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# Assessment of shelf life of wheat flour based quail meat enriched noodles during room temperature (35±2°C)

**DM More, SV Londhe, DP Patil, GR Gnagane, RN Waghmare and KK Khose**

**Abstract**
The present study was aimed to develop wheat flour noodles with addition of different levels of quail mince meat (0%, 40%, 50% and 60%). Birds (quails) were slaughtered and dressed in the department of Livestock Products Technology. The skin, subcutaneous fat, tendon, connective tissue were removed from quail meat and packed in low density poly ethylene (LDPE) and stored overnight at 4±1ºC for ageing and thawed quail meat which was further used for product preparation. The results indicated that, during storage at room temperature (35±2ºC), The sensory scores for all attributes decreased with the advancement of storage period, but the products were acceptable upto 60 days of storage. Contrarily moisture, fat and protein was decreased with the increase in storage but the pH, TBA number, tyrosine value and total plate counts increased considerably, but were within the spoilage limit up to 60 days of storage period. In all samples coliform counts were not detected throughout the storage period. Based on the above findings, it is concluded that the noodles made with incorporation of 40% quail mince meat in wheat flour based noodles were acceptable for a period of 60 days when packed aerobically in LDPE bags and stored at room temperature (35±2º C).

**Keywords:** Wheat flour, quail mince meat, extruder machine, spices

## 1. Introduction
In the last few decades, the little known Japanese quail (*Coturnix coturnix* Japonica) has been introduced to the Indian sub-continent as an alternative avian species in the processing poultry industry to mitigate chronic protein deficiency among the Indian population. Quails are present over large areas of Asia, Europe and Africa. Boosting the quail farming in rural area will not only supplement the shortage of animal proteins but will also generate supplement income for improvement of their socio-economic status.

Quail meat, is considered superior as compared to red meat because it contains low fat, low cholesterol and high amount of iron. Quail is one of the leanest types of poultry and a good source of protein, essential fatty acids and minerals such as sodium, potassium and iron (Boni *et al.*) [1]. The quail has more meat to bone ratio. In the poultry world quail meat production is negligible when compared to broilers. Manually deboned Japanese quail meat contains 72.5–75.1% water, 20-23.4% protein, 1.0–3.4% lipids and 1.2–1.6% mineral substances (3, 4). Mechanically deboned quail meat contains 17% protein, 10% fat and 2.6% minerals (Ribarski *et al.*) [2]. Convenience foods have played a vital role in the life of human beings and the products like noodles, cookies, breads, biscuits, cakes, chapattis and other ethnic foods are highly relished. Due to urbanization, increasing trend of working women, changing socio-economic status and increasing interest of school going children in snack foods and ease in carrying to long distant and remote area have also contributed to the enhanced consumption of processed and convenience meat products. Today's major challenge is to develop inexpensive foods that are nutritionally superior and highly acceptable to consumers. More work has been done to improve the functional properties and nutritive value of noodles through changes in formulations and processing, possibility of incorporation of quail meat in noodles as a source of protein remains almost unexplored. Present study was aimed to study the shelf life of developed wheat flour based quail meat enriched noodles at room temperature.

## 2. Materials and Methods
Japanese quail were procured from the department of poultry science, COVAS Parbhani. Birds were dressed and connective tissue, fat etc.

were separated and boneless meat were packed in low density polyethylene (LDPE) bags and stored overnight at 4 ± $1^0$C. Quail meat noodles were prepared as per method of the Kumar *et al.,* [3] and Kapse [4] with slight modification was used for preparation of quail meat noodles throughout the study. The spice mixes (2%) were added at the time of cooking of the quail meat noodles. Wheat flour based noodles were prepared by incorporating different levels (0%, 40%, 50%, 60%) of quail minced meat. Wheat flour based noodles prepared by incorporating selected levels of quail minced meat were aseptically packed in LDPE, stored at room temperature (35±2º C) and assessed for sensory properties using 8 point hedonic scale Keeton[5].Proximate composition, physico-chemical attributes and microbiological quality at regular interval. The Proximate composition (moisture, fat, protein) was determined by AOAC [6]. The pH was determined using digital pH meter by AOAC [6]. TBA value and tyrosine value was estimated by the method as suggested by Strange *et al*. [7]. The microbiological quality (Total plate count and E, *coli* count) was assed as per APHA [8]. Data obtained were analyzed as per Snedecor and Cochran [9].

