

# CONSIDERATIONS REGARDING QUALITY OF POULTRY MEAT STORED IN REFRIGERATION CONDITIONS

Elena Surmei<sup>1\*</sup>, M.G. Usturoi<sup>1</sup>

<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

## Abstract

Storage of the meat in refrigeration state induces some modifications, and their intensity is influenced by the time period and by the level of assured physical factors. In the paper are presented evolution of quantitative parameters of refrigerated poultry during storage period. Investigations were made on chicken broiler carcasses, with an average corporal mass of 1657.04 g, packed in polyethylene bags and stored for 6 days in refrigeration conditions (temperature of +2.87 °C and air moisture of 56.3%). From each carcass were gathered samples from the pectoral and thighs musculature, on which were effectuated the chemical and physical appreciations. The obtained results show the fact that unlike the vales specific for fresh meat the ones determinate in the 6<sup>th</sup> day of storage were lower with 3.8% for water and higher with 3.8% for dry matter. Water losses in content determinate a concentration on components per volume unit (100g meat) concreted in decreasing with 0.3% of protein content and with 1.2% of fat content. Evolution of meat pH value was normal, the recorded levels being of 6.05 at fresh meat and of 6.7 at the one stored for 6 days. The conclusion of the study is that qualitative modifications were due to the low level which was assured for air moisture.

**Key words:** meat, poultry, refrigeration, quality, chemical composition

## INTRODUCTION

Consumers appreciate more and more refrigerated poultry meat, both for its superior nutritive value and also for the fact that fulfil the characteristics of safety and hygienic foodstuff [4].

Appreciation of freshness state of poultry meat is based, mainly, on its sensorial attributes, but more on the level of physical-chemical indicators which define meat quality [1].

In poultry case we can discuss about a "white" meat (pectoral musculature) and about a "red" meat (the rest of musculature), between them appear differences of anatomic-histological order, but especially from the chemical composition point of view [6].

## MATERIAL AND METHODS

Biological material was represented by carcasses of broiler chickens, with a mean average of 1657.04 g, packed under vacuum, in polyethylene bags, sealed with aluminium clips.

Storage of the carcasses, which were in the original package, was realised on a 6 day period of time, in refrigeration conditions, at an average temperature of +2.87 °C and a air relative moisture content of 56.3%.

To realise the qualitative determinations, from each carcass were gathered 3 samples from pectoral musculature and 3 samples from thighs musculature (semimembranosus muscle); samples' gathering being made daily at the same hour.

Just after gathering samples were analysed to establish the gross chemical composition (water content, proteins and fats); determinations were made with spectrophotometer Food Check, which used the characteristics of infrared absorbency of the samples' spectres.

Determination of moisture content from the gathered samples was realised through drying method (with a RAYPA-DOD 50 type oven), and ash content through calcinations method using an oven model SUPER THERM C311.

For measuring the meat pH value was use a pH-meter Hanna Instruments 98240, practiced the method of successive immersion into a suspension formed by distilled water and triturate (aqueous extract).

\*Corresponding author: elenasurmei@gmail.com  
The manuscript was received: 18.04.2012  
Accepted for publication: 25.06.2012

**RESULTS AND DISCUSSIONS**

**Meat pH value**

Acidity is one of the most important indicators for appreciation of meat quality.

At the moment of bird slaughtering, acidity of the muscles is around 7.0-7.1, and after that decrease function of the glycogen reserves existed in muscles.

In according with the data from literature meat is considered to have a very good quality at a pH of 6.2; when pH value is higher than 6.7 meat became uneatable.

Mean acidity of the studied samples fluctuated between a minimum value of 6.05 – at fresh meat and 6.7 – at the one stored for six days (fig. 1).

