Original Research Article

Assessment of Shelf Life of Wheat Flour Based Noodles Enriched with Different Levels of Eggs

ABSTRACT

The current study was aimed to develop noodles with incorporation of different levels of chicken eggs (0%, 10%, 20% and 30%). Fresh chicken eggs were purchased from department of Poultry Science, College of Veterinary and Animal Sciences, Parbhani. The fresh eggs were washed and cleaned with distilled water. The eggs are broken in a glass jar and blended with salt water, wheat flour at appropriate concentration and prepared dough in the department of Livestock Products Technology which was subsequently used for product formulation. During storage at room temperature (35±2ºC) all the sensory scores of the product declined with the increase in storage period. Contrarily moisture, fat and protein decline 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 40 days of storage period. Coliform counts were not detected in all the samples throughout the storage period. The yeast and mould counts were not detected upto 10^{th} day of storage. However they appeared on 20^{th} day onwards and followed a significantly ($P<0.05$) increasing trend in all the treatments.

***Key words**: Noodles, Chicken egg, Dough, Storage period*

INTRODUCTION

India ranks third in the world in egg production. Total egg production in India is 47.3 billion/annum [1]. One of the greatest challenges today is to develop inexpensive foods that are nutritionally superior and highly acceptable to consumers. In the emerging era of fast and convenience foods, instant foods or ready-mixes 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. The application of thermal processes to eggs is widely used by the egg industry to produce more convenient egg products. Traditionally, liquid eggs are pasteurized to ensure food safety by reducing the quantity of microorganisms responsible for illness [2]. Recently, there has been an increased demand for dried egg products in the food industry for manufacture of ready-to-use products and handling considerations. Chicken meat [3] and white button mushroom [4] in preparing and improving the nutritive value of noodles have been documented but relatively little organized research and information is available on egg extruded noodle products.

A change in traditional food habits and induction of fast foods culture has shifted the reference of consumer, the egg product not being on exception There has been an increasing trend in consumption of egg and egg products that can be attributed to the health consciousness amongst people. The demand of novel egg products with an improved nutritional value and better shelf

life is increasing day by day. The high nutritional properties of egg make them ideal diet for humans with special dietary requirements. Noodles are a staple for diets the world around. They make up more than 40% of all wheat products and have become a major food source in Asia [5]. Furthermore, market for pastas and noodles in Taiwan increased by an average of 7.4% annually by an 2000 to 2005 [6]. As the economy grows in China and for East Asia, there is room for an innovative niche of noodle products made with healthy or ingredients to fulfill consumers, demands and concerns. The quality of a given noodle may be determined by its appearance and texture attributed.

MATERIAL AND METHODS

Raw materials

Fresh chicken eggs were purchased from Department of Poultry Science, College of Veterinary and Animal Sciences, Parbhani. Food grade common salt required for formulation of chicken eggs noodles were procured from the local market of Parbhani city. All the chemicals of analytical grade were procured from standard firms, viz. 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 the spice ingredients were cleaned to remove extraneous matter thereafter dried in hot air oven at 45 ± 2^{o}C for 2 hrs 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.

Preparation of wheat flour based chicken eggs noodles

Chicken eggs noodles were prepared as per method [7] with slight modification was used for preparation of chicken eggs noodles throughout the study. The fresh eggs were washed and cleaned with distilled water. 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.

Measurement of quality parameters

Proximate analysis

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

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.

Thiobarbituric acid value

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

Tyrosine value

Tyrosine value of wheat flour based enriched with chicken eggs noodles samples were estimated by the extraction method of [9]. Twenty gm of meat sample was blended with 50 ml pre-cooled 20 % Trichloro acetic acid (TCA) for 2 min. The extract was obtained by filtering the content through Whatman filter paper No. 42.TCA extract (2.5 ml) was added with equal amount of distilled water. 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 Ciacaltleus reagent (1:2 with distilled water) was added. After mixing, it was kept in dark for 30 min. at room temperature for color development. The absorbance (OD) was measured at 730 nm using spectrophotometer. Tyrosine value was calculated as mg tyrosine per 100g of sample by referring to the standard curve prepared as per the procedure of [10].

