THE NEW PIG CARCASS GRADING METHODS IN FRANCE

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BACKGROUND

Pig grading is regulated according to an EC scheme. This scheme for grading by using objective measurements to estimate lean proportion was introduced in 1984 (EC Regulation N°3220/84). Leanness would be calculated by full dissection. This expensive procedure has encouraged some Member States to use a national dissection method, which has introduced biases. To remove these distorsions the EC decided to simplify the dissection. A new definition of the lean meat proportion, based on the dissection of the 4 main joints, was adopted in 1994 (EC Regulation N°3127/94).. As a consequence all Member States would realize a new dissection trial and assess new grading methods. Finland, Denmark and France were the first 3 countries to start a dissection trial according the new EU rules.

Objective grading methods are used in France since 1986. Semi-automatic (hand operated but automatic recording) optical probes have always been used. The most common probe is the CGM (Capteur Gras Maigre, Sydel Company, Lorient, France) since 1993. One location (3/4 last ribs) was used for the prediction of the lean meat proportion and one location was used for the control. The equation was the same for all instruments.

OBJECTIVES

The main objective was to assess new pig carcass grading methods in France, based on the prediction of the new EU lean meat percentage, as defined by EC Regulation n° 3127/94. A secondary objective was to increase accuracy.

METHODS

Strategy : France wishes to rapidly and cheaply take benefit of the new developments in grading, while avoiding both a monopoly and distorsions between producers and slaugterers. As dissection trial is costly and time consuming, a specific calibration procedure was imagined and developped from both statistical and technical aspects. This strategy consists in separating the assessment of the grading methods into 2 steps :

1. A dissection trial, which aim is to assess an accurate equation predicting lean meat proportion from measurements, called « reference measurements » ;
2. A calibration trial (without dissection), which aim is to predict the « reference measurements » from the measurements of the to be approved method.

Dissection trial is common to all the grading methods, but there is one specific calibration trial for each method. A necessary hypothesis is that the « on-line measurements » do not increase accuracy for predicting lean meat proportion when « reference measurements » are predictors. It is the case when the reference method is much more accurate than the tested methods and include variables used by the tested method.

Dissection trial : A sample of 582 carcasses was selected between January and April 1996 in 5 slaughterhouses according the regional production. Two factors, sex (females and castrated males) and genotype (4 groups), were crossed into 8 modalities. Proportions by modalities were conform to those of the population. After chilling overnight, seven measurements called « reference measurements », 4 fat depths and 3 muscle depths, were measured on cold left sides. These measurements were : fat and muscle depths at 3rd/4th last ribs (3/4LR) and 2nd/3th last ribs (2/3LR) both 6 cm off the midline, fat at 3rd/4th last lumbar vertebra (3/4LV) 8 cm off the midline, and the ZP measurements on splitline (minimal fat over the gluteus medius and minimal muscle depth between gluteus medius and spinal canal). Lateral measurements were taken with a caliper after transversal cross-sections of the loin. Cutting, dissection of the half-left carcasses and calculation of the lean meat proportion were made according the general rules of EC Regulation n° 3127/94 and the details specified in Walstra and Merkus (1995). A robust regression (least median squares estimator) was used to detect the influent data. After removing these data, a classical regression (least mean squares estimator) was performed. The sex effect was tested.

Calibration trials : Three calibration trials were carried out : for the CGM (January 1997), ZP-method (March 1997) and Ultra-Meater (June 1997). Each calibration trial was carried out on 140 carcasses in 2 slaughterhouses. The to be calibrated method was used on line under normal industrial conditions by 2 operators on 300 carcasses. Sex was recorded. The CGM measurements were fat depth at 3/4LV 8cm off the midline, fat and muscle depths at 3/4LR 6 cm off the midline (parallel to the midline). The UM (Ultra-Meater) measurements were fat and muscle depths at 2/3LR 6 cm off the midline (perpendicular to the rind). The ZP-method measurements were the classical fat and muscle depths at splitline. Out of the 300 carcasses measured on-line in each slaughterhouse were randomly selected 70 carcasses. After chilling overnight, « reference measurements » were taken by 2 operators.

Outliers were detected by a robust regression from each depth of the tested method for predicting the reference measurement at the nearest location. After elimination of outliers classical regressions were performed predicting each of the 7 reference measurements from all the variables of the tested method. Sex effect was tested.

Assessing the final equations : The statistical theory of the calibration of predictors in regression was developped by Causeur and Dhorne (1996). Final equation is calculated replacing in the reference equation the 7 reference variables by their expression from the variables of the tested method. Estimation of root Mean Square Error (RMSE) is a combination of both Residual Standard Deviations (RSD) of the reference equation and of the calibration equations.

