# THE INFLUENCE OF MICROCLIMATE FACTORS ON THE QUALITY OF POULTRY MEAT STORED IN REFRIGERATION CONDITIONS

**Elena Surmei[1*], M.G. Usturoi[1]**

[1]*University of Agricultural Sciences and Veterinary Medicine Iasi, Romania*

**Abstract**

*In the paper are presented some results of a study, concerning the influence of the microclimate factors during storage of poultry meat, on some physical and microbiological indicators of quality. Investigations were made on broiler thighs and respectively breast, individually packed in polyethylene bags, divided into 3 differentiated batches by microclimate factors assured during the storage (Lc-1: +4°C and 95% U.R.; Lexp-1: +5°C and 85% U.R.; Lexp-2: +5°C and 70% U.R.). Duration of the experiment was 10 days during which time was made daily determination on pH and evolution of the total mesophilic aerobic plate count (NTGMA) and Enterobacter in the studied samples. Comparative analysis of pH value has indicated that the highest values were registered in case of group Lexp-2 (+5°C and 70% U.R.) both the breast (7.41) and thighs. Keeping meat samples at high temperatures has led to the multiplication of NTGMA and the Enterobacter. Thus, at the end of 10 days of storage, the considerable increase of NTGMA was registered in the batch Lexp-1 (+5°C and 85% U.R.) with 73.86% higher compared to fresh meat samples the pectoral musculature and with 67.63% in the thigh musculature.*

**Key words**: quality, poultry meat, pH value, NTGMA, Enterobacter, refrigeration

## INTRODUCTION

Poultry meat is in high demand by the general public, because they special in taste ease of preparation in various recipes, digestibility and high nutritional value.

Shelf-life of refrigerated fresh muscle food is determinate mainly by microbiological and physical qualities during storage and handling [2], [3].

The number of types of microorganisms capable of causing food spoilage is very large. However, depending on the initial microflora and the growth environment, only a few species *Pseudomonas* and *Enterobacter* are significantly represented in most spoilage microflora of chilled poultry meat [4].

## MATERIAL AND METHOD

Biological material was broiler thighs and respectively breast individually packed in polyethylene bags, divided into 3 differentiated batches by microclimate factors assured during the storage (tab. 1).

To realise the qualitative determinations, were gathered 3 samples from pectoral musculature respectively, 3 samples from thighs musculature; collected daily, at the same hour during a period of 10 days.

For measuring the meat pH value a pH-meter WTW Multi 350i was use with the successive immersion into a suspension formed by distilled water and triturate (aqueous extraction).

The microbiological index (total aerobic mesophilic germs plate count NTGMA and Enterobacter), was determinate using the method of series dilution [6].

*Corresponding author: elenasurmei@gmail.com
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Table 1 The microclimate factors assured during the storage

| Type of muscle | Batch | Storage period (days) | Temperature (°C) | Relative humidity (%) |
|---|---|---|---|---|
| Breast | Lc1 | 10 | +4 | 95 |
| | Lexp1 | | +5 | 85 |
| | Lexp2 | | +5 | 70 |
| Thighs | Lc1 | | +4 | 95 |
| | Lexp1 | | +5 | 85 |
| | Lexp4 | | +5 | 70 |

## RESULTS AND DISCUSSIONS

pH evolution for pectoral musculature showed increasing day by day under the influence of storage conditions assured, in the case of fresh samples of the 3 batches there was no difference between them. Average pH values were 6.00±0.01 in batch Lc-1, 5.99±0.01 in batch Lexp-1 and 6.01±0.01 in batch Lexp-2.

After 5 days of refrigerated storage we found significant difference between the batches Lc-1 vs. Lexp-2 and Lexp-1. Thus, at the end of investigations the pH values of meat samples reaches 7.19±0.05 for batch Lc-1, 7.38±0.05 in batch Lexp-1 and 7.41±0.05 for batch Lexp-2. In case of fresh samples gathered from the thighs, the average pH values was 6.02±0.03 in batch Lc-1, 6.03±0.04 in batch Lexp-1 and 6.02±0.03 at batch Lexp-2 and after 10 days of storage, 7.08±0.05 for batch Lc-1, 7.24±0.05 for batch Lexp-1 and 7.26±0.05 in batch Lexp-2. We observe that in the 2 type of muscles, the highest values of pH were registered in the case of batches Lexp-2 due to high temperature and humidity low in their storage environment (tab. 2).

