EVALUATION OF THE DESTRON PG-100 ELECTRONIC PROBE FOR GRADING WARM PORK CARCASSES

The Destron PG-100 electronic grading probe was evaluated for prediction of lean yield, comparison with the ruler measurement, and precision on 204 pork carcasses representing equal numbers of barrows and gilts and a warm carcass weight range of 56.8–111.4 kg. A complete cutout was done on the left side from each carcass to determine a regression equation for prediction of lean yield from the probe measurements of thickness of fat and muscle between the 3rd and 4th last rib, 7 cm off the mid-line. The Hennessy probe was used as the standard for this study. Both probes performed equally well when compared with the ruler measurement and in their ability to predict lean yield.

Key words: Electronic grading, pork carcasses, pork grading

Several electronic probes using the difference in reflectance between muscle and fat have been evaluated for use in pork grading over the past few years (Kempster et al. 1985). Two of these probes, the Hennessy Grading Probe (Hennessy and Chong Ltd., New Zealand) and the Fat-O-Meater (SFK Ltd., Denmark), were evaluated under Canadian conditions (Fortin et al. 1984a,b) and these results used to help develop a pork grading system utilizing the electronic probe to predict lean yield from muscle depth and fat thickness. This system was implemented in Canada on 31 Mar. 1986 (Canada Gazette 1986). The objective of this study was to evaluate the Destron PG-100, a new probe developed in Canada by International Destron Technologies, Markham, Ontario, for accuracy of measurement and prediction of lean yield.

The evaluation program for the Destron probe followed the protocol prescribed by Agriculture Canada (1985), the details of which are presented below. The Hennessy probe was used as the standard probe because it had been previously approved for grading pork carcasses in Canada.

A total of 204 warm pork carcasses,
selected over a 2-wk period by Agriculture Canada personnel on the slaughter floor at J. M. Schneider Inc., Kitchener, Ontario, was used in this study. Carcasses were selected so there was equal representation of barrows and gilts within the three prescribed weight groups of <72.6 kg, 72.6-81.6 kg, and >81.6 kg. The carcasses were then probed by one Agriculture Canada grader as follows: 1, left side — alternating the order at the same site between the Hennessy and Destron probes on the same carcass, the thickness of fat and muscle was measured between the 3rd and 4th rib, 7 cm off the mid-line of the split carcass and recorded for use in deriving the regression equations for predicting lean yield; 2, left side — the fat thickness was measured with a ruler at the site described in 1 and recorded for the bias test (probe vs. ruler); and 3, right side — two probings were done at exactly the same site (between the 3rd and 4th last rib and 7 cm off the mid-line of the split carcass) using the same Destron Probe to measure fat and muscle thickness and recorded for the precision test (relationship between repeated measurements). All left sides were both tagged and numbered with blue ink on the ham to maintain their identity throughout the testing period.

The carcasses were chilled overnight at approximately 4°C and the following day the left sides were wrapped with heavy brown carcass paper and cheesecloth before being transported to the Meat Science Laboratory at the University of Guelph. Each left side was cut by experienced personnel following the procedure to determine boned-defatted yields of Martin et al. (1981) with the exception that any lean trim from each primal cut was weighed with the respective boneless cuts except for the belly trim. The appropriate cuts and trim were weighed to the nearest 25 g on an electronic scale. The lean yield of each side was calculated, as specified in the protocol, by adding the weights of the boneless, defatted ham, loin, picnic, and butt plus the skinless belly, plus the tenderloin, plus the side ribs; this sum was multiplied by 2, and then divided by the warm carcass weight.

Regression equations were determined to predict lean yield based on actual cutout data and probe measurements. The bias of the probe measurement versus the ruler measurement and the precision of two repeated probe measurements at the same site were also evaluated. The prediction of lean yield was evaluated on the basis of residual standard error (RSE) following the example of MacNeil (1983) and the bias and precision were analyzed using regression analyses (Steel and Torrie 1960). All analyses were done using SAS procedures (Cary, N.C.).

