Quality Characteristics of Value Added Chicken Meat Noodles

Akhilesh K Verma, Pathak V and Singh VP*

Department of Livestock Products Technology, U.P. Pt. Deen Dayal Upadhyay Veterinary University & Go Anusandhan Sansthan, Mathura, U.P., India

Abstract

Background: Now a day snack foods are quite popular all over world. They are food of choice for children, women and highly mobilized population. Most of the snacks available are rich in carbohydrate and lower in protein. So the efforts were tried to incorporate the valuable animal protein in snacks.

Methods: Technology of chicken meat noodles preparation was standardized with various levels (0, 30, 40 and 50 percent) of meat along with whole wheat flour and other necessary ingredients. The emulsion was initially prepared then this emulsion was moulded into noodles and cooked in hot air oven at 65 ± 2°C for required time (7-8 hours). The analysis was performed on emulsion, physico-chemical qualities and sensory attributes using suitable method.

Results: On assessment product conations 30 percent meat was found best in all respect. The emulsion pH and stability overall showed decreasing trend with increase in level of meat. Among physico-chemical characteristics moisture showed non significant increasing trend while protein, fat, ash and water absorption index increased significantly ($P<0.05$) with increase in level of meat in noodles. The other parameters like crude fibre, yield, water solubility index, weight increase, volume increase and cooking loss decreased significantly ($P<0.05$) on increase in level of meat in noodles from 0 to 50 percent. All sensory attributes were significantly higher ($P<0.05$) in T1 as compared to T2, T3 and control except meat flavour intensity which was significantly ($P<0.05$) higher in T3 than other products.

Conclusion: On the basis of analysis done and sensory evaluation conducted it is concluded that noodles having 30% chicken meat represented an acceptable preference in term of sensory evaluation as compare to 0, 40, and 50%.

Keywords: Chicken meat noodles; Physio-chemical properties; Whole wheat flour; Sensory attributes

Introduction

Snacks are popular products all over the world due to convenience, variety and quality to carry from one place to another. It is a food of choice for children, women, and highly mobilized population. The consumption of snack foods is increasing day by day due to rapid urbanisation process and sociological changes [1]. The modern technology of snacks production is mostly based on the extrusion technology. These extended snacks are of various types like pretzels, cookies, noodles, sticks, biscuits, rings etc. noodles may be defined as a type of dough extrude in to various shape for cooking. Noodles are getting popularity in international food market due to rapid urbanization, Changing food habit, women engaged in outdoor job and changing life style of people. Noodles are basically cereal based, lacking some essential amino acids like tryptophane, threonine and lysine [2]. Incorporation of meat in such snack food can improve the nutritional qualities especially with respect to amino acid quality, flavour, odour and taste. Although a lot of work has been done to improve the functional properties and nutritive value of noodles through changes in formulations and processing; possibility of incorporation of meat in noodles as a source of protein remains almost unexplored. Hence the present study to find out the suitability of whole wheat flour and various levels of meat in chicken meat noodles preparation.

Materials and Methods

Source of Material

The good quality whole wheat was procured from local market then it was dried in hot air oven at 65°C for 2-3 hrs. After drying it was fine grounded in a flour mill to obtain fine quality wheat flour. The salt used in the study was Sodium chloride (NaCl) Tata salt food grade was procured from local market Mathura, India. The Mono sodium L- glutamate LR of S.D. Fine chemicals limited, was used in the preparation of spices to improve the flavour of products. The starch corn use in this experiment was of analytical grade and procured from Hi Media laboratories (P) Ltd, Mumbai.

The taste maker formulation used for addition in noodles is given in Table 1. These ingredients were procured from local market of Mathura, Utter Pradesh, and India. After removal of extraneous matters the ingredients were oven dried at 55 ± 2°C for 3 hrs. While the onion, garlic ginger and carrot were peeled off and then cut in to the small pieces for suitable to drying in the microwave (LG˙) at low frequency for 2.5 min. one side then turn it and further kept for 2.5 min again at same frequency. After they were taken out from micro oven and were kept in to the hot air oven at 60 ± 5°C for sufficient time such that they may be easily pulverised. The ingredients were ground mechanically in Inalsa food mixer and sieved through a fine (U.S.S. #30) mesh screen. The powders so obtained were mixed in suitable proportion to obtain a taste maker for chicken meat noodles. The taste maker was then immediately packed in pre-sterilized LDPE bags (low density polyethylene) for subsequent use.

