# THE USEFULNESS OF CLASSIFYING INSTRUMENTS ULTRA - FOM AND PG - 200 FOR ESTIMATION OF PORK CARCASSES MEATNESS IN POLAND

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## Introduction

The use of electronic technology in the construction of classification devices for pork carcass has caused considerable development and popularization of various types of the devices for the assessment of meat content in pork carcass after slaughter. Usually two types of devices are used: ultrasonic and optical-needle.
The assessment of pork carcass meatness by means of those devices consists in using regression equations developed in research centres , on the basis of correlation analysis of different measures of back fat and longissimus dorsi muscle and meat content set by dissection.

The EEC regulations ( instruction 2967/85) define precisely the conditions of testing the devices. The most important ones are as follows:
- measurement and precise dissection of minimum 120 half carcasses representing the population of pigs slaughtered in national slaughterhouses.
- settlement of musculature parameters ensuring the best correlation with meat content set by dissection.
- elaboration of regression equation for the carcass meatness for the carcass meatness asessment with the error RSD < 2,5 and coefficient of determination R= 0,64

Since 1991 EEC companies have been presenting in Poland the devices for assessment of meat content in pork carcass. Therefore the assessment of the usefulness of those devices in polish meat industry has become necessary.
The purpose of the investigation was to prove the usefulness of ultrasonic device ULTRA-FOM and the optical-needle device PG-200 for meatness of pork carcass in Poland.

## Material and methods

The experiment was carried out in compliance with the instructions of the EEC Commission No 2967/85 conserning the way of pork carcass assessment.
The experimental material were 369 pork carcasses chosen in random on slaughter lines of several slaughter houses in Poland. The subject of the investigation were pork carcasses of 60 to 110 kg. The following measures were taken on the warm, unskinned half carcass:
- the thickness of back fat and longissimus dorsi muscle (LD) taken 5,6,7,8 cm off the carcass cutting line along the back bone, at 3 points, at the level off: the last rib ( i.e. the connection of the rib with the back bone ), between 3 rd and 4 th rib and between 3 rd and 4th lumbar ring ( counting towards the head )

The instrumental measurements were made by means of the ultrasonic device ULTRA-FOM 100 (produced by the Danish Company SFK- Technology ) and the optical -needle device PG- 200 (produced by the German Company Eurocontroll Breitsameter GmbH ) on 169 and 200 carcasses respectively.
On a cooled half carcass the same measurements were taken with the use of a vernier at the same points at respective cross-sections. Partition and dissection of the left half carcasses were made according to the German method DLG updated in 1984. Out of each element of half carcasses, the following items were seperated:meat, subcutaneous fat, intermuscle fat, bones, skin, films and ligaments.

The results were worked out statistically. For each of the devices tested for carcass meat assessment standard deviation coefficients of single and multiple correlation and regression equations were calculated.

Results

On the basis of the analysis of the collected materials and statistical calculations it has been stated that a single measurement of back fat thickness or a muscle at different of a carcass half is not sufficient for the assessment of meat content with the accuracy defined by the EEC regulations.
The statistical analysis results have proved that meat content can be determined on the basis of at least three measurements taken at two different measure points of a halfcarcass.
This is certified by coefficients of single correlation put together in table 1.