## 3. Results and Discussion

### 3.1 Sensory quality

The observations on storage related changes in sensory quality of control and quail mince meat incorporated at different levels of 40%, 50% and 60% in wheat flour based noodles are presented in the Table No.1. Among the treatment, sensory score for appearance of quail mince meat incorporated wheat flour based noodles during storage was non-significant ($p$<0.05) upto 60 days. The 40% wheat flour based quail mince meat enriched noodles was significantly ($P$>0.05) have higher score as compare to the 50% and 60% of wheat flour based quail mince meat enriched noodles. The present findings are similar to Singh *et al.* [10] for the vacuum packed chicken snacks stored at room temperature (30±2ºC). The sensory score for flavour declining non-significantly ($P$<0.05) during storage at room temperature (35±2ºC) upto 60 day. The reduction in flavour scores in all products particularly at the later part of storage may be attributing to increased lipid oxidation resulting in malonaldehyde formation, liberation of free fatty acids and increase in microbial load. Similar observations were reported by Berwal *et al.* [11] for ready to eat chicken meat mince incorporated cookies. The juiciness score for quail mince meat incorporated wheat flour based noodles differ non-significantly ($p$<0.05) as compare to control during storage at room temperature (35±2ºC). The reduction in juiciness scores might be due to loss of moisture from the product during storage at room temperature (35±2ºC). Present findings are in close agreement with Kapse [4] for chevon enriched noodles. The sensory score for texture decline significantly (P>0.05) during storage of 60 days. The differences were observed to be non-significant ($P$<0.05) upto 30 days of storage. Thereafter the scores reduce significantly (P>0.05) with the progress of storage. The reduction in texture scores in all the products particularly at the later part of storage may be attributed to loss of moisture leading to hardening and also due to breakdown of fat and protein. Present findings are corroborated with the result of Berwal *et al.* [11] for ready to eat chicken meat mince incorporated cookies. The declining trend was observed for overall palatability of control and 40%, 50% and 60% quail mince meat incorporated wheat flour based noodles during storage at room temperature (35±2ºC). Though the overall palatability score was declining during storage but were within the acceptable limit upto 60 days at room temperature (35±2ºC). Similar findings were recorded by Berwal *et al.* [11] for ready to eat chicken meat mince incorporated cookies. The present finding suggest that, the 40% quail mince meat incorporated wheat flour based enriched noodles as well as control were more acceptable upto 60 days at room temperature (35±2ºC).

**Table 1:** Storage related changes in sensory attributes of quail meat enriched noodles during room temperature storage (35 ± 2ºC)

