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# Assessment of Shelf Life of Chicken Eggs Enriched Wheat Flour Based Noodles

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The goal of the current study was to create noodles that contained varying percentages of chicken eggs (0%, 10%, 20%, and 30%) With distilled water, the fresh eggs were washed and cleaned.In the department of Livestock Products Technology, eggs are cracked into a glass jar, mixed with salt, water, and wheat flour at the right ratio, and prepared dough that is then used to formulate products. All of the product's sensory evaluations decreased with increasing storage time at room temperature (35° C). Contrarily, the pH, TBA number, tyrosine value, and total plate counts increased significantly with increased storage but remained under the spoiling limit for the first 40 days of storage. However, moisture, fat, and protein decreased with increased storage. Coliform counts were not discovered in every sample over the course of storage. Up to the tenth day of storage, there were no indications of yeast or mould counts. They did, however, start to show up starting on day 20 and increased significantly (P 0.05) across all treatments.

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## 1. INTRODUCTION

In eggproduction,India ranks third in the world. Total egg production in India is 47.3 billion/annum. Today, one of the biggest problems is creating low-cost foods that are excellent in nutrition and extremely palatable to customers. Instant foods and ready-mixes are becoming more and more common in the new era of fast and convenience cuisine in order to make cooking easier and to accommodate last-minute guests who may arrive unexpectedly.. The egg business frequently uses thermal processing on eggs to create more palatable egg products. Historically, liquid eggs have been pasteurised to maintain food safety by lowering the number of pathogenic germs [1,2]. The need for dried egg products has recently expanded in the food industry due to the production of ready-to-use goods and handling considerations. Although the preparation and enhancement of the nutritional content of noodles using chicken meat [3] and white button mushrooms [4] has been reported, there is comparatively little organised research and information accessible on egg extruded noodle products.

A shift in conventional dining habits and the introduction of fast food culture has transformed consumer perception, and the egg product is no exception. The increased consumption of eggs and egg products can be ascribed to people's increased health consciousness. The need for unique egg products with higher nutritional content and longer shelf life is growing by the day. Eggs' great nutritional value makes them an appropriate meal for persons with unique dietary needs. Noodles are a staple for diets the world around.Noodles are a mainstay in cuisines all across the world. They account for more than 40% of all wheat products and have emerged as an important food source in Asia [5]. Furthermore, the market for pastas and noodles in Taiwan rose at a 7.4% annual rate from 2000 to 2005 [6]. As China's and East Asia's economies grow, there is potential for an inventive niche of noodle products made with healthy or ingredients to meet consumers' wants and worries. The appearance and texture of a certain noodle can be used to judge its quality.

The purpose of this study was to determine the shelf life of wheat flour-based noodles enhanced with various quantities of eggs, as well as assess the quality of the noodles based on their look and texture.

## 2. MATERIALS AND METHODS

### 2.1 Raw Materials

Fresh chicken eggs were purchased from Parbhani's Department of Poultry Science, College of Veterinary and Animal Sciences. The food grade common salt required for the preparation of chicken egg noodles was obtained from the Parbhani city local market. All analytical grade chemicals were obtained from reputable companies such as Himedia, Qualigens, and Loba Chemie. Spice ingredients viz., Aniseed (Soanf), Black pepper (Kali mirch), Capsicum (Lalmirch), Caraway seed (Ajowan), Cardamom (Badielaichi), Cinnamon (Dalchini), Cloves (Laung), Coriander powder (Dhania), Cumin seeds (Zeera), Dried ginger (Sunth), Mace (Jaypatry), Nutmeg (Jayfal) and Green cardamon dry (Chhoti elaichi) purchased from the local market of Parbhani city. All of the spice components were cleansed to remove any foreign matter before being dried in a hot air oven at 45 2oC for 2 hours and then ground in a grinder using suitable blade and finally sieved through a fine mesh to obtain dry spice mixture for preparation of chicken eggs noodles.

