# ASSESSMENT OF PIG CARCASSES BY MEANS OF MFA RECORDER

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## INTRODUCTION

The objective of pig carcass classification is to obtain a reliable estimate of the proportion of lean meat and fat in the carcass, for use as a basis for payment to both producer and retailer. The backfat thickness over the loin at the last ribs is known to be the best single measurement for the estimation of lean meat content. In several pig producing countries, including Sweden, backfat thickness is measured with the optical probe (intrascope). On the basis of these readings, the carcasses are sorted into different classes or grades. In Sweden the limits are 20, 24 and 29 mm between the grades used.

Variation within the classes, especially in the best one, is disregarded in the grading system in use. The economic stimulus for the use of breeding boars in the production of slaughter pigs having a high lean meat content is lacking in this respect.

Fifty percent precision in predicting the variation in lean meat content can be achieved with one single measurement. Two or more backfat thickness measurements, optimally combined give an even more reliable assessment (Kempster & Evans, 1979). If several measurements are to be made on each carcass it would seem desirable to use automatic recording equipment for the reading. In Denmark, grading has for several years been based on measurements taken with the MFA recorder (Meat Fat Automatic) (Pedersen & Busk, 1979). This instrument measures backfat thickness automatically at three places along the back. The readings are combined with the thickness of the muscle at the 3/4 last rib and with the carcass weight in a stepwise regression equation in order to arrive at an estimate of the meat content. The payment to the producer is then based on the estimated lean meat percentage, instead of according to class, as in most other countries.

It is known from several experiments in Sweden that the optical probe may not be ideal in all circumstances. The operator has to identify the fat and muscle boundary visually and read off from the scale. There is thus a certain degree of subjectivity associated with its use. It is also unsuitable for use in automatic fat measurement recording systems. The aim of the present experiment was to compare the Danish MFA recorder and the optical probe in the grading of pig carcasses at two Swedish abattoirs.

## MATERIALS AND METHODS

The experiment was carried out with a complete MFA recorder, borrowed from SFK, Denmark, and an optical probe, as ordinarily used at Swedish abattoirs. Both the MFA measurement and the calculation of lean meat percentage followed the routine used at Danish abattoirs (Pedersen & Busk, 1979). With the optical probe, the backfat thickness was measured at the tip of the last rib 8 cm from the midline of the split carcass. At the one plant the measurements were made on randomly selected carcasses on the line, while at the other, carcasses of pigs in the pig progeny testing program were used for the test. At the first plant, all the carcasses were evaluated by ordinary cutting, the value being based on the yield of joints and trimmings. At the other plant, the carcasses were evaluated by the cutting procedure used in the pig progeny testing programme, giving the lean meat percentage (Andersson, 1976). Backfat and muscle thickness were measured with a scale on the cold carcass at the same point as with the MFA and optical probe. The data were analysed by means of the SAS program (Barr et al., 1976).

## RESULTS

In Table 1 the means and standard deviations of carcass weight, lean meat content and various fat and muscle measurements are given for the 704 carcasses used in the experiment. The progeny tested pigs had a higher lean meat content than the other animals. The results obtained when cutting the carcasses were very close to those estimated with the MFA recorder. The side fat thickness was lower in the meatier pigs. The MFA recorder gave significantly lower readings than the optical probe, with mean differences of 3-4 mm at the last rib.

During cooling, changes have usually been found to occur in the fat depth. Both decreases andincreases have been registered. In Danish experiments

Table 1. *Means ($\bar{x}$) and standard deviations (S.D.) for different traits in the pig carcasses used in the experiment. Routine slaughter pigs at abattoir 1 and progeny tested pigs at abattoir 2.*

| | Abattoir 1 | | Abattoir 2 | |
|---|---|---|---|---|
| | $\bar{x}$ | S.D. | $\bar{x}$ | S.D. |
| Number | 376 | | 328 | |
| Carcass weight, kg | 74.30 | 5.10 | 72.43 | 3.83 |
| Estimated meat content, % | | | | |
| with MFA | 51.58 | 3.35 | 53.54 | 3.03 |
| with cutting | - | - | 53.94 | 3.63 |
| Backfat thickness, mm, last rib | | | | |
| Warm carcass, MFA | 18.08 | 4.07 | 17.44 | 3.37 |
| optical probe | 22.47 | 4.24 | 20.74 | 3.73 |
| Cold carcass, scale | 20.24 | 4.97 | 17.11 | 4.15 |
| Backfat thickness, mm, 3/4 last rib | | | | |
| Warm carcass, MFA | 17.77 | 4.62 | 17.53 | 4.42 |
| Cold carcass, scale | 18.78 | 5.00 | 16.87 | 4.31 |
| Muscle thickness, mm, 3/4 last rib | | | | |
| Warm carcass, MFA | 60.55 | 7.57 | 59.56 | 7.43 |
| Cold carcass, scale | 55.36 | 6.33 | 56.02 | 6.28 |

increases in fat depth at the 3/4 last rib were found (Pedersen & Busk, 1979). In our experiments, the fat depth seemed to be increased at abattoir 1 and decreased at abattoir 2. The reason for this difference is not clear, but it could be due to differences in cooling procedures in use at the two plants.

