*Haryana Vet.* **50** (December, 2011), pp 72-76

**Research Article**

# DEVELOPMENT AND QUALITY EVALUATION OF CHICKEN MEAT MINCE ENRICHED NOODLES

SURENDER KUMAR, NITA KHANNA* and NITIN MEHTA
Department of Livestock Products Technology, College of Veterinary Sciences
Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar-125 004

## ABSTRACT

The study was conducted to develop chicken meat mince (CMM) enriched noodles. Different levels (10-50%) of CMM were added in refined wheat flour (RWF) for the development of enriched noodles. They were dried in hot air oven at 60±2$^0$C for 5-6 hours to attain moisture level less than 12% so as to meet the PFA specifications for noodles. The noodles prepared with RWF acted as control and on incorporation of CMM, there was an increase in protein, moisture, fat and ash content and a decrease in breaking strength of noodles as compared to control. The noodles developed with addition of CMM had desirable organoleptic properties as indicated by the taste panel studies. However, based on sensory analysis, noodles with 20% CMM were found more acceptable than other levels and were found optimum for incorporation in RWF noodles for development of chicken enriched noodles.

**Key words:** Chicken meat mince, noodles, refined wheat flour, sensory analysis

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. Pasta products, which are Italian style extruded products such as spaghetti, vermicelli, noodles and macaroni have a great hold over Indian consumer markets due to their nutritional and organoleptic features (Mercier and Cantarelli, 1986). 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) and eggs (Khouryieh *et al.*, 2006) have been tried but a little work has been done on chicken meat enriched noodles. Keeping these facts in view, an attempt was made to develop noodles enriched with chicken meat mince (CMM). The incorporation of chicken meat in wheat based products has been found to enhance acceptability and increase the nutritive value. Along with a complementary nutritive value, the chicken meat enriched noodles may also offer an important avenue for profitable disposal of spent hen by using its meat for product development.

*Corresponding author: nita.khanna@rediffmail.com

## MATERIALS AND METHODS

**Place of Study:** The present study was carried out in the Department of Livestock Products Technology, College of Veterinary Sciences, LLRUVAS, Hisar to develop chicken enriched noodles using refined wheat flour and spent hen meat. Noodles were enriched with different levels of CMM. The developed products were evaluated for proximate composition, physical 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 procured from the local market, cleaned and then dried in hot air oven at 45±2$^0$C for 2 hours. They were ground, sieved through a size of 100 mesh, mixed and the fine powder form of spice mix was obtained. The spent hen (White Leghorn) of age about 1.5 years reared under similar feeding and management conditions were slaughtered, dressed and deboned. The meat was trimmed manually for removal of fat and connective tissue and was packaged in low density polyethylene bags and stored at –20$^0$C for further studies.

**Preparation of CMM:** The deboned frozen meat was minced with an electric meat mincer and then thoroughly kneaded after addition of 2% salt.

**Preparation of Refined Wheat Flour Noodles:** Refined wheat flour noodles were prepared following the procedure of Lakshmi Devi and Khader (1997). Noodles were prepared by adding spice mix (@2% in refined wheat flour (100 g) followed by the addition of water at three levels viz. 35, 40 and 45 ml to make uniform, smooth and non-sticky noodle dough. 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. They were dried in hot air oven at 60±2$^0$C for 5-6 hours to attain moisture level less than 12% so as to meet the PFA specifications for noodles. This recipe was used as control for further study (Treatment T1 as per Table 2).

**Preparation of CMM Enriched Noodles:** Chicken enriched noodles were prepared by using 2% spice mix, different levels of CMM and water that was added as per requirement for preparing dough of desired quality. The ratio of refined wheat flour and CMM used for noodle preparation has been mentioned in Table 2.

Stiff dough for the different ratios (Table 2) of RWF with CMM was prepared. The dough was folded and sheeted as described earlier. Noodles were dried in hot air oven at a temperature of 60±2$^0$C for 5-6 hours. This resulted in moisture content below 12% which was ascertained by proximate composition.

