE	20.9600 ± 1.7807[b]	10.6033 ± 1.1270[a]	14.5333 ± 1.5592[a]
MOISTURE RETENTION	87.8000 ± 0.2490[a]	89.6533 ± 0.3206[b]	89.8866 ± 0.2361[b]

IV. Proximate Composition

The influences of various levels of potato on proximate characteristics of chicken cutlets are presented in Table 3. Increased levels of potato incorporation in the formulations reflected significantly (P<0.05) lower values of moisture content of cooked cutlets containing 50% potato than 25% and control however values did not differ significantly among T_{25} and CONTROL. CONTROL cutlets had highest protein values followed by 25% and 50% potato added cutlets. Reduction in protein content of cutlets containing potato as binder may be due to high starch and low protein content in potato. Fat content was significantly (P<0.05) higher for potato incorporated cutlets compared to CONTROL. This may be due to higher fat retention of product due to addition of boiled potato as binder. Total ash content did not significantly (P<0.05) affected by addition of various levels of potato in chicken cutlets.

Table 3: Effect of incorporation of boiled potato on proximate composition of chicken cutlets

PARAMETERS	CONTROL	T_{25}	T_{50}
MOISTURE	65.2833 ± 0.5514[a]	65.0933 ± 0.4601[a]	63.3100 ± 0.2066[b]
PROTEIN	32.3100 ± 0.6615[b]	24.9466 ± 1.0491[b]	22.9033 ± 1.6445[a]
FAT	6.1800 ± 0.4899[a]	6.7400 ± 0.1221[b]	7.4333 ± 0.6333[c]
ASH	1.3666 ± 0.1763[a]	1.9333 ± 0.2403[a]	2.5333 ± 0.5811[a]

V. Sensory characteristics

The results obtained in the sensory evaluation of chicken cutlets are presented in Table no.4. Colour and appearance scores gradually increased as the level of potato incorporation increased to 25%. Colour and appearance scores were highly significant (P<0.01) for potato incorporated cutlets compared to CONTROL. No significant differences were observed with regard to flavour of cutlets incorporated with different levels of potato. No significant differences were observed in texture values in CONTROL and treatment values. Potato added cutlets had highly significant (P<0.01) values for juiciness due to high moisture absorbance capacity of boiled potato used as binder. However, the values of T25 and T50 did not differ significantly. All the potato incorporated cutlets had higher overall acceptability scores than the control cutlets because of the better colour and appearance and juiciness scores.

Table 4: Effect of incorporation of boiled potato on Sensory characteristics of chicken cutlets

PARAMETERS	CONTROL	T_{25}	T_{50}
FLAVOUR	6.8000 ± 0.1154[a]	7.2200 ± 0.1331[a]	7.0000 ± 0.1154[a]
COLOUR & APPEARANCE	6.8666 ± 0.0666[a]	7.6000 ± 0.0577[b]	7.4000 ± 0.0577[c]
TEXTURE	6.6833 ± 0.0928[a]	6.8000 ± 0.0577[a]	6.3666 ± 0.0882[a]
JUICINESS	7.0333 ± 0.0881[a]	7.3666 ± 0.0333[b]	7.4666 ± 0.0333[b]
OVERALL ACCEPTABILITY	6.7333 ± 0.1666[a]	7.4666 ± 0.0333[b]	7.0666 ± 0.0666[a]

From, the observations recorded in this study it can be concluded that incorporation of potato as binder and for value addition of chicken cutlets at 25% level improves the quality of chicken cutlets and also lowers the cost of production without any deleterious effect on the physico-chemical, nutritive and sensory qualities of the product.

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