Table 2 pH evolution of breast and thighs

| **Storage period (days)** | **Type of muscle** | **Batch** | $\overline{X} \pm s_{\overline{X}}$ | **V%** |
|---|---|---|---|---|
| 0 | Breast | Lc1 | 6,00±0,01 | 0,52 |
| | | Lexp1 | 5,99±0,01 | 0,46 |
| | | Lexp2 | 6,01±0,01 | 0,48 |
| | Thighs | Lc1 | 6,02±0,03 | 1,25 |
| | | Lexp1 | 6,03±0,04 | 1,39 |
| | | Lexp2 | 6,02±0,03 | 1,24 |
| 1 | Breast | Lc1 | 6,12±0,04 | 1,53 |
| | | Lexp1 | 6,21±0,05 | 1,72 |
| | | Lexp2 | 6,25±0,05 | 1,64 |
| | Thighs | Lc1 | 6,14±0,05 | 1,93 |
| | | Lexp1 | 6,19±0,04 | 1,54 |
| | | Lexp2 | 6,22±0,04 | 1,34 |
| 2 | Breast | Lc1 | 6,24±0,04 | 1,59 |
| | | Lexp1 | 6,32±0,04 | 1,37 |
| | | Lexp2 | 6,34±0,04 | 1,26 |
| | Thighs | Lc1 | 6,22±0,05 | 1,76 |
| | | Lexp1 | 6,31±0,04 | 1,40 |
| | | Lexp2 | 6,34±0,05 | 1,61 |
| 3 | Breast | Lc1 | 6,37±0,04 | 1,52 |
| | | Lexp1 | 6,49±0,05 | 1,65 |
| | | Lexp2 | 6,53±0,05 | 1,61 |
| | Thighs | Lc1 | 6,34±0,05 | 1,62 |
| | | Lexp1 | 6,45±0,04 | 1,47 |
| | | Lexp2 | 6,49±0,05 | 1,60 |

| | | | | |
|---|---|---|---|---|
| 4 | Breast | Lc1 | 6,45±0,05 | 1,75 |
| | | Lexp1 | 6,60±0,04 | 1,52 |
| | | Lexp2 | 6,65±0,05 | 1,72 |
| | Thighs | Lc1 | 6,44±0,04 | 1,45 |
| | | Lexp1 | 6,57±0,06 | 1,89 |
| | | Lexp2 | 6,60±0,06 | 2,16 |
| 5 | Breast | Lc1 | 6,53±0,07 | 2,33 |
| | | Lexp1 | 6,78±0,05 | 1,78 |
| | | Lexp2 | 6,81±0,06 | 2,07 |
| | Thighs | Lc1 | 6,60±0,05 | 1,53 |
| | | Lexp1 | 6,71±0,05 | 1,75 |
| | | Lexp2 | 6,74±0,05 | 1,71 |
| 6 | Breast | Lc1 | 6,77±0,05 | 1,56 |
| | | Lexp1 | 6,92±0,04 | 1,32 |
| | | Lexp2 | 6,95±0,04 | 1,33 |
| | Thighs | Lc1 | 6,72±0,06 | 1,87 |
| | | Lexp1 | 6,83±0,05 | 1,50 |
| | | Lexp2 | 6,86±0,05 | 1,52 |
| 7 | Breast | Lc1 | 6,90±0,05 | 1,61 |
| | | Lexp1 | 7,11±0,05 | 1,70 |
| | | Lexp2 | 7,14±0,05 | 1,63 |
| | Thighs | Lc1 | 6,87±0,05 | 1,60 |
| | | Lexp1 | 6,99±0,04 | 1,32 |
| | | Lexp2 | 7,04±0,05 | 1,71 |
| 8 | Breast | Lc1 | 7,08±0,05 | 1,74 |
| | | Lexp1 | 7,26±0,04 | 1,37 |
| | | Lexp2 | 7,30±0,04 | 1,32 |
| | Thighs | Lc1 | 6,95±0,06 | 2,00 |
| | | Lexp1 | 7,12±0,05 | 1,64 |
| | | Lexp2 | 7,14±0,06 | 1,81 |
| 9 | Breast | Lc1 | 7,19±0,05 | 1,46 |
| | | Lexp1 | 7,38±0,05 | 1,40 |
| | | Lexp2 | 7,41±0,05 | 1,49 |
| | Thighs | Lc1 | 7,08±0,05 | 1,46 |
| | | Lexp1 | 7,24±0,05 | 1,49 |
| | | Lexp2 | 7,26±0,05 | 1,42 |

Total mesophylic aerobic plate count (NTGMA). Another indicator which reveals freshness of chilled meat is represented by the total mesophylic aerobic plate count. The evolution of this indicator depends on the interaction of several factors, the most important being temperature and relative humidity of storage space.

