



Comparison of different methods for lean percentage evaluation in pig carcasses

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ABSTRACT

Present study was carried out on 64 pig carcasses selected according to backfat measures by instrumental method approved in Croatia. One day after slaughter the carcasses were dissected according to EU referent method. Dissected lean percentage was calculated by formula from Commission Regulation (EC) No 3127/94 and also by equations for estimation of lean percentage approved by Croatian Regulation. Lean meat percentage objectively determined by EU referent dissection method was 51.9% in average. When instrumental method and “two points” method were applied, estimated lean meat percentage was 55.1% and 56.6%, respectively. Comparison of dissection, as referent and objective method, with instrumental and “two points” methods for estimation of lean meat percentage showed that both estimation methods differ statistically ($p < 0.01$) from dissection. The differences indicate overestimation of meatiness in the pig carcasses. There is need for establishment of new formulae for lean meat percentage assessment in Croatia.

(Keywords: pig, carcass, lean percentage, assessment methods)

INTRODUCTION

The pork market of EU countries has been based on meat percentage for a long time. Pig carcasses with higher lean percentage achieve a better market price. For estimation of carcass lean percentage at the slaughter line, different procedures are used. In these procedures, on the basis of certain measures taken from pig carcass, the share of lean meat is calculated according to official verified mathematical equation.

In order to obtain the formula by which the meat percentage of pig carcasses can be estimated with highest reliability, it is necessary to carry out comprehensive dissection experiment. The criteria regarding the size of sample and the accuracy of estimation are regulated by EU legislative (Commission Regulation No 2967/85).

In Croatia, the estimation of pig carcass quality and payment on the basis of so called meat unit has been carried out since 1973. The first Regulation on pig carcass quality which applies methods for pig carcass classification into market classes (SEUROPO) at the slaughter line according to lean meat percentage (%), compatible to EU model has been adopted in 1995.

Two methods (instrumental and “two points”) and respective mathematical formulae for meat percentage estimation of pig carcasses were given by this Regulation. Equations approved by the Regulation were taken from German regulations, but both of them were previously submitted to evaluation of accuracy in carcass lean percentage estimation when applied to Croatian pig population (Petričević *et al.*, 1993). Kralik *et*

al., 1997 and *Kusec et al.*, 1998 published original formulae for “two points” method, constructed from dissectional data obtained on Croatian pig populations.

Until recently, only “two points” method by which muscle and fat thickness are measured manually with steel tape was used in Croatian abattoirs. Although nowadays automatic devices for measuring muscle and fat thickness are used, statistically verified equation, obtained by dissection of regular number of pig carcasses, has still not been established. At the same time, there is no legal obligation in Croatia by which the payment of pig carcasses should be based upon the determined market class i.e. meat percentage.

Equation coefficients are dependent on population lean meat mean, and after two years time period or after significant alteration in pig population they should be checked (Commission Regulation No 2967/85). *Čandek-Potokar et al.* (2004) reported an important increase of average lean meat percentage in the carcasses of Slovenian pig population. Consequently, the percentage of pig carcasses being graded into S and E classes was almost tripled from 1996 to 2004. Authors argued that the improvement was initiated by the payment according to carcass lean meat content and that further improvements can be expected when Hennessy optic probe is introduced. For the purpose of verifying or establishing a new estimation formula, new European regulations introduced simplified EU dissection method for objective establishment of lean percentage in pig carcasses (Commission Regulation No 3127/94, *Walstra and Merkus*, 1995). The change of dissection method and a positive shift in carcass leanness stimulated the renewing of methods for assessment of lean meat percentage in carcasses of Slovenian pigs; the equation was announced to get in use during 2004.

Since the formulae for lean percentage estimation in Croatia have not been corrected for a long time and population mean of muscle tissue share in pigs is probably altered, the aim of this paper is to compare the results of estimated lean percentage by two methods in use with the new referent dissection method prescribed in EU countries.

MATERIALS AND METHODS

The experiment included 64 pig carcasses originating from gilts and barrows produced at Croatian large industrial farms and small family farms. The carcasses were selected according to back fat measures by instrumental method approved in Croatia (Regulation No 119/1999) at different Croatian slaughterhouses. There was no stratification according to carcass weight. Measures for the estimation of lean meat percentage by instrumental and “two points” (TP) method were taken at the slaughter line. For the instrumental method of lean percentage estimation, following measures (n=60) were taken:

- F: the thickness of backfat (including rind) in millimetres, measured at 7 cm off the midline of the split carcass, between the second and third last ribs,
- M: the thickness of the muscle in millimetres, measured at the same time and in the same place as F.
- Measures for TP leanness prediction (n=62) were:
- F: the minimum thickness of subcutaneous fat (with skin) at the split of the carcass in millimeters, above *M. glutaesus medius*,
- M: the thickness of lumbar muscle at the split of the carcass in millimeters, measured as the shortest connection between the cranial end of the lumbar muscle and dorsal edge of the vertebral canal.

Left sides of the carcasses were dissected according to EU referent method one day after slaughter (n=64). Four main parts (ham, shoulder, loin and ribs) were dissected into muscles, bones, intramuscular fat and subcutaneous fat with skin; tender loin is taken into calculation as separate part. Share of meat was calculated by formula from Commission Regulation (EC) No 3127/94.

Referent lean meat percentage = $1.3 \times 100 \times \text{weight of tender loin} + \text{weight of lean (fascia included) in shoulder, loin, ham and belly} / \text{weight of tender loin} + \text{weight of dissected cuts} + \text{weight of remaining cuts}$.

Lean meat percentage was also calculated by equations that are approved by Croatian Regulation (N.N. No 119/1999). These equations are referred to estimation of lean meat percentage by instrumental and "two points" methods. The obtained data were statistically processed by GLM procedures of SAS program package, version 9.0 (SAS Ins. Inc., 2002).