| Type of Product | Storage Period (days) | | | | | Treatment |
|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | |
| | **Appearance** | | | | | |
| Control | 7.66±0.19 | 7.66±0.19 | 7.66±0.00 | 7.33±0.19 | 7.22±0.11 | $7.51^a$ |
| (WF) QMM 40% | 7.66±0.00 | 7.33±0.00 | 7.33±0.00 | 7.22±0.22 | 7.11±0.11 | $7.33^a$ |
| (WF) QMM 50% | 6.44±0.11 | 6.33±0.00 | 6.33±0.00 | 5.88±0.11 | 5.88±0.11 | $6.17^b$ |
| (WF) QMM 60% | 6.11±0.11 | 6.00±0.00 | 5.88±0.11 | 5.77 ±0.22 | 5.55±0.11 | $5.86^c$ |
| Storage Period Mean | 6.96 | 6.83 | 6.8 | 6.55 | 6.44 | |
| | **Flavour** | | | | | |
| Control | 7.55±0.11 | 7.44±0.11 | 7.44±0.11 | 7.22±0.11 | 7.22±0.11 | $7.37^a$ |
| (WF) QMM 40% | 7.55±0.11 | 7.44±0.11 | 7.11±0.11 | 7.00±0.00 | 6.88±0.39 | $7.20^a$ |
| (WF) QMM 50% | 6.10±0.29 | 5.88±0.29 | 5.88±0.11 | 5.88±0.11 | 5.77±0.11 | $5.91^b$ |
| (WF) QMM 60% | 5.44±0.11 | 5.33±019 | 5.33±0.19 | 5.33±0.19 | 5.22±0.11 | $5.33^c$ |
| Storage Period Mean | 6.66 | 6.52 | 6.44 | 6.35 | 6.27 | |
| | **Juiciness** | | | | | |
| Control | 7.44±011 | 7.44±0.11 | 7.33±0.19 | 7.33±0.19 | 7.33±0.19 | $7.37^a$ |
| (WF) QMM 40% | 7.66±0.19 | 7.33±0.00 | 7.11±0.11 | 7.00±0.19 | 6.88±0.11 | $7.20^a$ |
| (WF) QMM 50% | 5.77±0.11 | 5.77±0.11 | 5.66±0.19 | 5.55±0.11 | 5.33±0.19 | $5.62^b$ |
| (WF) QMM 60% | 5.55±0.22 | 5.55±0.11 | 5.44±0.29 | 5.44±0.22 | 5.22±0.11 | $5.44^b$ |
| Storage Period Mean | 6.60 | 6.52 | 6.38 | 6.33 | 6.19 | |
| | **Texture** | | | | | |
| Control | 7.77±011 | 7.77±0.11 | 7.66±0.19 | 7.55±0.11 | 7.55±0.22 | $7.66^a$ |
| (WF) QMM 40% | 7.33±0.00 | 7.33±0.19 | 7.33±0.19 | 7.22±0.11 | 7.22±0.11 | $7.28^b$ |
| (WF) QMM 50% | 6.55±0.11 | 6.44±0.55 | 6.11±0.11 | 5.88±0.11 | 5.88±0.11 | $6.17^c$ |
| (WF) QMM 60% | 6.32±0.33 | 6.00±0.19 | 5.88±0.44 | 5.77±0.11 | 5.44±0.29 | $5.88^d$ |
| Storage Period Mean | $6.99^a$ | $6.88^a$ | $6.74^a$ | $6.60^b$ | $6.52^b$ | |
| | **Overall Palatability** | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Control | 7.88±0.11 | 7.77±0.11 | 7.77±0.11 | 7.66±0.19 | 7.44±0.11 | 7.71[a] |
| (WF) QMM 40% | 7.77±0.11 | 7.33±0.19 | 7.22±0.11 | 7.22±0.22 | 7.22±0.11 | 7.35[b] |
| (WF) QMM 50% | 6.50±0.11 | 6.11±0.11 | 6.00±0.57 | 6.00±0.00 | 6.00±0.00 | 6.13[c] |
| (WF) QMM 60% | 5.88±0.11 | 5.66±0.32 | 5.55±0.11 | 5.55±0.11 | 5.44±0.12 | 5.62[d] |
| Storage Period Mean | 7.00 | 6.71 | 6.63 | 6.60 | 6.52 | |