### 2.2 Preparation of Wheat Flour Based Chicken Eggs Noodles

Throughout the trial, chicken eggs noodles were prepared according to procedure [7] with minor modifications. With distilled water, the fresh eggs were washed and cleaned. The eggs are broken in a glass jar and blended with salt water, wheat flour at appropriate concentrations to prepare it as a dough for experiment. The spice mixes (2%) were added at the time of cooking of the chicken eggs noodles. Wheat flour based noodles prepared by incorporating selected levels (30%) of eggs were assessed. at regular interval of 10 days upto the 40th day of storage for changes in sensory attributes, proximate composition viz. moisture, fat, protein, physico-chemical viz. pH, TBA, tyrosine value and microbiological quality. The experiment was repeated three times.

## 2.3 Measurement of Quality Parameters

### 2.3.1 Proximate analysis

The moisture, fat and protein content of chicken eggs noodles were determined by following the method of AOAC (1995).

### 2.3.2 Physico-chemical characteristics

**pH:**

The pH of wheat flour based enriched with chicken eggs noodles was determined by the method of [8]. 10 g of cooked chicken eggs noodles was made into fine suspension with addition of 50 ml distilled water and the pH of suspension was measured using digital pH meter.

### 2.3.3 Thiobarbituric acid value

TBA value was determined using the method described by [9] with minor modifications: 5 ml of aliquot of TCA extract (as above) was mixed with 5 ml of TBA reagent in a test tube, and the test tubes containing sample were kept in a water bath at 100o C for 30 minutes along with the control (blank with 5 ml of 10% TCA and 5 ml TBA reagent). The optical density was measured at 530 nm using spectrophotometer.

### 2.3.4 Tyrosine value

The extraction method of [9] was used to calculate the tyrosine value of wheat flour-based supplemented with chicken eggs noodles samples. For 2 minutes, 20 gramme of beef sample was blended with 50 ml of pre-cooled 20% Trichloroacetic acid (TCA] The material was filtered through Whatman filter paper No. 42 to get the extract. TCA extract (2.5 mL) and distilled water were mixed together. . To this freshly prepared 10 ml of 0.5 N NaOH solutions was added. The mixture was kept for 10 min and then diluted Folin and Ciocalteu reagent (1:2 with distilled water) was added. After mixing, it was left in the dark for 30 minutes at room temperature to develop the colour. A spectrophotometer was used to measure the absorbance (OD) at 730 nm. The tyrosine value was determined as mg tyrosine per 100g of sample using the standard curve constructed according to the procedure of [10].

### 2.3.5 Microbiological quality

The microbiological quality of wheat flour-based supplemented with chicken eggs noodles was evaluated during storage using the APHA-American Public Health Association [11] technique for total plate count (TPC) and Coliform count. Violet red bile agar media are utilised for coliform analysis.

### 2.3.6 Sensory evaluation

Semi-trained sensory panellists from the College of Veterinary and Animal Sciences, Parbhani, were involved in assessing the quality of chicken eggs noodles based on sensory attributes such as appearance, flavour, juiciness, appearance, and overall acceptability using an 8 point descriptive scale [12], where '8' denoted extremely desirable and '1' denoted extremely poor. Before evaluating the stored goods, it was checked for any undesirable flavours or colours. The sensory panellists were offered hot noodles after they had been warmed. The stored product was observed for any objectionable flavour and color before evaluation. Noodles were warmed and then served hot to the sensory panellists for evaluation.

## 2.4 Statistical Analysis

The data generated during the study were analyzed by Analysis of Variance technique following standard procedure [13].

## 3. RESULTS AND DISCUSSION

Table 1 shows the average ratings for changes in sensory quality of wheat flour noodles (control) and chicken eggs included at 30% in wheat flour based noodles.

