

The purpose of these studies was to determine the content of protein, intramuscular fat and moisture in meat of bovine animals in relation to individual muscles, age, sex and quality grade of carcasses.

Material and methods

The material for the studies was 80 head of cattle of the white-and-black-lowland breed chosen at random from among slaughter animals. In the selection of the material for studies the following variation factors were taken into consideration:

- muscles: psoas maior /PM/, biceps femoris /BF/, quadriceps femoris /QF/, semitendinosus /ST/, infraspinatus /IS/, triceps brachii /TB/, erectores spinae /ES/-cervical part /Sticking/,
- age of animals: 6-8 weeks, 5-8 months, 1.5-2 years and 2-5 years,
- sex of animals: males /M/, females /F/ and castrates /C/,
- quality grades of carcasses: grade I and II according to the polish classification criteria.

In each muscle examined the content of total protein was determined according to Kjeldahl method, that of intramuscular fat according to Soxhlet method, and that of moisture by the method of sample drying at 105° C so as to reach steady weight.

The results obtained were statistically analyzed, calculating mean values together with standard deviations. The significance of differences between the mean values with regard to muscles, sex and quality grade of carcasses was checked by means of the variation analysis. The significance of influence of age, however, was determined by means of classical confidence intervals.

Results

Mean values with standard deviations for the protein, fat and moisture content with differentiation of particular muscles, age, sex and quality grade of carcasses are given in tables 1, 2 and 3.

Table 1. The content of protein /in %/ by muscles, sex and grade in different age groups.

M S G	age groups			
	vealers	calves	cattle	cattle
	6-8 weeks	5-8 months	1.5-2 years	2-5 years
PM	20.74 ± 1.730	20.06 ± 1.062	20.77 ± 1.087	20.44 ± 1.350
BF	21.24 ± 1.949	20.77 ± 0.815	20.64 ± 1.525	20.77 ± 1.231
QF	19.97 ± 1.255	20.27 ± 0.938	20.50 ± 1.152	20.91 ± 1.381
ST	20.95 ± 1.677	21.29 ± 0.986	20.51 ± 1.338	20.89 ± 1.207
IS	20.29 ± 1.420	20.08 ± 0.962	20.58 ± 1.097	20.76 ± 1.439
TB	21.06 ± 1.611	20.72 ± 1.129	20.66 ± 0.921	21.41 ± 1.139
ES	20.48 ± 1.832	20.16 ± 1.159	20.17 ± 1.130	20.53 ± 1.523
M	20.56 ± 1.735	20.48 ± 1.020	20.36 ± 0.969	21.37 ± 1.445
F	20.79 ± 1.596	20.48 ± 1.141	20.77 ± 1.184	20.31 ± 1.314
C	---	---	20.52 ± 1.195	20.77 ± 1.024
I	20.70 ± 1.418	21.05 ± 0.957	20.61 ± 1.070	20.85 ± 1.444
II	20.65 ± 1.890	19.91 ± 0.866	20.48 ± 1.186	20.78 ± 1.231

Table 2. The content of fat /in %/ by muscles, sex and grade in different age groups.

M	age groups			
	vealers 6-8 weeks	calves 5-8 months	cattle 1.5-2 years	cattle 2-5 years
PM	1.17 ± 0.514	1.28 ± 0.532	2.54 ± 1.088	3.51 ± 1.975
BF	0.67 ± 0.161	0.85 ± 0.319	1.54 ± 0.683	2.02 ± 1.034
QF	1.11 ± 0.496	1.17 ± 0.476	1.85 ± 0.979	2.20 ± 1.294
ST	0.85 ± 0.300	0.87 ± 0.431	1.09 ± 0.491	1.45 ± 0.777
IS	1.22 ± 0.497	1.81 ± 0.725	3.67 ± 1.982	4.77 ± 2.308
TB	0.93 ± 0.359	1.01 ± 0.366	1.87 ± 1.095	2.37 ± 1.257
ES	1.51 ± 0.522	2.62 ± 1.688	3.00 ± 1.638	3.50 ± 2.015
M	1.03 ± 0.558	1.39 ± 1.152	2.10 ± 1.356	2.64 ± 1.875
F	1.10 ± 0.406	1.36 ± 0.762	2.47 ± 1.340	3.48 ± 2.264
C	----	----	2.10 ± 1.676	2.38 ± 1.413
I	1.09 ± 0.445	1.24 ± 0.659	2.39 ± 1.601	3.51 ± 2.237
II	1.04 ± 0.529	1.52 ± 1.198	2.05 ± 1.309	2.16 ± 1.255

M - muscles

S - sex

G - grade

Table 3. The content of moisture /in %/ by muscles, sex and grade in different age groups.

