

Prediction of meat traits of different pig breed combinations in Estonia

A. Tänavots, E. Somelar*, O. Saveli, K. Eilart, A. Põldvere, T. Kaart. Estonian Agricultural University, Institute of Animal Science, Kreutzwaldi 1, Tartu 51014, Estonia

Introduction

During the last decade the Estonian meat market has changed considerably. Consumers have started to require quality meat and meat products based on environmental, ethic and welfare concerns. Whether the acceptable pig carcass is fat or lean depends more on national predilection. As industrialisation develops, the desire for lean meat appears to dominate the definition of carcass quality (Whittemore, 1996). Different methods to estimate meat content and pork quality have been used during the times (Kempster and Evans, 1979).

The aim of this study was to estimate meat quality of live pigs and their carcasses, and to investigate the effect of breed combination on the meat quality.

Material and Methods

Hundred ninety-three pigs were tested ultrasonically between 1998...1999 in Kehtna Swine Testing Station. Animals originated from 22 different farms over Estonia. All pigs were kept according to the rules of control fattening, where two pigs were kept in the pen during testing time (at 25 to 100 kg) in stable feeding conditions. Five groups of purebred and crossbred pigs were under observation - purebred Estonian Landrace, Estonian Large White (ELW), Finnish Yorkshire (FY) and crossbred Hampshire ♂ x ELW ♀ (H/ELW), H/EL/ELW ♂ x EL ♀ (H/EL/ELW x EL).

Live Animal Measurements. Ultrasonic measurements, backfat thickness and diameter of loin eye, were made with Piglog 105 and A-Scan Plus. Pigs were tested one day before slaughter. The following traits were recorded: backfat thickness at last (x1) and 11...12th (x3) rib, 7 cm from midline (mm), and diameter of loin eye (x2), 7 cm from midline (mm). Lean meat percentage (y) was calculated using the formula: $y = 64.39 - 0.28x1 + 0.14x2 - 0.55x3$

During ultrasonic testing weight, date and origin farm were registered, where testing weight was 93...112 kg. To find season effect, testing year was divided into four parts: spring - March, April, May; summer - June, July, August; fall - September, October, November; and winter - December, January, February.

Carcass Measurements. All pigs were slaughtered on next day after ultrasonic testing in Valga Meat and Canning Factory. Ultrasonic measurements were made on slaughter day, where carcasses were evaluated with an Ultra-FOM 100 in the same points as described above. Carcass data as carcass length, weight, backfat thickness by rule (at scruff, at 6...7th rib, at middle and at lumbar) and pH (24 and 48 hours after slaughtering), were collected after slaughter. To measure pH and draw loin eye, half of the carcass was cut at last rib. Loin eye area was measured by planimeter, from same drawings, backfat and diameter of loin eye was measured. 48 hours after slaughtering, pH and boiling loss were found.

The General Linear Model (GLM) procedure (SAS Inst. Inc., 1991) was used for analysing the dataset by analyses of variance. The following statistical model was used:

$$Y_{ijkl} = \mu + Wt_{ijkl} + F_i + T_j + S_k + e_{ijkl}$$

Y = dependent variable; F_j = effect of farm 1...22; e_{ijkl} = random error.
 μ = general mean; T_j = effect of breed 1...5;
 Wt_{ijkl} = effect of pig weight at testing; S_k = effect of season 1...4;

The results are given as least-square means (Parring et al., 1997). Level of significances expressed conventionally: a, b, c – least square, within each effect with one letter in common do not differ significantly.

Results and Discussion

Measuring backfat by ultrasonic equipments and rule, significantly thinner backfat (9.38...14.71) and higher lean meat percentage (61.17...61.95 %) were found in three breed

cross (H/EL/ELW x EL), compared with other breed combinations (Table 1). Most scientists have found, that meat traits are hardly influenced by crossbreeding, as they are average or highly heritable (Skarman, 1965; Andersson, 1980). Meat traits are heredity as intermediate in crossbreeding. As Hampshire is well known in world by its thin fat and high lean meat percentage (Whittemore, 1996; Tänavots and Kaart, 1999), it has a significant influence on crossbred pig meat quality. Thicker backfat of ELW caused thicker backfat in H x ELW cross, compared with H/EL/ELW x EL cross.