From among of many calculated combinations done for different devices the following coefficients of multiple correlation of the highest values were achived: for ULTRA-FOM the coefficient of multiple corrrelation between the meat content in carcass and the fat thickness-$x_1$ and the muscle thickness-$x_3$ at the level of the last rib ( 7 cm from the carcass section line ) and also between the fat thickness-$x_2$ on the 3/4 rib (7 cm from the carcass section line ) R= 0.805 ; and for PG-200 the coefficient of multiple correlations between the meat content in carcass and the fat thickness-$x_1$ and the muscle thickness-$x_2$ at the level of the 3/4 rib and the fat thickness-$x_3$ at the level of the 3/4 lumbar ring, both measuring points 5 cm from the carcass section line R= 0.8521.
As a result of statistical calculation the following regression equations for ULTRA-FOM and PG-200 were elaborated:
ULTRA-FOM
$y= 50.41172- 0.2467x_1-0.2628x_2+0.11366x_3$ ( equation 1 )
PG-200
$y= 53.22293-0.28709x_1+0.12848x_2-0.26655x_3$ ( equation 2 )
RSD for both equations was respectively : RSD= 2.36 and RSD= 2.49
The statistical analysis elaborated on results of pork carcass measurements from meat industry permitted to estimate rectilinear regression equations that met the requirements of EEC regulations ( $R > 0.64$ and $RSD<2.5\%$ )
Equations 1 and 2 however turned out not to be true for the high-meat population that did not occur in industry and were not included into experimental material that is shown on fig.1.
The lowering of meatness measurement estiamted in equation 1 for high- meat porkers was on the average of 8.42% with oscillation from 2.42 to 11.40% for single carcasses.
Simmilar differences were observed un case of PG-200 and the average lowering of meatness measurement was.3.68%... with oscillation from. 0.14.. to.6.19.%
The lowering of meatness measurement has been observed after introducing into industry high-meat porkers.In the result additional dissection was considered necessary and measurements for 35 carcass of >52% meat content. Combination between the industrial population and 35 carcasses of high-meat content let us elaborate some new relationships and derivate curvlinear regression equations that look as follow:
ULTRA-FOM
$y=71.356-1.107x_1 + 0.18x_2 - 1.18x_3+ 0.0324x_4$ ( equation 3 )
$R= 0.86$ $R^2= 0.75$ RSD= 2.94
PG-200
$y=50.34 - 0.0503x_1 + 0.2578x_2 - 0.910x_3 + (0.00808x_3)^2$ (equation 4 )
$R= 0.92$ $R^2=0.84$ RSD= 2.97
where $x_1$ - as $x_1$ in equation 1
$x_2$ - as $x_2$ in equation 1
$x_3$ - as $x_3$ in equation 1
$x_4 = [( x_1 + x_3 ) / 2]^2$
The Diagnostic diagram of regression equation 3 , 4 is shown on Fig. 2 and 3

Coefficients of linear correlation after combination of material for measuring points defined for the estimation of meat content in carcass were rispectively for ULTRA-FOM and PG-200 devices :
- fat thickness x1 * % of meat in carcass
  were - 0.7710 - 0804
- muscle thickness x2 * % of meat in carcass
  were 0.3365 0.701
- fat thickness x3 * % of meat in carcass
  were - 0.7710 - 0.8330

The results of measurements and calculation have shown that elaborated regression equations 1 and 2 can not be useful for diagnosis of meat content in carcasses of high-meat porkers. Measurements and dissection of pork carcasses from both population, that is from industry and from breeding let us elaborate curvlinear regression equations ( equation 3 and 4 ) that diagnose accurately rispectively 74,51 % animals is case of ULTRA-FOM device and 84,47 % for PG-200 but with RSD higher then in equation 1 and 2 (rispectively RSD =2,95 % compared to RSD =2,36 and also RSD =2.97 compared to RSD=2.41 )
The higher RSD of meat content estimation is caused by high oscilation of meatness factor that is from about 25% up to 65% . At the present level of technical development it is very difficult to find the regression equation with the RSD that meet the EEC regulations ( that is RSD lower than 2.5%.
The only way to lower RSD is through rising meatness and lowering its oscillation (variation).
The analysis of completed material guides to the conclusion that the most important in ellaborating regression equations is very proper selection of experimental material . HITHERTO prevailing EEC indications in this respect create a great discretion in carcasses selection for research. Experimental material should represent in equal proportions all industrial values for meatness and carcasses weight. When contrary, regression equations will estimate badly meat content in carcasses of porkers representing small percentage of the population.

Conclusions:

1. Instruments ULTRA-FOM and PG-200 for valuation of meat content in pork carcasses are useful in meat industry for the objective classification of carcasses according to meatness factor. The efficiency of devices is about 250 animals/hour.

2. Experimental measurements let elaborate regression equations for valuation of meatness of porkers high-variable carcasses, oscillating from about 25% to about 65% of meat (content).

3. The selection of material for elaboration of regression equations should include also pork carcasses of various meatness and weight with the same number of animals in experimental groups.
When contrary, all elaborated regression equations might be less exact for estimation of meat content in high-meat carcasses ( high-meat porkers ).