The sensory scores for the appearance of egg enriched noodles during storage were stable up to the 20th day, after which it declined significantly (p0.05) until the end of storage, which could be due to pigment breakdown and lipid oxidation, as well as non-enzymatic browning caused by the reaction between lipid oxidation products and amino acids [14] and surface dehydration in aerobic packaging. The appearance scores of 30% chicken eggs enriched wheat flour noodles were poorer across the treatments but did not differ significantly ($p>0.05$). The appearance scores of wheat flour noodles (control) and chicken eggs included at levels of 30% in wheat flour based noodles were within the permitted limit at the end of storage. The current findings are supported by the results of [7] for wheat processing. The appearance scores of 30% chicken eggs enriched wheat flour noodles were poorer across the treatments but did not differ significantly ($p>0.05$). The appearance scores of wheat flour noodles (control) and chicken eggs included at levels of 30% in wheat flour based noodles were within the permitted limit at the end of storage. The current findings are consistent with the findings of [7] for the manufacture of wheat flour-based quail meat-enriched noodles.

Up to 40 days, the flavour scores of wheat flour noodles (control) and chicken eggs included at 30% in wheat flour based noodles differed insignificantly (P>0.05). The decrease in flavour scores, particularly in the later stages of storage, could be attributed to increased lipid oxidation, which results in malonaldehyde generation, free fatty acid liberation, and an increase in microbial load. The current findings are comparable to [7] in terms of preparing wheat flour-based quail meat-enriched noodles.

The sensory scores for juiciness of egg enhanced noodles during storage were consistent up to the 30th day, after which they substantially fell (p0.05) till the end of storage score. Over the control, 30% wheat flour based included chicken eggs noodles had the lowest juiciness scores. The decrease in juiciness scores could be attributed to moisture loss from the product after storage at ambient temperature (35±2ºC). Similar findings were made by [15], who observed that reducing fat and moisture improves the juiciness of meat products, and [7], who prepared wheat flour-based quail meat-enriched noodles.

The sensory score for texture was shown to be non-significant (P>0.05) up to 20 days of storage and then significantly (P0.05) during 40 days of storage. The drop in texture scores of wheat flour noodles (control) and chicken eggs integrated at 30% in wheat flour based noodles may be attributed to bacterial action degrading muscle fibre protein, resulting in lower water binding ability [16]. [17] observed similar findings for chevon-enriched noodles and [7] for the manufacture of wheat flour-based quail meat-enriched noodles.

During storage at room temperature (35±2ºC), the overall palatability of wheat flour noodles (control) and chicken eggs added at levels of 30% in wheat flour based noodles declined. The change in scores was non significant upto 30$^{th}$ day of storage, but afterwards decreased significantly (P<0.05). Among the treatments, wheat flour noodles (control) received the highest grade, followed by 30% chicken eggs incorporated wheat flour based enhanced noodles. Though the overall palatability score was declining during storage but were within the acceptable limit upto 40 days at room temperature (35±2ºC). Similar findings were recorded by [18] for ready to eat chicken meat mince incorporated cookies and [7] for preparation of wheat flour based quail meat enriched noodles.

### 3.1 Proximate Composition

Table 2 shows the observations on storage-related changes in the proximate composition of wheat flour noodles (control) and chicken eggs included with 30%, level in wheat flour-based noodles.

The moisture content of wheat flour-based chicken egg noodles reduced significantly (P0.05) throughout a 40-day storage period. The moisture level of 30% of chicken eggs mixed with wheat flour noodles was substantially greater (P>0.05) than the control. Similarly, the moisture level of wheat flour-based chicken eggs noodles was higher than the control, showing that protein-based chicken eggs noodles could be hydrated during the storage period.Chicken eggs have a higher moisture content. The increasing volume of chicken eggs may account for the 30% increase in wheat flour-based noodles. The results are very similar to those of [19] for the creation of cooked chicken sausage and [7] for the preparation of quail meat enriched noodles.

30% of chicken eggs included wheat flour based noodles had considerably (P0.05) higher fat content than the control. Throughout the storage period, the fat content of wheat flour noodles (control) and 30% of chicken eggs incorporated wheat flour based noodles decreases significantly (P0.05). Similarly decline trend in fat content was reported by [20] for chicken patties from spent hen during storage and [7] for preparation of wheat flour based quail meat enriched noodles.