Table 1. Least-square means of meat traits measured by ultrasonic equipments in different pig breed crossing combinations

Trait		EL	ELW	FY	H x ELW	H/EL/ELW x EL
		n=137	38	7	7	4
A-Scan	x1 (mm)	16.14 ^b	20.76 ^c	19.85 ^{bc}	18.10 ^{bc}	11.15 ^a
	x2 (mm)	54.21 ^a	55.03 ^a	58.86 ^a	56.65 ^a	53.84 ^a
	x3 (mm)	14.43 ^b	19.25 ^c	18.69 ^{bc}	16.19 ^{bc}	9.38 ^a
	y (%)	59.52 ^b	55.69 ^c	56.79 ^{bc}	58.35 ^{bc}	63.65 ^a
Piglog 105	x1 (mm)	18.52 ^{bc}	21.75 ^c	21.07 ^{bc}	18.00 ^b	11.02 ^a
	x2 (mm)	47.72 ^a	46.57 ^a	46.11 ^a	47.11 ^a	46.52 ^a
	x3 (mm)	17.60 ^{bc}	18.85 ^c	19.63 ^{bc}	13.81 ^{ab}	10.36 ^a
	y (%)	56.06 ^{bc}	54.27 ^c	53.91 ^{bc}	57.85 ^{ab}	61.95 ^a
Ultra FOM	x1 (mm)	17.32 ^{ac}	24.02 ^b	23.09 ^{bc}	23.54 ^{bc}	14.71 ^a
	x2 (mm)	50.50 ^a	50.74 ^a	50.69 ^a	45.10 ^a	54.26 ^a
	x3 (mm)	17.41 ^a	25.79 ^{bc}	22.03 ^{ac}	25.30 ^{bc}	13.94 ^a
	y (%)	57.32 ^b	50.88 ^c	53.29 ^{bc}	52.17 ^{bc}	61.17 ^a
By rule	backfat (x1) (mm)	13.78 ^{ab}	18.67 ^b	21.09 ^b	13.88 ^{ab}	8.59 ^a
	diameter of LD (mm)	58.25 ^{ab}	52.96 ^b	54.47 ^{ab}	57.26 ^{ab}	62.36 ^a
	area of LD (cm ²)	37.99 ^a	33.42 ^b	36.01 ^{ab}	39.96 ^a	41.97 ^a

Very thick fat was measured only with Ultra-FOM 100 in H x ESV cross (Figure 1). Quite surprising was thick fat of purebred FY pigs, which was not, however, significantly different compared with other purebred pigs. Backfat of EL pigs differed significantly on ELW measured by A-Scan Plus and Ultra-FOM 100. Diameter of loin eye did not differ significantly between breeds, measured by ultrasonic equipments. A significant difference, however, was found between ESV and H/EL/ESV x EL, where the diameter of loin eye (LD) of the cross was by 9.4 mm larger. As diameter of loin eye was quite equal, lean meat percentage was influenced more by differences between backfat. To compare between two points of ultrasound measurement, equal fat was found by A-Scan (difference 1.16...1.91). In case of using Piglog 105 the backfat thickness varied between 0.66...4.19 mm in different places of measurement. Inversely to other equipments, thinner fat in x1, than x2 was found by using Ultra-FOM 100, except for three breed crosses.

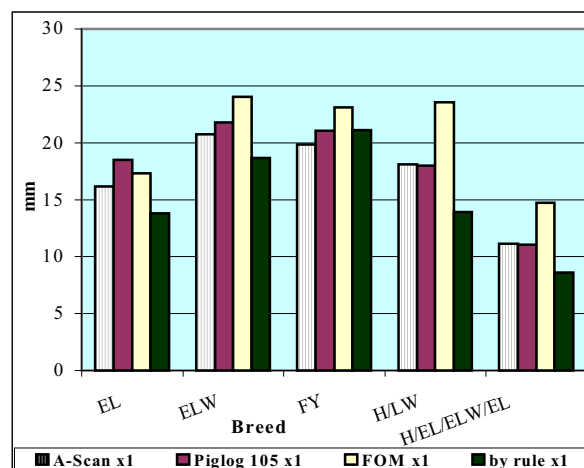


Figure 1. Backfat thickness measured by ultrasonic equipments in different pig combinations

