OPTIMAL SINGLE SITE FOR GRADING PORK CARCASSES

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Background

In a value system such as the Canadian system for grading pork carcasses which is based on the estimation of lean yield in the carcass, the negative relationship between the subcutaneous fat thickness and the amount of saleable meat in the carcass is used for estimating saleable meat yield. In 1986, with the introduction of reflectance probes the measurement of muscle depth became also possible under abattoir conditions. Since then, the measurements of fat thickness and muscle depth have been used to estimate saleable meat yield of pork carcasses. At the time of the introduction of electronic grading, the decision was made to measure at one single site only: between the 3rd and 4th ribs from the last rib (3/4 last rib) and 7 cm from the exposed surface at the mid-line (Fortin, 1989). That decision was based both on the accuracy and precision for estimating saleable meat yield, and logistic considerations such as ease of identification of the site and measurement under abattoir conditions. Hence, the selected site was deemed to be the optimal single site.
Over the past fifteen years, due to changes in management practice, pig genetic composition and market requirements, slaughter pigs have become leaner and heavier (Fortin, 2000). Furthermore, with the availability of non-invasive instruments utilising ultrasound, there is now an opportunity to review whether the criteria considered in 1986 for determining the optimal single site are still valid.

Objectives

In this study, the accuracy and precision for estimating saleable meat yield, two of the fore-mentioned criteria which were used in 1986 for determining the current optimal single grading site, are being re-examined.

Methods

Two hundred forty one carcasses (114 barrows and 127 gilts) were used. Sampling of the carcasses was stratified by carcass weight and fat thickness. The objective of the sampling procedure was to provide a sufficient number of carcasses at the extremes; thus ensuring an accurate estimation of saleable meat yield for all weights and levels of fatness. The range of backfat thickness was from 9 to 38 mm and warm carcass weight from 70 kg to 102 kg.
An Aloka SSD 1100 ultrasound machine with a 127 mm 3.5 MHz transducer fitted with a stand-off specifically designed for probing pig carcasses (AUS, Ithaca, NY, 14850-1257) was used to scan the loin at four locations: last rib, next to the last rib, at the fourth rib from the last rib and the sixth rib from the last rib. These locations are referred thereon as last rib, next to last rib, 3-4 last rib and sixth last rib. For each ultrasound image, the maximum width of the loin muscle was determined. Backfat thickness was then automatically measured at the 1/4, 1/2 and 3/4 positions of maximum width. These backfat thickness measurement positions are thereon referred as backfat thickness (1/4), backfat thickness (1/2) and backfat thickness (3/4), respectively. Backfat thickness and muscle depth 7 cm from the exposed surface at the mid-line were also measured. Backfat thickness (1/2) and backfat thickness at 7 cm from the exposed surface at the mid-line were anatomically close to each other. Saleable meat yield of the left side was expressed as a percent of the sum of saleable meat yield in each of the commercial cuts divided by cold side weight (Fortin et al. 2002).
At each rib location, the accuracy (R^2) and precision (residual standard deviation) of each backfat position in estimating saleable meat yield were determined by computing prediction equations from each backfat thickness measurement (1/4, 1/2, 3/4 and 7 cm). Once the most accurate and precise backfat position was determined, the rib location was then identified following the same statistical procedures.

Results and Discussion

Examination of the accuracy and precision parameters (Table 1) for estimating saleable meat yield from backfat thickness at the four positions for each rib location showed that backfat thickness at 7 cm from the exposed surface at the mid-line or at the 1/2 position generally provided the most accurate estimations (highest R^2 and lowest RSD values); in agreement with previously published reports (Kempster et al. 1982; Fortin et al, 1984; Fisher, 1990; Hulsegge et al., 1994). Similarly, the rib location which provided the most accurate estimation of saleable meat yield (derived from backfat thickness and muscle depth measured at the position 7 cm from the exposed surface at the mid-line) was the next to last rib location: R^2=0.72 and RSD=1.96 (Table 2). Measurements at the sixth last rib site proved to be the least reliable (lowest R^2 and highest RSD values) whereas the 3/4 last rib location was intermediate: R^2=0.65 and RSD=2.20. Others (Kempster et al. 1982; Fortin et al. 1984; Hulsegge et al. 1994) have reported a similar pattern.
Hence, if the choice of a single site for grading were to be made strictly on the basis of accuracy and precision, the current Canadian grading rib location would not be the rib location of choice. However, accuracy and precision are only two of several criteria that have to be considered before the optimal single grading site can be determined. Confirmation from additional data together with logistic considerations is required before contemplating a change to the official rib location. Furthermore, there is no indication to warrant a change of the position of the grading site.

Pertinent literature

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Table 1. Estimation of saleable meat yield from backfat thickness at the four positions for each rib location

Backfat thickness	R^2	RSD
Last rib		
Backfat thickness (1/4)	0.61	2.32
Backfat thickness (1/2)	0.65	2.20
Backfat thickness (3/4)	0.63	2.26
Backfat thickness (7 cm)	0.64	2.24
Next to last rib		
Backfat thickness (1/4)	0.63	2.27
Backfat thickness (1/2)	0.68	2.10
Backfat thickness (3/4)	0.67	2.12
Backfat thickness (7 cm)	0.67	2.12
3-4 last rib		
Backfat thickness (1/4)	0.58	2.41
Backfat thickness (1/2)	0.60	2.33
Backfat thickness (3/4)	0.57	2.41
Backfat thickness (7 cm)	0.60	2.35
Sixth last rib		
Backfat thickness (1/4)	0.52	2.59
Backfat thickness (1/2)	0.57	2.43
Backfat thickness (3/4)	0.56	2.47
Backfat thickness (7 cm)	0.57	2.44

Table 2. Estimation of saleable meat yield from backfat thickness[a] and muscle depth[a] at the four rib locations

Backfat thickness and muscle depth	R^2	RSD
Last rib	0.68	2.10
Next to last rib	0.72	1.96
3-4 last rib	0.65	2.20
Sixth last rib	0.63	2.25

[a] Measured 7 cm from the exposed surface at the mid-line.