Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 2660-2666

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 2660-2666**
Journal homepage: http://www.ijcmas.com

Original Research Article

Studies on Proximate Composition of Vacuum Packed Guinea Fowl Meat Sausages during Storage at Refrigeration Temperature (4±1° C)

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A B S T R A C T

The aim of present study was to investigate the effect of vacuum packaging on proximate composition of guinea fowl meat sausages during storage at refrigeration temperature (4±1° C). Guinea fowl meat sausages were subjected to two different types of packaging treatment i.e. aerobic packaging with low density polyethylene bags (control) and vacuum packaging using barrier bags (treatment) and stored at refrigeration temperature (4±1^{0}C). Proximate composition of guinea fowl meat sausages was analyzed on 0th, 3rd, 7th, 14th, 17th, 21th and 30th day. There was a non-significant effect of vacuum packaging on protein and moisture content of the product however protein content significantly (P>0.05) increased during storage period. There was a non-significant difference in fat and ash content in vacuum as well as aerobically packaged sample, however fat and ash significantly (P>0.05) decreased during storage period.

Keywords

Vacuum, Guinea fowl, Protein, Fat, Ash, Moisture

Introduction

Poultry industry in India has made impressive progress during the last three decades evolving from backyard venture to a full-fledged commercial agro industrial business. India is the fifth largest broiler producer in the world (FAO, 2007), with an annual growth rate of 10-15 percent.

Guinea fowl population comes at the third place after chicken and duck (Kumar, 2009). Mongin (1991) reported that compared to chicken farming, guinea fowl (*Numeda meleagris*) farming incurs low production costs. Guinea fowls have a better resistance to common poultry parasites and diseases, produce premium quality meat that is dark and delicate with the flavour resembling that of game, though the meat is tough and takes longer time to cook. Nutritionally guinea fowl meat is said to be rich in essential fatty acids and is leaner than chicken (Serre, 2002). In recent years there has been an increased demand for guinea fowl meat because it is lean and rich in essential fatty acids. The muscle is low in calories with only turkey meat having fewer calories than

it. Meat processing improves preservation by inhibiting microbial decomposition/ spoilage and results in flavourful and nutritious products. Only 2% of the meat in India is processed (APEDA, 2008), the remaining meat is sold in fresh or frozen form.

In the busy world of today, there is a great need of value added ready to eat food products, having increased shelf life because globalization has changed the lifestyle of people to great extent. In this regard sausages are better alternate to other conventional food types. Sausages are ground meat mixed with fat, salt, other seasonings, preservatives and sometimes fillers, and stuffed into casings. Sausages are also commonly served for breakfast, lunch, dinner or snacks (Pearson and Gillett, 1997).

There is a growing tendency for consumers to shun chemically treated products in favor of more natural products (Martinez-Tome *et al*., 2001). Faced with this demand, there is a need to develop techniques like vacuum packaging to maintain the natural qualities of cooked ready to eat foods without using chemical preservatives (Day, 1998). All this requires a combination of raw product quality with special attention to the production chain, careful handling and strict control of distribution temperatures (Coventry *et al*., 1995; Bharti and Sahoo, 1999; Brody, 2000). Foods must be prepared at relatively high temperatures (around 100^0C) and then packed in vacuum or modified atmosphere. The process is rounded off by a rapid cooling step followed by refrigerated storage. The end product should be reheated at approximately 70^0C for 2 min before consumption (Sallares, 1995). In addition, vacuum packaging minimizes the oxidation of unsaturated fatty acids and slows the development of rancid meat.

In Vacuum packaging moist foods do not dry out. Foods that are high in fats and oils do not become rancid, because there is no oxygen coming in contact with the fats, which causes the rancid taste and smell. Vacuum packaging was one of the first types of modified atmospheric packaging used for food. It utilizes a high barrier film that restricts oxygen transmission. Vacuum skin packaging is a modification which utilizes a thermoformable film that can be heat shrunk around the product, thereby reducing purge and showing clearly the product surface (Mead, 2004).

Materials and Methods

Raw materials and chemicals

Live birds (Guinea fowl) were procured from Instructional Poultry Farm, Pantnagar and were brought to the Department of Livestock Products Technology. Slaughter and dressing was carried out following standard procedure under humane conditions. The hot carcasses were stored in refrigerator at 4 ± 1^0C overnight. Next day carcasses were manually deboned and lean meat was collected and stored at -20^0C till further use. The Refined wheat flour, table salt, spice mix, condiments were purchased from local market. All the chemicals and media used in the study were of analytical grade and from standard firms (Hi media, Merck).

