RESEARCH ARTICLE

Compositional, Sensory and Quality Parameters of Chicken Patties Prepared with Carrots

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Abstract

A study was undertaken to determine the effect of the incorporation of grated carrot in chicken patties. Chicken patties were prepared by replacing lean meat with grated carrot at 3 levels, i.e., 10, 15, 20 %. The three treatments along with control were evaluated for physico chemical properties, sensory evaluation and β-carotene estimation. Each experiment was repeated four times. There was a significant increase (P<0.05) in cooking yield, moisture, crude fibre and ash content with an increasing level of grated carrot incorporation. Product pH, crude protein and crude fat showed a significant decrease (P<0.05) with an increase in the level of incorporation of grated carrot. Mean sensory scores for treatments were found to be significantly higher (P<0.05) for texture and overall acceptability, while general appearance was similar when compared to control. The optimum incorporation level of grated carrot was found to be 15 % for chicken patties preparation. Mean sensory scores of 15% grated carrot treatment for general appearance, flavour, texture, juiciness and overall acceptability were comparable with control treatment during the storage period. Chicken patties could be stored safely in LDPE pouches for 9 days at refrigeration temperature (4±1°C).

Keywords: Beta-carotene, Chicken meat, Chicken patties, Compositional, Functional foods, Sensory.

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Introduction

Foods of meat origin are a great source of high-quality protein with high biological value. Furthermore, these matrices have a substantially higher bioavailability of micronutrients including iron, selenium, vitamins A, B-12, folic acid, salt, potassium, and magnesium than plant sources (Lorenzo and Pateiro, 2013). Despite its nutritional value, meat is lacking in dietary fibre, a complex mixture of polysaccharides found naturally in cereals, vegetables, fruits, and nuts as part of plant material. A lack of dietary fibres in our diet has been linked to several health problems, including colon cancer, obesity, and cardiovascular disease (Larsson and Wolk, 2006). A fibre-rich diet, on the other hand, has a lower energy density and is higher in micronutrients, which reduces the risk of numerous diseases and promotes a better lifestyle. Many foods and food products, particularly meat products, do not only lack the minimal levels of dietary fibre required to meet the recommended daily intake (Verma and Banerjee, 2010), but also vary in the number and composition of fibres. According to the American Dietetic Association, a healthy adult should consume about 25 to 30 grammes of dietary fibre per day, with an insoluble/soluble fibre ratio of 3:1. As a result, initiatives have been undertaken to add nutritional fibres from diverse sources in meat product formulation in order to promote numerous technological benefits and the acceptance of meat products that benefit human health (Bis-Souza *et al.,* 2019).

Carrot is considered as one of the high nutrient quality crops, and therefore, it is consumed by people of all ages. The vegetable is good source of fibre, carbohydrate and some minerals. However, the carrot is famous for its rich beta-carotene content. β-carotene delivers provitamin A and also carries very powerful antioxidant activity (Tapiero *et al.,* 2004). Other carotenoids found in carrots are alpha-carotene, lutein, zeaxanthin, and lycopene. Besides its rich alfa- and beta-carotene contents, the root contains a wide range of

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bioactive compounds including chlorogenic acids (Arscott and Tanumihardjo, 2010), quercetin, luteolin, kaempferol, myricetin, cyaniding, pelargonidin and peonidin as phenolic compounds (Kammerer *et al.,* 2004); Falcarinol, falcarindiol, and falcarindiol-3-acetate as polyacetylenes; and vitamin C (Ergun and Süslüoğlu, 2018). This study was therefore aimed to determine the effect of the incorporation of grated carrot in chicken patties on its compositional, sensory and quality parameters, and keeping quality.

MATERIALS AND METHODS

Boneless chicken meat was purchased from local market of Anand and kept at refrigeration (4±1oC) overnight. It was thoroughly washed and subsequently used for product formulation. Carrots used in this experiment were also purchased from the local market. Different spices listed in Table 1 were purchased from the local markets and kept in the hot air oven for an h at 60° C and ground to a fine powder and used in the experiment subsequently.

Condiment paste was prepared by grinding onion, garlic, and ginger in a 3:1:1 ratio. Chemical and microbiological media were procured from standard firms. Plastic packaging films of 200 gauge were used for the storage.

Preparation of Grated Carrot and of Patties

The carrots were hand-picked based on exterior features such as colour, rot, maturation stage, odour, size, and physical damage caused by transit or handling. Carrots were washed under tap water. After cleaning, carrots were hand peeled and grated in a food processor.

