J.Meat Sci., 2015, 11(1) : 54 - 56

Research Note

Effect of Soya and Potato on Shelf-life of Chicken Meat Emulsion under Refrigerated Condition

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ABSTRACT

A study was conducted to determine the shelf-life of chicken meat emulsions prepared from spent hen meat and preserved under refrigerated (4 ± 1°C) condition so that fresh chicken nuggets could be prepared as per need. Three different types of emulsions were prepared viz. T_1 as control (100 % chicken meat), T_2 (80 % chicken meat+ 20 % soya) and T_3 (80 % chicken meat+ 20 % boiled potato) and were analyzed for various physico-chemical and microbial parameters during storage under refrigerated condition (4 ± 1°C) for one week. The pH and TBA value showed increasing trend in all the emulsions but significant ($p>0.01$) increase was noticed from 5th day onwards. Total plate count, psychrophilic count and yeasts & moulds count increased significantly ($p>0.01$) as the days advanced, with higher counts in extended emulsions as compared to control. Coliform count also increased significantly ($p>0.01$) but indicated higher count in control than extended emulsion.

Keywords : *Emulsion, Extender, Minced soy, Boiled potato*

Received: 01-03-2015 Accepted: 16-07-2015

To reduce its cost and improvement of nutritional value, different types of cheaper extenders may be added in meat products and among this, soya and boiled potato have good potential. As the price of meat and meat proteins are usually higher than the plant proteins, thus all meat products could only be available at higher prices, which may significantly limits its consumption. Various soya protein products have been extensively tried as extenders in meat products for improving pH, emulsion stability, water holding capacity, cooking yield etc. Berry (1990) was of the opinion that inclusion of soya reduced many of the negative effects of storage on quality. Several researchers have indicated that soya protein retarded rancidity development in meat products (Kotula *et al*. 1976. Addition of Texturized Soya Protein in the meat products was found to decrease cooking losses (Jindal and Bawa 1988). The cooking loss in Turkish style hamburgers prepared with addition of 0, 10, 20 & 30% hydrated soya flour decreased with increase in soya flour content in finished product (Kaya *et al*. 1988). Manjhi (1973) used mashed potato at 15 % level in sausage formulation. Incorporation of potato at a level of 25% as extender can reduce the cost of cutlet by 5.4 % without affecting the consumer's acceptability (Prabhakar *et al*. 1993).

Hence, a reduction in cost by cheaper extender in product preparation will be a desirable venture and the profitable marketability of product depends upon its shelf-life. Above all, preservation of emulsions and preparation of nuggets as per need gives extra freshness in the product in terms of appearance, colour, texture, flavor and juiciness. Therefore, the present study was undertaken to estimate the effect of extenders on shelf-life of chicken meat emulsions under refrigerated condition (4 ± 1°C) with the aim to prepare the fresh chicken nuggets at desired time without adverse effect on its physico-chemical and microbial qualities. To compare the effect, similar quantities (20 %) of potato was used as extender in the present study.

Preparation of chicken meat emulsions: Chicken meat emulsions were prepared in bowl chopper after deboning and mincing the meat of spent hen. Three types of emulsions were prepared by addition of same ingredients such as rice flour (10 %), spices mix (2.5 %), condiments mix (2.5 %), STPP (0.2 %), sodium nitrate (0.01 %), sodium nitrite (0.01 %), vegetable oil (5 %), salt (2 %), ice flakes (5 %) except different extenders. Type I emulsion contained only minced chicken meat with other ingredients without any extender and was taken as control (T_1). Type II emulsion (T_2) contained 20 % minced soy nuggets as extender by replacing equivalent quantity of minced chicken meat. Type III emulsion (T_3) contained 20 % boiled and mashed potato as extender by replacing equivalent quantity of minced chicken meat.

Analytical procedures: About 100 g emulsion from each formulation was packed in LDPE bags (100 gauge) and stored in refrigerator at 4±1 °C for one week and evaluated at alternate days for their physico-chemical and microbiological qualities.

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pH determination: A combined glass electrode pH meter (Yorco pH meter with electrode) was used by directly inserting the electrode into raw meat emulsion samples, kept in glass beakers, soon after its preparation.

Estimation of TBA value: The method of Tarladgis *et al*. (1960) was followed for estimation of TBA Value. The optical density was measured at 530 nm using spectrophotometer (SICOSPEC-100) and the reading (O.D.) was multiplied by the factor 7.8 to convert to mg of malonaldehyde per kg of sample.

Microbiological analysis: Standard methods of APHA (1984) were followed. Pour plate technique was used for determining the total plate count using plate count agar, Violet Red Bile Glucose Agar (VRBGA) for coliform count and PDA for Yeast and mould. Colonies were counted and expressed as $\log_{10}$ colony forming units (cfu) g of sample.

Statistical analysis: The data were subjected to Analysis of variance as per Snedecor and Cochran (1989). Mean values of different treatments were compared by applying Duncan's multiple range test (Duncan 1955) for the statistically significant difference.

