Development and Evaluation of Quality of Noodles Enriched with Chicken Meat Powder

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A B S T R A C T

The study was carried out to develop noodles enriched with chicken meat powder (CMP). Different levels (10-50%) of CMP were added in refined wheat flour (RWF) to formulate noodles. The developed noodles were dried in hot air oven at $60\pm2°C$ for 5-6 hours to attain moisture content less than 12% as per the PFA specifications for noodles. The noodles developed only with RWF used as control. There was an increase in protein, moisture, fat and ash content and a decrease in breaking strength of noodles with incorporation of CMP in compared to control. The CMP enriched noodles had desirable organoleptic properties. But as per sensory evaluation, noodles with 20% CMP enrichment were most acceptable as compared to others and were found to be optimum for enrichment in RWF noodles for development of CMP enriched noodles.

Introduction

In the emerging era of fast and convenience foods, instant foods are becoming increasingly popular in view of kitchen convenience as well as for meeting the urgent and exigency situation of offering hospitality to unexpected guests. Growing urbanization, changing socio-economic status and improved lifestyles have contributed to enhanced consumption of processed and convenience meat products (Kumar *et al.,* 2001). The major challenge today is to develop inexpensive foods that are nutritionally superior and highly acceptable to consumers. Wheat is abundant in some areas of the world and is one of the least expensive cereals available for creating fabricated foods high in nutrition. Various attempts to increase the nutritional value of noodles by the use of vegetable source like pulses, ground nut and soybean (Singh, 2001; Sowbhagya and Ali, 2001; Shogren *et al.,* 2006), fish protein concentrate (Woo and Erdman, 1971) have been well tried but a little work has been done on chicken meat enriched noodles. The incorporation of chicken meat in wheat based products has been found to enhance

acceptability and increase the nutritive value. Keeping all these facts in view, an attempt was made to develop noodles enriched with chicken meat powder (CMP) from spent hen. Along with a complementary nutritive value, the chicken meat powder enriched noodles may also offer an important avenue for profitable disposal of spent hen by using its meat for food product development.

Materials and Methods

Place of study

The present study was conducted in the Department of Livestock Products Technology, College of Veterinary Sciences, LUVAS, Hisar to develop CMP enriched noodles by using refined wheat flour and powder from spent hen meat. The controls as well as incorporated noodles were subjected to proximate composition, physico-chemical properties, cooking parameters and sensory studies.

Raw materials

Refined wheat flour (RWF) and common salt were procured from local market, Hisar. Spice mix was developed in the laboratory itself and contained ingredients as mentioned in Table-1. The ingredients were cleaned and then dried in hot air oven at $45\pm2°C$ for 2 hours and then ground, sieved through a size of 100 meshes, mixed and spice mix in fine powder form was obtained. The spent hen (White Leghorn) of age about 1.5 years reared under similar feeding and management conditions were slaughtered as per standard procedure in experimental slaughter house of Department of Livestock Products Technology, College of Veterinary Sciences, LUVAS, Hisar, dressed, deboned and packaged in low density polyethylene bags and stored at -20°C for further studies.

Preparation of Chicken meat powder (CMP)

Minced meat was placed in a pan and the minimum quantity of water was added to start the cooking. The traditional cooking was done for about 35 minutes till the meat was thoroughly browned as par recommendation of Bate Smith *et al.,* (1943). This precooked meat mince was dried in a cabinet tray drier at 60ºC for 9 hours and then stored in air tight food grade plastic jars at an ambient temperature $(27\pm2°C)$ for further use in noodle enrichment.

Preparation of Noodles

Noodles were prepared following the procedure of Lakshmi Devi and Khader (1997). Control noodles were prepared by using 100% RWF while Chicken enriched noodles were prepared by using various levels of RWF and CMP as given in Table-2. 2% spice mix was used both in control as well as CMP enriched noodles. Desired levels of water were added to each treatment to find out optimum level of water which gave dough of acceptable handling quality. The dough was then folded and sheeted through a hand operated noodle machine to get a sheet of 3 mm thickness. This sheet was again passed through the rolls to get a final sheet of 1.5 mm thickness. The dough sheet was then cut into noodle strips. These were dried in hot air oven at $60\pm2°C$ for 5-6 hours to get moisture content below 12% (as to meet the PFA specifications for noodles).