### 3.2 Proximate composition

The observations on storage related changes in proximate composition of control and quail mince meat incorporated at 40%, 50% and 60% in wheat flour based noodles are presented in the table No.2. The moisture content of wheat flour based quail mince meat noodles decrease significantly (P>0.05) with the progress of storage period upto 60 days. In fresh product the moisture content was 13.66 per cent which reduce considerably at the end of storage period. Higher moisture content of quail mince meat (QMM) 60% added in wheat flour based noodles may be attributed due to higher amount of quail mince meat. The findings are in agreement with those of Rindhe [12] for preparation of cooked chicken sausage and Karthikeyan [13] for chicken patties from spent hen during storage respectively. The fat content of 40%, 50% and 60% of quail mince meat incorporated wheat flour based noodles was significantly (P>0.05) higher than that of control. The fat content of all noodles decline significantly (*P*>0.05) throughout the storage period. Similarly decline trend in fat content was reported by Patil *et al.* [14] for WPC extended chicken patties during storage. Like that of fat, protein content of quail mince meat 40%, 50% and 60% incorporated wheat flour based noodles was significantly (P>0.05) higher than that of control. This might be due to increase protein content by addition of quail mince meat 60% over that of control and other treatments. During storage, the protein content showed a significant (*P*>0.05) declining trend. This declining trend in protein content might be due to proteolysis of quail meat protein. The present findings are close to those reported by Rindhe [12] for the cooked chicken sausage and Karthikeyan [13] for chicken patties from spent hen during storage respectively.

### 3.3 Physico-chemical properties

The Storage related changes in physico-chemical properties of control and quail mince meat incorporated at 40%, 50% and 60% in wheat flour based noodles at room temperature (35±2ºC) are presented in Table No.3. The pH of the quail mince meat noodles differ significantly (P>0.05) with progress of storage but the differences were observed to be non-significant till 15th day of storage. Thereafter, it increase significantly (P>0.05) to the end of storage. Similarly the pH of product differs significantly (P>0.05) within the treatments. The increasing pH during storage might be due to degradation of lactic acids and production of protein metabolites by bacteria Jay, [15]. Present findings are in agreement with that of Rindhe [12] for cooked chicken sausage and Rajbanshi *et al.* [16] for evaluation and storage study of chicken meat pickle.

The TBA values of wheat flour noodles and quail mince meat 40%, 50% and 60% incorporated wheat flour based noodles increase non-significantly (*P*<0.05) throughout the storage period of 60 days. The increasing trend in TBA value particularly at the end of storage period is indicative of oxidative rancidity but the values on 60th day were within the spoilage limit of 1-2 malonaldehyde mg/kg for meat Witte *et al.* [17]. Similar observations were recorded by Berwal *et al.* [11] for chicken mince meat incorporated cookies under aerobic packaging at ambient temperature and Kapse [4] for chevon enriched noodles stored at room temperature (35±2ºC). Tyrosine values of wheat flour noodle and quail mince meat 40%, 50% and 60% incorporated wheat flour based noodles increasing significantly (P>0.05) with progress of storage upto 60th day. Increase in the value at the end of storage might be due to production of free amino acids during deamination process Pearsons [18] Similar observations were reported by Bhattacharya *et al.* [19] for preparation of duck sausage stored at refrigeration temperature (4±1ºC).

**Table 2:** Storage related changes in proximate composition of quail meat enriched noodles during room temperature storage (35 ± 2ºC)

