The evaluation of beef cattle quality, based on the interrelations of some measurements of carcasses with their morphological structure

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Objectivization of beef carcass quality evaluation is becoming more important as the now-adopted traits for carcasses differentiation into quality grades on the basis of carcass shape and subcutaneous fat distribution do not always reflect carcass meatiness and give grounds for subjective judgements.
The absence of easily measurable traits do not allow to establish the limits of carcass quality range.
The aim of this work was to find interrelations among carcass weight, morphological structure and some measurements in order to select the most acceptable measurable features for carcass evaluation.
The following interrelations were studied:
- bone length and weight;
- muscle thickness and meat weight;
- fat thickness and carcass fat weight.

Carcasses of young beef animals of different age, sex and finish were investigated.
Measurements were taken by means of a measuring knife, a metallic reel or a rule. Carcass length was measured from the hind to the front shank (on the internal side).
The muscle layer was measured on the internal side along the tangential line to the middle of the 1st rib up to the outlet of the knife or the ruler from the carcass on the outside.
Fat thickness was measured along the line between the coarticulation of the 2nd and the 3rd segments of the breastbone and going vertically from the bone/muscle interface in the plane of the saggital splitting of the plate. The morphological structure of the right side was determined on the basis of the results on deboning and on the yields of meat, fat, bones, cartilages and sinews.
In order to estimate the correlation coefficient (r) between carcass weight and desinewed meat yield the latters' values for 87 carcasses (27 steers, 34 heifers and 22 bull-calves) were mathematically processed. Below, comparative data on carcass weight and desinewed meat yield as related to age (Table 1), as well as correlations among these traits and carcass finish grade are presented (Table 2; Figure).

It is clear from Table 1 that there is a high direct correlation between the two traits irrespective of sex.

Table 1

Carcass weight/desinewed meat yield relation depending on animals' sex

Sex	$r \pm m_r$
Steers	0.9954 ± 0.02
Heifers	0.9975 ± 0.01
Bull-calves	0.99 ± 0.031

Table 2

Correlations between carcass weight and meat yield as related to the finish grade

Finish grade	No. of carcasses	Side weight, kg, M±m	Desinewed meat yield, kg, M±m	$r \pm m_r$
Best	136	90,44 ± 1.41	68.6 ± 1.16	0.94 ± 0.0294
Medium	228	77.72 ± 1.27	58.31 ± 1.01	0.99 ± 0.094
Under-medium	65	73.07 ± 2.21	52.92 ± 1.67	0.96 ± 0.0353

Therefore, there is a direct relationship between carcass weight and desinewed meat yield for all the groups, this serving the ground to assume the "carcass weight" trait a highly significant argument in the estimation of the yield of desinewed meat.
Changes in such traits as carcass length, muscle and fat thickness as related to carcass weight and animals' age and sex can be seen from Table 3.
As is clear from Table 3, carcass weight and the values of all the measurements increase with age. Carcasses of steers and bull-calves are longer as compared to heifers of the same age, though there may be exceptions. Muscle thickness of bull-calves is greater than that of heifers and steers of the same age, and it is greater for steers than for heifers, this being attributed to more developed breast muscles. The thickness of the fat layer grows with age and carcass weight.
Interrelations of carcass weight, desinewed meat yield and fat to muscle and fat measurements are given in Table 4 (as mean values).