Deboned chicken meat was cut into small pieces and minced in mincer. Chicken patties were prepared as per the method of Naveena et al. (2008) using ingredients as per the recipe presented in Table 2. Grated carrot was incorporated at 10 %, 15 % and 20 % levels replacing lean meat. The final composition of patties is shown in the Table 3. Minced meat and condiments were separately fried in refined oil. Thereafter fried meat, condiments, spices and bread crumbs were mixed in the grinder. After uniform mixing of all the ingredients, the formed batter was subjected to molding for patties preparation with the help of metallic molds, 900 W power for 15 min. After reaching a temperature of 72° C the patties were allowed to cook for 10 min before being turned upside down and kept at 180° C for another 5 min. The patties after cooling to room temperature were packed in LDPE film pouches and stored at 4±1° C for the further studies.

Table 1: Composition of spice mix

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

Cooking Yield

Percentage of cooking yield was determined by calculating differences in weight of the chicken patties before and after cooking. The cooked chicken patties were cooled to room temperature and again weighed to calculate the cooking yield.

$$\text{Cooking yield} = \frac{\text{Weight of cooked chicken patties}}{\text{Weight of raw chicken patties}} \times 100$$

Proximate Composition and Measurement of pH

The moisture, protein, fat, fibre and ash content of chicken patties were determined as per standard methods of AOAC (1995). The pH of the cooked chicken patties was determined by following the procedure of Troutt et al. (2012).

Beta-Carotene Estimation

The β-carotene was estimated in the patties at NDDB,

Table 2: Formulation of chicken patties

Ingredients	Amount (%)
Chicken meat	76.00
Bread crumbs	10.00
Condiments	10.00
Spices	2.25
Salt	1.75
Sodium nitrite	150 ppm

Table 3: Formulations of chicken patties with incorporation of different levels of grated carrot

Ingredients	Treatments			
	T1	T2	T3	T4
Chicken meat %	76	66	61	56
Grated carrot %	0	10	15	20
Bread crumbs %	10	10	10	10
Condiments %	10	10	10	10
Spices %	2.25	2.25	2.25	2.25
Salt %	1.75	1.75	1.75	1.75
Sodium nitrite %	150 ppm	150 ppm	150 ppm	150 ppm

T1=Control, T2, T3, T4 =Grated carrot incorporated at 10, 15 and 20 % level, respectively.

Table 4: Effect of different levels of grated carrot on the proximate composition and quality parameters of chicken patties

Treatment	Parameter							
	Moisture	Crude protein	Crude fat	Ash	Crude Fibre	β-carotene	pH	Cooking Yield
T1	$39.05^{a} \pm 0.38$	$25.63^{d} \pm 0.07$	$14.22^{b} \pm 0.44$	$4.20^{a} \pm 0.14$	$1.31^{a} \pm 0.04$	0.99	$6.30^{d} \pm 0.002$	$87.09^{a} \pm 0.49$
T2	$40.94^{b} \pm 0.53$	$23.51^{c} \pm 0.12$	$13.52^{b} \pm 0.09$	$4.78^{b} \pm 0.03$	$2.83^{b} \pm 0.07$	1.71	$6.26^{c} \pm 0.003$	$89.60^{b} \pm 0.01$
T3	$42.69^{c} \pm 0.66$	$21.77^{b} \pm 0.21$	$12.44^{a} \pm 0.04$	$4.74^{b} \pm 0.02$	$4.27^{c} \pm 0.06$	2.08	$6.24^{b} \pm 0.001$	$89.94^{bc} \pm 0.02$
T4	$49.43^{d} \pm 0.32$	$19.55^{a} \pm 0.14$	$12.29^{a} \pm 0.03$	$5.24^{c} \pm 0.03$	$5.17^{d} \pm 0.12$	2.55	$6.22^{a} \pm 0.005$	90.60c ± 0.20
CD (0.05)	1.537	0.457	0.701	0.232	0.257	-	0.264	0.003
SEm	0.499	0.148	0.228	0.075	0.084	-	0.010	0.813
CV%	2.310	1.310	3.460	3.170	4.910	-	0.590	0.590

Figures with different superscripts within the columns differ significantly at 5% level.

