Ultra - Fom 300 the new equipment for after slaughter meatness evaluation of pork carcasses

Blicharski T.(1), Borzuta K. (2), Ostrowski A. (1), Lisiak D. (2), Strzelecki J. (2)
(1) Institute of Genetics and Animal Breeding, Polish Academy of Science, Jastrzębiec, Poland
(2) Meat and Fat Research Institute, Poznań Poland
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Introduction

Intensive development of ultrasonic techniques causes ever-growing range of their applications in live and after slaughter meatness evaluation of pigs. Ultrasonic equipment is non-invasive and can be applied for entire carcasses and half-carcasses. The construction of this equipment excludes mechanical moving parts and in the result it is reliable and durable.

Objective

The purpose of research was to evaluate the precision of functioning and to elaborate regression equations for the new Danish ultrasonic apparatus for evaluation of carcasses meatness – Ultra Fom 300 (UF 300).

Material and methods

For the elaboration of an optimum regression equation estimating meatness there have been utilized results of measurements made with use of UF 300 and results of dissection of 128 pork half-carcasses.

Ultra Fom 300, equipped with 64-elements linear head of 50 mm length, has been utilized to make the following ultrasonic measurements on hot carcasses:

x1 – thickness of back fat above the last rib, 7 cm from carcass middline;
x2 – height of loin eye above the last rib, 7 cm from carcass middline;
x3 – thickness of back fat above ¾ rib (counting form the end), 7 cm from carcass middline;
x4 – height of lion eye above ¾ rib (counting from the end), 7 cm from carcass middline.

Chilled half-carcasses have been linearly measured with use of a slide caliper and then submitted to simplified dissection with use of Walstra and Markus method (1996).

Results of the apparatus measurement and results of dissection have become the basis for elaboration of the regression equation estimating meatness.

Results and discussion

The medium meatness of dissected half-carcasses was 50.7% with the variability of meat content in a carcass from 35% to 65%. The weight of half-carcasses after chilling was from 30 to 53 kg. Such meatness and weight level of examined carcasses and their variability are representative for the present status in Poland (Borzuta 1999).

Average values of linear measurements, (made with use of a slide caliper), and ultrasound measurements, (with use of Ultra Fom 300), of back fat thickness in two measurement points have been very closed to each other. Apparatus measurements of loin muscle height were indicating lower average values of this parameter when comparing to linear measurements. The reason of these differences might be a different position of a half-carcass during apparatus measurements, (hanging position), and during sliding caliper measurements, (laying position), as well as different thermal state of meat (hot and chilled).

The analysis of values of correlation coefficients (table 2) has shown high interdependence between results of measurements and percentage content of meat in a carcass.

It has to be outlined the high value of correlation coefficients between ultrasonic measurements of back fat thickness (x1, x2) and carcass meatness, which were respectively r= -0,87 and r= -0,86. Also obtained during research correlations between ultrasonic measurements of muscles thickness (x3, x4) and carcass meatness have shown higher values in comparison to correlations obtained during research carried on another ultrasonic equipment (Blicharski and Ostrowski 1997, Borzuta 1998, Lowe 1993).

High values of correlation coefficients between ultrasonic measurements UF 300 of individual tissues and content of meat in a carcass allow expecting the higher precision of meatness evaluation in comparison to another ultrasonic equipment.

On the basis of the mentioned above analysis of parameters the optimum has been considered the regression equation that evaluates meatness (Y) utilizing results of ultrasonic measurements in the following carcass measurement points:

x1 – back fat thickness above the last rib in a distance of 7 cm from carcass middline;
x2 – back fat thickness above ¾ last rib in a distance of 7 cm from carcass middline;
x4 – height of loin eye above ¾ last rib in a distance of 7 cm from carcass middline.

The equation formula is:

$$Y = 61{,}2798 - 0{,}35134 * x(1) + 0{,}27525 * x(4) - 1{,}28959 * x(2) + 0{,}01863 * x(2)^2$$

The equation has got the following parameters:

$R = 0.94$, $R^2 = 0.89$, $RSD = 2.21$

The average meatness estimated with use of UF 300 amounted to 51,2% and was higher by 0.46 of percentage point than the average meat content obtained in the result of dissection. The estimated meatness of carcasses shows a high correlation r= 0,91 with the one obtained in the result of dissection. These values prove obtaining expected and significant improvement of the precision of ultrasonic equipment functioning (Lake 1999). The obtained error estimation is lower than requirements of United Europe, e.g. lower

than 2,5% (Council Reg. No. 3220/84) and significantly lower than the regression equation error RSD = 2,9%, elaborated in Poland for another ultrasonic equipment, not utilizing multi-element measurement heads (Borzuta 1998).

CONCLUSIONS:

1) There has been considered the high measurement conformity of back fat thickness measurements with use of a slide caliper with Ultra Fom 300 equipment. Correlation coefficients between these measurement methods are respectively 0,94 and 0,95, dependently on measurement points. The mentioned above apparatus measures less accurately loin eye thickness because the correlation coefficient characterizing the interdependence between apparatus measurements and slide caliper measurements is approximately 0,7.
2) There have been obtained high values of correlation coefficients between back fat and muscle thickness ultrasonic measurements and carcass meatness.
3) For Ultra Fom 300 equipment there has been elaborated the regression equation having the following statistical parameters: $R^2 = 0,86$, RSD = 2,21.

Literature

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Table 1. Some parameters of 128 investigated carcasses

Parameter		$\bar{x}$	SD
Carcass weight	kg	38,6	3,52
Meat content Walstra	%	50,7	6,49
Merkus			
Linear measurements:			
- x_1	mm	17,9	8,01
- x_3	mm	58,3	8,46
- x_2	mm	18,5	7,84
- x_4	mm	56,8	8,43
Instrumental measurements:			
- x_1	mm	18,0	6,51
- x_3	mm	51,6	6,15
- x_2	mm	18,8	6,50
- x_4	mm	48,7	5,90

Table 2. Correlation coefficients for linear and instrumental measurements

Measurements	Corelation between measurement and meat content in carcass r	Correlation between linear and instrumental measurement r
Linear measurements:		
- x_1	-0,89	-
- x_3	0,61	-
- x_2	-0,90	-
- x_4	0,53	-
Instrumental measurements:		
- x_1	-0,87	0,94
- x_3	0,51	0,70
- x_2	-0,86	0,94
- x_4	0,55	0,65