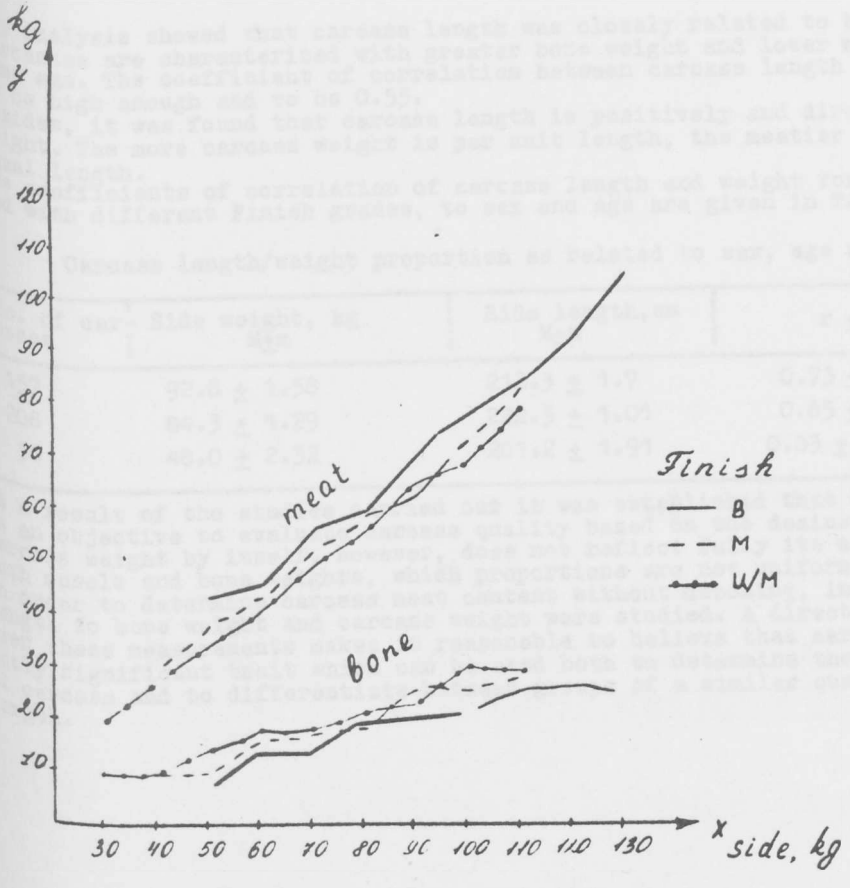

Fig. Empirical regression lines of desinewed meat and bone yields (y) to carcass weight (x) for young cattle

Table 3

Carcass weight and measurements as related to sex and age (mean values)

Age months	Carcass weight, kg			Carcass length, cm			Muscle thickness, cm			Fat thickness, cm		
	bull-calves	heifers	steers	bull-calves	heifers	steers	bull-calves	heifers	steers	bull calves	heifers	steers
12	152,6	146.7	162.0	204.1	199.9	209.0	12.6	11.6	12.0	5.6	5.5	5.7
18	218.9	186.2	204.2	209.0	218.1	222.0	16.4	14.4	14.8	7.7	6.29	6.7
24	-	202,7	233.0	-	224.2	279.8	-	14.3	16.7	-	6.8	7.7
36	-	238.4	309.0	-	236.8	309.3	-	17.0	21.9	-	7.9	12.0

Table 4

Correlations between fat thickness and desinewed meat yield

Age, months	Carcass weight, kg	Desinewed meat yield per side, kg	Muscle thickness, cm	Fat yield per side, kg	Fat thickness, cm
		Bull - calves			
12	145.00	58.54	11.3	4.24	3.6
18	199.8	73.20	14.5	6.3	4.8
		Heifers			
12	140.4	53.9	10.0	5.74	6.5
24	196.3	78.42	12.33	9.72	6.8

The analysis of the relation of muscle thickness to desinewed meat yield indicated that the correlation coefficient ranged within 0.69-0.88. The correlation between fat thickness and fatty meat yield is of an unstable nature, this being due to extraordinary lability of fat depositions in carcasses and to the point of measurement taking.

The analysis showed that carcass length was closely related to bone weight; i.e. longer carcasses are characterized with greater bone weight and lower meat weight in case of the same age. The coefficient of correlation between carcass length and bone weight turned out to be high enough and to be 0.55.

Besides, it was found that carcass length is positively and directly related to carcass weight. The more carcass weight is per unit length, the meatier is the carcass in case of equal length.

The coefficients of correlation of carcass length and weight for all the groups characterized with different Finish grades, to sex and age are given in Table 5.

Table 5

Carcass length/weight proportion as related to sex, age and finish grade

No. of carcasses	Side weight, kg M±m	Side length, cm M±m	$r \pm m_r$
157	92.8 ± 1.58	212.3 ± 1.7	0.73 ± 0.037
208	84.3 ± 1.29	222.5 ± 1.01	0.65 ± 0.04
30	48.0 ± 2.32	201.2 ± 1.91	0.83 ± 0.058

As a result of the studies carried out it was established that carcass weight can be used as an objective to evaluate carcass quality based on the desinewed meat yield factor. Carcass weight by itself, however, does not reflect fully its meatiness since it involves both muscle and bone weights, which proportions are not uniform.

In order to determine carcass meat content without deboning, interrelations of carcass length to bone weight and carcass weight were studied. A direct relation established between these measurements makes it reasonable to believe that carcass length is a sufficiently significant trait which can be used both to determine the meatiness of each individual carcass and to differentiate between groups of a similar quality by carcass weight and length.