The means, standard deviations, ranges, and coefficients of variation for the carcass data are presented in Table 1. These data compare favorably with a previous cutout of 224 carcasses (Fortin et al. 1984a) with the

Table 1. Means, standard deviations, ranges, and coefficients of variation for carcass and probe data (n = 204)

<table>
<thead>
<tr>
<th>Hog cutout</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>Coefficient of variation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm carcass wt (kg)</strong></td>
<td>77.8</td>
<td>8.2</td>
<td>56.8-111.4</td>
<td>10.5</td>
</tr>
<tr>
<td>Lean yield (%)</td>
<td>53.8</td>
<td>2.5</td>
<td>44.9-59.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Grade fat thickness (mm)</td>
<td>33</td>
<td>5.8</td>
<td>19-52</td>
<td>17.7</td>
</tr>
<tr>
<td>Actual probe measurements (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Destron</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>19.1</td>
<td>6.1</td>
<td>8.0-40.0</td>
<td>32.1</td>
</tr>
<tr>
<td>Muscle</td>
<td>49.4</td>
<td>8.1</td>
<td>22.0-67.0</td>
<td>16.5</td>
</tr>
<tr>
<td><strong>Hennessy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>20.5</td>
<td>5.4</td>
<td>9.2-45.6</td>
<td>26.6</td>
</tr>
<tr>
<td>Muscle</td>
<td>48.3</td>
<td>8.5</td>
<td>19.6-69.6</td>
<td>17.6</td>
</tr>
</tbody>
</table>
exception of the percent lean yield which was about 4.0 percentage points higher after expressing the 1984 average lean yield percentage on the same basis as reported in this study (A. Fortin, pers. commun.). Part of this difference was attributed to including the lean trim from the primal cuts in the calculation of the lean yield for this study which was not the case in 1984. Also, some improvement in lean yield of market hogs over time can be expected and may have contributed to some of this difference. All other experimental conditions were the same for both studies with the exception of the actual carcasses.

A prediction equation was derived for each probe from the actual carcass data collected on the slaughter floor at J. M. Schneider, Inc. and the cutout data collected at the University of Guelph. The two equations

\[ y = 56.09 - 0.270 \text{ (fat)} + 0.058 \text{ (muscle)} \]

for Destron

\[ y = 56.22 - 0.295 \text{ (fat)} + 0.076 \text{ (muscle)} \]

for Hennessy were almost identical with respect to the regression coefficients (52.2 and 52.1%, respectively) and RSE (1.71 for both). Therefore, it appears that both equations are essentially the same in their ability to predict the lean yield as determined in this study.

When a comparison of each electronic probe with the ruler measurement of fat was made to evaluate bias, the regression analysis showed that the intercept of the Destron with the ruler was over five times closer to 0 (0.89 vs. 4.72) than for the Hennessy and the slope nearer to 1 (0.85 vs. 0.73) with a higher \( R^2 \) (90 vs. 86%) and lower RSE (1.95 vs. 2.08). This indicates that the Destron was closer to the ruler measurement with less bias over the range of carcasses evaluated in this study.

The Destron was also tested for repeated measurements at the same probe site. When one measurement was regressed against the other, the intercept was 0.3 and the slope 0.99 which indicated a near perfect relationship. The correlation coefficient between the two measurements was 0.98. These results indicated a high repeatability in fat thickness measurement for the Destron.

The accuracy of the Hennessy reported here compares favorably with the results of Kempster et al. (1985) and Fortin et al. (1984), although a lower RSE was found in this study. Furthermore a lower RSE (1.71 vs. 2.13) was also found for the prediction equations in this study when compared to that of Fortin et al. (1984a).

It appears that from the results of this study the Destron and Hennessy performed equally well when prediction capability, precision, and bias were considered. The Destron could be used with the same level of confidence as the Hennessy for grading pork carcasses.

The authors express their sincere appreciation to J. M. Schneider, Inc., Kitchener, and Agriculture Canada, for their cooperation and assistance with this research. The Destron has since been approved for grading pork carcasses in Canada.


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