Preparation of Guinea fowl meat Sausages

Partially thawed deboned meat was cut into small cubes and ground in a Hobart Mincer with 5 mm plate followed by 3mm plate. Emulsion was prepared using the formulation: Guinea fowl meat 65%, Vegetable oil (fat) 10%, Ice flakes 11%, Refined wheat flour 4%, Condiments 5.5%,

Table salt 2%, Spices mix 2.5%, Sodium nitrite 150 ppm and STPP 0.2% in bowl chopper by adding these ingredients. Then the emulsion was stuffed into 17 mm diameter cellulose casings using hydraulic sausage filler and linked manually. Stuffed raw sausages were cooked in water at 80 ± 5^0C for 45 min.

The product was vacuum packed (anaerobically) and aerobically in adequate number of multilayer barrier bags and LDPE bags respectively. For the vacuum packaging weighed samples were vacuum packaged in Multilayer poly bags by using 15 lb pressure, softener 03 and sealing 2.5 as parameters. After that the packets were stored at refrigeration temperature (4 ± 1^0C). The samples of Guinea fowl sausages were analyzed for proximate composition at regular intervals of 0, 3, 7, 14, 21 and 30 days. The experiment was carried out in three replicates with each analysis done thrice.

Analytical procedure

Proximate analysis

1. **Moisture:** The Moisture content of guinea fowl meat sausages was determined as per Standard procedures of Association of Official Analytical Chemist (AOAC 1995).

2. **Protein:** The protein content of guinea fowl meat sausages was determined by micro-Kjeldhal method as given in AOAC (1995).

3. **Fat (ether extract):** The estimation of fat content of guinea fowl meat sausages, Soxhlet method (AOAC 1995) was used.

4. **Total Ash:** The percent total ash of guinea fowl meat sausages was calculated as per (AOAC, 1995) method.

Statistical analysis

Statistical analysis of the data obtained, was done using ANOVA technique according to the method described by Snedecor and Cochran (1994).

Results and Discussion

1. Moisture

As indicated in (Table: 1) moisture content (%) of guinea fowl meat sausages treatment and control did not differ significantly ($P>0.05$), as well as the effect of storage period. The effect of vacuum packaging on moisture content was not significant and interactions between these two factors were also non significant. Similar was the findings of Bhoyar *et al*. (1997) who observed no significant differences in moisture content of restructured chicken steaks in both vacuum packaging and aerobic packaging. Kenawoi (2003) found that loss of moisture content was not significant ($P>0.05$) in vacuum packaged samples compared with LDPE packaged samples also. While (Lin *et al*., 2004) reported that vacuum packaging treatment resulted in lower weight loss of the product. Maca *et al*. (1997) reported first decrease and then increase in the moisture content and proposed that it might be due to break down of protein which releases water at later stage.

2. Protein

Data presented in Table 2 indicated that there was non significant effect ($P>0.05$) of treatment on protein values of guinea fowl meat sausages observed throughout the storage period, but there was significant

effect (P>0.05) of storage period on protein values of guinea fowl meat sausages observed throughout the storage period. Sharma *et al* (2002) reported that if moisture content is lower than protein content increased. Bhoyar *et al*. (1998) also reported no significant change in protein content of chicken steaks during frozen storage in vacuum as well as LDPE (250 gauge) packaging. The finding of Sachdev *et al*. (2002) suggested that moisture reduced while protein increased significantly during the extended storage of cooked chicken at room, refrigeration and frozen temperature.

3. Ether extract

The ether extract values showed a non-significant (P>0.05) effect of treatment throughout the observation period however interaction between these two factors were highly significant. Ether extract values were found to increase with the advancement of storage period.

These results are in agreement that of Bhoyar *et al*. (1998) who observed no change in ether extract content of chicken meat with storage time in either type of packaging i.e. vacuum packaging and normal atmospheric packaging.

4. Total Ash

Data presented in Table: 4 indicated that storage period had significantly (P>0.05) affect on the ash content in both Aerobic packaging and Vacuum packaging. Interaction between these two factors were also not significant (P>0.05). At each interval of observation, the values of ash content were high for Vacuum packaging than Aerobic packaging sample.

