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REVIEW OF LIVE PIG BODY AND CARCASS ESTIMATION METHODS USED IN ESTONIA

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Abstract

Evaluation of pigs leanness led to decreasing of backfat thickness, but loin eye area remained at first unchanged. The first significant tool for breeders to estimate live pigs leanness, Piglog 105, was introduced in 1994. Intensive selection for leanness traits increased size of loin eye area and overall lean meat content of pigs. Equipment's and methods to estimate pig's carcass quality in slaughterhouses remained only for calculation of payment for farmers and for scientific research. To make more smart decisions to increase pig meat quality cooperation with practical breeders, slaughterhouses and scientist is required.

Introduction

Until the 1930s the opportunities for experimental research were limited because of the lack of suitable testing stations. Research in the field of pig breeding intensified during the second decade of Estonia's independence, when the National Pig Testing Station was established in 1931 (Anonymous, 1938).

The first trials of using ultrasonic equipments

In the Soviet Union manufacturing of ultrasonic apparatuses for measuring the fat thickness of pigs started in the early 1960s. Ultrasonic machine ТУК-2 only worked when plugged in, and was, therefore, difficult to operate. Even the more recent equipment was too complicated to use in production conditions, and its reliability was poor (Eilart, 1977). Because of that, E. Meisner (1973) recommended measuring the backfat of live pigs with a measuring stick, whereas the skin and fascias had to be pierced with a scalpel.

The first attempt to assess backfat thickness of pigs by using an ultrasonic apparatus in Estonia was carried out in 1961 by E. Meisner *et al.*, (1963). The total of 70 Landrace pigs were tested using an Austrian ultrasonic device 500S. It was found that fat thickness measured by ultrasound and ruler differed by 1–2 mm as an average. The correlation between ultrasonic apparatus and ruler measurements of backfat ranged between r = 0.79–0.92. Although the results obtained with ultrasound and ruler were relatively close, it was concluded, that checking the accuracy of ultrasound measurements using a ruler is not feasible, and as a 1–2 mm error is considered normal. The results of the trials showed, that the ultrasonic apparatus used was capable of measuring the backfat thickness of live pigs quite accurately. It was also found that checking ultrasound measurements of slaughtered pigs using a ruler was not sufficiently accurate, as different technicians obtained different results and the measuring conditions were also different (Meisner *et al.*, 1963).

Trials in Kehtna Pig Testing Station

In 1976, the Kehtna Pig Testing Station obtained a portable ultrasound apparatus Krautkramer USM-2 manufactured in Germany. In the same year this device was used for testing 320 pigs of the Estonian Landrace and the Large White breed. Some locations gave different results on fat thickness measured by ultrasound in live pigs and by rulers in carcasses. The most accurate measures were obtained for the last rib region, where approximately 70% of the measurements did not differ from each other more than 3 mm. The variance in fat thickness was possibly caused by the difficulties in recording ultrasonic readings due to movement of pigs, post-mortem changes in adipose tissue, as well as processing and storage of carcasses. The conclusion was drawn that the ultrasound apparatus USM-2 was sufficiently precise to measure fat thickness of live pigs, and it was recommended to be used on both breeding and large-scale farms (Eilart, 1977).

The first comprehensive comparative trial of using ultrasonic equipments was carried out by K. Eilart (1983) at the Estonian Institute of Animal Breeding and Veterinary Science (EIABVS) in 1983. The accuracy of ultrasonic equipments 'Biolokaator' and fat-meter KM-3A developed by the engineers of the Special Design Office of the Institute and the pig farm of the Pärnu Inter-Collective Farm as well as the accuracy of the German device Krautkramer USM-2, were compared. Small differences in measurement results were found at the points of last rib and lumbar, while the difference was bigger at the point of 6th–7th rib. Considering the ±2 mm accuracy criterion of measurement at the point of 6th–7th rib, 59–60% of measurements made with Biolokaator were within the allowed measurement error, whereas other devices provided even better results – over 80% of measurements were within the allowed error. It was found that in case of higher body weights, the accuracy of fat thickness measurement is better. (Eilart, 1983).