The protein content of chicken eggs 30% included wheat flour based noodles was considerably greater (P0.05) than the control.This could be owing to a 30% increase in protein content from the addition of chicken eggs above the control. Protein content decreased significantly (P0.05) during storage up to 40 days. This declining trend in protein content might be due to proteolysis of chicken egg protein. The present findings are close to those reported by [20] for chicken patties from spent hen during storage and [7] for preparation of wheat flour based quail meat enriched noodles.

**Table 1. Storage related changes in sensory attributes of chicken eggs enriched noodles during room temperature storage (35 ± 2°C)**

| Type of Product | Sensory attributes | | | | | Treatment mean |
|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 40 | |
| Control | 7.53±1.94 | 7.46±1.92 | 7.26±1.87 | 7.03±1.81 | 6.93±1.79 | 7.24[a] |
| (WF) eggs 30% | 7.40±1.83 | 7.33±1.82 | 7.13±1.76 | 6.96±1.72 | 6.73±1.66 | 7.11[a] |
| Storage period mean | 7.46[a] | 7.39[a] | 7.19[a] | 6.99[b] | 6.83[b] | |
| **Flavour** | | | | | | |
| Control | 7.73±1.99 | 7.56±1.95 | 7.36±1.90 | 7.26±1.87 | 7.23±1.86 | 7.42[a] |
| (WF) eggs 30% | 7.46±1.85 | 7.33±1.81 | 7.23±1.79 | 7.13±1.76 | 6.86±1.72 | 7.20[a] |
| Storage period mean | 7.59[a] | 7.44[a] | 7.29[a] | 7.19[a] | 7.04[a] | |
| **Juiciness** | | | | | | |
| Control | 7.43±1.91 | 7.26±1.87 | 7.40±1.86 | 7.13±1.84 | 6.93±1.79 | 7.23[a] |
| (WF)eggs 30% | 7.33±1.81 | 7.23±1.79 | 7.13±1.76 | 7.06±1.74 | 6.86±1.69 | 7.12[a] |
| Storage Period mean | 7.38[a] | 7.24[a] | 7.26[a] | 7.09[a] | 6.89[b] | |
| **Texture** | | | | | | |
| Control | 7.26±1.87 | 7.23±1.86 | 7.13±1.84 | 7.03±1.81 | 6.90±1.78 | 7.11[a] |
| (WF) eggs 30% | 7.20±1.78 | 7.13±1.76 | 7.06±1.74 | 6.93±1.71 | 6.86±1.69 | 7.03[a] |
| Storage Period mean | 7.23[a] | 7.18[a] | 7.09[a] | 6.98[b] | 6.88[b] | |
| **Overall Palatability** | | | | | | |
| Control | 7.401.91 | 7.30188 | 7.161.85 | 7.131.84 | 7.00 | 7.19[a] |
| (WF) eggs 30% | 7.26±1.79 | 7.33±1.81 | 7.10±1.75 | 6.93±1.71 | 6.96±1.72 | 7.11[a] |
| Storage Period mean | 7.33[a] | 7.18[a] | 7.13[a] | 7.03[a] | 6.98[b] | |

**Table 2. Storage related changes in proximate composition characteristics of chicken eggs enriched noodles during room temperature storage (35 ± 2°C)**

| Type of product | Proximate composition | | | | | Treatment mean |
|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 40 | |
| **Moisture (%)** | | | | | | |
| Control | 12.09±0.07 | 11.80±0.55 | 11.35±0.02 | 11.12±0.04 | 11.06±0.02 | 11.50[b] |
| (WF) eggs 30% | 68.04±2.27 | 62.84±0.43 | 62.41±0.28 | 61.29±0.29 | 60.05±0.63 | 63.02[a] |
| Storage Period mean | 40.07[a] | 37.32[b] | 36.88[c] | 36.25[d] | 35.78[e] | |
| **Fat (%)** | | | | | | |
| Control | 1.86±0.08 | 1.17±0.08 | 1.69±0.07 | 1.89±0.07 | 1.53±0.08 | 1.68[b] |
| (WF) eggs 30% | 12.33±0.33 | 10.33±0.44 | 9.36±0.49 | 7.99±0.06 | 6.60±0.30 | 9.41[a] |
| Storage period mean | 7.09[a] | 6.30[b] | 5.53[c] | 4.75[d] | 4.06[e] | |
| **Protein (%)** | | | | | | |
| Control | 13.59±0.05 | 13.14±0.12 | 12.19±0.42 | 11.52±0.23 | 11.12±0.05 | 12.31[b] |
| (WF) eggs 30% | 14.01±0.01 | 13.25±0.09 | 13.03±0.02 | 12.260.14 | 12.06±0.01 | 12.92[a] |
| Storage period mean | 13.80[a] | 13.19[b] | 12.61[c] | 11.89[d] | 11.59[d] | |