Table.1 Effect of vacuum packaging and storage period on moisture content (%) of guinea fowl meat sausages (Mean±S.E.)*

Storage days	Aerobic packaging	Vacuum packaging	Day mean
0	66.489^{aA} ±0.114	66.489^{aA} ±0.114	66.489^{aA} ±0.114
3	65.483^{bA} ±0.432	64.978^{bB} ±0.784	65.230^{bAB} ±0.608
7	65.271^{bA} ±0.591	66.263^{bceB} ±0.410	65.767^{cdfC} ±0.501
14	65.877^{cbdA} ±0.346	65.836^{cdefA} ±0.348	65.857^{cfA} ±0.347
17	65.504^{bdA} ±0.346	65.543^{defA} ±0.348	65.524^{dfA} ±0.347
21	65.944^{dA} ±0.319	65.896^{efA} ±0.309	65.92^{fA} ±0.314
30	65.787^{dA} ±0.387	65.588^{fA} ±0.454	65.688^{fA} ±0.420
Treatment mean	65.765±0.362	65.799±0.411	
CD at 5%	0.444		

* Mean±S.E. with different superscripts in each column denoted by small alphabets (a,b,c,d,e,f) and in row denoted by capital alphabets (A,B,C)differ significantly (P>0.01)

Table.2 Effect of vacuum packaging and storage period on protein content (%) of guinea fowl meat sausages (Mean±S.E.)*

Storage days	Aerobic packaging	Vacuum packaging	Day mean
0	19.968^{aA} ±2.115	19.964^{aA} ±2.115	19.968^{aA} ±2.115
3	21.522^{bcA} ±0.4995	21.038^{bA} ±0.214	21.28^{bA} ±0.357
7	21.292^{bA} ±0.672	20.707^{abcA} ±0.580	20.999^{bA} ±0.626
14	22.501^{cdA} ±0.489	22.129^{dA} ±0.294	22.315^{cA} ±0.392
17	22.504^{cdA} ±0.513	22.401^{dA} ±0.029	22.453^{cA} ±0.271
21	22.646^{dA} ±0.629	22.454^{dA} ±0.235	22.550^{cA} ±0.432
30	22.696^{dA} ±0.643	22.654^{dA} ±0.497	22.675^{cA} ±0.569
Treatment mean	22.876±0.794	21.621±0.570	
CD at 5%	0.986		

* Mean±S.E. with different superscripts in each column denoted by small alphabets (a,b,c,d) and in row denoted by capital alphabet (A)differ significantly (P>0.05)

Table.3 Effect of vacuum packaging and storage period on ether extract content (%) of guinea fowl meat sausages (Mean±S.E.)

Storage Days	Aerobic packaging	Vacuum packaging	Day mean
0	12.088^{aA} ±0.206	12.088^{aA} ±0.206	12.088^{aA} ±0.206
3	10.702^{bA} ±0.574	11.635^{aB} ±0.759	11.169^{bAB} ±0.667
7	10.542^{bA} ±0.589	10.590^{bA} ±0.345	10.566^{cA} ±0.467
14	10.461^{bA} ±0.398	10.489^{bA} ±0.339	10.475^{cA} ±0.368
17	10.452^{bA} ±0.398	10.460^{bA} ±0.348	10.456^{cA} ±0.373
21	10.359^{bA} ±0.417	10.372^{bA} ±0.517	10.367^{cA} ±0.467
30	10.353^{bA} ±0.42	10.372^{bA} ±0.514	10.363±0.467
Treatment mean	10.708±0.429	10.856±0.432	
CD at 5%	0.502		

* Mean±S.E. with different superscripts in each column denoted by small alphabets (a,b,c) and in row denoted by capital alphabets (A,B)differ significantly (P>0.05)

Table.4 Effect of vacuum packaging and storage period on Ash content (%) of guinea fowl meat sausages (Mean±S.E.)*

Storage Days	Aerobic packaging	Vacuum packaging	Day mean
0	1.480^{aA} ±0.321	1.480^{aA} ±0.321	1.480^{aA} ±0.321
3	1.483^{aA} ±0.316	1.483^{aA} ±0.316	1.483^{aA} ±0.316
7	1.391^{aA} ±0.102	1.468^{aA} ±0.065	1.429^{aA} ±0.083
14	0.713^{bcA} ±0.359	1.096^{aB} ±0.147	0.905^{bAB} ±0.253
17	0.512^{bA} ±0.169	1.071^{bB} ±0.207	0.792^{bC} ±0.187
21	0.812^{cA} ±0.279	1.067^{bA} ±0.209	0.939^{bA} ±0.244
30	0.770^{cA} ±0.254	0.972^{bA} ±0.187	0.871^{bA} ±0.221
Treatment mean	1.023±0.257	1.234±0.207	
CD at 5%	0.267		

* Mean±S.E. with different superscripts in each column denoted by small alphabets (a,b,c) and in row denoted by capital alphabets (A,B)differ significantly (P>0.05)

These results are in agreement with that of Kim *et al*. (1999) who also observed in proximate analysis of the vacuum packaged chilled pork bellies sample there was no significant difference in the ash content.

From the above study it can be concluded that the Vacuum packaging maintains the proximate composition of guinea fowl meat sausages better than aerobic packaging.

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