**Noodle Cooking:** Noodles (40 g) were cooked in 500 ml of boiling tap water. The water was held at a gentle boil and the noodles were stirred occasionally. The optimum cooking time, which was the time required (in minutes) for the white core in the noodle strand to disappear, was determined. After cooking was completed, the noodles were cooled in running tap water for one minute and then drained.

**Sensory Evaluation:** The products developed were evaluated for the sensory characteristics viz. color, mouthfeel, texture, flavor and overall acceptability using 9 point Hedonic scale (Nelson and Trout, 1964) by a panel of 8-10 semi-trained judges of the department. Analysis of control and chicken meat mince enriched noodles

**1. Proximate Composition:** Moisture, protein, fat and ash content were determined as per standard procedures of AOAC (1995).

**2. Physical Properties:**

**i) 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). The fixture supported the sample across a span of known distance (L). The force was applied to the centre of sample (which was central to the support) and the breaking load (F) was determined. Tensile stress (at mid-point) = Moment (M)/ Modulus of cross section (Z). Where M= F/2 x L/2, Z= I/ (T/ 2), I (Moment of Inertia) = WT3/12. Substituting these values in above formula: Breaking strength at mid point= 3FL/ 2WT2 where F is applied force (g), L is the length (mm), W is the width (mm) and T is the thickness of the noodle stick (mm).

**ii) Bulk Density:** The method as described by Sahay and Singh (2001) was used to determine the bulk density. A container was taken whose volume was calculated by measuring its inner dimensions. The container was filled with noodles and then weighed. The bulk density (g/ml) was calculated as: Weight of sample (g)/ Volume of container (ml).

**iii) True Density:** True density was determined following the method of Sahay and Singh (2001). A single noodle was taken and its length and diameter was measured to calculate its volume. The noodle was then weighed on an electrical balance. The true density (g/ ml) was calculated as: Weight of sample (g)/ Volume of sample (ml).

**3. Cooking Parameters:**

**i) Cooking Time:** Cooking time was determined (in minutes) according to the method adopted by Oh *et al.* (1983). The noodles were cooked in boiling water.

**Table 1**
**Spice mix formulation**

| Name of ingredient | Percentage (w/w) |
|---|---|
| Coriander | 15 |
| Cumin seed | 15 |
| Caraway seed | 10 |
| Aniseed | 10 |
| Black pepper | 10 |
| Red Chilli | 08 |
| Soanth | 08 |
| Cinnamon | 05 |
| Cloves | 05 |
| Big cardamom dry | 05 |
| Mace | 05 |
| Nutmeg | 02 |
| Green cardamom dry | 02 |
| Total | 100 |

When the white core of noodles was disappeared, these were considered to be cooked. Noodles were cooked for 5 minutes then examined every 30 seconds for white core to disappear by pressing a cooked noodle between two glass slides.

**ii) Water Uptake:** To measure the degree of noodle hydration during cooking, the water uptake was determined as the difference between noodle weight after and before cooking following the procedure of Vetrimani and Rahim (1994). Noodles (40g) were cooked in 500 ml boiling water for 10-15 minutes. The water uptake (ml/g) by noodles was calculated by using following formula: (w2-w1)/w1; where w2 is weight of cooked noodles and w1 is weight of raw noodles (before cooking).

**iii) Swelling Index:** Swelling index was determined according to the method of Chen *et al.* (2002). Forty grams of raw noodles were taken and cooked in 500 ml boiling water for 10-15 minutes. Swelling index was estimated by using the formula: Swelling index=(w1-w2)/w2; where w1 is weight of cooked noodles and w2 is weight of cooked noodles after complete drying in oven.

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

## RESULTS AND DISCUSSION

To develop the chicken enriched noodles, 2% spice mix, various levels of CMM (10-50%) with RWF as given in Table 2 were used. Different levels of water were added to each treatment to find out optimum level of water which gave dough of acceptable handling quality. It was found that 32 ml water was required to be added in dough preparation for 10% CMM noodles. For 20, 30, 40 and 50% CMM enriched noodles, 22, 14, 4 and 0 ml water, respectively was required for the preparation of dough. The requirement of water decreased with an increase in CMM as CMM has high moisture content. It was found that noodles enriched with more than 30% levels of CMM 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 CMM levels above 30% (i.e. 40% and 50%) were not continued for further studies. The prepared noodles were dried in hot air oven at temperature level of 60±2$^0$C for 5-6 hours.

