

RESEARCH ON THE IMPLICATIONS OF AGE AT SLAUGHTER ON THE CHEMICAL COMPOSITION OF MEAT FROM CATTLE RAISED IN FAMILY FARMS

Ancuța Elena Coșuleanu, Roxana Lazăr, P.C. Boișteanu

Universitatea de Științe Agricole și Medicină Veterinară „Ion Ionescu de la Brad” Iași
e-mail : cosuleanu_ancuta@yahoo.com

Abstract

The purpose of this study is to analyze the chemical composition of the major muscle groups in correlation with the age of cattle at slaughter. The conducted researches are part of a study program on the quality of cattle meat according to the physiological status before slaughter. We have analyzed meat samples collected from cattle raised in family farms to determine the chemical composition (content of protein, fat, water and collagen) and assess its quality. The values of protein content from longissimus dorsi muscle ranged from 21.9% at 6 months and 21% at the age of 10 years. In semitendinos muscle the fat content has an upward trend, from a rate of 1.2% at the slaughter made at 6 months and 3% at the age of 10 years. The percentage of water in the intercostal muscles ranged from 66.9% to 75.5%, and the content in collagen from the neck muscles varied between 19.8% and 20.3%. The value analysis of the obtained chemical parameters shows the major influence of age on them, the protein and water content decreased with the increasing of animal age, and the fat had an upward trend.

Key words: cattle, slaughter age, chemical composition of meat

INTRODUCTION

Bovine meat quality assessment is a process that includes the determination of chemical parameters that underlay the nutritional value of this essential aliment [3]. The commercial evaluation of bovine production meat is under the influence of quantitative criteria (weight) and qualitative related on the carcass composition and muscle characteristics [1].

Because meat is a staple food in human nutrition its quality is an important issue for both consumers and processors.

The gross chemical composition of meat has a considerable impact on its quality because it determines the features that are valued by consumers (tenderness, succulence, and flavor) [2].

There were taken samples to determine the chemical parameters of cattle meat, depending on the age at which the slaughter was done, in order to assess the moment at which the meat has optimal characteristics for human consumption.

MATERIAL AND METHODS

The biological material was represented by 6 cattle, clinically healthy, half breed of

local race, slaughtered at the ages of 6 months, 2, 4, 6, 8, 10 years, raised in household systems in Moldova, therefore it couldn't be provided the racial homogeneity, this being not important for the last link in the commercialization chain of cattle meat, namely the normal consumer who doesn't know whether the meat comes from a specialized meat breed or not. Age was the only factor analyzed because in the case of this animals there were respected the same conditions in the flow of the applied slaughter technique and the feeding regime could not be detailed with precision.

To determine the effect of age at slaughter on the chemical composition there were taken samples of meat from the main muscles (longissimus dorsi, semitendinosus, neck and intercostals muscles), the tests were performed on matured meat preserved by freezing.

The qualitative assessment was performed with the automated analyzer Food - Check.

In terms of composition it was studied the content in protein, fat, water and collagen.

RESULTS AND DISCUSSION

Meat quality is determined by its digestibility and nutritional value that are reflected in its chemical composition. Meat is a very important source of protein, representing the item most balanced from human nutrition.

The protein content from longissimus dorsi muscle (table 1) is around the average value of 21.5%, ranging from 21.9% in the individual sacrificed at 6 months and 21% at 10 years. It has been observed that the

proportion of muscle proteins decreased with the increasing of animal age.

Table 1
Changes in the chemical composition of longissimus dorsi muscle

Age at slaughter	Protein (%)	Collagen (%)	Fat (%)	Water (%)
6 months	21.9	20.2	1.8	76.1
2 years	21.8	19.7	3.3	74.6
4 years	21.5	19.8	3.5	74.6
6 years	21.5	19.7	3.6	74.3
8 years	21.3	19.7	4.4	73.9
10 years	21.0	19.3	5.5	72.9