| Type of Product | Storage Period (Days) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | Treatment mean |
| | Moisture (%) | | | | | |
| Control | 11.97±0.31 | 11.66±0.16 | 11.26±0.08 | 11.21±0.03 | 11.06±0.03 | 11.43[d] |
| (WF) QMM 40% | 13.67±0.16 | 12.72±0.07 | 12.48±0.07 | 11.76±0.05 | 11.33±0.13 | 12.39[c] |
| (WF) QMM 50% | 14.18±0.15 | 13.55±0.06 | 13.27±0.17 | 13.08±0.05 | 12.74±0.13 | 13.36[b] |
| (WF) QMM 60% | 14.85±0.09 | 14.21±0.03 | 13.58±0.14 | 13.38±0.11 | 13.16±0.03 | 13.83[a] |
| Storage Period Mean | 13.66[a] | 13.03[b] | 12.65[c] | 12.35[d] | 12.07[e] | |
| | Fat (%) | | | | | |
| Control | 1.95±0.02 | 1.85±0.02 | 1.81±0.03 | 1.80±0.04 | 1.79±0.04 | 1.84[c] |
| (WF) QMM 40% | 1.94±0.03 | 1.88±0.04 | 1.86±0.03 | 1.84±0.03 | 1.83±0.03 | 1.87[c] |
| (WF) QMM 50% | 2.02±0.01 | 1.99±0.00 | 1.95±0.03 | 1.94±0.03 | 1.96±0.00 | 1.97[b] |
| (WF) QMM 60% | 2.14±0.02 | 2.10±0.01 | 1.99±0.00 | 1.98±0.03 | 1.97±0.00 | 2.04[a] |
| Storage Period Mean | 2.01[a] | 1.96[b] | 1.90[c] | 1.89[c] | 1.89[c] | |
| | Protein (%) | | | | | |
| Control | 13.50±0.29 | 12.64±0.31 | 11.83±0.10 | 11.27±0.05 | 11.02±0.03 | 12.05[d] |
| (WF) QMM 40% | 19.17±0.30 | 18.27±0.31 | 18.02±0.01 | 17.70±0.15 | 17.10±0.14 | 18.05[c] |
| (WF) QMM 50% | 22.83±0.36 | 21.82±0.21 | 21.03±0.02 | 20.39±0.12 | 19.97±0.02 | 21.21[b] |
| (WF) QMM 60% | 24.66±064 | 24.42±0.24 | 23.93±0.02 | 23.05±0.13 | 21.90±0.01 | 23.59[a] |
| Storage Period Mean | 20.04[a] | 19.28[b] | 18.70[c] | 18.10[d] | 17.50[e] | |

**Table 3:** Storage related changes in physico-chemical characteristics of quail meat enriched noodles during room temperature storage (35 ± 2ºC).

| Type of Product | Storage Period (Days) | | | | | Treatment mean |
|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | |
| | pH | | | | | |
| Control | 5.59±0.04 | 5.61±0.03 | 5.99±0.09 | 6.12±0.06 | 6.21±0.00 | 5.90[a] |
| (WF) QMM 40% | 5.83±0.03 | 5.85±0.03 | 5.91±0.06 | 6.04±0.07 | 6.11±0.00 | 5.95[b] |
| (WF) QMM 50% | 5.90±0.03 | 5.93±0.02 | 5.99±0.00 | 6.00±0.00 | 6.07±0.07 | 6.00[c] |
| (WF) QMM 60% | 5.93±0.00 | 5.95±0.00 | 6.00±0.006 | 6.01±0.00 | 6.20±0.02 | 6.01[bc] |
| Storage Period Mean | 581[a] | 5.83[a] | 5.97[b] | 6.04[c] | 6.14[d] | |
| | TBA (mg Malonaldehyde/Kg) | | | | | |
| Control | 0.13±0.00 | 0.22±0.00 | 0.24±0.00 | 0.28±0.00 | 0.30±0.00 | 0.24 |
| (WF) QMM 40% | 0.21±0.00 | 0.23±0.00 | 0.25±0.00 | 0.28±0.01 | 0.29±0.00 | 0.25 |
| (WF) QMM 50% | 0.22±0.01 | 0.24±0.00 | 0.27±0.00 | 0.30±0.00 | 0.31±0.00 | 0.26 |
| (WF) QMM 60% | 0.25±0.01 | 0.28±0.00 | 0.29±0.00 | 0.32±0.00 | 0.33±0.00 | 0.29 |
| Storage Period Mean | 0.20 | 0.24 | 0.26 | 0.29 | 0.31 | |
| | Tyrosine (mg/g) | | | | | |
| Control | 0.26±0.00 | 0.49±0.00 | 0.53±0.00 | 0.58±0.00 | 0.64±0.02 | 0.50[a] |
| (WF) QMM 40% | 0.37±0.00 | 0.52±0.00 | 0.81±0.00 | 0.88±0.00 | 0.90±0.00 | 0.69[b] |
| (WF) QMM 50% | 0.46±0.01 | 0.67±0.01 | 0.82±0.00 | 0.89±0.00 | 0.91±0.00 | 0.75[c] |
| (WF) QMM 60% | 0.56±0.00 | 0.67±0.00 | 0.87±0.00 | 1.01±0.00 | 1.16±0.01 | 0.85[d] |
| Storage Period Mean | 0.41[a] | 0.59[b] | 0.76[c] | 0.84[d] | 0.90[e] | |