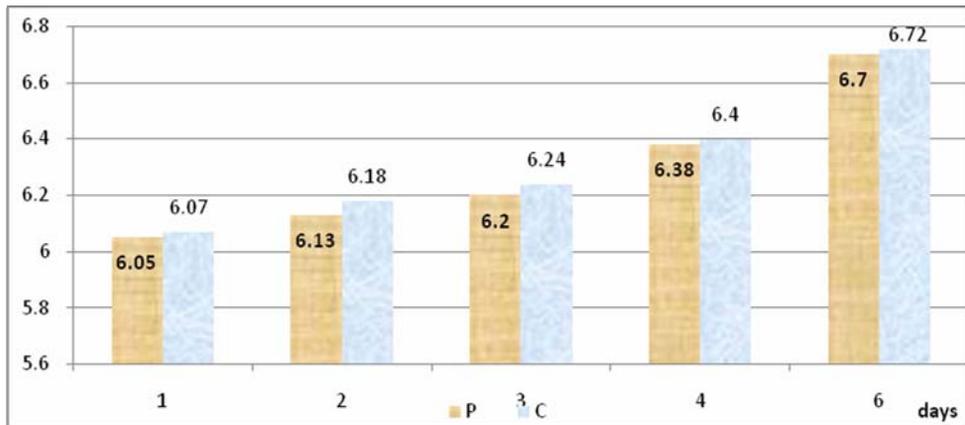


Fig. 1 Variation of pH value for poultry refrigerated meat (P – pectoral musculature; C – thighs musculature)

In the case of pectoral musculature, pH value increased from 6.05 (at 24 hours after slaughtering), to 6.72 (in the 6<sup>th</sup> day of storage). Initially, this increase of pH was due to the proteolysis realised by the own enzymes, and after that also contributes the activity of alteration microorganisms [2].

Also in the case of thighs musculature were recorded an increase of acidity from 6.07 as it was in the first day up to 6.75 in the 6<sup>th</sup> day of storage.

The fact that pH value of thighs musculature was higher than the one of pectoral muscles, must be attributed to the different biochemical character of the two types of muscles: red muscular fibres have relatively small reserves of glycogen, fact which show a relatively low activity of glycogen enzymes [8].

**Chemical composition**

Protein content. Trophic-biological value of meat is given by its content in proteins substances but, especially, by the protein quality, respectively by the existed proportions between essential and non-essential amino acids [5].

Poultry meat has the protein content between 16.8% (thighs musculature) and 20.4% (breast musculature) [3].

In the case of gathered samples from pectoral musculature, proteins recorded a level of 22.1%, at fresh meat and of 21.8%, at the one stored for 6 days, with a mean of 21.9±0.06%.

The effectuated analysis on meat gathered from thighs muscles enlightened a protein content between 21.1% (at fresh meat) and 20.1% (determinate in the last day of storage), resulting an average value of 20.64±0.18% (fig. 2).

Regarding the evolution of protein content from the studied meat, its storage in refrigeration state for 6 days determine the diminishing with 0.3%, in the case of pectoral musculature, respectively with 1% in the one from thighs level.

Our data could be consider normal, if we have in view the fact that in similar experimental conditions, Kristine Ramane and Ruta Galoburda (2008) found differences of 2.5% between the protein content of thighs and breast musculature.

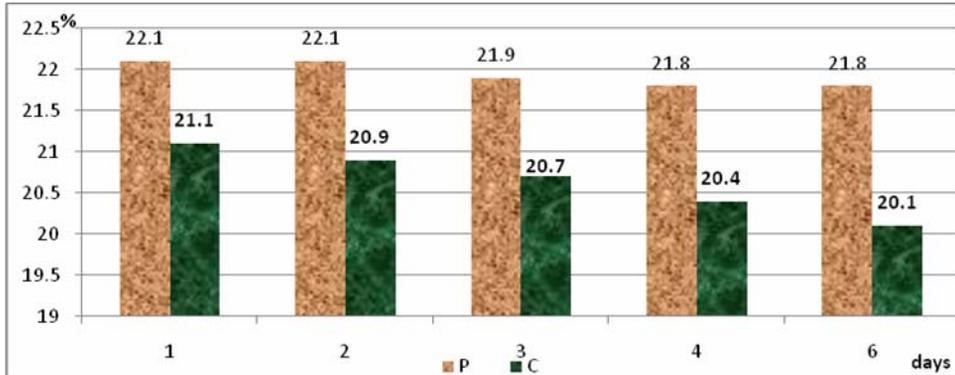


Fig. 2 Content in proteins of refrigerated poultry meat (P – pectoral musculature; C – thighs musculature)