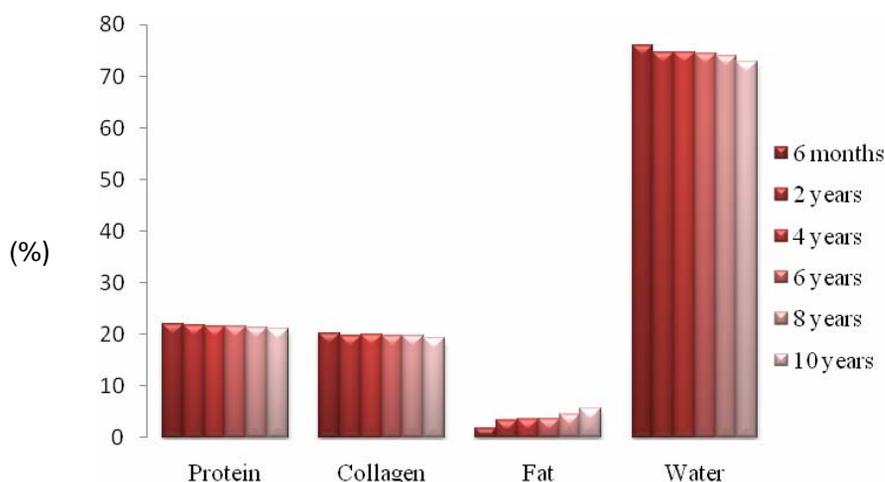


Fig. 1. The chemical composition of longissimus dorsi muscle

The collagen content has recorded a minimum of 19.3% at the subject slaughtered at 10 years and a maximum of 20.2% at 6 months. In the case of the individual's slaughtered at 2, 6 and 8 years it has been obtained the same value (19.7%).

The values determined for the fat content showed an upward trend, varying between high limits around the average of 3.68% (Fig. 1).

In accordance with the presented parameter values was found and the percentage of water which varied between 76.1% (6 months) and 72.9% (10 years).

In the muscle semitendinosus the content of protein has presented a downward trend in relation to animal age

at slaughter, except the subject of 8 years, which had a value of 21.7% (table 2).

Table 2
Changes in the chemical composition of semitendinosus muscle

Age at slaughter	Protein (%)	Collagen (%)	Fat (%)	Water (%)
6 months	22.1	20.4	1.2	76.6
2 years	21.8	20.2	2.4	75.5
4 years	21.6	19.7	3.1	75.0
6 years	21.6	20.2	2.6	75.6
8 years	21.7	20.1	3.0	75.1
10 years	21.6	20.0	3.0	75.1

The collagen had an average value of 20.10%, being obtained a percentage of 20% at age of 10 years and 19.7% at 4 years.

The percentage of fat increases generally, being observed a substantial

increase from the age of 6 months (1.2%) to 4 years (3.1%), in the rest periods the

content increased but without consistently differences (Fig. 2).

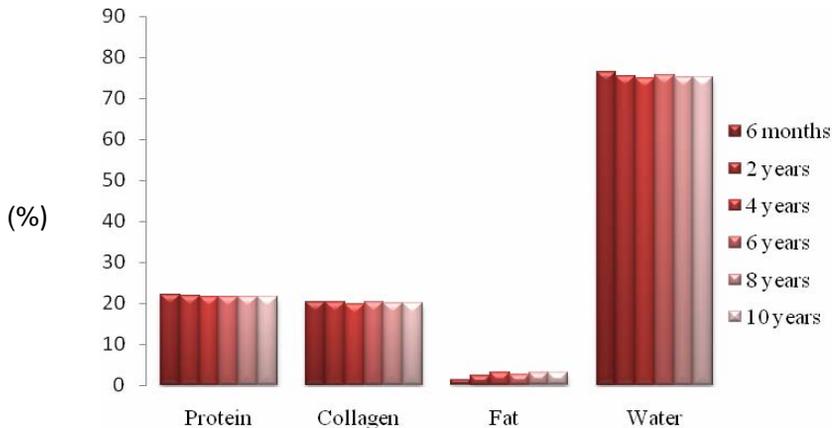


Fig. 2. The chemical composition of semitendinosus muscle

The water content decreased, with exceptions that may be due to race, nutrition, since these animals were reared in household systems.

At the neck muscles it has been observed that the proportion of proteins decreased with the increasing age of the animal, but the recorded differences are of the decimals order, the average value being 21.66% (Table 3).

Table 3
Changes in the chemical composition of neck muscles

Age at slaughter	Protein (%)	Collagen (%)	Fat (%)	Water (%)
6 months	21.9	20.3	1.9	76
2 years	21.4	19.8	3.8	74.3
4 years	21.7	20.2	2.6	75.5
6 years	21.5	20.3	2.5	75.8
8 years	21.9	20.2	2.3	75.7
10 years	21.6	19.9	3.0	75.0

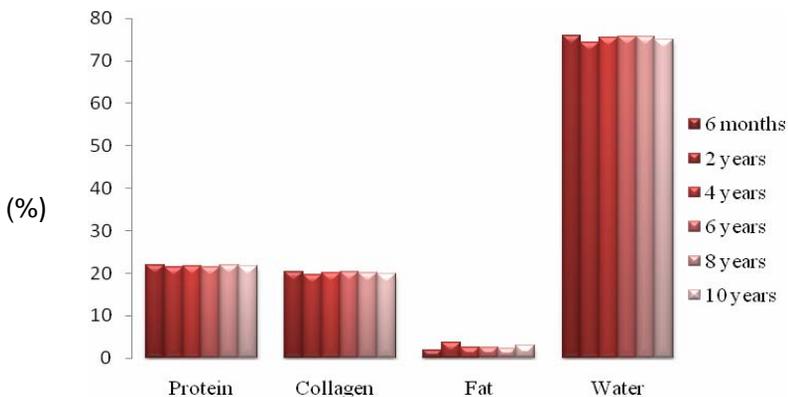


Fig. 3. The chemical composition of neck muscles

In the case of the collagen content the difference between the minimum and maximum obtained was 0.5%.

