Physical Properties and Microbiological Quality of Quail Breast Meat during Frozen Storage

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ABSTRACT

Quality of quail breast meat samples were analyzed during frozen storage (-18±2°C) of 60 days period. Six weeks old broiler quails were slaughtered dressed hygienically and breast meat samples were collected. Quail breast meat samples were cut into small pieces and packed in low density polyethylene pouches taking optimum care to avoid contamination and stored at -18 ± 2°C for 60 days. These stored samples were evaluated for physical properties and microbiological quality after thawing at 4 ± 1°C for 12 h at an interval of 15, 30, 45 and 60 days. During the study, drip loss increased, while the ERV decreased with advancement of the storage period. Similarly standard plate count, E. coli, Staphylococcal count and psychrophilic count decreased with progress of frozen storage period. All of the meat samples were found negative for Salmonella spp. It is concluded from the study that quail meat can be safely stored in frozen state for 60 days without any deterioration.

Keywords: Frozen storage, microbial quality, physical characteristics, quail breast meat

Introduction

Quails are distributed worldwide over large areas of Asia, Europe and Africa, but in the last two decades, the little known Japanese quail (Coturnix coturnix Japonica) has been introduced to the Indian sub-continent as an alternative to avian species. For quail meat production broiler quails are slaughtered at about six weeks of age (Boni et al., 2010). Quail meat is tender, very delicious having unique taste and low calorific value and high dry matter content (Runjun and Sethi, 2014). White meat, including quail meat, is considered superior to red meat because it contains low fat, low cholesterol and has a high amount of iron (Jaturasitha et al., 2004).

Chemical and nutritional properties of quail meat are interesting, which helps in its marketing. As quail meat is not only a excellent source of vitamins viz; pyridoxamine (0.600 mg, vitamin B6), niacian (7.538 mg, vitamin B3), riboflavin (0.260 mg) and thiamine (0.244 mg), vitamin C (6.1 mg) and vitamin A (73 IU) but also a significant source of phosphorus (275 mg), potassium (216 mg) and iron (3.97 mg), which are higher in quail meat as compared to chicken meat (Tavaniello, 2013). The quail meat also contains main amino acids viz; glutamic acid and arginine (Boni et al., 2010). Quail meat, particularly the breast fillet is very lean and dietary properties of quail breast meat are superior as compared to leg meat and the essential amino acids content of quail breast meat is 6.5% higher than leg meat especially isoleucine and valine concentrations (Genchev et al., 2008).

Many times in the market, quail meat may pass through frozen storage till it reaches to retailer. Even if it is not in organized manner, it may be due to delay in transportation and fluctuation in market rates, break in cold chain during transport or frozen storage. Such frozen meat fetches lower market prices than fresh meat. In India, fresh meat has more demand and is sold at higher price than that of frozen meat. Some of the retailers do malpractices of mixing fresh and frozen meat for getting more benefit. In order to detect the malpractices during selling as well as to protect the interest and health of consumers, the present study was carried out to evaluate the physical properties and microbiological quality of quail breast meat during freeze - thaw cycle.

Materials and Methods

Live broiler quails of 6 weeks old were collected from quail farm located at COVAS, Parbhani, which were
slaughtered, dressed hygienically and breast meat samples were collected. Quail breast meat samples were washed with clean water and kept in a chiller (at 4 ± 1°C) for ageing, after which they were cut into small pieces and packed in low density polyethylene pouches taking optimum care to avoid contamination and stored at -18 ± 2°C for 60 days.

During this study physical properties and microbial quality of frozen storage quail breast meat samples were analyzed. The frozen meat samples (-18 ± 2°C) were removed from the freezer after every 15 days, thawed at refrigeration temperature (4 ± 1°C) for 12 h and analyzed for physical properties and microbiological quality. Drip loss was calculated by measuring the exudates/meat juices after thawing of samples at 4 ± 1°C for 12 h. The procedure of Strange et al. (1977) was followed with slight modification for determination of ERV. The microbiological quality (standard plate count, E. coli, Staphylococcal count, psychrophilic count and Salmonella spp) was assessed as per APHA (1992). Data obtained during the study were analyzed as per Snedecor and Cochran (1989).

Results and Discussion

Physical Properties

Data regarding the drip loss and extract release volume (ERV) of quail breast meat during frozen storage is presented in Table 1. Drip loss of quail breast meat increased significantly (p<0.05) with advancement of frozen storage of 60 days. Similar results regarding increase in drip loss during frozen storage were observed by Kandeepan and Biswas (2003) for buffalo meat, Doifode (2007) for chevon and Swami (2011) for rabbit meat. The increase in drip loss may be due to several factors such as shortening of the sarcomere (Honikel et al., 1968), the degree of distortion of fat and water translocation (Ramsbottom and Koonz, 1939), increased enzyme activity (Strange, 1987) etc. While significant decline (p<0.05) in the extract release volume (ERV) of quail breast meat were observed throughout the frozen storage period. The decline in ERV value was observed to be gradual with progress in storage period. On zero day, ERV value was 28.33 ml, which decreased consistently upto 17.33 ml on 60th day of frozen storage. Cut off limit of ERV is 17 ml (Pearson, 1968), which is indicative of spoilage. Similar findings regarding decline in ERV values were recorded by Jayesh and Venkatramanujam (2002) for frozen mutton, Doifode (2007) for frozen chevon and Swami (2011) for frozen rabbit meat.