Microbiological quality

The microbiological quality of wheat flour based enriched with chicken eggs noodles was assessed as per the method of APHA-American Public Health Association [11] for total plate count (TPC) and *Coliform* count during storage.

Sensory evaluation

The semi trained sensory panelists consisting of academic staff members from College of Veterinary and Animal Sciences, Parbhani were involved to assess the quality of chicken eggs noodles on the basis of sensory attributes viz., appearance, flavour, juiciness, texture and overall acceptability using 8 point descriptive scale [12] where ‘8’ denoted extremely desirable and ‘1’

denoted extremely poor. 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.

RESULTS AND DISCUSSION

Sensory quality

Average scores for changes in sensory quality of wheat flour noodles (control) and chicken eggs incorporated at levels of 30% in wheat flour based noodles are presented in the Table 1.

The sensory scores for appearance of egg enriched noodles during storage was stable upto 20th day there after it declined significantly ($p<0.05$) till the end of storage which might be due to pigment breakdown and lipid oxidation and non-enzymatic browning resulting from reaction between lipid oxidation products and amino acids [13] as well as surface dehydration in aerobic packaging. Among the treatments, the appearance scores of 30% chicken eggs enriched wheat flour noodles were lower but did not differ significantly ($p>0.05$). At the end of storage the appearance scores of wheat flour noodles (control) and chicken eggs incorporated at levels of 30% in wheat flour based noodles were within the acceptable limit. Present findings are corroborated with the result of [7] for preparation of wheat flour based quail meat enriched noodles.

The flavor scores of wheat flour noodles (control) and chicken eggs incorporated at levels of 30% in wheat flour based noodles differs non significantly ($P>0.05$) upto 40 day. The reduction in flavour scores 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. The present findings are similar to [7] for preparation of wheat flour based quail meat enriched noodles.

The sensory scores for juiciness of egg enriched noodles during storage was stable upto 30th day thereafter it declined significantly ($p<0.05$) till the end of storage score. The lowest scores for juiciness were recorded for 30% wheat flour based incorporated chicken eggs noodles over control. The reduction in juiciness scores might be due to loss of moisture from the product during storage at room temperature (35±2ºC).Similar observations were recorded by [14] who reported reduction in fat and moisture influences the juiciness of meat products and [7] for preparation of wheat flour based quail meat enriched noodles

The sensory score for texture were observed to be non-significant ($P>0.05$) upto 20 days of storage and thereafter declined significantly ($P<0.05$) during storage of 40 days. The decline in texture scores of wheat flour noodles (control) and chicken eggs incorporated at levels of 30% in wheat flour based noodles might be due to degradation of muscle fiber protein by bacterial action [15] resulting decreased water binding capacity. Similar observations were reported by [16] for

chevon enriched noodles and [7] for preparation of wheat flour based quail meat enriched noodles.

The declining trend was observed for overall palatability of wheat flour noodles (control) and chicken eggs incorporated at levels of 30% in wheat flour based noodles during storage at room temperature (35±2ºC). The change in scores was non significant upto 30th day of storage, but afterwards decreased significantly (P<0.05).Among the treatments, the highest score was recorded for wheat flour noodles (control) as compare to 30% chicken eggs incorporated wheat flour based enriched 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 [17] for ready to eat chicken meat mince incorporated cookies 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^{o}C)

Type of Product	Sensory attributes					Treatment mean
	0	10	20	30	40	
Appearance						
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]	

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

Proximate composition

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

The moisture content of wheat flour based chicken eggs noodles decreased significantly (P<0.05) with the progress of storage period upto 40 days. Similarly, the moisture content of wheat flour based chicken eggs noodle was higher than control indicating the hydration ability of protein based chicken eggs noodles during the entire storage period. The moisture content of 30% of chicken eggs incorporated with wheat flour based noodles were significantly (P>0.05) higher than control. Higher moisture content of chicken eggs 30% added in wheat flour based noodles may be attributed due to higher amount of chicken eggs. The findings are in close agreement with those of [18] for preparation of cooked chicken sausage and [7] for preparation of quail meat enriched noodles.