At the beginning of storage samples for pectoral musculature the average values is 5.21 lg CFU/cm$^2$ for batch Lc-1, 5.28 lg CFU/cm$^2$ for batch Lexp-1, and 5.25 lg CFU/cm$^2$ for batch Lexp-2 reaching at the end of 10 days of storage an average values of 8.58 lg CFU/cm$^2$ for batch Lc-1, 9.18 lg CFU/cm$^2$ for batch Lexp-1 and 9.09 lg CFU/cm$^2$ for batch Lexp-2.

Our data could be consider normal, if we have in view the fact in similar experimental conditions, [1] have identified a total mesophylic aerobic plate count on the surface of pectoral musculature with limits of variation between 5.1 lg CFU/cm$^2$ (0 day) and 8.78 lg CFU/cm$^2$ after 11 days of storage under refrigeration conditions (+4°C and 95% U.R).

The initial load of mesophylic germs from the thighs presented the average value of 5.42 lg CFU/cm$^2$ in the case of batch Lc-1, the 5.53 lg CFU/cm2 for batch Lexp-1, respectively 5.49 lg CFU/cm$^2$ in case of Lexp-2. After 10 days of storage, the samples were registered mean values of 8.52 lg CFU/cm$^2$ in batch Lc-1, 9.27 lg CFU/cm$^2$ in batch Lexp-1 and of 9.12 lg CFU/cm$^2$ for batch Lexp-2.

We observe both in the case of breast as well thighs the greatest values of NTGMA were registered on batch Lepx-1 (+5°C and 85% U.R.) due to high temperature and humidity of storage.

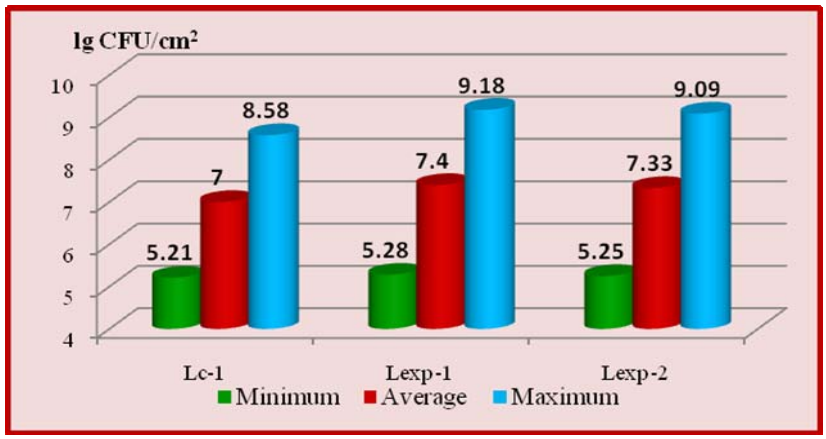


Fig. 1 Graphical representation of the minimum, average and maximum surface NTGMA the pectoral muscle

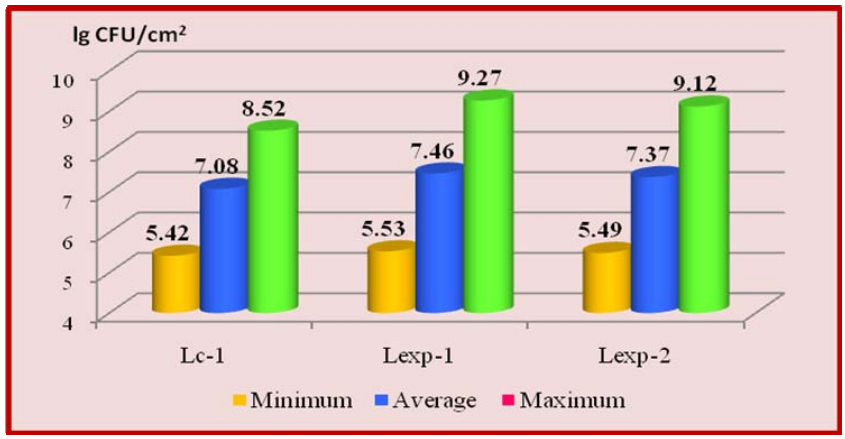


Fig. 2 Graphical representation of the minimum, average and maximum NTGMA on the surface of thigh muscle

Total number of bacteria Enterobacter had an ascending line both in the case of pectoral as well thighs musculature [8], [5] identified on poultry meat stored under refrigeration conditions a total number of bacteria Enterobacter in the range of 2-7.5 lg CFU/cm2 from the first day by on day 8, respectively on 10 day of storage.

The fresh samples meat gathered from pectoral musculature were registered average values 3.75 lg CFU/cm$^2$ for batch Lc-1, of 3.79 lg CFU/cm$^2$ for batch Lexp-1 and 3.74 lg CFU/cm$^2$ for batch Lexp-2, and at the end of investigations we achieve mean value of 7.37 lg CFU/cm$^2$ at batch Lc-1, 8.12 lg CFU/cm$^2$ at batch Lexp-1 and 8.04 lg CFU/cm$^2$ for batch Lexp-2.

