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Effect of subcutaneous fat thickness variations near the P2 position on pork carcass classification

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Summary

Subcutaneous fat thickness at and near the P2 position in pig carcasses is shown to depend on the direction from the P2 position that the measurement is taken. The fat thickness increases more rapidly laterally to the P2 position than it does in other directions and decreases in thickness medially to the P2 position.

The interaction of sex by position along the backbone, and the difference in fat thickness between the sides, make only minor contributions to the overall variation in fat thickness.

The relevance of the findings to pig carcass classification is discussed, and it is recommended that a template be used to check the accuracy of those using classification equipment.

1. INTRODUCTION

The subcutaneous fat thickness at the P2 position in slaughtered pigs is now measured routinely in many abattoirs in Australia and this measurement is being introduced in many other abattoirs as part of carcass classification trials (W. R. Ramsay, personal communication). The P2 position is defined as the point 6.5 cm lateral to the midline of the carcass at the level of the head of the last rib (Buck, Harrington and Johnson 1962). Measurements are made with an introscope. This is an optical probe that allows the fat/muscle interface to be observed, and the fat thickness to be measured.

Mean subcutaneous fat thicknesses have been reported for specific positions on pork carcasses (Anon. 1979). However, there are no detailed data in Australia on variations in fat thickness close to the P2 position. Under working conditions, measuring devices such as the introscope are not always placed at the exact P2 position, as operators can make only a subjective assessment of its location. Therefore, the effect on fat thickness readings of misplacing a measuring device is not fully understood.

The aims of this work were to examine the variation in fat thickness in pig carcasses near the P2 position and to determine what errors are likely to occur if a fat measuring device is misplaced during carcass classification.

2. MATERIALS AND METHODS

Fat thickness data were collected from pig carcasses delivered to two butchers' shops at Cairns, in north Queensland.

After the fore and hindquarters were removed, the middles were separated by a band saw cut along the midline of the back. The head of the last rib of each side was located and each middle was divided by a saw cut perpendicular to the backbone through the posterior edge of the head of the last rib. This cut displays what we refer to as the P2 surface. Three chops, each 19 mm thick, were then cut anterior and posterior to the P2 surface enabling measurements of fat thicknesses in seven (E1 to E7) parallel planes 'along the backbone'.

Beginning at a point 4.5 cm lateral to the midline, six measurements of fat thickness at 1 cm intervals (D1 to D6) were taken on each chop so that a total of 42 measurements was recorded in an 11.4 cm^2 area around the P2 position. Both sides of 40 carcasses (of which 20 were entire males and 20 were females) were measured. Their mean weight was 50.7 kg, with a range of 35 to 65 kg.

The data were analysed using analysis of variance. Student's test was used to test for differences between means once overall differences had been established by the F test in the analysis of variance.

3. RESULTS

The analysis of variance (Table 1) shows that the following contribute significantly to the variability in fat thickness around the P2 position in pig carcasses: the side (C), the position along the chop (D), the position along the backbone (E), the interaction between the position along the chop and the position along the backbone (DE), and the interaction between the sex of the carcass and the position along the backbone (AE).

Table 1. Analysis of variance in subcutaneous fat depth due to various factors

Source	d.f.	m.s.	f
A*	1	1308.25	1.38
:AB	38	949.359	
C	1	43.6119	28.37**
AC	1	0.1238	0.08
D	5	552.2	359.25**
AD	5	1.4301	0.93
CD	5	2.0526	1.34
ACD	5	0.8203	0.53
E	6	67.1619	43.69**
AE	6	4.5638	2.97**
CE	6	1.7931	1.17
ACE	6	1.8152	1.18
DE	30	8.1772	5.32**
ADE	30	0.5859	0.38
CDE	30	0.5794	0.38
ACDE	30	0.4125	0.27
:ABCDE	3154	1.5371	

*A = Sex.
B = Carcasses within sexes.
C = Side.
D = Position along the chop.
E = Position along the backbone.
**Significant at 1% level.

The meat fat thickness of 13.91 mm for the right sides was higher ($P < 0.01$) than that for the left sides (13.68 mm).

A mean was calculated for all the measurements taken at each 'position along the chop' (D1, D2, D3, ..., D6). These means (Table 2) show in general terms that the fat thickness increases as the measurements are taken progressively further from the backbone.

Fat thicknesses at the D2/E4 position (2 cm lateral to P2) ranged from 0.5 mm less than, to 4.5 mm more than, the fat thickness at P2. On average, thickness on the D2 plane was within 1 mm of the corresponding mean reading at the D4 plane.

Table 2. The meat fat thickness at each of the 42 positions (mm)

	E1*	E2	E3	E4	E5	E6	E7	Mean (D)
D1†	15.4	15.1	15.0	15.1	15.3	15.9	16.4	15.4*e*
D2	14.2	14.1	14.0	14.0	14.1	14.9	15.2	14.4*d*
D3	13.8	13.6	13.4	13.4	13.6	14.4	14.8	13.9*c*
D4	13.6	13.3	13.1	12.8	13.1	13.8	14.2	13.4*b*
D5	13.4	13.2	12.8	12.4	12.5	12.9	13.1	12.9*a*
D6	13.5	13.2	12.9	12.5	12.3	12.5	12.7	12.8*a*
Mean (E)	14.0*c*	13.8*b*	13.6*a*	13.4*a*	13.5*a*	14.1*c*	14.4*d*	

*E1–E7 = position 'along the backbone'; E1 closest to the head.
†D1–D6 = position 'along the chop'; D6 closest to the backbone.
D4/E4 = P2 position.
Means in the same column or row followed by a different letter are significantly different at the 1% level.