These developed noodles were evaluated for proximate composition, physical properties, cooking parameters and sensory evaluation.

Proximate composition

Moisture, protein, fat and ash content were determined as per standard procedure of AOAC (1995).

Physico-chemical properties

Breaking Strength (Tensile Strength)

Breaking strength of dried noodles was determined by performing the test on a Three-point Bend Rig (Oh *et al.,* 1985).

Bulk Density and true density

The method as described by Sahay and Singh (2001) was used to evaluate bulk density and true density of dried noodles.

Cooking parameters

Cooking time

It was determined as per the method adopted by Oh *et al.,* (1983).

Water Uptake

To measure the degree of noodle hydration during cooking, the water uptake was determined as the difference between noodle weight before and after cooking according to the procedure of Vetrimani and Rahim (1994).

Swelling Index

It was determined following the method of Chen *et al.,* (2002).

Sensory evaluation

The developed products were evaluated for the sensory characteristics viz. color, mouthfeel, texture, flavor and overall acceptability using 9 point Hedonic scale (Nelson and Trout, 1964).

Statistical analysis

Data obtained were subjected to suitable statistical design as per Snedecor and Cochran (1994).

Results and Discussion

The CMP enriched noodles were formulated using 2% spice mix, various levels of CMP (10-50%) and RWF as given in Table- 2. Desired levels of water were added to each treatment to optimise level of water which gave dough of acceptable handling quality. It was found that the water required for dough preparation for 10, 20, 30, 40 and 50% CMP enriched noodles was 41, 43, 45, 47 and 51 ml, respectively. The water required for CMP noodles increased with increase in level of CMP as CMP has lower moisture content and binding power than refined wheat flour. The noodles enriched with more than 30% levels of CMP could not be well sheeted and the resulted noodles were not acceptable in terms of physical appearance and texture. In addition, proper shape of the noodles was not maintained. Therefore, the noodles prepared with CMP levels above 30% (i.e. 40% and 50%) were not continued for further studies. The developed noodles were dried in hot air oven at temperature level of $60\pm2°C$ for 5-6 hours to reduce moisture content below 12%.

Proximate Composition of Refined Wheat Flour (RWF) and Chicken Meat Powder (CMP)

The moisture, crude protein, crude fat and ash content were 10.22, 11.19, 1.35 and 0.63%, respectively for refined wheat flour (RWF) and 7.08, 74.25, 10.42 and 4.81%, respectively for chicken meat powder (CMP). The Protein, crude fat and ash content were significantly ($p<0.05$) higher for CMP as compared to RWF (Table-3). The findings for proximate composition of RWF were in accordance with those of Gopalan *et al.,* (1985) and Hooda (2002). According to Loesecke (1998) suggested the maximum moisture level up to 10% in dried beef and dried fish may be having protein content up to 82% if it is pre-cooked before drying. The

maximum limit of fat as reported by Loesecke (1998) in dehydrated meat was 30%. He further submitted that fat would drip during drying in case of poultry. He reported about 3.5% ash content in dehydrated beef. However, no significant importance was given in literature to ash content in dehydrated meat because it depends upon the utilization of different salt levels in drying.

Proximate composition of control and CMP Enriched Noodles

Moisture content of control and noodles enriched with 10, 20 and 30% CMP was found to be 8.98, 8.91, 8.88 and 8.93%, respectively (Table-4). The developed products were as per PFA norms (second amendment 1996) according to which the moisture content of macaroni products should not be more than 12.5%. The analysis of variance revealed non-significant ($p \leq 0.05$) effect of CMP enrichment on moisture content of dried noodles.

