EVALUATION OF CARCASS COMPOSITION IN LIVE PIGS WITH ON-FARM ULTRASOUND MEASUREMENT

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Introduction
Evaluation of the lean meat percentage of live animals before slaughter is very important from an economical and technical point of view. It enables farmers to produce different crossbreeds for desired purposes. Evaluation of the lean meat percentage of pigs before slaughter with ultrasound measurements could facilitate co-operation between pork production and meat products manufacture. As a result, the meat industry would get optimal raw material for its process. As is well known, the lean meat percentage is based on the yields of pork cuttings.
In this research the ultrasonic on-farm performance test was used to evaluate the lean meat percentage in pig carcasses.

Materials and Methods
The on-farm performance test includes measurement of fat thickness with ultrasound (Scanoprobe II, Scanco Inc. USA). In this study, the thickness of subcutaneous fat was measured in 75 live pigs with ultrasound at four points a couple of days before slaughter. The points were the shoulder (just behind the scapula, 6 cm from the midline of the back), the loin (in the midline of the back, between the 12th and 13th ribs), the S1 point (between the 15th rib and 1st lumbar vertebra, 8 cm from the midline of the back) and the ham (10 cm from the pigtail in the midline of the back). The test animals included 36 two-breed crosses (Landrace x Yorkshire) and 39 three-breed crosses (Duroc x Landrace x Yorkshire). Furthermore, there were 38 castrates and 37 gilts. On the slaughter line, the lean meat percentage of carcasses was measured with the Hennessy GP4. A day after slaughter the carcasses were commercially cut and the cuts were weighed (Honkavaara 2002, Swatland 2000). Cutting yields were calculated as a percentage of the carcass without head and feet. Regression analysis was used to evaluate the variation in the lean meat percentage of pig carcasses against the ultrasound values.

Results and Discussion
The average live weights of tested pigs and their shoulder, loin, S1 point and ham fat thicknesses are shown in Table 1. Ultrasound measurement indicated shoulder fat to be thickest, followed by ham fat and S1 point fat, while loin fat was thinnest.

Table 1: The average fat thickness values measured with ultrasound in 75 live pigs.

Variable	Mean	Std dev	Min	Max
Live weight, kg	104.7	4.6	93.0	114.5
Shoulder fat, mm	16.9	0.9	14.0	20.0
Loin fat, mm	10.8	0.9	8.0	13.0
S1 point fat, mm	11.0	1.1	8.0	13.0
Ham fat, mm	11.8	1.1	9.0	15.0

In this study, the average slaughter weight of pig carcasses was 78.1 $\pm$ 4.0 kg. Their lean meat percentage was 58.8 $\pm$ 1.9 %. Table 2 shows the average cutting yields of tested animals. The heaviest primal cut was the ham, followed by the forequarter, belly and back and tenderloin.

Forequarter cuts accounted for 28.3 % of the variation in the thickness of shoulder fat while foreshank meat explained 13.3 %, boneless shoulder 5.2 %, subcutaneous fat 5.0 % and fatty trimmings 2.9 %. Cross breeding had some effect on the variation in shoulder fat. In two-breed crosses, forequarter cuts explained 43.2 % and in three-breed crosses 28.5 % of the variation in shoulder fat thickness. Sex also had an effect on the variation in shoulder fat. In castrates, forequarter cuts accounted for 55.4 % of the variation while in gilts they accounted for only 18.6 % of the variation.

It was found that retail back cuts could explain only 11.0 to 11.4 % of the variation in loin fat and S1 point fat thickness. Fatty trimmings and subcutaneous fat explained most of the variation in back fat thickness. Cross breeding had no significant effect on the variation in loin fat and S1 point fat thickness only 9.1 to 17.8 % while sex affected the variation in back fat thickness. Back cuts of gilts explained 39.5 % and those of castrates only 11.5 % of the variation in loin fat thickness. In addition, back cuts of gilts explained 33.2 % of the variation in S1 point fat thickness whereas those of castrates could only explain 25.7 %

Furthermore, retail ham cuts explained only 19.0 % of the variation in ham fat thickness: hindshank meat explained the most at 6.1 %, followed by fatty trimmings at 4.0 % and abdominal cut at 3.3 %. Cross breeding had an effect on the variation in ham fat thickness. In two-breed crosses ham cuts explained 31.7 % and with three-breed crosses 20.8 % of the variation in ham fat thickness. Sex also had some effect on the variation in ham fat. Ham cuts of castrates explained 29.0 % while those of gilts explained 24.1 % of the variation in ham fat thickness.

In this study, the measured fat thickness values explained only 7.8 % of the variation in the lean meat percentage of pig carcasses. S1 point fat thickness explained 3.4 %, loin fat thickness 2.5 %, shoulder fat thickness 0.9 % and ham fat thickness 0.9 % of the variation in the lean meat percentage. Fat thickness values of two-breed crosses explained only 4.6 %, and those of three-breed crosses 15.8 % of the variation in the meat percentage of carcasses. Fat thickness values of castrates explained 20.2 %, whereas those of gilts explained only 10.8 % of the variation in the lean meat percentage of carcasses.

Table 2: Average yield of retail cuts of 75 pig carcasses (mean ± standard deviation without head and feet).

Retail cuts	Yield, %
Forequarter:	30.1 ± 1.1
Anterior back	5.7 ± 0.4
Boneless shoulder	10.2 ± 0.8
Fatty trimmings	3.7 ± 0.7
Foreshank meat	1.1 ± 0.2
Skin	1.5 ± 0.3
Subcutaneous fat	2.7 ± 0.5
Bones	5.2 ± 0.5
Back:	16.9 ± 0.8
The *longissimus dorsi* muscle	8.8 ± 0.6
Fatty trimmings	1.6 ± 0.3
Skin	0.8 ± 0.1
Subcutaneous fat	2.3 ± 0.6
Bones	3.4 ± 0.3
Tenderloin:	1.8 ± 0.1
Trimmed tenderloin	1.4 ± 0.1
Trimmings	0.4 ± 0.1
Belly:	17.1 ± 0.9
Boneless belly	10.9 ± 0.9
Fatty trimmings	1.4 ± 0.4
Skin	1.4 ± 0.2
Bones	3.4 ± 0.3
Ham:	31.9 ± 0.9
Inside joint	5.5 ± 0.4
Outside joint	6.8 ± 0.5
Corner joint	3.5 ± 0.3
Roasting joint	2.8 ± 0.3
Hindshank meat	2.0 ± 0.2
Fatty trimmings	2.9 ± 0.6
Skin	1.6 ± 0.2
Subcutaneous fat	3.1 ± 0.8
Abdominal cut	2.1 ± 0.4
Bones	3.8 ± 0.3

Conclusions

The results show that the yields of retail cuts of pig carcasses were nearly insignificant in explaining the variation of fat thickness in the shoulder, back and ham when measured with ultrasound on the farm. Furthermore, the results show that it is not possible to evaluate the lean meat percentage of pig carcasses by ultrasound fat thickness measurement on the farm a couple of days before slaughter. This suggests that ultrasonic estimation of muscle dimensions, like the loin muscle area in live pigs, should be included in the procedure in addition to fat thickness measurement.

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