In 1992, the fattening performance and meat quality of pigs was evaluated at EIABVS. Lean meat content of pigs were found by UltraFOM 100 and SKG equipments and by ZP(two points)-method. It was ascertained that the carcasses of Estonian Large White pigs had thinner backfat (25.6 mm) than those of Estonian Landrace pigs (27.1 mm), measured at the point of 6th–7th rib, whereas significant difference in the loin eye area were observed between these breeds. Using the ZP(two points)-method, it was established that pigs of the Estonian Large White breed had higher percentage of lean meat (50.3%) than Estonian Landrace pigs (49.6%). Most of the carcasses met the requirements of the R-grade (45–50%), while the Estonian Landrace (56.7%) had higher lean meat percentage than the Estonian Large White (49.3%). The lean meat requirements of the commercial U-grade (50–55%) were met in 39.5% of Estonian Landrace pig carcasses and 41.3% of the Estonian Large White breed of pigs. Elite class (lean meat >55%) carcasses were observed in 1.3% of Estonian Landrace and 8% of Estonian Large White pigs (Eilart, Põldvere, 1993).

Lean meat estimation methods verified by dissection

In the 1994, research on estimating the accuracy of the UltraFOM 100 lean meat meter and the ZP-method to be used on meat processing plants was initiated, which lasted until 1996 (Eilart, Põldvere, 1997). The studies revealed that the carcass weight and backfat thickness of Estonian Landrace pigs did not change significantly from year to year, while the diameter of *m. longissimus dorsi* increased by 1.2 cm^2. Along with the increase in the lean meat percentage, deterioration of meat quality was observed.

The lean meat percentage determined by using a lean meat meter was by 2.3% in 1994, 3.4% in 1995 and 4.3% in 1996 higher than that calculated by the ZP-method. Similarly, comparing the two methods for determining the percentage of lean meat of Estonian Large White pigs, M. Rei *et al.* (1994) found that lean meat meter showed a 0.85% higher result. A trial carried out in 1995 showed that the lean meat percentage determined by UltraFOM 100 and the ZP-method differed by 3.7%, whereas it was higher in case of using UltraFOM 100 (Eilart, Põldvere, 1996; 1997). The accuracy of different methods was also examined by dissecting 15 carcasses, whereas the lean meat percentage determined by the ZP method was by 5.2%, and that determined by using a lean meat meter by 2.2% higher. They concluded that dissection trials aimed at verifying the UltraFOM 100 formula and examining the possibilities of using the ZP-method should be carried on (Eilart, Põldvere, 1997).

Introduction of Piglog 105 and UltraFOM 100

Ultrasonic apparatus Piglog 105 was first put into use in Estonia in May 1994.

The first review of Piglog 105 and its testing and adjustment for Estonian pig breeds was published in 1994 by K. Eilart. The apparatus was used to measure lean meat percentage of 22 Estonian Landrace pigs. As a formula which was obtained in testing Polish pigs was used in Piglog, the results were compared to the lean meat percentage calculated by using the ZP-method. It was found that the reading of Piglog 105 was on an average by 5% (0.4–12.2%) lower than the lean meat percentage obtained using the ZP-method. The author notes that the apparatus can successfully be used on breeding farms for measuring initially only the backfat and the diameter of *m. longissimus dorsi*.

In 1998 a comparative trial of the ultrasound device UltraFOM 100, used in slaughterhouses, and the ZP-method was carried out. Lean meat content measured by using the ultrasonic apparatus was by 2.3% higher than that calculated using the ZP-method, whereas the correlation between the two methods was 0.44. It was found that both methods are suitable for assessing the content of lean meat (Põldvere, Eilart, 1999[a,b]).