**Content in lipids.** This chemical component of meat presented the highest variation amplitude between the studied muscles.

So, if the minimal value was founded in pectoral muscles ( $1.84 \pm 0.022\%$ ), the maximal one was recorded at the muscles from thighs ( $6.52 \pm 0.30\%$ ). These difference was noticed also visual, when samples were

gathered, when was enlightened both inner-muscular fat and also the fat deposits from the level of gathering area (especially at thighs muscles).

As regarding the lipids content at the level of pectoral muscles was observed an increasing tendency starting with day one of storage ( $1.2\%$ ) up to day 6 ( $2.4\%$ ) (fig. 3).

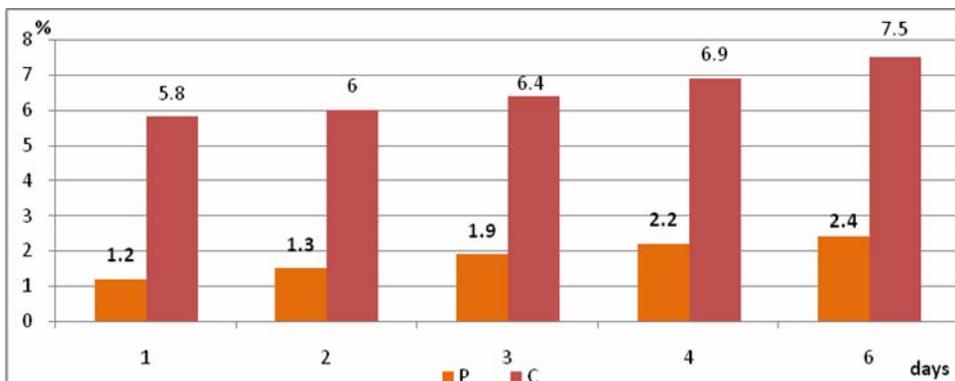


Fig. 3 Content in lipids of refrigerated poultry meat (P – pectoral musculature; C – thighs musculature)

Referring at the proportion of lipids determine in thighs muscles, this one recorded values of around 3 times higher than the one in pectoral muscles; the increase of lipid content in adipose and muscular tissues is strong connected with water content decrease [9]. During storage of meat in refrigerated state, water content decrease, leading to the increase of lipids content [10]. As a general view, water content from the analysed meat samples varied between  $71.68 \pm 0.20\%$  (thighs musculature) and

$72.93 \pm 0.20\%$  (pectoral musculature), values close to the ones mentioned in the literature for broiler chicken ( $72.1\%$ ), (tab. 1).

Regarding the dry mater content in the studied muscles was determining a variation interval between limits of  $27.07 \pm 0.30\%$  (pectoral musculature) and  $28.32 \pm 0.20\%$  (thighs musculature). Difference of  $1.25\%$  could be explained that the fat content in thighs muscles is higher face to the one determine at the pectoral muscles.

