THE USEFULNESS OF DIFFERENT TRAITS FOR THE TISSUE COMPOSITION DETERMINATION IN BEEF CARCASSES

Wichłacz H., Borys A., Grześkowiak E., Borzuta K.
Meat and Fat Research Institute - Branch in Poznaä, ul. Głogowska 239, Poland

Keywords : beef carcass, vision measurements, carcass composition

Background

The main aim of beef classification is to sort carcasses into sets of similar attributes to facilitate trade and provide a basis for market support measures. Generally, it is done through describing commercially important traits of beef carcasses such as conformation and fatness, which are used also in the EUROP subjective system (Cuthbertson, 1983). The great progress in objective evaluation methods used in pork carcass classification has given impulse to do the same also in beef classification (Cross and Whittaker, 1992; Hopkins, 1989).
Nowadays there are conducted many studies to aiming at finding the best objective methods (Borggaard et al., 1996; Ferguson et al., 1995; Fielding, 1995; Hopkins, 1995). One of them is the vision method. Although this method is used very often alone or with an optical probe, it would also be interesting to join vision measures with other carcass traits to accomplish the value of multiple square correlations (R^2) and residual standard deviation (RSD). According to Kempster (1986), a combination of independent variables was found to provide the most precise prediction of the carcass composition.
This study has been carried out to find a practical method for the tissue composition determination using via and other independent carcass traits.

Methods

The study was carried out on 60 half carcasses of young bulls, heifers and cows of Polish Black and White Lowland breed. In the course of slaughter kidney fat was separated from the carcass and weighed. The vision measurements were taken, using a video camera. The obtained pictures of sides were processed into digital images with a special module. In the computer, in turn, the measurements of surface area, length and two widths of half carcasses were taken. Moreover the surface area of uncovered muscles on outer side was also measured as a percentage of a half-carcass area. After taking all the measurements, the sides were divided into primal cuts and then a dissection into the basic morphological components was performed.
The vision data were used to calculate indices of conformation as a ratio of carcass weight to those measurements.
All the data were used to calculate means (x), standard deviation (sd), coefficient of variance (cv %), simple correlation (r), multiple correlation square (R^2), and residue standard deviation (RSD) using STATISTICA.

Results and discussion

The descriptive statistics for the studied traits are shown in Table 1. According to these data, coefficients of variance are the highest for fat and the lowest for bone content. The fat traits are very important in beef assessment. In order to determine accurately carcass fat it is necessary to take the data into consideration. In Table 2 there are a few independent traits which correlate with carcass fat. The usefulness of these traits can be seen in Table 3. Generally, vision measurements along with carcass weight, but without an area of uncovered muscles (%), very highly correlated with carcass bone and meat. The remaining traits highly correalated with carcass meat and fat components.
Great variability and broad range of carcass components without a stable layer of subcutaneous fat and damages inflicted during slaughter suggest taking into advantage different traits. In this way carcass assessment can be improved. One of the solutions is to combine vision measurements with other traits. In a slaughter line it is possible to weigh kidney fat. The percentage kidney, pelvic and heart fat is used to predict either the yield grade itself or the percentage of boneless closely trimmed retail cuts from the round, loin, rib and chuck (USDA). In what manner to take in account kidney fat in slaughter line it is only technical problem which can be resolved by using two weights.
According to the data in Table 3, also subjective assessment increases the coefficient of determination (R^2) and decreases the residual standard deviation (RSD).

Conclusions

1. The study has shown a great usefulness of the examined traits for the tissue composition assessment in beef carcasses.
2. An increase in meat and fat assessment precision (%)can be obtained by combining various traits of different methods.
3. Taking into account kidney fat weight, an area of uncovered muscles on the outer side - via (%), and fat assessment increases the precision of meat and fat determination in beef carcasses.

References

1. Borggaard C., Madsen N.T., Thodberg H.H. (1996). In line image analysis in the slaugther industry, illustrated by beef carcass classification. Meat Sci.,vol.43 Supplementary Issue.
2. Cross H.R. and Whittaker A.D. (1992). The role of instrument grading in a beef value-based marketing system. J.Animal Sci., vol.70, pp. 984-989.
3. Cuthbertson A. (1983). Beef carcass classification - methods and some implication of its role in marketing, production and breeding. 34th Annual Meeting of the European Association for Animal Production,Madrid 3-6 October 1983.
4. Fielding W.G. (1995). Carcass tracking, computer assisted vision grading as tool for value based marketing. 41th ICoMST, San Antonio, Texas, USA.
5. Ferguson D.M., Thompson J.M., Barrettt-Leonard, Sorensen B. (1995). Prediction of beef carcass yield using whole carcass viascan 41th ICoMST, San Antonio, Texas, USA.
6. Hopkins D.L (1989). Reliability of three sites for measuring fat depth on the beef carcass. Australian Journal of Animal Science, vol.29, pp.165-168.
7. Hopkins D.L., Roberts A.H.K. (1995). The value of carcass weight, fat depth measures and eye muscle area for predicting... Meat Science, vol. 41, no 2, pp.137-145.
8. Kempster A.J. (1986). Estimation of the carcass composition of different cattle breeds and crosses from conformation assessments adjusted for fatness. J.Agric.Sci, 106, 239-254..

Table 1. Average results of consistance measurements of different chilled beef muscles (deep to drive of needles into muscle BF, mm)

Muscle layers	Experiment 1			Experiment 2		
	quick chilling (-5°C)	slow chilling	average	quick chilling (-10°C)	slow chilling	average
1	7,53	8,37	7,95[a]	9,34	10,48	9,91[a]
2	8,59	9,51	9,05[a]	9,80	11,28	10,54[a]
3	9,60	10,05	9,83[b]	11,31	11,96	11,63[b]
4	10,56	10,40	10,48[b]	11,46	12.57	12,01[b]
5	10,22	9,75	9,99[b]	11,65	11,56	11,61[b]
6	9,99	8,79	9,40[b]	12,07	12,10	12,09[b]
All layers	9,41[a]	9,48[a]		10,94[b]	11,66[b]	

There are no significant statistical differences betwen the averages of a given item signed with the same letters

Table 2. Percentage part of short and long sarcomers in different layers of differently chilled beef muscles biceps femoris

Experiment	Layers of M. BF	Chilling methods	% part of sarcomers		chi square
			short	long	
1 (-5°C)	I	quick	6.26	40,84	10,87**
		slow	2,32	50,58	
	II	quick	7,42	39,68	13,32**
		slow	3,94	48,96	
	III	quick	7,84	40,38	0,85
		slow	10,21	41,57	
2 (-10°C)	I	quick	14,55	35,45	54,57**
		slow	1,59	48,41	
	II	quick	9,32	40,68	29,19**
		slow	1,36	40,64	
	III	quick	8,18	41,82	10,92**
		slow	3,18	46,82	

Limit point chi square at $P \leq 0,01 = 6,63$