*Means with common superscript did not differ significantly (P<0.05)*

## 3.2 Physico-chemical Properties

The data on storage related changes in physico-chemical properties of wheat flour noodles (control) and chicken eggs incorporated at 30% in wheat flour based noodles at room temperature (35±2ºC) are presented in Table 3.

The pH of wheat flour noodles mixed with chicken eggs varies significantly (P0.05) with storage progress, however the variations are non-significant until the 10th day of storage. It then increases dramatically (P0.05) till the end of storage. Similarly, the pH of the product varies significantly (P0.05) between treatments. The wheat flour-based noodles containing 30% chicken eggs had the highest pH during storage. The increased pH during storage could be attributed to lactic acid breakdown and the formation of protein metabolites by bacteria [16]. The current findings coincide with [21] for the evaluation and storage study of chicken meat pickle and [7] for the manufacture of wheat flour based quail meat enriched noodles. TBA values of wheat flour noodles (control) and chicken eggs 30% incorporated wheat flour based noodles grow in a non-significant (P>0.05) manner until the 20th day of storage. Following that, it rises dramatically (P0.05) to the end of the 40-day storage period. The increase in TBA value, especially near the end of the storage period, indicates oxidative rancidity, however the readings on the 40th day were within the spoiling limit of 1-2 malonaldehyde mg/kg for meat [22]. Similar results were obtained by [23] for the manufacture of egg cubes during storage at room temperature (35±2o℃) and [17] for chevon enhanced noodles stored at room temperature (35±2o℃) Tyrosine levels in wheat flour noodles (control) and chicken eggs 30% included wheat flour noodles increased significantly (P>0.05) as storage progressed up to the 20th day. Among the treatments, wheat flour noodles with 30% chicken eggs showed the greatest rise in tyrosine value. The generation of free amino acids during deamination may account for the increase in value at the end of storage [10].

Similar observations were reported by [24] for preparation of duck sausage stored at refrigeration temperature (4±1ºC) and [7] for preparation of wheat flour based quail meat enriched noodles stored at (35±2ºC).

## 3.3 Microbiological Analysis

Table 4 shows the storage-related variations in microbiological quality of wheat flour noodles (control) and wheat flour noodles integrated with 30% level of chicken eggs at room temperature (35±2ºC).

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

| Type of product | 0 | 10 | 20 | 30 | 40 | Treatment mean |
|---|---|---|---|---|---|---|
| **pH** | | | | | | |
| Control | 5.51±0.06 | 5.55±0.06 | 5.73±0.03 | 5.99±0.00 | 6.21±0.05 | 5.78$^{b}$ |
| (WF) eggs 30% | 6.62±0.00 | 6.68±0.03 | 6.76±0.03 | 6.80±0.04 | 6.86±0.06 | 6.74$^{a}$ |
| Storage Period mean | 6.07$^{a}$ | 6.12$^{a}$ | 6.25$^{a}$ | 6.39$^{b}$ | 6.48$^{b}$ | |
| **TBA (mg malonaldehyde /Kg)** | | | | | | |
| Control | 0.13±0.00 | 0.24±0.01 | 0.32±0.02 | 0.32±0.04 | 0.38±0.03 | 0.28$^{b}$ |
| (WF) eggs 30% | 0.290.00 | 0.310.01 | 0.350.02 | 0.510.00 | 0.640.02 | 0.42$^{a}$ |
| Storage period mean | 0.21$^{a}$ | 0.27$^{a}$ | 0.33$^{a}$ | 0. 41$^{b}$ | 0.51$^{c}$ | |
| **Tyrosine (mg/g)** | | | | | | |
| Control | 0.310.02 | 0.360.07 | 0.390.10 | 0.410.11 | 0.440.11 | 0.38$^{b}$ |
| (WF) eggs 30% | 0.36±0.00 | 0.48±0.06 | 0.49±0.07 | 0.52±0.08 | 6.35±0.14 | 0.50$^{a}$ |
| Storage period mean | 0.33$^{a}$ | 0.42$^{b}$ | 0.44$^{b}$ | 0.46$^{b}$ | 0.54$^{c}$ | |