### 3.4 Microbial analysis

Storage related changes with regard to total plate count and coliform count at room temperature (35±2ºC) are presented in the Table No. 4. The storage related changes with regard to total plate count and coliform count at the 60% of wheat flour based quail mince meat noodles had significantly (P>0.05) higher total plate count (TPC) than control and other treatments. The higher TPC in wheat flour based quail mince meat noodles might be due to the incorporation of high level of quail meat and also due to high moisture content. The present findings are in close agreement with the observations of Berwal *et al* [11] for ready to eat chicken mince meat incorporated cookies under aerobic packaging at ambient temperature (25±2ºC) Coliform counts were not detected in control as well as in wheat flour based 40%, 50% and 60% quail mince meat noodles during entire storage of 60th day at room temperature (35±2ºC). It could be due to destruction of bacteria during high temperature cooking, hygienic practices followed during and after preparation of quail meat mince wheat flour based noodles (40%, 50% and 60%) as well as control noodles could be the additional reason for the absence of the coliform count. Similar findings were reported by Kapse [4] for chevon enriched noodles.

**Table 4:** Storage related changes in microbiological quality of quail meat enriched noodles during room temperature storage (35 ± 2ºC)

| Type of Product | Storage Period (Days) | | | | | Treatment mean |
|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | |
| | Total plate count (log cfu / g) | | | | | |
| Control | 1.18±0.05 | 1.81±0.10 | 2.12±0.08 | 2.93±0.07 | 3.30±0.08 | 2.26[a] |
| (WF) QMM 40% | 1.42±0.08 | 1.94±0.08 | 2.21±0.13 | 2.93±0.24 | 3.66±0.03 | 2.45[b] |
| (WF) QMM 50% | 1.48±0.08 | 2.12±0.16 | 2.48±0.06 | 3.03±0.07 | 4.00±0.10 | 2.62[b] |
| (WF) QMM 60% | 1.72±0.05 | 2.18±0.05 | 2.78±0.06 | 3.31±0.30 | 4.09±0.13 | 2.81[c] |
| Storage Period Mean | 1.45[a] | 2.01[b] | 2.39[c] | 3.05[d] | 3.76[e] | |
| | Coliform count (log cfu/g) | | | | | |
| Control | ND | ND | ND | ND | ND | ND |
| (WF) QMM 40% | ND | ND | ND | ND | ND | ND |
| (WF) QMM 50% | ND | ND | ND | ND | ND | ND |
| (WF) QMM 60% | ND | ND | ND | ND | ND | ND |
| Storage Period Mean | ND | ND | ND | ND | ND | |

Means with common superscripts did not differ significantly (*P*<0.05)
(WF) QMM40% - quail mince meat incorporated at 40% in wheat flour based noodles
(WF) QMM50% - quail mince meat incorporated at 50% in wheat flour based noodles
(WF) QMM60% - quail mince meat incorporated at 60% in wheat flour based noodles

## 4. Conclusion

The shelf life of noodles made with wheat flour and incorporated with 40%, 50% and 60% quail mince meat was assessed at room temperature (35±2ºC). The sensory scores for all attributes decreased with the advancement of storage period, but the products were acceptable upto 60 days of storage. During the storage of wheat flour based quail mince meat noodles the moisture, fat and protein decline significantly, while pH and tyrosine value increased significantly (p>0.05) and the TBA value increases non-significantly (*P*<0.05) during storage upto 60 days. Similarly total plate count was increased significantly during 60 days of storage but were within the spoilage limit indicating that the product could be safely stored for 60 days without adversely affecting quality of the noodles whereas, coliform count were not detected in all four samples throughout the storage period at room temperature (35±2ºC).

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