STUDY ON THE EVOLUTION OF MYOGLOBIN COMPOUNDS AFTER SLAUGHTER

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Abstract
The evolution of the molecular system involved in the color of the meat during the muscle rigor and agening was analyzed comparative in different kind of muscles from pork and beef meat collected from animals of different ages and species. This work hints to study the influence of some agents on pigments content in meat, during the muscle rigor and ageing. Along this paper hinted to prove the importance of some parameters such as: the species, the age and the type of muscle and the color of the meat. For study it has been used meat of two species (porcines and bovines) and tree types of muscle (trapez cervical, obliquus extern and longissimus dorsi). To highlight the influence of the age and the breed of the animal on the color of its meat, the pigments concentration was calculated. It has been determined that the full aged bovines'meat tissue has an increased content of pigments.

Keywords: colour meat, myoglobine compounds, rigor muscle

1. INTRODUCTION

Color is the single most important factor of meat products that influences consumer buying decision and affects their perception of the freshness of the product. Knowing the factors that affect color is important to understanding problems when they occur.
The color of the meat depends on its chemical structure, on its myoglobin's (Mb) contained and on Mb's chemical state.(Fig. 1) [1]
The structure of the muscle together with its pH influence the absorption and the incidental light diffusion, that is a more intense color. Some of the changes are due to the rate of myoglobin oxygenation. The changes in pH affect the charge on the proteins making up the muscle. Changes in protein charges alter the spacing between the fibres of the meat, and this affects how light is reflected and absorbed, and thus affects the visual appearance.
Color intensity is affected by many factors with most being related to the mount of myoglobin: species, muscle location and function, age, nutrition.[2]
The colour stability is also dependent on the metabolic type, as the metmyoglobin's forming from myoglobin depends on: the oxygen diffusion speed and its consumption, the myoglobin's self-oxidation in O_2 presence, the already made metmyoglobin can be party lower down to myoglobin enzyme.[3]
Increased time from slaughter results in reduced color stability because co-factors necessary for the reduction of metmyoglobin are depleted as postmortem time increases.[4] Products made with frozen meat will be darker initially and will not maintain the fresh color for as long as products made from meat which has never been frozen.[5] The particular shinning of the colour of the meat is given by: the bleeding way which influences the quantity of haemoglobin in blood, the freshness of section, the rapport between the muscle and the fat tissues and the rapport between the quantity of pigments in their lowered state and their oxidized one. [6, 7]

2. MATERIAL AND METHODS

For study it has been used meat of two species: porcines and bovines. Within the same species it has been taken samples from different age animals and also samples of different muscle. It has been used meat of tree types of muscle (*trapez cervical, obliquus extern, longissimus dorsi*). The samples were from the pork and beef semi-carcasses 1 hour after slaughtering. After then they were kept in refrigeration condition (at 0-4^{o}C).