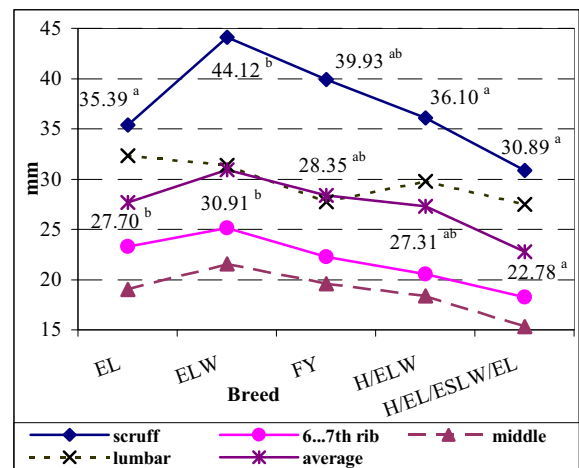


Figure 2. Carcass backfat depth measured by rule

Carcass weight did not differ between the breeds, being 70.21...72.40 kg and was lower in H/EL/ESV x EL cross and higher in FY breed (Table 2). Significantly longer carcass was in purebred pigs in EL (99.15 cm) and shorter in FY (93.43 cm). Crossbred pig carcasses were also significantly shorter than in EL.

Higher fat for carcasses were measured in scruff and thinner in middle (Figure 2). As in Ultrasonic test, thicker fat was found in ELW pig carcasses by rule. They had significantly higher fat compared with EL and crossbred pig carcasses. Backfat was quite equal measured at 6...7 rib, middle and lumbar.

Table 2. Least-square means of meat traits in different pig breed combinations after slaughter

Trait		EL	ESV	FY	H x ESV	H/EL/ESV x EL
Carcass	weight (kg)	71.45 ^a	71.79 ^a	72.40 ^a	71.58 ^a	70.21 ^a
	length (cm)	99.15 ^b	97.07 ^{ab}	93.43 ^a	95.07 ^a	94.24 ^a
Backfat at (by rule)	scruff (mm)	35.39 ^a	44.12 ^b	39.93 ^{ab}	36.10 ^a	30.89 ^a
	6...7 th rib (mm)	23.29 ^a	25.15 ^a	22.29 ^a	20.51 ^a	18.23 ^a
	middle (mm)	19.01 ^a	21.54 ^a	19.60 ^a	18.40 ^a	15.32 ^a
	lumbar (mm)	32.33 ^a	31.34 ^a	27.71 ^a	29.79 ^a	27.48 ^a
Average		27.70 ^b	30.91 ^b	28.35 ^{ab}	27.31 ^{ab}	22.78 ^a
pH 24		5.56 ^a	5.57 ^a	5.51 ^a	5.57 ^a	5.41 ^a
pH 48		5.51 ^a	5.54 ^a	5.35 ^a	5.60 ^a	5.49 ^a
pH difference		0.05	0.03	0.16	-0.03	-0.08
Boiling loss (%)		44.46 ^a	43.04 ^a	43.19 ^a	45.12 ^a	45.29 ^a

No significant differences were found between breed combinations for meat pH and boiling loss. But it should be noted, that 24 hours after slaughtering meat pH from crossbred pigs was lower than in 48 hours, while in purebred pigs this trait was higher. Meat from crossbred pigs had slightly higher boiling loss.

As market demands more and more quality lean meat and in pig selection for breeding consider more about meat quality traits, the different possibilities to measure live pig meat quality and enhance measuring accuracy must be investigated. Moreover, the ability of local and imported breeds to produce quality meat by crossing must be estimated. According to trial results, crossing with Hampshire boar gave thin fat and high lean meat percentage. From local breeds, Estonian Landrace breed gave better results for producing fattening pigs.

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