The results (Table 1) showed that pH values of emulsions exhibited an increasing trend in all the formulations at each interval of storage period upto 7th day observation. However, 20 % soy based emulsion showed higher pH value (varied from 6.42 to 6.47) while control showed lower pH value (varied from 6.31 to 6.35) among all emulsions. The progressive increase in pH value of chicken meat emulsions during storage might be due to accumulation of metabolites of bacterial action on meat and deamination of protein. Extender based emulsions reflected significantly ($p<0.05$) lower TBA value(0.42 to 0.56

Table 1: Changes in pH, TBA value, microbial profiles of chicken meat emulsions during refrigeration (4 ± 1 °C) storage (Mean ± S. E.)

Treatment	1st day	3rd day	5th day	7th day
		pH Value		
Control (T_1)	6.31±0.02	6.42±0.02	6.37±0.01	6.32±0.06
Soy based emulsion (T_2)	6.45±0.03	6.38±0.03	6.33±0.03	6.46±0.03
Potato based emulsion (T_3)	6.40±0.03	6.35±0.02	6.47±0.02	6.42±0.05
		TBA value (mg malonaldehyde / kg meat)		
Control (T_1)	0.45±0.02	0.42±0.01	0.40±0.03	0.48 ±0.03
Soy based emulsion (T_2)	0.44 ±0.01	0.42 ±0.03	0.54 ±0.04	0.50 ±0.03
Potato based emulsion (T_3)	0.47 ±0.01	0.61 ±0.02	0.56 ±0.02	0.53 ±0.02
		Total plate count ($\log_{10}$ cfu/g)		
Control (T_1)	2.68±0.06	2.70±0.06	2.65±0.07	2.68±0.06
Soy based emulsion (T_2)	2.70±0.06	2.65±0.07	3.16±0.06	3.20±0.07
Potato based emulsion (T_3)	3.15±0.07	3.65±0.01	3.70±0.07	3.72±0.01
		Psychrophilic count ($\log_{10}$ cfu/g)		
Control (T_1)	0.98±0.02	1.02±0.03	1.06±0.03	1.02^{a}±0.03
Soy based emulsion (T_2)	1.10±0.03	1.14±0.03	1.19±0.02	1.14^{b}±0.03
Potato based emulsion (T_3)	1.25±0.02	1.30±0.04	1.35±0.03	1.30^{c}±0.02
Days mean	1.48±0.04	1.55±0.03	1.60±0.03	1.54^{d}±0.02
		Coliform count ($\log_{10}$ cfu/g)		
Control (T_1)	0.95±0.05	0.94±0.02	0.91±0.06	0.98±0.13
Soy based emulsion (T_2)	0.96±0.05	0.92±0.05	1.12±0.03	1.08±0.14
Potato based emulsion (T_3)	1.07±0.04	1.39±0.05	1.22±0.04	1.16±0.04
		Yeast & Moulds count ($\log_{10}$ cfu/g)		
Control (T_1)	1.03±0.15	1.07±0.04	1.06±0.09	1.29±0.05
Soy based emulsion (T_2)	1.32±0.08	1.36±0.07	1.57±0.10	1.64±0.07
Potato based emulsion (T_3)	1.78±0.09	2.56±0.10	2.71±0.07	2.90±0.07

Means in a column or rows having same or no superscript are not significantly ($p > 0.05$) different

and 0.40 to 0.53 mg Malonaldehyde / kg in 20 % soy based and potato based emulsion respectively) as compared to control (0.45 to 0.61 mg. Malonaldehyde / kg) with the advancement of storage period. This might be due to higher fat content in control emulsion than extended emulsions.

Microbiological qualities of emulsions: Among microbiological qualities of meat emulsions, total plate count (Table 1) remained same in 1st and 3rd day of refrigerated storage might be due to lag phase of microbes. But after wards, on 5th and 7th day progressive higher counts in emulsions due to multiplication of micro-organisms were noticed. Potato based emulsion 20 % showed higher psychrophilic count (1.06 to 1.60 $\log_{10}$ cfu/g) as compared to soy based and control emulsions (1.02 to 1.55 and 0.98 to 1.48 $\log_{10}$ cfu/g respectively). However, reverse pattern was found during coliform count of emulsions. Control emulsion indicated relatively higher coliform count (0.95 to 1.39 $\log_{10}$ cfu/g) as compared to soy and potato based emulsions (0.94 to 1.22 and 0.91 to 1.16 $\log_{10}$ cfu/g respectively). During refrigerated (4 ± 1°C) storage of emulsions a progressive and significant increase in yeast and mould count was observed. Potato based emulsion showed significantly ($p<0.05$) higher count (1.06 to 2.90 $\log_{10}$ cfu/g) as compared to soy based and control emulsions (1.07 to 2.71 and 1.03 to 2.56 cfu/g respectively). Naveena (2002) also reported significant increase in TPC and yeast and mould count in tenderized buffalo meat during refrigerated (4 ± 1°C) storage.

It was conclude that refrigeration of emulsions for one week resulted in gradual decrease in quality attributes but was well within the limits of acceptability upto 5th day although on 7th day the quality gets deteriorated. However, 20% soya based chicken emulsion was considered to be superior in terms of its quality characteristics followed by control and 20% potato based chicken meat emulsion.

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