*Corresponding author: Dr VP Singh, Department of Livestock Products Technology, U.P. Pt. Deen Dayal Upadhyay Veterinary University & Go Anusandhan Sansthan, Mathura, U.P., India, Tel: (+91) 9412190865; E-mail: sushma@berkeley.edu

Ingredients	Percentage
Anise (Soanf)	4
Black pepper (Kali mirch)	2
Turmeric powder	1
Capsicum (Mirch powder)	3
Nutmeg (Jaiphal)	0.2
Cardamom dry (Chhoti elaichi)	1
Fenugreek	0.3
Clove (Loang)	0.2
Coriander (Dhania)	5
Cumin seeds (Zeera)	4
Ginger	3
Garlic	3
Onion	25
Sugar	3
Salt	2
Starch	24.8
Carrot	18
Monosodium glutamate	0.5

Table 1: Taste maker formulation.

Ingredients (%)	Level of meat (%)			
	0	30	40	50
Minced chicken meat	00	27.0	36.0	45.0
Salt	2.0	2.0	2.0	2.0
Whole wheat flour	90	63.0	54.0	45.0
Starch corn	08	08	08	08
Water requirement (ml)	54.311	22.972	12.940	4.925
Cooking Time (min.)	9.167	11.167	12.50	13.75

Superscript row wise differ significantly (P<0.05)

Table 2: formulation of chicken meat noodles preparation using whole wheat flour and various level of meat.

Methodology

The boiler chicken were procured from poultry farm of DUVASU, MATHURA and slaughtered as per standard procedure in the experimental slaughterhouse of Department of Livestock Products Technology, College of Veterinary Science and animal husbandry, Mathura, Utter Pradesh. The dressed boiler chicken carcasses were brought to the laboratory and hot deboned manually. After removal of all separable connective tissues, fat, fascia and blood vessels the deboned chicken meat (DCM) was packed in low density polyethylene (LDPE) bags and stored over night at 4 ± 1°C in a refrigerator for conditioning and then frozen at -18 ± 1°C for subsequent use. Frozen meat samples were taken out as per requirement and cut into smaller cubes after partial thawing in a refrigerator (4 ± 1°C). The meat chunks were then double minced using 6 mm and 4 mm grinder plates to get fine minced chicken meat (MCM) for experimental use. Four different batches of noodles were prepared i.e. control (C), 30 percent meat level (T_1), 40 percent meat level (T_2) and 50 percent meat level (T_3) noodles were blended with whole wheat flour, minced chicken meat, common salt, corn starch and water was added in the proportions as mentioned in Table 2 to each batch as per requirement for the formation of dough. By the mixing of these ingredients dough was prepared.

The prepared dough was extruded through the manually operated stainless steel extruder into round shape. Then these extruded noodles were kept in a hot air oven (Scientech Ltd.) at 65 ± 2°C for required time (7-8 hours) for drying of chicken meat noodle. The dry and cool chicken noodles were manually broken into 10-15 cm long to obtain chicken meat noodles. Then chicken meat noodles were packed and sealed with the help of a sealer (Singhal®, HSP-200, India) in presterilised LDPE packages.

The pH of meat emulsion (dough) and chicken meat noodle were determined by blending 10 g of sample with 100 ml distilled water for 1 min. using pestle and mortar [3]. The pH of the suspension was recorded by dipping combined glass electrode of an Elico pH meter (Model: LI 127). The yield of cooked emulsion mass was recorded as emulsion stability percent by the method as described by Baliga and Madaiah [4]. Moisture, fat, protein and ash percentage of the product were estimated as per AOAC [5]. The percent crude fibre in noodles was calculated by using the procedure of Saura-Calixto et al. [6]. The weight of chicken meat noodles was recorded before and after drying and the difference was calculated and expressed as percentage. Water absorption index and Water solubility index were determined in accordance with method described by Anderson et al. [7]. Cooking loss was evaluated according to method of Ozkaya and Kahveci [8]. 25 g noodle was cooked in boiling water (250 ml) on the basis of their optimum cooking time. Volume increase and Weight increase were measured according to method of Ozkaya and Kahveci [8]. Optimum cooking time of noodles was measured according to method of Singh et al. [9].

