Estimation of EC-lean meat percentage in major cuts of pig carcasses based on multiple measurements of fat thickness with the Hennessy Grading Probe 2

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SUMMARY

To examine the scope for estimation of the EC-lean meat percentage in the major cuts (ham, shoulder, belly and loin) by multiple fat thickness measurements in these cuts, 30 carcasses were randomly selected. At 15 locations on the right side of the carcass fat thickness measurements were taken with the Hennessy Grading Probe 2. The day after slaughter the right sides were dissected according to the IVO-standard method. The major cuts were further separated according to the EC-reference method. During the experiment three problems emerged. Firstly, the algorithm, which calculates fat thickness from the optically measured tissue profile, was not appropriate for every location. Secondly, the definition of the probing position did not always coincide with the anatomical postion of the first layers of the intended muscle underneath the subcutaneous fat. Thirdly, for some locations it was not possible to perform correct measurements, because of the presence of bone.

The measurement of fat thickness between the 13th and 14th thoracic vertebrae from cranial and 7 cm off the midline appeared to be the best single estimator of the EC-lean meat percentage in the major cuts. Fat thickness between the 3rd and 4th thoracic vertebrae from caudal and 6 cm off the midline constituted a good alternative. Multiple measurements, compared to a single measurement, hardly reduced the residual standard deviation of the estimation of EC-lean meat percentage in the cuts.

INTRODUCTION

The Dutch pork industry is interested in a method to sort out major pork cuts (ham, shoulder, belly and loin) based on the EC-lean meat percentage of these cuts. The prediction of the EC-lean meat percentage of pork cuts based on measurements between the 3rd and 4th from last-rib at classification might be improved by multiple probing. The aim of this study is to investigate the scope for improvement of the accuracy of prediction EC-lean meat percentage in major cuts by multiple probing.

MATERIALS AND METHODS

Thirty pork carcasses were randomly chosen and fat thickness measurements were taken 45 min. p.m. at 15 locations on the right side of the carcass with the Hennessy Grading Probe 2 (HGP-2) (Figure 1). The day after slaughter the right side of each carcass was dissected according to the IVO-standard method. For practical reasons the major cuts (ham, shoulder, belly and loin) were frozen. After thawing the cuts were further separated into lean, fat and bone according to the EC-reference method.

Statistical analyses included multiple regression. Best subsets of prediction variables were chosen with RSELECT (THISSEN and GOEDHART, 1990), a procedure based on a branch and bound algorithm from FURNIVAL and WILSON (1974).

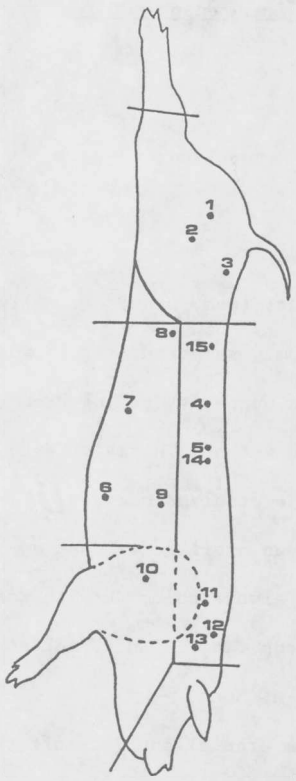

Figure 1. Probe locations.

code	description
1	Fat thickness (mm) at the level of the caudal point of the symphysis pubis, 15 cm off the midline,
2	Fat thickness (mm) at the level of the cranial point of the symphysis pubis, 22 cm off the midline,
3	Fat thickness (mm) 4 cm under the cranial point of the symphysis pubis, 6 cm off the midline,
4	Fat thickness (mm) between the last thoracic vertebrae and the first lumbar vertebrae, 6 cm off the midline,
5	Fat thickness (mm) between the 13th and 14th thoracic vertebrae from cranial, 7 cm off the midline,
6	Fat thickness (mm) between the 9th and 10th thoracic vertebrae from cranial, 35 cm off the midline,
7	Fat thickness (mm) 5 cm above last rib, 35 cm off the midline
8	Fat thickness (mm) at the middle of the 5th lumbar vertebrae from cranial, 20 cm off the midline,
9	Fat thickness (mm) between the 9th and 10th thoracic vertebrae from cranial, 20 cm off the midline,
10	Fat thickness (mm) at the middle of the first thoracic vertebrae from cranial, 22 cm off the midline,
11	Fat thickness (mm) between the 6th and 7th cervical vertebrae from cranial, 10 cm off the midline,
12	Fat thickness (mm) at the middle of the 4th cervical vertebrae from cranial, 7 cm off the midline,
13	Fat thickness (mm) at the middle of the 3rd cervical vertebrae from cranial, 10,5 cm off the midline,
14	Fat thickness (mm) between the 3rd and 4th thoracic vertebrae from caudal, 6 cm off the midline,
15	Fat thickness (mm) between the 3rd and 4th lumbar vertebrae from caudal, 6 cm off the midline.