The fat content had a downward trend, recording a minimum of 1.9% at the slaughter done at the age of 6 months and a maximum of 3.8% at age 2 years. The water

content at the age of 4 years was 75.5%, ranging in descending trend (Fig. 3).

In the intercostals muscles the protein content ranges from a minimum of 19.3% at the individual of 6 months and a maximum of 20.9% obtained at ages 8 and 10 years (table 4).

Table 4
Changes in the chemical composition of intercostals muscles

Age at slaughter	Protein (%)	Collagen (%)	Fat (%)	Water (%)
6 months	19.3	17.6	13.2	66.9
2 years	19.4	17.5	13.0	66.9
4 years	20.9	18.9	6.4	72.1
6 years	20.3	19.7	5.8	73.4
8 years	20.9	19.1	6.1	72.4
10 years	20.9	19.1	6.1	75.5

The collagen had presented an upward trend, except for values obtained at ages of 8

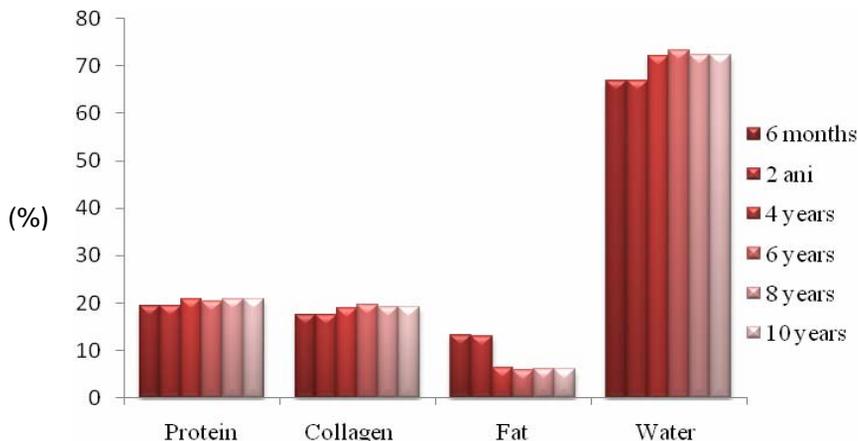


Fig. 4. The chemical composition of intercostals muscles

CONCLUSIONS

1. Meat is an important source of nutritional principles whose proportion is influenced by the age at slaughter and the muscle anatomical position.

2. The protein content has decreased with the increasing age of the animal.

3. The fat content has increased, being observed the fact that in white muscles (*longissimus dorsi*, *semitendinosus*) the proteins were in an amount greater than that of intermediate muscles (neck muscles), but the maximum proportion has been registered in red muscles (intercostals muscles).

4. The proportion of water in the muscles has a downward trend, but nevertheless the percentage recorded in all the muscles categories was high, being around 74%, the only exception being observed at the intercostals muscles which had a lower percentage.

5. The collagen content has varied in small limits between the age groups, the meat quality being influenced by its degree of maturation

and 10 years when it had been obtained a percentage of 19.1%, below the maximum value obtained (19.7%). The content of fat had presented a minimum of 5.8% (6 years) and a maximum of 13.2% at 6 months (with differences due to age, state of fattening). In the case of this muscular group the content of intramuscular water had decreased from a maximum of 75.5% (10 years) to a minimum of 66.9% (6 months), the gravitational pole of these elements being 71.20% (Fig. 4).

and the proportion of constituted fibers (white - *longissimus dorsi* muscle is a white muscle, red - the intercostals are red muscle) and only in a very small proportion of its quantity.

6. The effectuated studies, representing an intermediate step in the investigation of the influence of age at slaughter on meat quality, reveal that the cattle for meat processing industry should be slaughtered at an age up to 2 years because of its higher nutritional value.

REFERENCES

- [1] Arthaud V.H., Mandigo R.W., Koch R.M., Kotula A.W.: Carcass composition, quality and palatability attributes of bulls and steers fed different energy levels and killed at four ages, *J. Anim. Sci.*, 1977, 44: 53-64
- [2] Patten L.E., Hodgen J.M., Stelzleni A.M., Calkins C.R., Johnson D.D., Gwartney B.L.: Chemical properties of cow and beef muscles: benchmarking the differences and similarities, *J. Anim. Sci.*, 2008, 86: 1904-1916
- [3] Williams P.G.: Nutritional composition of red meat, *Health and Behavioural Sciences Papers*, 2007, 113-119