**Table 2**
**Levels of chicken meat mince (CMM) added to refined wheat flour (RWF)**

| Treatment | RWF (%) | CMM (%) |
|---|---|---|
| T1 | 100 | 0 |
| T2 | 90 | 10 |
| T3 | 80 | 20 |
| T4 | 70 | 30 |
| T5 | 60 | 40 |
| T6 | 50 | 50 |

**Table 3**
**Proximate composition of raw materials used for making chicken enriched noodles**

| Parameter (%) | RWF | CMM |
|---|---|---|
| Moisture | 10.22$^b$±0.12 | 70.67$^a$±2.03 |
| Crude protein | 11.19$^b$±0.022 | 21.05$^a$±0.24 |
| Crude fat | 1.35$^b$±0.023 | 5.64$^a$±0.041 |
| Ash | 0.63$^b$±0.012 | 1.08$^a$±0.011 |

Means bearing different superscripts in a row differ significantly ($p<0.05$); RWF=Refined wheat flour; CMM=Chicken meat mince

This resulted in moisture content below 12%.

**Proximate Composition of Raw Materials:** The values of all the parameters (moisture content, crude protein, crude fat and ash content) were significantly ($p<0.05$) higher for CMM as compared to RWF (Table 3). The findings for proximate composition of RWF are in accordance with those of Gopalan *et al.* (1985) and Hooda (2002) and that of CMM were in close approximation with Kondaiah and Panda (1992) and Kharb (2002).

**Proximate Composition of Control and CMM Enriched Noodles:** The moisture content of control and CMM enriched noodles did not vary significantly and all 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% (Table 4). The crude protein content showed a significantly ($p<0.05$) increasing trend with an increase of the concentration of CMM with the highest protein (%) in 30% CMM enriched noodles. This was attributed to high protein content in CMM enriched noodles as compared to RWF. Similar increase 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 CMM in noodles was recorded. This was due to the obvious difference

**Table 4**

**Proximate composition, physico-chemical properties, cooking characteristics and sensory evaluation of CMM enriched noodles**

| Parameters | Control noodles | CMM enriched noodles | | |
|---|---|---|---|---|
| | | 10% | 20% | 30% |
| **Proximate Composition** | | | | |
| Moisture (%) | $8.98^{a} \pm 0.045$ | $8.88^{a} \pm 0.035$ | $8.89^{a} \pm 0.059$ | $8.92^{a} \pm 0.047$ |
| Crude protein (%) | $11.21^{g} \pm 0.32$ | $12.14^{f} \pm 0.21$ | $13.13^{e} \pm 0.54$ | $14.10^{d} \pm 0.20$ |
| Crude fat (%) | $0.92^{f} \pm 0.10$ | $1.36^{e} \pm 0.15$ | $1.78^{d} \pm 0.12$ | $2.21^{c} \pm 0.14$ |
| Ash (%) | $0.62^{g} \pm 0.006$ | $0.67^{f} \pm 0.008$ | $0.71^{e} \pm 0.007$ | $0.76^{d} \pm 0.005$ |
| **Physico-Chemical Properties and Cooking Characteristics** | | | | |
| Breaking strength ($g/mm^2$)(uncooked) | $2026^{a} \pm 4.33$ | $1996^{b} \pm 5.74$ | $1971^{c} \pm 3.79$ | $1942^{d} \pm 6.63$ |
| Bulk density (g/ml) (uncooked) | $0.50^{a} \pm 0.044$ | $0.49^{a} \pm 0.035$ | $0.47^{a} \pm 0.032$ | $0.45^{a} \pm 0.045$ |
| True density (g/ml) (uncooked) | $1.27^{a} \pm 0.031$ | $1.27^{a} \pm 0.023$ | $1.28^{a} \pm 0.042$ | $1.29^{a} \pm 0.044$ |
| Cooking time (minutes) | $8.30^{d}$ | $9.00^{c}$ | $9.30^{b}$ | $10.00^{a}$ |
| Water uptake (ml/g) (cooked) | $1.96^{a} \pm 0.10$ | $1.94^{a} \pm 0.092$ | $1.91^{a} \pm 0.081$ | $1.87^{a} \pm 0.078$ |
| Swelling index | $2.25^{a} \pm 0.084$ | $2.23^{a} \pm 0.079$ | $2.20^{a} \pm 0.11$ | $2.16^{a} \pm 0.094$ |
| **Sensory Evaluation** | | | | |
| Colour | $8.15^{a} \pm 0.076$ | $8.05^{ab} \pm 0.005$ | $8.00^{ab} \pm 0.00$ | $6.7^{c} \pm 0.153$ |
| Mouthfeel | $8.05^{a} \pm 6.05$ | $7.9^{a} \pm 0.067$ | $7.9^{a} \pm 0.067$ | $6.75^{b} \pm 0.112$ |
| Texture | $8.10^{a} \pm 0.10$ | $8.0^{ab} \pm 0.075$ | $7.9^{ab} \pm 0.067$ | $6.45^{c} \pm 0.138$ |
| Flavor | $7.50^{d} \pm 0.13$ | $7.65^{c} \pm 0.107$ | $8.1^{ab} \pm 0.067$ | $8.2^{d} \pm 0.082$ |
| Overall acceptability | $8.10^{a} \pm 0.067$ | $7.85^{bc} \pm 0.076$ | $8.0^{ab} \pm 0.067$ | $6.9^{d} \pm 0.098$ |