Sensory evaluation

The sensory qualities of samples were evaluated using 8 point descriptive scale [10] by sensory semi trained panellists of nine judges to evaluate the sensory qualities of chicken meat noodle. The evaluation was based on sensory characteristics (colour and appearance, flavor, texture, mouth coating, saltiness, meat flavor intensity and overall palatability) to determine optimum level of meat in different group of flour.

Statistical analysis

Data were analysed statistically on 'SPSS-16.0' software package as per standard methods [11]. Duplicate samples were drawn for each parameter and the experiment was replicated thrice (n=6). Sensory evaluation was performed by a panel of nine member judges three times, so total observations being 27 (n=27).) Data were subjected to one way analysis of variance and level of significance among the treatments.

Results

The results obtained in the study on emulsion is presented in Table 3 whereas, mean values of physico-chemical characteristics of chicken meat noodles are depicted in Table 4. The sensory scores obtained from 8-point hedonic scale on the preferences of semi trained judges are given in Table 5.

The emulsion prepared from whole wheat flour and various levels of meat (0, 30, 40 and 50%) was assessed for pH and emulsion stability. Replacement of flour with different levels of minced chicken meat (C, T_1, T_2 and T_3) showed the decreasing trend of pH with the increase in amount of the meat in meat emulsions. The values obtained in the study on pH in the emulsion prepared from whole wheat flour were

Parameter	Level of chicken meat (%)			
	0	30	40	50
pH	6.838^c±0.031	6.573^b±0.047	6.455^a±0.042	6.352^a±0.032
Emulsion stability (%)	98.970±0.101	98.899±0.119	98.674±0.239	98.473±0.291

Superscript row wise differ significantly (P<0.05)

Table 3: pH and emulsion stability of whole wheat flour based chicken meat emulsion (Mean ± SEM).

Parameters	Level of chicken meat (%)			
	0	30	40	50
Moisture (%)	9.450±0.051	9.638±0.111	9.745±0.167	9.749±0.172
Protein (%)	15.325[a]±0.551	24.113[b]±0.690	30.608[c]±0.531	34.108[d]±0.371
Fat (%)	4.087[a]±0.098	4.572[b]± 0.085	5.781[c]±0.064	6.251[d]±0.070
Ash (%)	3.272[a]±0.063	3.767[b]±0.044	3.987[c]±0.058	4.217[d]±0.048
Crude fibre (%)	4.626[d]±0.090	3.859[c]±0.095	2.608[b]±0.062	2.063[a]±0.069
Yield (%)	66.194[c]±0.714	63.745[bc]±0.602	61.596[b]±0.624	55.165[a]±1.456
Water absorption index (g/g)	1.588[a]±0.022	1.672[b]±0.009	1.717[b]±0.020	1.787[c]±0.023
Water solubility index (%)	0.085[c]±0.002	0.079[bc]±0.002	0.073[b]±0.002	0.065[a]±0.002
Weight increase (%)	3.268[c]±0.058	2.968[b]±0.058	2.825[b]±0.039	2.62[a]±0.061
Volume increase (%)	323.503[d]±2.256	290.522[c]±2.186	277.488[b]±1.553	249.449[a]±2.723
Cooking loss (%)	7.603[d]±0.272	6.516[c]±0.069	5.635[b]±0.210	4.070[a]±0.170

Superscript row wise differ significantly (P<0.05)

Table 4: Physico-chemical parameters of whole wheat flour based chicken meat noodles (Mean ± SEM).