RESULTS AND DISCUSSION

During the experiment it proved to be impossible to perform correct measurements for locations 2 and 3, because of the presence of the aitch-bone. Furthermore a considerable variation in fat thickness exists at some locations. This variation is probably due to two sources of error. Firstly, the algorithm, which was developed for calculation of fat thickness from the optically tissue profile over the longissimus dorsi may not be suitable for a proper interpretation of the profile at other locations. Secondly, the probing-locations are defined by taking certain distances with regard to particular carcass characteristics. This definition does not always coincide with the anatomical position of the intended muscles underneath the subcutaneous fat.

Residual standard deviations (RSD) and percentages of variance explained (R^2) for the prediction of the EC-lean meat percentage in major cuts based on fat thickness measured at different locations are presented in Table 1.

Fat thickness between the 13th and 14th thoracic vertebrae from cranial and 7 cm off the midline appears to be the best single estimator for the EC-lean meat percentage in the cuts. Fat thickness between the 3rd and 4th thoracic vertebrae from caudal and 6 cm off the midline constitutes a good alternative. The values of the RSD in the major cuts is lower than 2.50 %. EC-regulations (1984,1985) for approval of prediction formulae for estimation of the EC-lean meat percentage state that the RSD must be lower than 2.50 %. No EC-regulations exist, however, for estimation of the EC-lean meat percentages in the major cuts. HULSEGGE et al. (1990) already reported that the RSD of the estimation of the EC-lean meat percentage in the ham, shoulder and loin, based on fat- and muscle thickness measurements at the 3/4 LR (6 cm off the midline), is lower than 2.50 %.

Table 1. RSD and R^2 for regression of the EC-lean meat percentage in major cuts based on single and multiple regression on fat thickness measured at different (coded) locations.

major cut	location codes	RSD	R^2
Ham	1	1.50	0.69
	5	1.70	0.60
	14	1.71	0.60
	1, 5	1.31	0.77
	1, 5, 10	1.18	0.79
	1, 5, 10, 13	1.16	0.81
Shoulder	5	1.82	0.38
	1	1.84	0.37
	14	1.94	0.30
	1, 5	1.75	0.45
	1, 5, 14	1.74	0.48
Belly	1, 5, 11, 14	1.73	0.50
	5	2.36	0.56
	14	2.49	0.51
	1	2.71	0.42
	5, 13	2.23	0.62
	5, 10, 13	2.06	0.63
Loin	5, 10, 12, 13	1.96	0.70
	4	1.85	0.46
	5	1.97	0.39
	14	2.01	0.36
	7, 14	1.65	0.56
	4, 7, 15	1.65	0.58
	4, 7, 14, 15	1.63	0.60

Table 1 indicates that a single measurement of fat thickness provides an adequate prediction of the EC-lean meat percentage in the major cuts. The use of multiple measurements, compared to a single measurement, hardly reduces the RSD values, although the R^2 values are increased. These results are in agreement with those of FORTIN et al. (1984) for estimation of EC-lean meat percentage in the carcass.

CONCLUSION

In this study a single measurement of fat thickness provides an adequate prediction of the EC-lean meat percentage in the major cuts. Multiple probing, compared to a single probing, gives a small reduction of the RSD values and a small increase of the R^2 values. However the accuracy of the estimates of the regressioncoefficients is possibly reduced due to the addition of prediction variables of relatively low importance. Therefore the additional effort in taking multiple measurements may outweigh the relative small gain in precision of the prediction of the EC-lean meat percentage in major cuts.

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