STUDY ON THE USE OF NEW OPTICAL-NEEDLE DEVICE CGM FOR ESTIMATING THE LEAN MEAT PERCENTAGE IN PIG CARCASSES

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Introduction

Among many methods of estimating meat percentage in pig carcasses the most important one is optical-needle and ultrasound technique. Meat percentage estimation performed by the means of this method is based on regression equations provided for domestic pig population with reference to analysis of correlations between fat thickness and *longissimus dorsi (LD)* muscle thickness on the one side, and meat percentage obtained from dissection (Borzuta 1998, Dobrowolski *et al*. 1993, Daumas and Dhorne 1998).

In Poland, as new classification devices were introduced to domestic slaughterhouses, many regression equations were provided for the purpose of estimating meat percentage. In 2002, researches were begun on re-testing various devices within the framework of twinning project PHARE no. PL.01.04.06, co-financed by European Union. One of the devices tested in this project is French probe CGM, in which modern optical-digital converter have been used, the resolution of which is twenty times higher than in optic-needle devices of older generation (Komender 2003).

Objectives

The objective of the research was to provide the regression equation for the purpose of meat percentage estimation in pig carcasses with new optical-needle CGM device.

Methodology

On slaughter lines of three slaughterhouses 286 carcasses were chosen for measurements and dissection, arranged in three groups of similar size, differing as for back fat thickness, i.e. group 1 from 4 to 16 mm, group 2 from 17 to 28 mm, group 3 from 29 to 44 mm (Borzuta *et al*. 2003). The carcasses were chosen from the weight range 60 to120 kg, and they originated half from gilts and half from castrated males.

On the chosen, left half-carcasses the measurements of fat and LD muscle thickness were performed with CGM probe in two points, i.e. at the level of last rib and between 3rd and 4th thoracic vertebrae, counting vertebras from the end. The needle was

inserted 6 cm from split line, paralelly to cut surface. Dissection was performed by a team of 10 trained burchers supervised by experts from Poland and Denmark. The team used the referential dissection method obligatory in European Union (Walstra and Markus 1996), which anticipates dissection of 4 main joints, i.e. ham without shank, shoulder without shank, loin, belly and tenderloin. Regression equation for estimating meat percentage was calculated with multiple linear regression MLR.

Results & Discussion

Examined carcasses had average meat percentage amounting to 52,84% and represented population of normal distribution. High, statistically significant correlation coefficients were obtained ($P \leq 0,01$) between performed fat and muscle thickness measurements and meat percentage in carcass (tab. 1). Considerably higher correlations were obtained for fat thickness rather than LD muscle thickness, what is commonly known (Daumas *et al*. 1998, Blicharski *et al*. 2000, Borzuta 1998). Correlation coefficients for manual measurements performed on cross-section areas of half-carcasses turned to be only slightly higher than for measurements performed with the probe, what proves high accuracy of the probe.

In the set of meat percentage measurement results there were not any outliers found and therefore regression equations were also provided for all dissected half-carcasses.

The equations are as follows:

a/ Equation with carcass weight (W) and four measurement points

$Y = 50,17026 – 0,30012F1 – 0,36252F2 + 0,11475M1 + 0,19995M2 – 0,04152 W$
Estimating error RMSE = 2,21 $R^2 = 0,82$

b/ Equation with four measurement points, without carcass weight
$Y = 48,80655 – 0,33616F1 – 0,36445F2 + 0,10173M1 + 0,18911M2$
Estimating error RMSE = 2,23 $R^2 = 0,82$

c/ Equation with two measurement points
$Y = 50,11930 – 0,62421F2 + 0,26979M2$
Estimating error RMSE = 2,38 $R^2 = 0,79$

Calculation results prove that each of three regression equations mentioned above can be used for implementation into industry as they meet the European Union regulations as for estimating error, which cannot exceed 2,5% (EC Regulation 3127/94). Analysis of those equations indicates, however, that including carcass weight into regression analysis decreased the estimating error RMSE only by 0,02, what practically is of no importance whatsoever for classification results. Abandoning the measurement points F1 and M1, however, causes increase of estimating error from 2,23 to 2,38. As in two-point measurement RMSE does not exceed the value of 2,5%, the producer of the probe decided to introduce the device with that simplified measurement procedure into the industry, what significantly increases the CGM probe efficiency. A little bit lower

estimating error was provided only for France, RMSE = 2,17 for castrated males and in Belgium (RSME = 2,08), but in both countries 4 measurement points were included into the equation (Daumas and Dhorne 1998).

The results of regression analysis for one-point measurement equation were given in tab. 2

Conclusions

1. Research performed on numerous population of dissected pig carcass proved high, statistically significant correlation between meat percentage in carcass and fat and *longissimus dorsi* muscle thickness at the level of last rib and in the cross-section area between 3rd and 4th thoracic vertebrae, counting vertebras from the end.
2. Multiple linear regression equation provided for CGM probe for the purpose of estimating lean meat percentage in pig half-carcasses takes into account two measurement features of fat thickness and the *longissimus dorsi* muscle thickness defined in the thesis results and its estimating error RMSE = 2,38.

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Tables and Figures

Table 1. Coefficient correlations between muscling indexes and meat content of pig carcasses

Correelated traint	Indexes measured handly by ryler	Indexes measured by CGM
Thickness of backfat	- 0,43	-
F_1	- 0,82	- 0,77
M_1	0,59	0,45
F_2	- 0,83	- 0,78
M_2	0,58	0,48

F_1 – fat thickness under the last rib, 6 cm from middline, measured parallely to this line

F_2 – as F1 but measurement was made between 3 and 4 last back vertebra

M_1 – thickness of m. LD measured in the same point as F_1

M_2 – thickness of m. LD measured in the same point as F_2

Table 2. Regression analysis for CGM device

Traits	Regression coefficient	s	t	P
intercept	50,11930	1,08476	46,20	0,0001
F2	-0,62421	0,02289	-27,27	0,0001
M2	0,26979	0,01767	15,27	0,0001