Table 1 Chemical composition of refrigerated poultry meat

Studied muscles/ effectuated determinations (%)		Statistical estimators			
		$\bar{X} \pm s_{\bar{x}}$	V%	Minim (%)	Maxim (%)
Pectoral muscle	Water	72.93±0.20	6.40	65.54	77.79
	DM	27.07±0.30	17.26	22.2	34.45
	Proteins	21.98±0.05	0.59	21.8	22.1
	Lipids	1.78±0.22	27.63	1.2	2.4
Semimembranosus muscle	Water	71.68±0.20	1.04	70.29	72.60
	DM	28.32±0.20	2.65	27.40	27.71
	Proteins	20.7±0.18	1.96	20.1	21.1
	Lipids	6.36±0.29	10.22	5.6	7.2

Protein content recorded variations between 20.7±0.18 (thighs musculature) and 21.98±0.05 (pectoral musculature), due to the in-homogeneity of meat chemical composition (breast have a higher content in proteins).

Content in lipids of thighs musculature was with 4.58% higher face to the value obtained for pectoral muscles.

## CONCLUSIONS

Study of evolution of qualitative parameters of poultry meat stored in refrigeration conditions enlightened the following aspects:

1. the highest increase of pH value during storage in refrigeration regime was observed at thighs musculature (with 0.68% higher face to fresh meat), due to an intense proteolyse activity, in comparison with the situation at pectoral musculature level;

2. at the end of storage in refrigerated state, proteins content at the level of pectoral muscles was with 1.3% higher than the one from thighs muscles;

3. content in lipids establish for thighs musculature was with 4.68% higher face to the one at pectoral level, this one increasing with around 0.34% per day.

## RECOMMENDATIONS

To maintain the initial quality of poultry meat stored in refrigeration conditions, we recommend to be used specific temperatures for this type of storage (0-4°C), but especially assuring of a higher air moisture, of 85-95%.

In this way, is preventing the lost of water contented in meat and implicit of a part of nutritive substances.

## ACKNOWLEDGEMENTS

This study was supported by funds provided by state contract POSDRU-CPP107-DMI1/5/S/77222.

## REFERENCES

- [1] Balamatsia, C.C., E.K. Paleologos, M.G. Kontominas and I.N. Savvaids: Correlation between microbial flora, sensory changes and biogenic amines formation in fresh chicken meat stored aerobically or under modified atmosphere packaging at 4°C: possible role of biogenic amines as spoilage indicators. *Antonie van Leeuwenhoek* 2006, DOI 10.1007/10482-005-9003-4.
- [2] Bauliane, M. and A.J. King: Meat colour and biochemical characteristics of unacceptable dark-coloured broiler chicken carcasses. *J. Food Science* 1998, 63(5):759-762.
- [3] Holman A., Vadjnal R., Zledner B., Stibilj V. Chemical composition of chicken meat from free range and extensive indoor rearing. *Arch. Geflugelkd* 2003, 67(3): 120-124.
- [4] Hui Y.H., Nip W.K., Rogers R.W., Young O.A.: *Meat Science and Applications*, Marcel Dekker Inc., New York, 2001.p.351-357.
- [5] Hucl, J., Suchy, P., Jelinek, E., Strakova: Chemical composition of muscle of hybrid broiler chickens during prolonged feeding. *Czech. J. Anim. Science* 2002, 47(12):51-5181.
- [6] Jimenez, S.M., M.S. Salsi, M.C., Tiburzi, R.C. Rafaghelli and M.E. Pirovani: Combined use of acetic treatment and modified atmosphere packaging for extending the shelf-life of chilled chicken breast portion. *Journal of Applied Microbiology* 1999, 87, pp. 339-344.
- [7] Kristine Ramane, Ruta Galoburda: Changes in quality of parents stock hens meat during chilled storage. *Food Science* 2008.
- [8] Qiao M., Fletcher D.L., Nortchcutt J.K.: The effect of broiler breast meat colour and pH, moisture, water-capacity, and emulsification capacity. *Poultry Science* 2001, 80, pp.676-680.
- [9] Warris P.: *Meat Science*, CAB Publishing, 2000, pp. 310.
- [10] Varnam A.H., Sutherland J.P.: *Meat and Meat Products: Technology, Chemistry and Microbiology*, Springer, UK, 1995, pp.430.