



Assessment of Physical and Microbiological Characteristics of Quail Meat During Storage

Naureen Naeem^{1*}, Muhammad Amjad Khan¹, Akeela Ashraf¹, Shabbir Hussain², Syeda Mona Hassan²

1. Department of Biology, Lahore Garrison University, Lahore, Pakistan.

2. Department of Chemistry, Lahore Garrison University, Lahore, Pakistan.

*Corresponding Author's Email: naureen.naeem@lgu.edu.pk

ABSTRACT: Analysis of physical and microbiological quality of quail meat samples was carried out during frozen storage ($-18 \pm 2^\circ\text{C}$) of 90 days period. Slaughtering of six weeks old broiler quails was done hygienically. Quail meat samples were packed in low density polyethylene pouches taking best possible care to avoid contamination and stored at $-18 \pm 2^\circ\text{C}$ for 90 days. These stored samples were evaluated for physical properties and microbiological quality after thawing at $4 \pm 1^\circ\text{C}$ for 12 h at an interval of 15, 30, 60 and 90 days. It was observed that drip loss increased, while the extract release volume (ERV) decreased with progression of the storage period. Similarly standard plate count, *Escherichia coli*, *Staphylococcus aureus* and psychrophilic count decreased with advancement of frozen storage period. While all of the meat samples were found to be negative for *Salmonella* spp. It is concluded from the study that quail meat can be safely stored in frozen state for up to 3 months without any deterioration.

Keywords: Quail meat, microbial quality, frozen storage, physical characteristics.

INTRODUCTION

Quail meat is an ideal food for all groups of ages, due to its high meat yield, low shrinkage during cooking, easy cooking and serving. All types of quails are excellent sources of vitamin B6, niacin, thiamin,

panthothenic acid and riboflavin. (El-Dengawy et al. 2001). Quails can be found worldwide in areas of Asia, Europe and Africa, now a day a new Japanese quail (*Coturnix japonica*) is found in the market which has been introduced in the last two decades, to the Indian sub-continent as an

alternative to avian species. For the production of quail meat broiler quails are slaughtered at about six weeks of age (Boni et al., 2010). Quail meat is nutritious, tender and very delicious with exclusive taste and low calorific value (Runjun and Sethi, 2014). Consumption of quail meat should be increased as it contains low fat, low cholesterol and has a high amount of iron (Jaturasitha et al., 2004). Presence of a large number of *Staphylococci*, and *S. aureus* as food poisoning microorganisms is considered as a good indicator for inadequate sanitation, less temperature control and the possible presence of enterotoxin producing strains of *S. aureus* (Zang, 2001).

A total of one- hundred random samples of local freshly slaughtered and frozen Japanese quail carcasses (n=50) were collected from different markets at Kalyobia. These samples were evaluated microbiologically. The mean values of Aerobic plate count in fresh and frozen quail were 9.8×10^5 and 9×10^4 cfu/g , respectively. The mean values of *Enterobacteriaceae* counts of fresh and frozen Quail were 1.71×10^5 and 4.55×10^4 , respectively. *Coliform* counts were varied from 2.6×10^2 to 6.1×10^4 with a mean value of $1.15 \times 10^4 \pm 1.87 \times 10^3$ cfu/g for fresh samples while for frozen quail samples varied from 10^2 to 5.4×10^3 with a mean value of $5.7 \times 10^3 \pm 1.45 \times 10^3$ cfu/g. Quail meat has to pass through frozen storage till it reaches to retailer. 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. 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.

Defects due to improper storage conditions lead to quality deterioration in meat quality, before reaching to retailer quail meat. If still it is not in planned manner, it may be due to delay in transportation and fluctuation in market rates, break in cold chain during transport or frozen storage. This deteriorated frozen meat fetches lower market prices than fresh meat. Generally, 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 meat during freeze - thaw cycle.

MATERIALS AND METHODS

40 Live broiler quails of 6 weeks old were collected from quail farm located at Pattoki, UVAS, which were slaughtered, dressed hygienically. Meat samples were collected and stored in polythene pouches after washing with clean water and kept in a chiller (at $4 \pm 1^\circ\text{C}$) or ageing, after which they packed in low density polyethylene pouches taking optimum care to avoid contamination and stored at $-18 \pm 2^\circ\text{C}$ for three months.

During this study physical properties and microbial quality of frozen storage quail meat samples were analyzed. The frozen meat samples ($-18 \pm 2^\circ\text{C}$) were removed from the freezer after every 15 days in first half and after 30 days in second half till 90 days, thawed at refrigeration temperature ($4 \pm 1^\circ\text{C}$)

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 $4 \pm 1^\circ \text{C}$ for 12 h. For the determination of ERV the procedure of (Sonale et al., 2014) was followed with slight modification. The microbiological quality (standard plate count, *E. coli*, Staphylococcal count, psychrophilic count and Salmonella spp.) was assessed as per (American Public Health Association APHA, 1992). Data obtained during the study were analyzed as per Genchev et al. (2008).

RESULTS AND DISCUSSION

Microbiological Quality

The various microbial counts of quail breast meat during frozen storage are depicted in Table 1. Standard plate count (SPC) of quail meat decreased gradually with increase in the storage period and found to be non significant at 0 and 15 days storage. Afterwards, the values for SPC declined significantly ($p < 0.05$). Similar declining trend was observed by (Biswas et al. 2006, Ziauddin et al. 1993). The decrease in SPC which might be due to sudden cold shock experienced by the bacteria especially at freezing temperature, tend 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 Venkatramanujam, 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 (Sureshkumar et al., 2003).