M	age groups			
	vealers 6-8 weeks	calves 5-8 months	cattle 1.5-2 years	cattle 2-5 years
PM	77.27 ± 0.757	77.32 ± 1.113	75.89 ± 1.123	74.80 ± 1.298
BF	76.23 ± 0.831	76.51 ± 0.644	76.30 ± 0.997	75.59 ± 1.026
QF	76.98 ± 0.709	77.08 ± 0.867	76.20 ± 1.087	75.66 ± 1.096
ST	76.49 ± 0.941	76.56 ± 0.761	76.89 ± 1.220	76.17 ± 1.119
IS	77.03 ± 1.030	76.99 ± 0.812	75.14 ± 1.660	73.66 ± 1.895
TB	76.53 ± 0.822	76.76 ± 0.821	75.96 ± 1.127	75.26 ± 1.277
ES	77.14 ± 1.017	76.57 ± 1.034	75.99 ± 1.410	74.97 ± 1.512
M	77.01 ± 1.056	76.90 ± 0.926	76.23 ± 1.424	75.06 ± 1.618
F	76.60 ± 0.738	76.75 ± 0.877	75.60 ± 0.912	75.22 ± 1.798
C	----	----	76.32 ± 1.457	75.20 ± 1.207
I	76.66 ± 0.790	76.39 ± 0.608	75.94 ± 1.373	74.62 ± 1.652
II	76.95 ± 1.038	77.27 ± 0.935	76.16 ± 1.266	75.69 ± 1.239

The results of the statistical analysis make it possible to find some definite regularities in the influence of particular factors of variation on basic composition of bovine meat.

Muscles. In a comparison of 7 muscles examined no significant differences in protein content were found, whereas a distinct differentiation with regard to fat and moisture content could be observed.

It seems that a relationship between fat and moisture content and motor activity of muscles is likely to exist. Muscles, the work of which is greater when alive /BF, QF, ST, TB/ were characterized by lower fat content but by higher moisture content. Those relations were reversed in muscles doing less work /PM, IS, ES/.

From the point of view of muscle location in the animal carcass it was found that the muscles of the forequarters were characterized by a higher fat level in adult subjects /1.5-2 and 2-5 years/. In young animals /6-8 weeks and 5-8 months/ no distinct regularity was found in this respect.

Age. Examination results did not show that the protein level in muscles was likely undergo significant changes with age. These changes were, however, observed in fat and moisture content. In a general evaluation it was found that the level showed a distinct tendency to increase with age whereas that of moisture was to decrease. Those changes, however, varied in particular muscles. Some of them, as e.g. ST did not show any changes concerning either fat or moisture; also BF did not change with age as far as moisture content was concerned. In other muscles examined, fat increase and moisture decrease were distinct but unequal. The greatest differences were shown by IS.

Distinct changes in fat and moisture content were observed only in the comparison of young animals with adult ones. Closer age groups of animals, both young and adult, were characterized by a lack of changes or by small differences only.

The variation of fat and moisture content with age of animals was also observed in each sex and each quality grade.

Sex. The differentiation of the basic composition in relation to sex was, as a rule, connected with the quality grade of the carcasses /significant interaction sex x grade/.

Sex distinctly influenced the protein and fat content only in adult animals at the age of 2-5 years. In this age group the meat of males was characterized by a significant higher protein content, whereas that of females by fat content.

A significant but small differentiation in moisture content was observed in relation to sex, but only in animals at the age of 6-8 weeks and 1.5-2 years; the meat of males was characterized by a higher moisture content than that of females.

Quality grade of carcasses. It was observed that the quality grade of carcasses was influenced only by the level of fat and moisture. The content of intramuscular fat was distinctly higher in carcasses of grade I than II, but only in adult animals 2-5 years of age. Differences in moisture content, however, appeared only in animals 5-8 months and 2-5 years old, and in each case carcasses of grade II contained more moisture than those of grade I.

Conclusions

The results of the studies presented make it possible to find the following regularities:

1. Individual muscles of the animal carcass differ from one another only in the content of fat and moisture; no differences, however, were found in reference to protein level. The differences in fat and moisture content between the individual muscles vary depending on the age of animals. There exist definite regularities in fat and moisture content in relation to motor activity and anatomical location of the muscle.

2. With the age of animals a general tendency of intramuscular fat increase and moisture decrease at an unchanged protein level can be observed. These changes depend, however, on the kind of muscles, some of which show small changes, whereas others - very distinct ones.

3. The sex of the animals distinctly differentiates the muscles with regard to the protein and intramuscular fat content and only in adult animals; moisture content is characterized by relatively small variation.

4. The quality grade of carcasses differs only with regard to fat and moisture content.

5. The variation of the basic composition does not result from the effect of one factor only. The investigation results distinctly point to the correlation of variation factors and their influence on protein, intramuscular fat and moisture content.