Mean values bearing different superscripts in a row differ significantly ($p<0.05$)

in the proximate composition of raw materials. Similar findings were reported by Mytle (1999) on addition of 30% paneer to RWF noodles.

**Physico-chemical Properties and Cooking Characteristics:** The breaking strength of control noodles was the highest ($p<0.05$) and showed a decreasing trend with an increase in level of CMM (Table 4) 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 CMM 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. With increasing level of CMM, there was a significant ($p<0.05$) increase in cooking time as more heat treatment was required for the preparation of chicken enriched noodles. Vetrimani and Rahim (1994) and De Oliveira *et al.* (2006) also reported cooking time for pasta products above 8.30 minutes. The water uptake and swelling index of control and CMM enriched noodles were comparable irrespective of the levels of CMM used.

**Sensory Evaluation:** The scores for colour, mouthfeel, texture, flavor and overall acceptability for control and CMM enriched noodles are presented in Table 4. The colour scores for control noodles and those with 10, 20, 30% CMM enrichment were 8.15, 8.05, 8.0 and 6.7, respectively. The colour scores decreased with an increase in the level of CMM 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 the highest for control noodles (8.05) followed by 10% CMM (7.9), 20% CMM (7.9) and 30% CMM (6.75). The mouthfeel scores decreased with increase in CMM enrichment at 10 and 20% levels with a significant ($p<0.05$) decrease at the highest level of CMM (30%).

A decrease in texture scores with increase in level of CMM was observed with a significantly ($p<0.05$) lower texture score at the highest level of CMM. 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% CMM were 7.5, 7.65, 8.1 and 8.2, respectively. The analysis of variance revealed that flavour score increased with an addition of CMM. At 20 and 30% levels of incorporation of CMM, 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% CMM (8.0), 10% CMM (7.85) and 30% CMM (6.9). Though all the scores were in acceptable range (above 6.0), but on sensory basis, the inclusion of CMM at 20% level closely approximated that of control for all the sensory attributes and was cosidered as optimum for enrichment in noodles.

The present study revealed that chicken meat mince enrichment had no significant effect on moisture content but increased protein, fat and ash percentage in noodles. The breaking strength decreased with CMM addition but was in well acceptable range. On sensory analysis, 20% CMM level was found organoleptically superior than all other levels and thus 20% level of CMM enrichment in noodles was adjudged suitable.

## REFERENCES


Anon. (1980). Engineering Properties of Food Material. Published by CIAE Bhopal. pp. 20-22.

AOAC. (1995). Official Methods of Analysis. (16th edn.), Association of Official Analytical Chemists, Washington D.C.