Parameters	Level of chicken meat (%)			
	0	30	40	50
Appearance and colour	4.703[a]±0.128	6.629[c]±0.178	5.851[b]±0.182	5.148[a]±0.218
Flavour	4.960[a]±0.155	6.851[b]±0.157	5.000[a]±0.244	5.259[a]±0.156
Texture	4.925[a]±0.140	6.740[b]±0.173	5.000[a]±.184	5.222[a]±0.154
Mouth coating	5.000[a]±0.130	6.851[b]±0.166	5.296[a]±.183	5.333[a]±0.160
Saltiness	4.925[a]±0.159	6.740[c]±0.189	5.370[ab]±0.186	5.481[b]±.171
Meat flavour intensity	00±0.00[a]	5.481[b]±0.179	5.666[b]±0.130	5.814[b]±0.119
Overall acceptability	5.148[a]±0.174	6.740[b]±0.173	5.629[a]±0.170	5.629[a]±.161

Superscript row wise differ significantly (P<0.05)

Table 5: Sensory scores of whole wheat flour based chicken meat noodles (Mean ± SEM).

found significantly (P<0.05) different in the emulsion prepared for C with T_1, T_2 and T_3. The emulsion prepared for C was also significantly (P<0.05) different from the other levels of meat emulsion pH. However, no significant difference was observed in between T_2 and T_3 emulsion but these values were significantly (P<0.05) different from other levels of meat emulsion in pH.

The overall mean values of emulsion stability were in decreasing trend with the increase in level of meat from 0 to 50%. Analysis of the variance of data on emulsion stability showed non significant difference of meat level on the emulsion stability values.

The data obtained for various physico-chemical properties i.e. moisture, fat, protein, ash, crude fibre, yield, water absorption index (WAI), water solubility index (WSI), weight increase, volume increase, and cooking loss of chicken meat and control noodles. The mean values of proximate composition (moisture, protein, fat, ash) and water absorption index showed increasing trend with the increase in amount of meat in chicken meat noodles. The increase was none significant in moisture values whereas, significant (P<0.05) in other parameters related to proximate composition and WAI content. The other values such as yield, crude fibre, WSI, weight increase, volume increase and cooking loss were in the decreasing trend with respect to increase in level of meat from 0 to 50%.

The study of analysis of variance showed overall none significant effect of level of meat on moisture content while significant (P<0.05) differences were observed among the levels of meat in protein, fat, ash contents, crude fibre, volume increase and cooking loss. The mean values of water absorption index and weight increase of control was significantly (P<0.05) different from T_2 and T_3 noodles whereas, T_2 and T_3 noodles were non significantly different among each other. The yield of the C noodles having no meat was none significantly different

with T_1 noodles and T_1 noodles was also non significantly different from T_2 product. However, these noodles were found significantly (P<0.05) different in yield from T_3 noodles. The percent values of water solubility index of C and T_3 products as well as T_2 and T_3 noodles were non significantly different among each other but the values of control noodles and T_3 were significantly (P<0.05) different from the T_1 and T_2 noodles.

Replacement of flours with different levels of chicken meat (0, 30, 40 and 50) had significant effect (P<0.05) on protein content of chicken meat noodles. The overall mean contents of fat were in the increasing order with the increase level of meat in whole wheat flour based chicken meat noodles. The increased ash contents with increased level of meat might be due to the higher contents of minerals in meat as compared to whole wheat flour. The contents of crude fibres was showing decreasing trend with the enhancement of meat level in chicken meat noodles. The overall mean values of the yield observed decreasing trend with the enhancement of meat level that might be due to the increase in moisture contents in the products. The overall mean weight decreased among all types and levels of meat showed lowest value in products containing 50 percent meat. The overall mean values of the chicken meat and control noodles prepared from whole wheat flour with various meat levels (0 to 50%) showed decrease in volume increase values. The reason may be increase in protein and moisture contents with increase in level of meat and decrease in contents of carbohydrates. The overall means values of water solubility index were decreased in whole wheat flour chicken meat noodle with increase in incorporation of meat levels.

The scores of sensory evaluation were obtained on various sensory attributes such as appearance and colour, flavour, texture, mouth coating, saltiness, meat flavour intensity and over all acceptability. All the values obtained for the sensory attributes of various types of

chicken meat noodles and controls were very well accepted by the sensory panellists. Whole wheat flour based chicken meat noodles (T$_1$) scored the highest values in respect to all sensory attributes except meat flavour intensity. Thus the product was selected for further study. The level of significance showed that the score for colour and appearance for the products containing 0 and 50 percent meat were non significantly different (P>0.05) among each other while these values were significantly different (P<0.05) from the product T$_1$ and T$_2$. The T$_2$ and T$_3$ noodles were also significantly (P<0.05) different from each other. The sensory attributes such as flavour, texture, mouth coating, and overall acceptability scores for product C and chicken meat noodles (T$_2$ and T$_3$) were non significantly different (P>0.05). However, these scores were significantly (P<0.05) different from the chicken meat noodles (T$_1$). The saltiness scores of control and T$_2$ products observed non significantly different (P>0.05) from each other and the similar trend was noticed in the noodles having 40 and 50 percent meat. But score for saltiness of product T$_1$ was significantly different from rest of the noodles.