RESULTS AND DISCUSSION

Dissection trial : A good compromise between accuracy and feasability was achieved using 7 predictors : 4 fat depths and 3 muscle depths. No significant sex effect was observed neither for residual variances nor for the coefficients as a whole. The high number of predictors, including 2 tissues and 3 anatomical regions, is probably sufficient to take into account differences between females and castrated males. Estimations, made on 522 carcasses after removing of 7 influent data, have given a RMSE = 1.67 and the following prediction formula :

Y = 53.28 - 0.102 Fsplit - 0.119 F23LR - 0.299 F34LR - 0.231 F34LV + 0.076 Msplit + 0.058 M23LR + 0.135 M34LR

Calibration trials : The proportions of outliers were estimated to 12 % for CGM, 10 % for Ultra-Meater and 9 % for ZP method. A significant sex effect was observed for the 3 methods. Separate formula were therefore calculated.

Assessing final equations : The final equations and errors, separated for females and castrated males, are presented in the table 1. A significant sex effect between females and castrates in the prediction of lean meat percentage was reported in The Netherlands by Engel and Walstra (1993), in France by Daumas et al. (1994), in Belgium by Casteels et al. (1996) and in Germany by Branscheid et al. (1997). But until now, all countries had ignored this effect.

RMSE from splitline measurements (ZP method) is higher, as observed for a long time, close to 2.5, the maximal level authorised in EU. RMSE was lower for CGM (1.98 for females and 2.17 for castrates) than for Ultra-Meater (2.24 for females and 2.21 for castrates). A second site and a highest resolution for CGM can contribute to its best accuracy. CGM has also been approved in Belgium, where RMSE was 2.08 for one costal site under experimental conditions and without calibration (Casteels et al., 1996).

Implementation in slaughterhouses : The new grading methods were implemented in the french slaughterhouses on June 1997. The CGM method is used in most factories, grading 90 % of the pigs in France. The 12 millions pigs classified during the second half-year of 1997 have reached an average lean meat proportion of 60.0. Females have an highest average (61.5) and a lower standard deviation (1.9). Castrates, with an average of 58.5, have 3 points less than females. This large difference and the large standard deviation for catrates (3.1) both contribute to a global standard deviation of 3.0. For a same average slauhterweight (87.0 kg), females have 1.6 mm muscle depth more, 2.9 mm costal fat depth less and 2.2 mm lumbar fat depth less than castrates.

To easily and cheaply implement the ZP-method in the small slaughterhouses a specific ruler was developed. One face is for female and the other for castrate. Scales are designed converting readings for fat depth into lean meat proportion and readings for muscle depth into bonus or malus (difference with the average lean proportion resulting of an average muscle depth). Operator can therefore mark or write the lean meat proportion without any calculator.

CONCLUSIONS : For the second time France has modified its objective grading methods. The new methods now predict the new lean meat proportion, as defined by the EC regulation n° 3127/94 (dissection of the 4 main joints). They were implemented in the french slaughterhouses on June 1997. On average, this new estimated lean proportion is 60.0, i.e. the same level as in Denmark and the highest in EU behind Belgium.

On April 1998, 3 methods are approved in France : CGM, Ultra-Meater and ZP-method. The last one is dedicated to the small slaughterhouses (less than 200 pigs per week). Its RMSE is close to 2.5. CGM method is more accurate than Ultra-Meater method.

A significant sex effect for the 3 methods has leaded to include sex as predictor. France is therefore the first country using separate equation for each sex in pig carcass grading methods. The separate results by sex help producers to adapt their management, feeding differently females and castrates when possible and economically interesting.

In the future new grading methods can be tested and approved in some months without dissection thanks to an original calibration procedure. This procedure, developed in France in 1996, was used for testing the 3 methods presently approved.

LITERATURE

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Table 1 : Equations and error of the 3 methods *(1) CGM : 3/4LR, UM : 2/3LR, ZP : at splitline.(2) CGM : 3/4LV.*

METHOD	SEX	INTERCEPT	MUSCLE (1)	FAT 1 (1)	FAT 2 (2)	RMSE
CGM	Female	61.68	+ 0.154	- 0.449	- 0.142	1.92
«	Castrate	58.15	+ 0.255	- 0.570	- 0.198	2.06
Ultra-Meater	Female	60.87	+ 0.209	- 787		2.13
«	Castrate	58.44	+ 0.304	- 0.953		2.17
ZP-method	Female	54.84	+ 0.194	- 0.545		2.45
«	Castrate	48.35	+ 0.255	- 0.488		2.49