Table 2. *Correlation coefficients between different measurements of backfat och muscle thickness and the meat content or value of the carcass.*

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Abattoir 2 | | | | | |
| 1. Backfat | cold carcass | | 0.80 | 0.88 | 0.86 | 0.79 | -0.29 | -0.22 | -0.80 | -0.83 |
| 2. last rib | optical probe | 0.81 | | 0.81 | 0.73 | 0.74 | -0.18 | -0.12 | -0.67 | -0.70 |
| 3. | MFA | 0.88 | 0.85 | | 0.78 | 0.78 | -0.23 | -0.17 | -0.75 | -0.75 |
| 4. Backfat | cold carcass | 0.87 | 0.80 | 0.88 | | 0.89 | -0.28 | -0.22 | -0.87 | -0.86 |
| 5. 3/4 las rib | MFA | 0.78 | 0.81 | 0.86 | 0.91 | | -0.30 | -0.32 | - | 0.79 |
| 6. Muscle | cold carcass | -0.28 | -0.17 | -0.17 | -0.29 | -0.24 | | 0.74 | 0.47 | 0.47 |
| 7. thickness | MFA | -0.15 | -0.11 | 0 | -0.12 | -0.15 | 0.70 | | - | 0.42 |
| 8. % lean with | MFA | -0.82 | -0.81 | - | -0.87 | - | 0.33 | | | 0.87 |
| 9. % lean cutting | | | | | | | | | | |
| 10. Value after | cutting | -0.77 | -0.69 | -0.71 | -0.79 | -0.75 | 0.39 | 0.47 | 0.83 | |
| | | | | | Abattoir 1 | | | | | |

The fat thickness in the region 3/4 last ribs is known to give the best estimate of the percentage of lean in the carcass (Kempster & Evans, 1979). In Table 2 the correlations between the different fat and muscle measurements and the lean percentage or carcass value are given. The MFA readings had higher correlations than those obtained with the optical probe, the highest value being obtained at 3/4 last rib as in other experiments. Muscle thickness had a lower correlation than fat measurements.

Multiple regressions of percentage lean or values for all possible combinations of measurements, together with carcass weight, were computed in order to identify those giving the best prediction. The results for the most important combinations are shown in Table 3. The best estimate was obtained when three measurements and muscle thickness were included in the prediction equation. Inclusion of carcass weight only marginally increased the precision of the prediction.

## DISCUSSION

In the experiments a great increase in the precision of lean prediction was gained when several measurements were combined. For practical reasons it is not advisable to take more than one reading with the optical probe. With the MFA recorder all readings are registered automatically. All the readings can therefore be handled with ease in the computer system in order to give optimal information on the carcasses.

In experiments with the MFA performed in Great Britain (Kempster et al., 1979), it has also been found that in addition to the improved precision, a saving in labour could be gained with the MFA. A very high rate of precision, $R^2$= 0.86, was obtained with the MFA recorder in an experiment in Germany (Schön & Pedersen, 1977). As leanness is the main determinant of commercial value, a grading system based on leanness estimated with high precision is a good basis for price setting.

However, a decision to replace the optical probe will also depend on factors other than precision, such as cost of the equipment, efficiency in operation and the possibility of putting the information so obtained to better use. One MFA recorder is now to be installed in a Swedish abattoir for comparative tests against the Hennessy "Fat Depth Indicator" in order to explore fully the potential of the two sets of equipment when in normal use.

All the experiments together with the long experience with MFA grading in Denmark speak in favour of the use of automatic equipment for pig carcass grading in Sweden.

Table 3. *Prediction of value or percentage lean meat in carcasses from combinations of measurements: Multiple correlation squared ($R^2$) and residual standard deviations (RSD)*

| | $R^2$ | RSD |
|---|---|---|
| Abattoir 1. Value of carcass | | |
| Optical probe, last rib fat | 0.54 | |
| Weight + optical probe last rib fat | 0.57 | |
| Stepwise procedure, MFA-recorder | | |
| Step 1. 3/4 last rib fat | 0.559 | 0.224 |
| Step 2. + 3/4 last rib muscle | 0.613 | 0.210 |
| Step 3. + loin fat | 0.680 | 0.192 |
| Step 4. + 3/4 lumbar fat | 0.690 | 0.189 |
| Step 5. + weight | 0.698 | 0.187 |
| Abattoir 2. Percentage of lean meat | | |
| Optical probe, last rib fat | 0.49 | |
| Weight + optical probe last rib fat | 0.50 | |
| Stepwise procedure, MFA recorder | | |
| Step 1. 3/4 last rib fat | 0.622 | 2.227 |
| Step 2. + loin fat | 0.698 | 1.995 |
| Step 3. + 3/4 lumbar fat | 0.737 | 1.863 |
| Step 4. + 3/4 last rib, muscle | 0.761 | 1.761 |

## REFERENCES


Andersson, K. 1976. *Swedish University of Agricultural Sciences. Research Information. The Research Conference, S-750 07 Uppsala 7. Sweden.*

Barr, A.J., Goodnight, J.H., Sall, J.P. & Helvig, J.I. 1976. *A user's guide to SAS.* Raleigh, N.C.

Kempster, A.J. & Evans, D.G. 1979. *Anim. Prod.* 28:87-96.

Kempster, A.J., Jones, D.W. & Cuthbertson, A. 1979. *Meat Science.* 3:109-120.

Pedersen, O.K. & Busk, H. 1979. Stencil. *The National Institute of Animal Science. Copenhagen.*

Schön, L. & Pedersen, O.K. 1977. *Commission of the European Communities, Information on Agriculture No 38.*