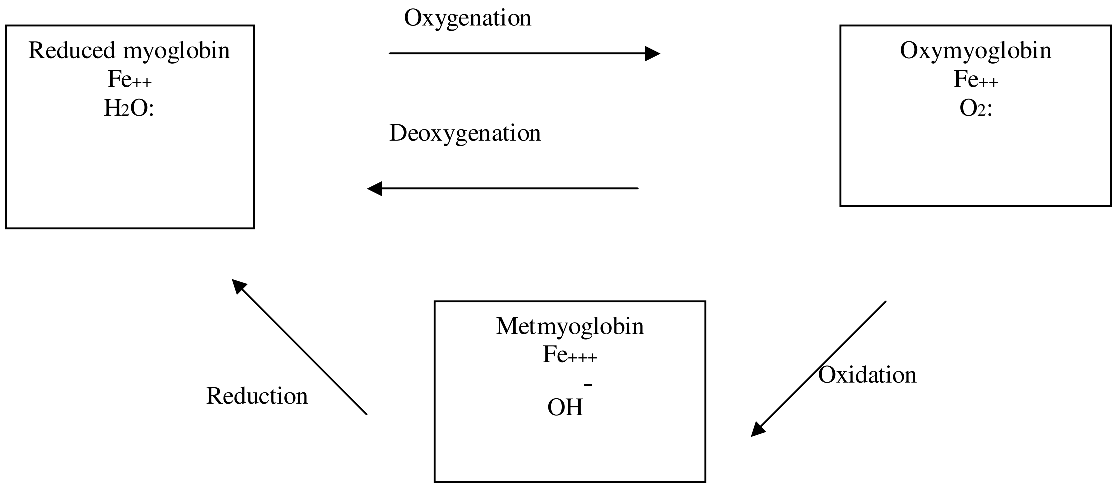

Figure 1 Chemical state of myoglobine

In order to determine the pigment concentration in meat, the spectrophotometric analysis of watery meat sample to the method of Braunard. [8]

The relative proportions of oxymyoglobin (MbO2), metmyoglobin(MMb) and myoglobin(Mb) can be determined through the measurement of optical densities of the isobestic points from the variations curbs of extinction milimolar coefficient (E_{mM}), for pure solutions of mioglobin, oximioglobina and metmyoglobin depending of the wavelength.

It was found out that mioglobin and oxymyoglobin have the same coefficient E_{mM} at the wavelenghth 507, 527, 535, 573 and 593 µm ; oxymyoglobin and metmyoglobin have the same coefficient E_{mM} at 442, 523 and 404 µm; myoglobin and metmyoglobin have the same coefficient E_{mM} at 442, 523 and 404 µm.

The percentage of metmyoglobin (% MMb) and myoglobin (%Mb) is determined from the binary diagram Broumand. The oxymyoglobin proportion (%MbO2) can be calculated from the relation:

$$\%MbO2=100 – (\% MMb + \%Mb)$$

Table 1. The total pigments concentration

Pars sacrofemoralis cow	18,2 mg/g
Pars sacrofemoralis calf	7,6 mg/g
Pars sacrofemoralis swine	4,3 mg/g

It has been determined that the full-aged cattles'muscle tissue has an increased content of pigments (18,2 mg/g).

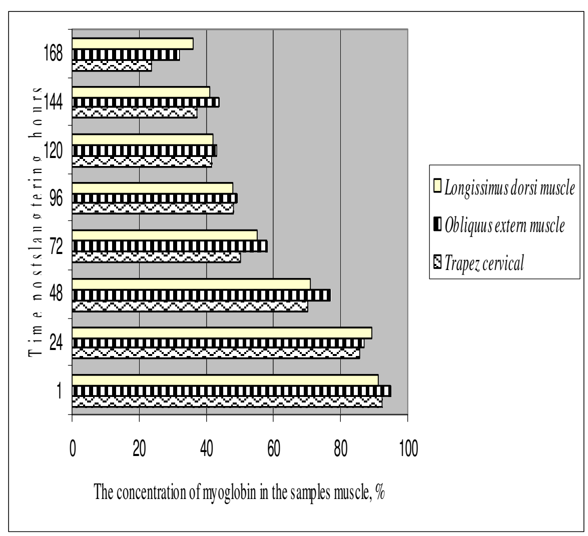

Figure 2 – The evolution of the myoglobin concentration in the samples muscle after slaughtering

The meat of full-aged bovines, having the muscle fibre rich in sarcoplasm, is of an intense red colour. The meat of young bovines, having the muscle fibre rich in miofibrils, is of a light red to pink colour as the pigments content is of (7,6 mg/g).