Chen, Z., Sagis, L., Legger, A., Linssen, J.P.H. Schols, H.A. and Voragen, A.G.J. (2002). Evaluation of starch noodles made from three typical Chinese sweet potato starches. *J. Food Sci.* **67**: 3342-47.

De Oliveira, M.K.S., Martinez-Flores, H.E., De Adnrade, J.S., Garnica-Romo, M.G. and Chang, Y.K. (2006). Use of pejibaye flour (*Bractris gaspaes Kunth*) in the production of food pastas. *J. Food Sci. Technol.* **41**: 933-937.

Gopalan, C., Rama Sastri, B.V. and Balasubramanian, S.C. (1985). Nutritive Value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.

Hooda, S. (2002). Nutritional evaluation of fenugreek supplemented wheat products. M.Sc. thesis, CCS Haryana Agricultural University, Hisar.

Kharb, R. (2002). Studies on dehydration of spent hen meat mince. M.Sc. thesis, CCS Haryana Agricultural University, Hisar.

Khouryieh, H., Herald, T. and Aramouni, F. (2006). Quality and sensory properties of fresh egg noodles formulated with either total or partial replacement of egg substitutes. *J. Food Sci.* **71**: 433-437.

King, C.J., Lam, W.K. and Sandall, O.C. (1968). Physical properties important for freeze-drying poultry meat. *Food Technol.* **22**: 1302.

Kondaiah, N. and Panda, B. (1992). Processing and utilization of spent hens. *World Poult. Sci. J.* **48**: 255-268.

Kumar, S., Anjaneyula, A.S.R. and Gupta, H.K. (2001). Sustained Animal Production, SSARM, CCS Haryana Agricultural University, Hisar, India, pp. 223-232.

Lakshmi Devi, N. and Khader, V. (1997). Preparation of vermicelli from wheat flour-pulse blends for geriatric. *J. Food Sci. Technol.* **34**: 513-514.

Mercier, C. and Cantarelli, C. (1986). Pasta and Extrusion Cooked Foods. Elsevier Science Publication Ltd. p. 41.

Mytle, M. (1999). Development of technology for milk protein enriched noodles. Ph.D. thesis, CCS Haryana Agricultural University, Hisar.

Nelson, J.A. and Trout, G.M. (1964). Judging Dairy Products. (4th edn.), Olsen Publishing Co. Milwakee, USA.

Nielsen, M.A., Sumner, A.K., and Whalley, L.L. (1980). Fortification of pasta with pea flour and air classified pea protein concentrate. *Cereal Chem.* **57**: 203-206.

Oh, N.H., Seib, P.A., Deyoe, C.W. and Ward, A.B. (1983). Noodles II. The surface firmness of cooked noodles from soft and hard wheat flours. *Cereal Chem.* **60**: 433-438.

Oh, N.H. Seib, P.A., Deyoe, C.W. and Ward, A.B. (1985). Noodles IV. Influence of flour protein extraction rate, particle size and starch damage on the quality characteristics of dry noodles. *Cereal Chem.* **62**: 441-446.

PFA, The Prevention and Food Adulteration Act, 1954 and PFA rules, 2nd Amendment (1996). Eastern Book, Lucknow.

Sahay, K.M. and Singh, K.K. (2001). Unit Operation of Agricultural Processing. Vikas Publications, New Delhi.

Shogren, R.L., Hareland, G.A. and Wu, Y.V. (2006). Sensory evaluation and composition of spaghetti fortified with soy flour. *J. Food. Sci.* **71**: S428-32.

Singh, D. (2001). Supplementation of wheat flour noodles with soyabean flour. M.Sc. thesis, CCS Haryana Agricultural University, Hisar.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. First East West Press Edition, New Delhi.

Sowbhagya, C.M. and Zabiuddin, Ali, S. (2001). Vermicelli noodles and their quality assessment. *J. Food Sci. Technol.* **38**: 423-432.

Vetrimani, R. and Rahim, A. (1994). Effect of drying of vermicelli in hot air oven on its cooking quality. *J. Food Sci. Technol.* **31**: 400-403.

Woo, H.C. and Erdman, A.M. (1971). Fish protein concentrate enrichment of noodles. *J. Home Econ.* **63**: 263.