Three ultrasonic devices – portable Piglog 105 and A-Scan Plus for live pigs, and the stationary UltraFOM 100 for carcasses were compared in measuring the subcutaneous fat thickness and diameter of *m. longissimus dorsi,* as well as calculating the lean meat percentage in the trial carried out in 1998–1999. A total of 55 pigs of different breeds, originating from nine farms were reared from 25 to 105 kg at a testing station. Similar fat thicknesses and lean meat percentages were found by using UltraFOM 100 and Piglog 105, however, significantly leaner pigs were tested by using the A-Scan Plus. Diameter of *m. longissimus dorsi* measured with Piglog 105 was significantly smaller (46.92 mm), while it was higher in case of using A-Scan Plus (56.24 m). The authors suggested that it is necessary to ascertain the factors affecting the ultrasonic scanning results beside those related to the human factor (Tänavots *et al*., 1999).

The crossbreeding program 'Marble Pork' of the Estonian Pig Breeding Association started in 1995, whereas measuring of carcass traits of the progeny of top boars at slaughterhouses was initiated in 2001 (EPBA, 2010). Estonia's last pig control testing station was closed in 2001, and since then evaluation of boars has been based on the relatives bred on breeding farms. A total of 1,311 boars were slaughtered in two slaughterhouses during 2002–2005. Estonian Large White and Pietrain pigs were slaughtered significantly later, whereas they had shorter carcasses than Estonian Landrace pigs. However, lighter carcasses were found in Pietrain boars, while the carcasses of Estonian Large White pigs were by 2.35 kg heavier than those of Estonian Landrace pigs.

Pietrain carcasses were by 6.06–9.01 cm shorter than those of the white breeds. In general, all breeds had a similar subcutaneous fat thickness, still the fat deposition level in the Estonian Landrace boars differed from that of Estonian Large White and Pietrain pigs. Examination of carcass traits provides a lot of useful information for pig breeders. It should be included into breeding programs as one of the methods of breeding value estimation of boars. Currently, estimation of boars by carcass traits is laborious, and carcass traits are not being used (Tänavots, Põldvere, 2006).

Digital imaging used estimation leanness

The Estonian Pig Breeding Association obtained a carcass evaluation system ScanStar from Germany, which enables the researchers to take digital photos of opened loin eyes and the fat above it. A total of 202 pigs were measured using ScanStar during 2006. Subcutaneous fat thickness at the thinnest point was 6.35–10.50 mm, while it was 10.88–18.87 mm above *serratus dorsalis*. Fat thickness increased significantly along with the increase in the carcass weight up to 79 kg. Similar changes were observed in the fat area. Loin eye area gained constantly in each carcass weight class, although the growth did not differ significantly between the 65–69, 70–74 and 75–79 kg classes (Tänavots, Põldvere, 2007).

UltraFOK 300 in slaughterhouses

The first stationary lean meat apparatus UltraFOM 300 was introduced at an Estonian meat processing plant at the end of 2003. A total of 15,212 pigs were included in an experiment in 2007. Carcasses were measured after slaughter using UltraFOM 300. The average carcass weight of slaughter pigs was 51.60–99.90 kg. All meatiness traits depended significantly on the farm of origin. Young boars with 50.0–69.9 kg carcass weight showed superior meatiness traits. Fatteners (gilts and barrows) weighing 85.0–99.9 kg had significantly thicker subcutaneous fat, smaller diameter of *m. longissimus dorsi* and lower lean meat content. Higher carcass weights resulted in significantly lower lean meat content. It was suggested, that carcass weight should be included in the breeding program to ensure uniformity of pig carcasses (Tänavots, Põldvere, 2008).

Conclusions

Current technologies provide relatively accurate means of estimating the meat quality of both breeding and slaughter pigs. Modern apparatuses deliver large quantities of data, so it is very important to make sure which type of information is most useful in achieving the specific targets established. Close collaboration between scientists and practical breeders is required.

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