Also, the meat samples gathered from thigh muscle were registered initial average value of 3.78 lg CFU/cm$^2$ for batch Lc-1, 3.99 lg CFU/cm$^2$ for batch Lexp-1, respectively 3.89 lg CFU/cm$^2$ for batch Lexp-2. After, the storage period (10 days) these values reached on levels of 7.42 lg CFU/cm$^2$

for batch Lc-1, 8.21 lg CFU/cm$^2$ for batch Lexp-1 and 8.07 lg CFU/cm$^2$ in case of batch Lexp-2.

Similary the total mesophylic aerobic plate count, highest values were registered in the case of samples meat within the batch Lexp-1 being favoured by hight temperature and relative humidity (fig. 3, 4).

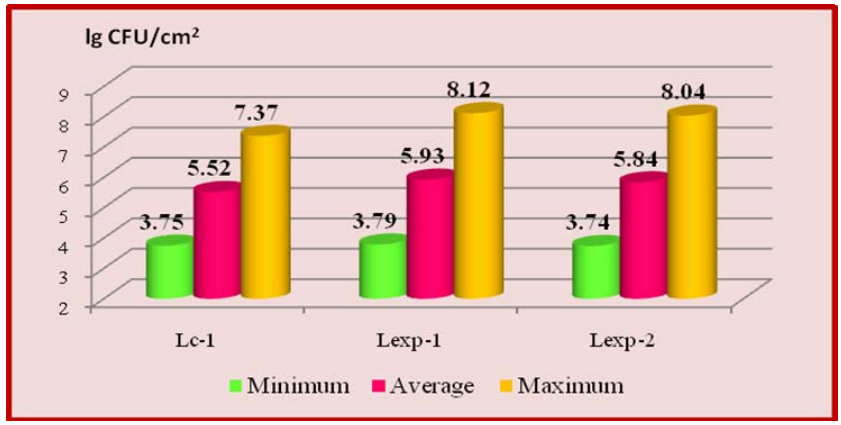


Fig. 3 Graphical representation of the minimum, average and maximum Enterobacter bacteria on the surface of pectoral muscles

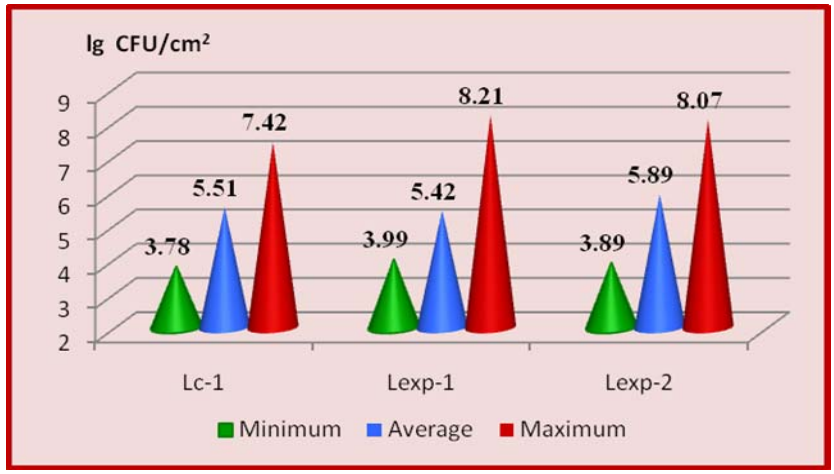


Fig. 4 Graphical representation of the minimum, average and maximum Enterobacter bacteria on the surface of thigh muscle

## CONCLUSIONS

The meat suffers severe changes qualitative point of view, on a longer period of time, during storage, one of them being high acidity. This growth is the result of accumulation of amines and ammonia by the psihrofile bacteria [7]. Following the 10 days of storage in case of pectoral musculature studied the pH values increased at the end of 10 days storage with 19.83% in batch Lc-1, 23.20% in batch Lexp-1 and 23.29% in batch Lexp-2 from baseline. In the case of thigh musculature this value increased by 17.60% at batch Lc-1, 20.06% at batch Lexp-1 and 20.59% for batch Lexp-2 compared to initial registered.

Highest value of total mesophylic aerobic plate count batch in the case of pectoral as well thighs musculature was registered in case of batch Lexp-1 with 73.85% greater compared with fresh meat in case of pectoral musculature, and with 67.63% in case of thighs musculature.

The most outstanding values were registered for the experimental batch Lexp-1 in terms of total number of *Enterobacter bacateries* for pectoral musculature (8.12) and thighs musculature (8.21).

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