Precision of the lean meat content estimation with the automatic grading equipment AUTOFOM on Polish pig carcasses

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Keywords: lean meat content, ultrasound, Polish pig carcasses

Background

In the recent days the meat industry puts more and more stress on introducing objective carcass grading systems, able to save personal costs and eliminate human error in the process. There is also more interest put on increasing the amount of information about meat content not only of the whole carcass, but also of the particular cuts. Equipment fulfilling this demand is the AUTOFOM system developed and introduced in Denmark in 1995. The AUTOFOM system is a three-dimensional, digital ultrasonic scanner, able to measure muscle and fat thickness on the total length of the back of the carcass, from ham to shoulder. (Broendum et al., 1996). Big number of measurements of fat and muscle on the carcass gives a possibility for better lean meat content estimation independently of genotype differences in anatomy of the animals. This is extremely important in Poland with an existing big variation of meat content (from app. 35% to 65%), resulting from different breeds or crossings. (Borzuta et al., 1998, Ostrowski et al., 1997).

Objective

The objective of this work was to develop the regression equation for the lean meat content estimation with the Danish AUTOFOM system for Polish pig carcasses. Until now, such equations were developed only for Denmark, USA, Germany and Sweden.

Materials and Methods

The analysis was made on 128 pig carcasses, representing a random sample form the population with the following distribution over EUROP classes: class S – 2, class E – 10, class U – 29, class R – 38, class O – 41 and class P –8. The sample was equally distributed into gilts and castrates. The average lean meat content of the sample was 47.48 % with a standard deviation of 5.05.

The fat and muscle measurement on the back of the carcass were made directly after dehairing using the ultrasonic transducers and analysis software of the AUTOFOM system and stored on the central computer. The measurements were made by the line speed of app. 200 carcasses per hour. Left half-carcasses were dissected after chilling according to the DLG method. (Borzuta et al., 1997). The statistical analysis was done with the support of the computer center of SFK-Technology.

Results and discussion

The statistical regression analysis of 128 specific fat and muscle measurements delivered by the AUTOFOM system resulted in selecting 48 parameters with statistically significant multiple regression coefficients varying from 0.05192 to 0.00562. (Fig. 1). The multiple regression equation was characterized by the following statistical parameters:

- residual standard deviation (RSD)   = 2.00
- coefficient of determination (R^2)   = 0.843
- multiple regression coefficient (R)   = 0.918

The estimated residual standard deviation (RSD) = 2.00 is the lowest value for all grading equipment tested in Poland (Borzuta et al., 1994). The regression equations developed in Denmark and Germany were characterized by lower RSD values (Broendum et al., 1996). This can be explained by the extremely high variation of lean meat content in carcasses of Polish pigs. This resulted also in reasonable differences in distribution of carcasses over the classes according to the dissection and to the AUTOFOM estimation. (Tab. 1.) The analysis shows that the regression equation underestimates the lean meat content in lean carcasses and overestimates in fat ones. (Tab. 1, Fig. 1)

To avoid the phenomenon a correction factor was calculated using a linear regression of estimated values to the dissection results. The correction of the regression equation slightly increased the RSD but significantly improved the distribution over the classes. The results from the corrected equation are very close to the dissection results (Tab. 1).

High precision, high speed and operator-free, automatic grading procedure of the AUTOFOM system makes it a system of choice for all modern abattoirs. The only limiting factor for its wide distribution in Poland can be the price of the system.

Conclusions

1. The AUTOFOM grading system is a high-speed, automatic device estimating the lean meat content of the pig carcasses with very high precision, RSD = 2.00 and R = 0.918, which are the best values among all instruments tested in Poland.
2. The multiple regression equation for the AUTOFOM system is based on 48 measurements of fat and muscle thickness on the back of the carcass.

3. Due to the extremely high variation of the lean meat content of Polish pigs, a correction factor was used for the equation, im
proving the distribution of estimated values over the classes. The corrected equation is characterized by RSD = 2.18 and
R = 0.918.

Literature

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Tab. 1. Statistic parameters of the original and corrected regression equations for the lean meat content of Polish pigs measured
with the AUTOFOM system.

	Regression equation	Corrected regression equation	Dissection
Mean	47,48	47,48	47,48
SD	4,637	5,505	5,051
RSD	2,00	2,18	
R^2	0,843	0,843	
R	0,918	0,918	
S	0	2	2
E	7	10	10
U	34	33	29
R	45	37	38
O	36	37	41
P	6	9	8

Fig.1 Diagnostic graph of lean meat content calculated using regression equation
for Auto-Fom device with (broken line) and without correction (constant line)

$y = 0.8428x + 7.4655$
$R^2 = 0.8428$