Microbiological quality

The various microbial counts of quail breast meat during frozen storage are depicted in Table 2. Standard plate count (SPC) of quail breast meat decreased gradually with increase in the storage period. The decrease in SPC was however observed to be non-significant on zero and 15th day of frozen storage. Afterwards, the count declined significantly (p<0.05). Similar declining trend was observed by Ziauddin et al. (1993) and Kandeepan and Biswas (2005) for buffalo meat

### Table 1. Physical qualities of quail meat influenced by frozen storage (18±2°C)

<table>
<thead>
<tr>
<th>Days of storage</th>
<th>Drip loss (%)</th>
<th>ERV (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td>Zero</td>
<td>28.33 ± 0.67</td>
</tr>
<tr>
<td>15</td>
<td>2.29 ± 0.07</td>
<td>26.33 ± 0.34</td>
</tr>
<tr>
<td>30</td>
<td>3.98 ± 0.07</td>
<td>23.67 ± 0.33</td>
</tr>
<tr>
<td>45</td>
<td>6.03 ± 0.12</td>
<td>20.67 ± 0.35</td>
</tr>
<tr>
<td>60</td>
<td>8.04 ± 0.21</td>
<td>17.33 ± 0.33</td>
</tr>
</tbody>
</table>

*values bearing different superscript of columns differ significantly. Each value is mean of five replicates

### Table 2. Microbiological quality of quail meat during frozen storage (18±2°C)

<table>
<thead>
<tr>
<th>Days of storage</th>
<th>SPC</th>
<th>E. coli</th>
<th>PC</th>
<th>SC</th>
<th>Salmonella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td>5.10 ± 0.11</td>
<td>2.20 ± 0.10</td>
<td>3.00 ± 0.06</td>
<td>2.20 ± 0.11</td>
<td>ND</td>
</tr>
<tr>
<td>15</td>
<td>4.93b ± 0.10</td>
<td>2.07b ± 0.07</td>
<td>2.83b ± 0.03</td>
<td>2.07b ± 0.09</td>
<td>ND</td>
</tr>
<tr>
<td>30</td>
<td>4.70bc ± 0.10</td>
<td>1.83bc ± 0.09</td>
<td>2.60bc ± 0.06</td>
<td>1.84bc ± 0.07</td>
<td>ND</td>
</tr>
<tr>
<td>45</td>
<td>4.43cd ± 0.09</td>
<td>1.67cd ± 0.10</td>
<td>2.47cd ± 0.07</td>
<td>1.63cd ± 0.07</td>
<td>ND</td>
</tr>
<tr>
<td>60</td>
<td>4.20d ± 0.15</td>
<td>1.47d ± 0.09</td>
<td>2.20d ± 0.10</td>
<td>1.40d ± 0.06</td>
<td>ND</td>
</tr>
</tbody>
</table>

*values bearing different superscript of columns differ significantly. Each value is mean of five replicates

SPC - Standard plate count  
PC - Psychrophilic count  
SC - Staphylococcal count
and by Swami (2011) for rabbit meat during frozen storage. Decrease in SPC might be due to sudden cold shock experienced by the bacteria especially at freezing temperature, which tends to extend the lag phase of bacterial population (Sen, 1996).

Analysis of fresh and frozen quail breast meat indicated gradual decrease in E. coli count with progress in storage period. There was non-significant difference on zero and 15th day of storage, thereafter it decreased significantly (p<0.05) with increase in storage period. Similar declining trend in E. coli count was observed by Jayesh and Venkataramanujam (2002), Kandeepan and Biswas (2005), Doifode (2007) and Swami (2011) for frozen mutton, buffalo meat, chevon and rabbit meat, respectively, with the progress of storage period. The variation in E. coli count throughout the storage period indicates that the freezing helped to decrease the count. The formation of intracellular ice crystals during frozen storage resulted in reduction of microbial count during storage (Suressh Kumar et al., 2003).

Irrespective of storage period there was no indication of occurrence of Salmonella spp in quail breast meat samples. The findings were in agreement with Biswas et al. (2006) for buffalo meat, Doifode (2007) for chevon and Swami (2011) for rabbit meat during storage.

During frozen storage of 60 days staphylococcal count of quail breast meat also declined gradually. Similar declining trend was observed by Thushani et al. (2003) and Mahmoudzadeh et al. (2010) in frozen shrimp and frozen stored fish burger, respectively. The reduction in the count may be due to influence of freezing application (-18 ± 2°C) on bacteria that led to damage of the cell membrane and DNA denaturation of bacterial cells causing death of the bacteria during freezing (Panoff et al., 1998; Pavlov, 2007).

Gradual decline in the psychrophilic count of quail breast meat samples was observed with progress of storage period at 18±2°C. On 30th and 60th day of freeze thaw cycle psychrophilic count differed significantly. However between day zero and after 15th, thereafter between 30th and 45th day a non-significant decrease in the count was observed. The observations were in close agreement with Kandeepan and Biswas (2005) and Doifode (2007) for buffalo meat and chevon, respectively, during cold storage. The decrease in count may be attributed to cold shock to microorganisms during frozen storage. Sen (1996) reported that the frozen shock extended the lag phase of microorganisms resulting in reduction of microbial count. The increased enzymatic activities of psychrotrophs at low temperature hugely contributed to deterioration of meat.

It is concluded from the study that the quail breast meat can be stored safely upto 60 days at -18 ± 2°C without affecting physical and microbial quality.

References


Tavaniello, S. 2013. Effect of cross-breed of meat and egg line on productive performance and meat quality in Japanese quail (Coturnix japonica) from different generations. Doctorate Thesis submitted to University of Molise, Campobasso, Italy.