RESULTS AND DISCUSSION

The data collected in dissection experiment were statistically processed and the results are presented in *Table 1*. The weight of the warm carcasses was between 53 and 109 kg, with average value of 80.6 kg. This indicates large variation in slaughter weights of Croatian pigs and a need to act in the direction of increase in uniformity. The carcass weight is not included as an adjustment factor in payment system, which should be reconsidered if higher uniformity of carcasses is desired. The mean backfat thickness in experimental sample was 17.5 mm. The thickness of *m. longissimus dorsi* was measured in the same way; the mean value in investigated sample of pig carcasses was 53.9 mm. With these measures and by application of formula prescribed by Croatian national Regulation, the lean meat percentage of investigated pig carcasses was calculated; mean of the estimated lean share was 55.1%. Backfat thickness (14.7 mm) and the muscle thickness (68.4 mm) taken for estimation of lean meat percentage by "two points" method were also measured. Mean estimated lean percentage obtained by this method was 56.6%. Lean meat percentage objectively determined by EU referent dissection method was 51.9% in average.

Table 1

Results of descriptive statistics for warm carcass weight and measures used for lean meat percentage estimation of investigated pig carcasses

Measure	Method	Mean	St.dev.	Min	Max	N
Warm carcass weight (kg)		80.6	10.60	53	109	64
Fat thickness (mm)	Instrumental	17.5	6.40	6.80	38	60
Muscle thickness (mm)		53.9	10	32.60	72	60
Fat thickness (mm)	„Two points“	14.7	6.72	5	35	62
Muscle thicknes (mm)		68.4	6.77	50	80	62

Certain differences in lean meat percentage of investigated pig carcasses can be observed from previous table. In order to establish significance of differences between results of lean meat percentage estimation the data were statistically processed by GLM procedure of SAS 9.0 program package.

Table 2

Lean meat percentage of investigated pig carcasses

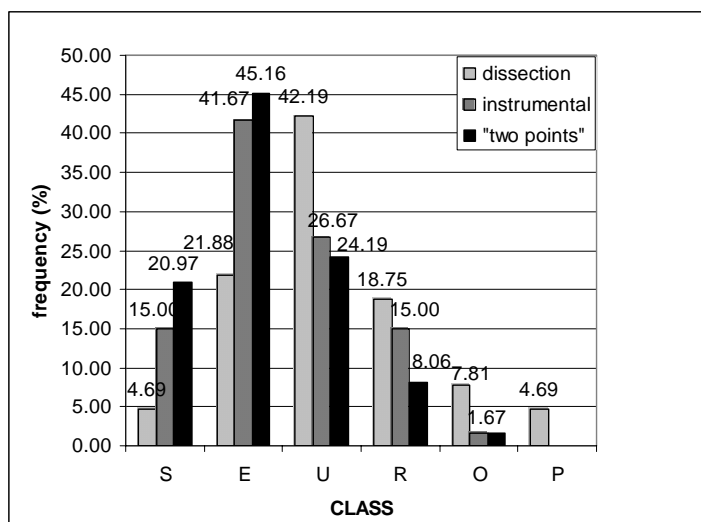
Method	„Two points“	Instrumental	Dissection
Mean	56.55 ^a	55.13 ^a	51.90 ^c
Std. Dev.	5.028	4.919	5.780
Min. value	44.78	44.02	36.47
Max. value	68.24	66.75	65.54
N	62	60	64

Means within row with different superscript (a,c) differ at P<0,01.

From *Table 2* it can be observed that there were no statistically significant differences between lean meat percentage of pig carcasses estimated by TP method and instrumental method, but both estimations differed statistically (P<0.01) from lean meat percentage objectively determined by EU referent dissection. The methods for lean meat percentage evaluation obviously overestimated the meatiness of Croatian pig population and therefore there is a need to establish new coefficients in formulas for lean meat percentage assessment.

Figure 1

Relative distribution (%) of the pig carcasses into SEUROP quality classes



From *Figure 1* it can be observed that dissection, as the referent method, has classified only 4.69% of the pig carcasses into quality class S, whereas the methods for lean meat percentage estimation classified markedly more pig carcasses into this quality class (TP 20.97%, instrumental 15%). On the basis of dissection, the highest number of the pig carcasses was classified into quality class U (42.19%), in which TP method classified 24.19% and instrumental 26.67% of the pig carcasses. It can also be observed that

according to dissected lean percentage, 4.69% of the pig carcasses fell into quality class P, while by other two methods none of the pig carcasses were classified into this class.

The presented results suggest that examined on-line lean percentage estimation methods prescribed in Croatia are not reliable for classification of pig carcasses into market classes any more.

CONCLUSION

On the basis of the investigation on comparison of different methods for lean percentage evaluation in pig carcasses, following can be concluded:

- Estimated lean percentage by TP and instrumental and methods differed statistically ($p < 0.01$) from lean meat percentage objectively determined by EU referent dissection.
- There were no statistically significant differences between lean meat percentage of pig carcasses estimated by TP and instrumental method. This indicates that there was no significant influence of personnel who manages apparatus for measuring back fat and muscle thickness by instrumental method.
- Dissection, as the only objective and referent method, has classified only 4.69% of the pig carcasses into quality class S, whereas the other two methods of lean meat percentage estimation have classified markedly greater number of pig carcasses into this quality class (TP: 20.97%, instrumental: 15%). Dissection has classified 4.69% of the pig carcasses into quality class P while the other two methods have not classified any of the pig carcasses into this market class.
- The methods for evaluation of lean percentage overestimate the meatiness in the pig carcasses of the Croatian pig population.
- There is need to establish new coefficients in formulae for lean meat percentage assessment in Croatia.

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