Pathogenic *E. coli* was isolated from 10% & 4% of the examined fresh and frozen quail meat samples, respectively. Public health importance of the isolated bacteria and possible sources of quail meat contamination were discussed (Schluntd et al. 2004). The microbiological safety and quality of poultry meat are equally important to producers, retailers and consumers, and both involve microbial contaminants on the processed product. Two quite different groups of microorganisms are relevant: on the one hand certain foodborne pathogens, as discussed below, and, on the other, organisms that are generally harmless to human health, but, being psychrotrophic, are able to multiply on the product during chill storage. Spoilage results mainly from 'off'-odour development, and product shelf-life is determined both by the number of spoilage organisms present initially and the temperature history of the product at all stages of production and subsequent storage and handling and quail meat can be safely stored in frozen state for 60 days without any deterioration (Sonale et al, 2014). For chill-stored poultry, (Doifode, 2007) demonstrated that virtually all the odorous substances found at spoilage could be attributed to microbial growth and metabolism. The Quail processing and production is not so common, but still it contributes a major part in the human diet. Recently Quail meat production is increasing worldwide, however there is a lack of data on microbial profile of quail meat. The largest

quail meat producers are Europe and USA. Its valuable taste and dietary properties are main factors in determining the growing interest of consumers (Genchev et al., 2008). Meat Contamination with microorganism like *Salmonella* and *Staphylococcus aureus* has always been a great challenge for meat industries as they are the most important cause of food borne diseases. There is an increasing concentration of meat producers to control these microbes by improving hygiene during slaughtering and by introduction of food safety systems (Tsola et al., 2008).

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.

Staphylococcal count of quail meat was also found to decline gradually during frozen storage of 90 days. 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 decrease in the count may be due to effect of freezing application ($-18 \pm 2^{\circ}\text{C}$) on bacteria that led to damage of the cell membrane and also due to DNA denaturation of bacterial cells causing death of the bacteria during freezing (Sonale et al., 2014; Pavlov, 2007).

Table 1. Microbiological quality of quail meat during frozen storage ($-18 \pm 2^{\circ}\text{C}$)

Days of storage	Microbial Counts ($\log_{10} \text{cfu/g}$) Mean \pm SE				
	SPC	<i>E. coli</i>	PC	SC	<i>Salmonella</i>
Zero	$5.17^a \pm 0.11$	$2.21^a \pm 0.10$	$3.01^a \pm 0.06$	$2.21^a \pm 0.11$	ND
15	$4.96^{ab} \pm 0.10$	$2.05^{ab} \pm 0.07$	$2.84^a \pm 0.03$	$2.08^{ab} \pm 0.09$	ND
30	$4.82^{bc} \pm 0.10$	$1.84^{bc} \pm 0.09$	$2.61^b \pm 0.06$	$1.85^{bc} \pm 0.07$	ND
60	$4.44^{cd} \pm 0.09$	$1.68^{cd} \pm 0.10$	$2.48^b \pm 0.07$	$1.64^{cd} \pm 0.07$	ND
90	$4.19^d \pm 0.15$	$1.48^d \pm 0.09$	$2.21^c \pm 0.10$	$1.41^d \pm 0.06$	ND

*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

A gradual decline in the psychrophilic count of quail meat samples was found with advancement of storage period at $18 \pm 2^{\circ}\text{C}$. On 60th and 90th day of freeze thaw cycle psychrophilic count differed significantly. However between day zero and

after 15th, thereafter between 30th and 60th day a non-significant decrease in the count was observed. The findings were found to be in agreement with (Kandeean 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 slight deterioration of meat might be due to increased enzymatic activities of psychrotrophs at low temperature.

Physical Properties

Data regarding the drip loss and extract release volume (ERV) of quail breast meat during frozen storage is presented in Table 2. Drip loss of quail breast meat increased significantly ($p<0.05$) with progress of frozen storage of 90 days. Similar results regarding increase in drip loss during frozen storage were observed by (Biswas et al., 2006) for buffalo meat, (Swami, 2011) for rabbit meat and (Doifode, 2007) for chevon.

This increase in drip loss might be due to several factors such as shortening of the sarcomere, water translocation and the degree of distortion of fat (Sonale et al., 2014), increased enzyme activity (Sonale et al., 2014) etc. While significant decline ($p<0.05$) was observed throughout the frozen storage period in the extract release volume (ERV) of quail meat. It might be due to be gradual progress in storage period. On zero day, ERV value was 28.30 ml, which decreased consistently up to 17.34 ml on 90th day of frozen storage. Cut off limit of ERV is 17 ml (Pearson, 1968), which is sign of indication for spoilage. Parallel findings concerning decline in ERV values were observed by (Doifode, 2007) for frozen chevon and (Swami, 2011) for frozen rabbit meat and (Jayesh and Venkatramanujam, 2002) for frozen mutton. It is concluded from the study that the quail meat can be stored safely up to 60 days at $-18 \pm 2^{\circ}\text{C}$ without affecting physical and microbial quality.

Table 2. Physical qualities of quail meat influenced by frozen storage ($-18\pm 2^{\circ}\text{C}$)

Days of Storage	Drip loss (%)	ERV (ml)
Zero	Zero	$28.34^a \pm 0.67$
15	$2.30^a \pm 0.07$	$26.34^b \pm 0.34$
30	$3.99^b \pm 0.07$	$23.68^c \pm 0.33$
60	$6.04^c \pm 0.12$	$20.68^d \pm 0.35$
90	$8.05^d \pm 0.21$	$17.34^e \pm 0.33$

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

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