The mean fat thickness at the D5 and D6 planes (that is towards the backbone) closely approximated the mean D4 plane fat thickness. At D6/E4 (2 cm medial to P2) thicknesses ranged between 2.5 mm less than, and 2.5 mm more than, the fat thickness at P2. On average, the D5 plane fat thickness was only 0.5 mm less than the D4 plane fat thickness.

Mean fat thickness was calculated for each of the seven positions 'along the backbone' (E1, E2, E3, ..., E7). Mean E1 and E7 measurements (Table 2) were within 1 mm of the mean fat thickness at the P2 surface. At the E1/D4 position (nearly 6 cm from P2), differences from the P2 measurement of up to 3.5 mm were recorded in individual carcasses.

Fat thickness increased more rapidly posterio-laterally to P2 than in other directions.

4. DISCUSSION

Our results show that, of the factors investigated which can influence the subcutaneous fat thickness near the P2 position in pigs, the distance from the backbone (D) is the most important.

The fat thickness increases uniformly over the 3 cm lateral to the P2 position in most animals, and generally any misplacement in that direction of a fat thickness measuring device will result in a false P2 measurement. However, the error is small (< 1 mm) within 2 cm of the P2 position which is the area that an introscope is likely to be inserted into under working conditions. Previous work (Whan, Arthur and Moore 1977) has shown that an error of this size would have little effect on price in wholesale marketing. On the other hand, if such an error was regularly recorded it would make the monitoring of reductions of backfat thickness less accurate in individual herds and in the national herd.

In our view lateral or medial misplacement of a measuring device need not occur as it is possible to measure the 6.5 cm objectively from the midline cut or backbone to the P2 position. Adjustments to the distance from the 'midline' would need to be made if carcasses have been split at the abattoir as such splits are not necessarily central. Similarly, care may be needed with very light pigs to ensure that the measurement is being made over the eye muscle.

It is difficult to estimate the level of the head of the last rib accurately. Our experiment covered extremes likely in anterior/posterior misplacements of an introscope. The small mean error detected over this range indicates that the pattern of fat thickness in these directions is not of great practical importance in carcass classification. However, posterio-lateral deviation from P2 during measurement should be avoided because of the more rapid increase in fat thickness in that direction.

The significantly different pattern of fat distribution along the backbone in different sexes (the AE interaction) is difficult to explain. In the context of the aims of the experiment its relevance is minimal. The very low F statistic in Table 1 for AE compared to the F statistics for D and E indicates that the 'sex/position along the backbone' interaction makes only a minor contribution to the overall variation in fat thickness. We consider the interaction to be of no importance in classification.

Although the precision of the experiment detected a 0.2 mm difference in fat thickness between sides it is most unlikely that a real difference exists. In any case, the difference is so small that taking all measurements for classification *from one side only* would be of no practical value as the measurement under working conditions is not sufficiently accurate to detect 0.2 mm differences. Introscope readings can vary a few millimetres depending on the pressure

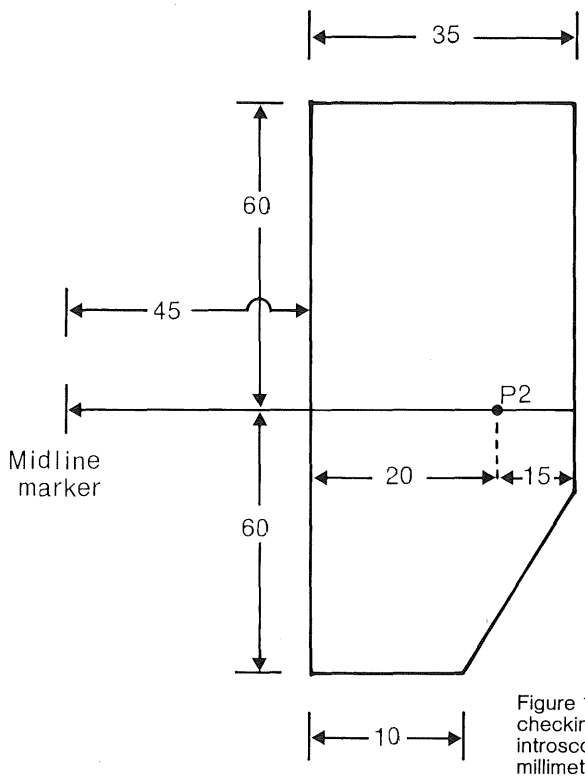

Figure 1. A proposed template for checking the accuracy of positioning an introscope (measurements in millimetres).

applied by the operator to the skin with the barrel of the introscope. Also, the fat layer may be physically distorted by the blade of the introscope (Harrington 1976). Thus, variations in measurements between operatives and any variation due to distortion of the fat layer during measurement may mask any slight errors due to distance from the P2 position.

Factors such as the time available to make measurements and the dedication of the operator will affect accurate location of the P2 position. We believe that inaccuracies in fat measurement during pig carcass classification due to malpositioning of the measuring device should not be practically significant provided measurements are taken within the template shown in Figure 1. Such a template would be useful in checking the work of classifiers. The medial border of the template has been set at 4.5 cm from the midline because we obtained no data on the pattern of fat thickness any closer to the midline.

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