The crude protein content showed a significantly ($p < 0.05$) increasing trend with an increase of the concentration of CMP with the highest protein (%) in 30% CMP enriched noodles. This was attributed to high protein content in CMP enriched noodles as compared to RWF. Similar trend was reported by Nielsen *et al.,* (1980) and Mytle (1999) on addition of Pea protein concentrate and paneer, respectively in noodles. A significant ($p < 0.05$) increase in fat and ash content on addition of CMP in noodles was recorded. This was due to the obvious difference in the proximate composition of raw materials. Mytle (1999) reported fat enhancement from 0.93 to 9.88 by 30% paneer enrichment to refined wheat flour noodles. Vetrimani ad Rahim (1994) reported an ash content of 0.60% for 'maida' vermicelli and 1.2% for 'suji' vermicelli. The ash content was increased from 0.60 to 0.98 by 30% paneer

additions to refined wheat flour noodles (Mytle, 1999).

Sensory evaluation The scores for colour, mouth feel, texture, flavor and overall acceptability for control and CMP enriched noodles are presented in Table-5. The colour scores for control noodles and those with 10, 20, 30% CMP enrichment were 8.15, 8.05, 7.85 and 6.5, respectively. The colour scores decreased with an increased CMP level with a significant ($p < 0.05$) decline only at 30% level. Khouryieh *et al.,* (2006) reported that the colour, stickiness and firmness scores of cooked egg noodles were significantly ($p < 0.05$) affected by the types of egg substitutes and their chemical composition. The mouthfeel score were highest for control noodles (8.05) followed by 10% CMP (7.9), 20% CMM (7.85) and 30% CMM (6.95). The mouthfeel scores decreased with increase in CMP enrichment at 10 and 20% levels with a significant ($p < 0.05$) decrease at the highest level of CMP (30%).

Texture scores were 8.1, 7.7, 7.7 and 6.25 for control, 10% CMP, 20% CMP and 30% CMP, respectively. A decrease in texture scores with increase in level of CMP was observed with a significantly ($p < 0.05$) lower texture score at the 30% level of CMP. De Oliveira *et al.,* (2006) reported that the Texture of the spaghetti and twist noodles, which was measured in terms of their firmness, showed a significant reduction ($p < 0.05$) in firmness when 15% Pejibaye flour was added to the product.

The flavour scores for control, 10, 20 and 30% CMP enrichments were 7.5, 7.6, 7.85 and 8.0, respectively. The analysis of variance revealed that flavour score increased with addition of CMP. At 20% and 30% levels of incorporation of CMP, the flavor scores were significantly ($p < 0.05$) better than control. The overall acceptability score was the highest for

control noodles (8.10) followed by 20% CMP (7.84), 10% CMP (7.75) and 30% CMP (6.85). Though all the scores were in acceptable range (above 6.0), but on sensory basis, the inclusion of CMP at 20% level closely approximated that of control for all the sensory attributes and was considered as optimum for enrichment in noodles.

Table.1 Spice mix formulation

Sr. No.	Name of ingredient	Percentage (w/w)
1	Coriander	15
2	Cumin seed	15
3	Caraway seed	10
4	Aniseed	10
5	Black pepper	10
6	Red Chilli	08
7	Soanth	08
8	Cinnamon	05
9	Cloves	05
10	Big cardamom dry	05
11	Mace	05
12	Nutmeg	02
13	Green cardamom dry	02
	Total	**100**

Table.2 Levels of refined wheat flour (RWF) and chicken meat powder (CMP) to develop CMP enriched noodles

Treatment	RWF%	CMP%
T_1	100	0
T_2	90	10
T_3	80	20
T_4	70	30
T_5	60	40
T_6	50	50

Table.3 Proximate composition of RWF and CMP used for making chicken enriched noodles

Parameter (%)	RWF	CMP
Moisture	$10.22^a \pm 0.12$	$7.08^b \pm 0.02$
Crude protein	$11.19^a \pm 0.02$	$74.25^b \pm 3.09$
Crude fat	$1.35^a \pm 0.02$	$10.42^b \pm 0.14$
Ash	$0.63^a \pm 0.01$	$4.81^b \pm 0.14$