The fat content of 30% of chicken eggs incorporated wheat flour based noodles was significantly (P<0.05) higher than that of control. The fat content wheat flour noodles (control) and 30% of chicken eggs incorporated wheat flour based noodles decline significantly (P<0.05) throughout the storage period. Similarly decline trend in fat content was reported by [19] 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% 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 chicken eggs 30% over that of control. During storage, the protein content showed a significant (P<0.05) declining trend upto 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

[19] for chicken patties from spent hen during storage and [7] for preparation of wheat flour based quail meat enriched noodles.

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)

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 incorporated with chicken eggs differ significantly (P<0.05) with progress of storage but the differences were observed to be non-significant till 10th day of storage. Thereafter, it increases significantly (P<0.05) to the end of storage. Similarly the pH of product differs significantly (P<0.05) within the treatments. The wheat flour based noodles incorporated with chicken eggs 30% was recorded highest pH during storage. The increasing pH during storage might be due to degradation of lactic acids and production of protein metabolites

by bacteria [15]. Present findings are in agreement with [20] for evaluation and storage study of chicken meat pickle and [7] for preparation of wheat flour based quail meat enriched noodles.

The TBA values of wheat flour noodles(control) and chicken eggs 30% incorporated wheat flour based noodles increases non-significantly ($P>0.05$) till 20^{th} day of storage. Thereafter, it increases significantly ($P<0.05$) to the end of storage period of 40 days. The increasing in TBA value particularly at the end of storage period is indicative of oxidative rancidity but the values on 40^{th} day were within the spoilage limit of 1-2 malonaldehyde mg/kg for meat [21] Similar findings were recorded by [22] for preparation of egg cube during storage under ambient conditions (27±2ºC) and [16] for chevon enriched noodles stored at room temperature (35±2ºC).

Tyrosine values of wheat flour noodle (control) and chicken eggs 30% incorporated wheat flour based noodles increasing significantly ($P>0.05$) with progress of storage upto 20^{th} day. Among the treatments, the significant increase in tyrosine value was recorded for wheat flour based noodles incorporated with 30% chicken eggs. Increase in the value at the end of storage might be due to production of free amino acids during deamination [10].

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

Type of product						**Treatment mean**
	0	**10**	**20**	**30**	**40**	
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)

Similar observations were reported by [23] 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).

Microbiological analysis

Storage related changes in microbial quality of wheat flour noodles (control) and wheat flour noodles incorporated with 30% level of chicken eggs at room temperature (35±2ºC) are presented in the Table 4.

It is observed from table 4. that, the total plate count of wheat flour noodles (control) and wheat flour noodles incorporated with 30% level of chicken eggs differ significantly (P<0.05). Among the treatments, the wheat flour noodles incorporated with 30% chicken eggs had significantly (P<0.05) higher total plate count (TPC) than control. The higher TPC in wheat flour noodles incorporated with 30% level of chicken eggs might be due to the incorporation of high level of chicken eggs and also due to high moisture content. The count however, increased significantly with the progress of storage of 40 days but the values were within the permissible limit for chevon enriched noodles as observed by [16]. The present findings are in close agreement with the observations noted by [7] for preparation of wheat flour based quail meat enriched noodles stored at room temperature (35±2ºC).

Coliform counts were not detected in wheat flour noodles (control) as well as in wheat flour noodles incorporated with 30% chicken eggs during entire storage of 40^{th} day at room temperature (35±2ºC). It could be due to hygienic practices followed during and after preparation of wheat flour noodles incorporated with 30% chicken eggs as well as control noodles for the absence of the coliform count. Similar observations were reported by [16] for chevon enriched noodles and [7] for preparation of wheat flour based quail meat enriched noodles.

The yeast and mould counts were not detected upto 10^{th} day of storage. However they appeared on 20^{th} day onwards and followed a significantly (P<0.05) increasing trend in all the treatments. Among the treatments the counts were significantly higher for wheat flour noodles enriched with 30% level of chicken eggs as compared to control noodles. Similar findings were observed by [24] for effect of ambient storage on the quality characteristics of aerobically packaged fish curls incorporated with different flours.

Table 4: Storage related changes in microbiological quality of chicken eggs enriched noodles during room temperature storage (35 ± 2°C)

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)

CONCLUSION

Based on the above observations, 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±2° C).

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