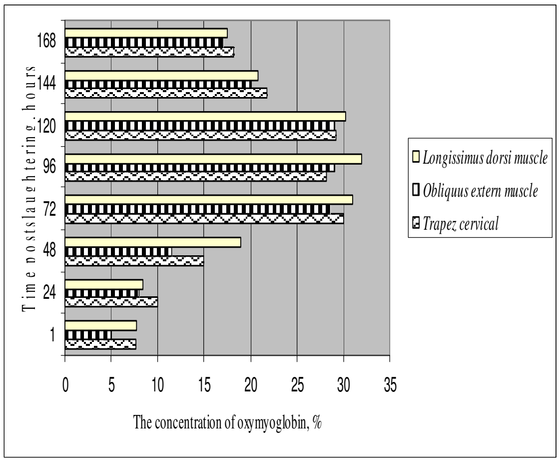

Figure 3 - The evolution of the oxymyoglobin concentration in the samples muscle after slaughtering

The experiments proved that the total pigments content in bovines'meat is richer than in porcines'meat.

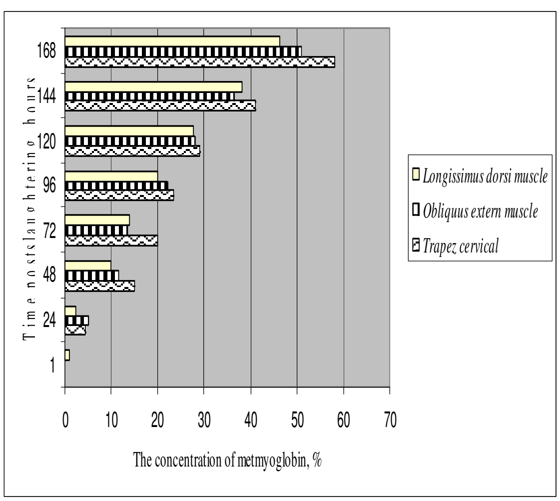

Figure 4 – The evolution of the metmyoglobin concentration in the samples muscle after slaughtering

In figures 2, 3, 4 is to be noted the evolution of the pigments'concentration of myoglobin regarding different types of muscle postslaughtering: *trapez cervical, obliquus extern, longissimus dorsi.*

The results prove a going down of a myoglobin's concentration once oxymyoglobine and metmyoglobine are formated. At 72 hours after slaughter, the content of oxymyoglobine at the three types of muscles recorder a going down owing to its change into metmyoglobine. Sensory the variations of myoglobin components determined in the first 72 hours post slaughter, the mentaining of the lit red colour.

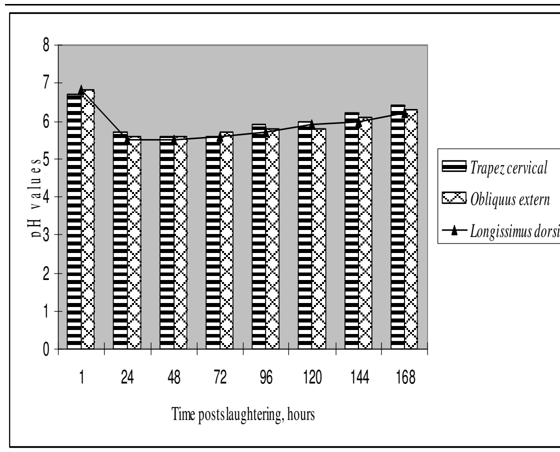

Figure 5 The evolution of the pH values during in the post slaughtering time

Consequently, in the former 72 hours post slaughtering the color of the meat remains of an intense red but after 144 hours, owing to the increase of metmyoglobine percentage the colour becomes darker for the muscles (*trapez cervical, obliquus extern)* and brown red for muscle *longissimus dorsi.* The variation of the pigments' concentration is related to pH changing and the values can be noticed in the fig. 5. The depreciation of sensorial quality of meat, expressed through colour, appears after a 144 hours interval after the slaughter in the case of keeping in refrigeration conditions, when the pH decreases.

3. CONCLUSIONS

Higher pH gives a darker red colour to the meat, white a lower pH gives a ligher red colour to it. Together with the animals'advancing in age the pigments' content get bigger so their meat's color is of a more intense red.

The metabolic type influences the concentration of myoglobine: the neck muscle (*trapez cervical)* and the visceral muscle *(obliquus extern)* are darken in colour than under lumbars ones (*longissimus dorsi).*

Each species is identified by different levels of light pigments.

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