Table 5: sensory characteristics of chicken patties

Treatment	General appearance	Flavour	Texture	Juiciness	Overall acceptability
T1	$7.60^{c} \pm 0.087$	$7.90^{b} \pm 0.049$	$6.58^{a} \pm 0.071$	$7.19^{c} \pm 0.024$	$7.33^{b} \pm 0.043$
T2	$6.84^{a} \pm 0.067$	7.00= ± 0.058	$7.16^{b} \pm 0.058$	$6.38^{a} \pm 0.067$	$7.24^{b} \pm 0.062$
T3	$7.25^{b} \pm 0.030$	$7.00^{a} \pm 0.062$	$7.00^{b} \pm 0.067$	$7.16^{b} \pm 0.062$	$7.93^{c} \pm 0.045$
T4	$7.57^{c} \pm 0.083$	$7.04^{a} \pm 0.063$	$7.00^{b} \pm 0.052$	$6.84^{c} \pm 0.073$	$7.00^{a} \pm 0.058$
SEm	0.071	0.059	0.063	0.060	0.053
CD (0.05)	0.202	0.168	0.180	0.171	0.152
CV%	3.200	2.690	3.000	2.870	2.380

Figures with different superscripts within the column differ significantly at 5% level

CALF Lab adopting IS 15120.2002 method of BIS (2002) with minor modifications. The method involved sample saponification, extraction, evaporation and detection on HPLC-PDA detector. Homogenized sample was saponified with the help of alcoholic KOH for 45 min. The saponified sample solution was cooled in ice bath and extracted by using the petroleum ether 3-4 times. Organic layer of each extraction was collected and washed with water to remove aqueous impurities. Separated organic layer evaporated by using rotary evaporator and dried residue was diluted with IPA and injected on HPLC system. The calibration standards were run along with samples. The responses of standard and samples were used to calculate the unknown concentration of beta-carotene in samples.

Sensory Evaluation

Chicken patties 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). Semi trained panelists comprising of faculty and students were used as panel for evaluation of product. The purpose of the experiment was described to the panelists without exposing the identity of the treatment, and they were asked to record their choice.

Statistical Analysis

Data obtained were analyzed using one way analysis of variance (ANOVA) for treatment comparison with Tukey's post-hoc test by SPSS software (Snedecor and Cochran, 1994). The level of significance was determined at 5 % level.

RESULTS AND DISCUSSION

Quality Parameters and Proximate Composition

The observations on the quality parameters and proximate composition of chicken patties containing 0, 10, 15 and 20 % grated carrot are presented in Table 4. A significant ($P<0.05$) reduction in pH was seen in the product with the highest 20% carrot concentration. A significant ($P<0.05$) increase in cooking yield was found in products with increasing levels of carrot incorporation, with the greatest mean value at 20% carrot. Though treatment T3 remained at par with T2 and T4, the least cooking yield was found in the control group.

Moisture increased significantly ($P<0.05$) with increasing degree of grated carrot inclusion, that might be attributed to the greater moisture content of carrots. The crude protein and fat content of the products decreased significantly ($P<0.05$) with increase in the level of incorporation of carrot with lowest ($P<0.05$) value recorded for the product containing 20% carrot (Table 4). The probable reasons for the decreased protein content may be attributed to the comparatively lower protein content of carrot. The fat of the T3 and T4 treatments was significantly lower ($P<0.05$) than that of T1 (control) and T2 treatments. The crude fibre content of chicken patties containing 20% grated carrot (T4) was significantly greater ($P<0.05$) than that of control (T1) and chicken patties

containing 10% , 15% and 20 % grated carrot (T2, T3 and T4), all differed significantly from one another. The lowest fibre content was found in control chicken patties, whereas the greatest fibre content was found in chicken patties with 20% grated carrot. Ash content showed an increasing trend with increasing level of grated carrot incorporation in chicken patties. The ash content of the chicken patties incorporated with 20 % grated carrot was significantly higher ($P<0.05$) than that of control. The beta-carotene content showed gradual increase with increasing level of carrot (Table 4). The results of the present study to some extent concurred with those of Czepa and Hofmann (2004) using different cultivars of carrot.

Sensory Characteristics

Based on the appearance and sensory evaluation (Table 5), it was observed that there was a significant difference in the overall acceptability among the chicken patties incorporated with grated carrot. Chicken patties incorporated with 15 % level was considered to be the best due to its better overall acceptability. Czepa and Hofmann (2004) reported variable sensory qualities of carrot products prepared from different cultivars of carrot.

CONCLUSION

Based on sensory scores and physico-chemical properties, grated carrot can be incorporated optimally at the 15 % level in functional chicken patties.

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