Discussion

The decline in pH with increased meat contents was due to the acidic nature of chicken meat. This finding was very well agreed with the reports of Yu [12] on fish noodles and Chin et al. [13] who incorporated surimi powder in wet yellow noodles preparation. The decreased emulsion stability with increased meat level was very well agreed with the results of Singh et al. [14] who stated that emulsion stability of chicken snack containing 60% chicken meat to be 93.91% which was found to be lowest among all the treatments.

The increased moisture percent with increase in meat level might be due to high moisture contents in chicken meat as compared to the flour used. This finding was in favour of the reports given by Zayas [15] on functionality of proteins in food. Kale [16] also found highly significant (P<0.01) difference in protein content in chicken meat stick and found that there was increase in protein content while increase in incorporation of meat in chicken meat stick. Similar trend of increased protein contents with increase in fish meat in fish noodles was also reported by Yu [12] and Peranginagin et al. [17] on dried noodles incorporated with surimi.

The increasing trend of fat content in products with increased meat level might be due to higher contents of fat in chicken meat in comparison to the flours used. Verma et al. [18] also found increase in fat content with increase in meat replacement during the preparation of chicken meat noodles. The significant (P<0.05) effect on ash contents was also observed by the Chin et al. [13] in surimi based wet yellow noodles and Eyidemir and Hayta [19] in apricot kernel flour based noodles.

The decreased crude fibre contents with increase in meat level might be due to higher crude fibres in grains flours as compared to food of animal sources. The findings were very well supported by the findings of Hussein Ahmed et al. [20] on the use of various flours in pasta preparation. Singh et al. [21] also reported decreased cooking yield with increase in meat level during preparation of chicken meat snacks. The present study was also in agreement of Sharma and Nanda [22] who concluded that cooking yield of chips prepared by taking 95% chicken meat was lesser than other formulations containing lower meat percentage.

The findings on volume of chicken meat noodles were in the order of Eydimir and Hayta [19] reports on volume increase of noodles.

The decreased WSI with the increase in meat level might be due to degradation of starch during extrusion with these flours and less binding properties with meat [23].

The sensory evaluation of whole wheat flour enriched noodles with chicken meat containing 30 percent level was highly acceptable. The scores for the colour and appearance, flavour, texture, mouth coating, saltiness and overall acceptability were higher for the whole wheat flour having 30 percent chicken meat as compared to the other groups. Thus might be due to better binding in between whole wheat flour and meat and also due to better emulsion properties at a certain level of meat incorporation in chicken meat noodles. The scores for the meat flavour intensity were highest in the whole wheat flour chicken meat noodles having highest (50 percent) level of chicken meat. This might be due to the highest percentage of meat. These findings were very well in the agreement of Yu, Breen et al. and Peri et al. [12,24,25], reports with the incorporation of animal proteins in flour based products.

The incorporation of chicken meat had an effect on the physicochemical and sensory attributes of noodles. The incorporation of chicken meat significantly increased (P<0.05) in the ash, protein, fat, moisture and water absorption index as the levels of chicken meat increased. However, they had significantly decreased (P<0.05) crud fiber, pH, water solubility index, weight increase, volume increase, yield and cooking loss. However, emulsion stability decreased none (P>0.05) significantly as the level of meat incorporation increased from 0 to 50 %. The sensory evaluation results showed there were increased in all parameter with the increasing incorporation of chicken meat at 30% chicken meat incorporation (T$_1$ noodles) except meat flavour intensity which was highest in T$_3$ noodles. So T$_1$ noodles represented an acceptable preference in term of sensory evaluation as compared to C, T$_2$ and T$_3$.

Acknowledgements

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