*Means with common superscript did not differ significantly (P<0.05)*

**Table 4. Storage related changes in microbiological quality of chicken eggs enriched noodles during room temperature storage (35 ± 2ºC)**

| Type of product | Microbiological Quality | | | | | Treatment mean |
|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 40 | |
| **Total Plate Count (log cfu / g)** | | | | | | |
| Control | 1.21±0.05 | 1.92±0.10 | 2.24±0.08 | 2.99±0.08 | 3.35±0.08 | 2.34[b] |
| (WF) eggs 30% | 1.72±0.05 | 2.18±0.05 | 2.78±0.06 | 3.12±0.30 | 4.09±0.13 | 2.82[a] |
| Storage period mean | 1.46[a] | 2.05[a] | 2.21[c] | 3.05[d] | 3.72[e] | |
| ***E-Coli* (log cfu / g)** | | | | | | |
| Control | ND | ND | ND | ND | ND | ND |
| (WF) eggs30% | ND | ND | ND | ND | ND | ND |
| Storage period mean | ND | ND | ND | ND | ND | |
| **Yeast and mould (log cfu / g)** | | | | | | |
| Control | ND | ND | 1.86±0.12 | 2.13±0.05 | 2.21±0.08 | 1.54[a] |
| (WF) egg 30% | ND | ND | 1.53±0.12 | 190±0.04 | 2.06±0.03 | 1.09[b] |
| Storage period mean | ND | ND | 1.70[b] | 2.01[c] | 2.14[d] | |

*Means with common superscript did not differ significantly (P<0.05)*

Table 4 shows that the total plate count of wheat flour noodles (control) and wheat flour noodles containing 30% chicken eggs differ significantly (P0.05). The wheat flour noodles with 30% chicken eggs had a considerably (P0.05) greater total plate count (TPC) than the control.

The greater TPC in wheat flour noodles mixed with 30% chicken eggs could be attributed to the inclusion of a high level of chicken eggs as well as the high moisture content. The count, on the other hand, grew dramatically throughout the course of 40 days of storage, although the values remained within the permitted range for chevon-enriched noodles, as observed by [17]. The current findings are consistent with those reported by [7] for the manufacture of wheat flour-based quail meat-enriched noodles maintained at room temperature [35±2ºC).

Coliform counts were not discovered in wheat flour noodles (control) or wheat flour noodles containing 30% chicken eggs for the whole 40th day of storage at room temperature (35±2ºC). It could be attributed to hygienic practises used during and after the manufacturing of wheat flour noodles infused with 30% chicken eggs, as well as the absence of the coliform count in control noodles. [17] observed similar findings for chevon-enriched noodles and [7] for the manufacture of wheat flour-based quail meat-enriched noodles. Yeast and mould levels were not discovered until the 10th day of storage. However, they began to show on the 20th day and followed a significantly (P0.05) increasing trend in all treatments. Among the treatments, wheat flour noodles enhanced with 30% chicken eggs had considerably higher counts than control noodles. [25] discovered a similar effect of ambient storage on the qualitative attributes of aerobically packaged fish curls mixed with various flours.

## 4. CONCLUSION

It is concluded that wheat flour noodles enriched with 30% chicken eggs were acceptable for a period of 40 days when packed aerobically in LDPE bags and stored at room temperature (35±2º C).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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