Table.4 Proximate composition of Control and CMP enriched noodles

Parameters (%)	Control noodles	CMP enriched noodles		
		10%	20%	30%
Moisture	8.98[a] ±0.05	8.91[a] ±0.06	8.88[a] ±0.04	8.93[a] ±0.02
Crude protein	11.21[d] ±0.32	17.44[c] ±0.23	23.84[b] ±0.43	29.97[a] ±0.50
Crude fat	0.92[d] ±0.10	1.75[c] ±0.11	2.78[b] ±0.13	3.66[a] ±0.11
Ash	0.62[d] ±0.01	1.01[c] ±0.01	1.48[b] ±0.01	1.86[a]±0.01

Table.5 Sensory characteristics of control and CMP enriched noodles

Sensory parameter	Control noodles	CMP enriched noodles		
		10%	20%	30%
Colour	8.15[a] ±.08	8.05[ab] ±0.15	7.85[b] ±0.08	6.5[c] ±0.17
Mouthfeel	8.05[a] ±0.05	7.9[a] ±0.07	7.85[a] ±0.08	6.95[b] ±0.14
Texture	8.10[a] ±0.10	7.7[b] ±0.13	7.7[b] ±0.11	6.25[c] ±0.11
Flavour	7.50[d] ±0.13	7.6[c] ±0.10	7.85[bc] ±0.08	8.00[ab] ±0.11
Overall acceptability	8.10[a] ±0.07	7.75[c] ±0.08	7.84[bc] ±0.07	6.85[d]±0.09

Table.6 Physico-chemical properties and cooking characteristics of CMP enriched noodles

Parameters	Control noodles	CMP enriched noodles		
		10%	20%	30%
Breaking strength (g/mm^2) (uncooked)	2026[a] ±4.33	1916[b] ±3.38	1894[c] ±7.56	1860[d] ±4.21
Bulk density (g/ml) (uncooked)	0.50[a] ±0.04	0.43[a] ±0.03	0.42[a]±0.04	0.40[a]±0.05
True density (g/ml) (uncooked)	1.27[a] ±0.03	1.30[a] ±0.04	1.31[a] ±0.03	1.32[a]±0.03
Cooking time (minutes)	8.30[a]±0.03	8.00[b]±0.04	7.30[c]±0.03	7.00[d]±0.03
Water uptake (ml/g) (cooked)	1.96[a] ±.10	1.85[a] ±0.09	1.82[a] ±0.08	1.79[a] ±0.11
Swelling index	2.25[a] ±0.08	2.13[a] ±0.08	2.09[a] ±0.12	2.05[a]±0.08

Physico-chemical Properties and Cooking Characteristics

The breaking strength of control noodles was found to be maximum (p<0.05) and showed a decreasing trend with correponding increase in level of CMP (Table-6) but was observed satisfactory when compared with results obtained by Oh *et al.,* (1985) for dried noodles made with composite flours.

The bulk and true density of control and CMP enriched noodles were comparable and

were in accordance with the observations of King *et al.,* (1968) and Anon (1980) for chicken meat and refined meat flour, respectively. The cooking time for control noodles was 8.30 minutes. Vetrimani and Rahim (1994) and De Oliveira *et al.,* (2006) also asserted cooking time for pasta products around 8.30 minutes. With increasing level of CMP enrichment, there was a significant (p<0.05) decrease in cooking time because during chicken meat powder preparation, precooking for about 35 minutes had already done before adding it in the dough for developing enriched noodles. The water

uptake and swelling index of control and CMP enriched noodles were comparable irrespective of the levels of CMP enrichment.

In conclusion, the study revealed that chicken meat powder enrichment had no significant effect on moisture content but increased protein, fat and ash percentage in noodles. The breaking strength decreased with CMP addition but was in well acceptable range. Keeping all parameter in view, including sensory evaluation, 20% CMP level was found superior than all other levels of enrichment and hence 20% level of CMP enrichment in noodles was most suitable.

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