REPRODUCIBILITY OF CLASSIFICATION METHOD

M. Šprysl., J.Čítek, R. Stupka
Czech University of Life Sciences Prague, Department of Animal Science, Czech Republic

Abstract

The objective of this study was to document the accuracy of the classification equipment used in the Czech Republic with respect to error problems in lean meat percentage prediction like equipment error. For this purpose a total of 360 pigs were measured in abattoir. From the results obtained one could say that various instruments provide identical measurement of fat depth (r = 0.57-0.97), while for muscle depth the performance is worse (r = 0.38-0.78) which causes a fluctuation in the prediction of lean meat percentage with differences ranging from -2.56% to +2.81%.

Introduction

Every classification equipment used for predicting lean meat percentage at abattoirs in the EU must be approved by Commission Decision EC No. 3127/94. In most European countries slaughter pigs are brought to slaughter at an age of six months which means the carcass weight in the range 75–90kg and average lean meat percentage 55-60%. Their classification takes place in SEUROP system using objective measurements to estimate lean proportion. Leanness is calculated by full dissections which are very expensive and has particular biases. To remove these distortions the EC state definition of the lean meat share on the base of the 4 main joints dissection (EC regulation n° 3127/94; Walstra, Merkus, 1995; Busk et al., 1999, Brøndum et al., 1998; Scholz et al., 2002, Collewet et al., 2005).
For lean meat measuring most EC countries have used probes based on indirect measuring back fat as well as loin eye area depth (reflectance, optical or ultrasound). It means that these values are observed indirectly so the predicted values deviate from the true value thanks of various measurement techniques which are differ (Kien, Borzuta, 2002, Pulkrábek et al., 2004, Nissen et al., 2006).
Invasive manual equipments, penetrate the skin, are mainly influenced by the slaughter process and operator as well as abattoirs and countries.
Errors can also occur because of differences between the same types of classification methods and equipment. There are no rules for testing and calibration of the equipments, which means that a variation between the same types of equipment can exit and must be determined (Engel, Walstra, 1991, Daumas et al., 1998, Olsen, 2003). It concern of error of equipment resp. variation between copies of the same equipment, or the capacity of the instrument to measure fat depth and muscle depth correctly.

Material and Methods

Because is expected that variation between copies of the same type of equipment is small, but nobody knows the size of it, the objective of this experiment was to assess the variation between the same type of equipment.
From point of the view 360 carcasses was measured with three different pieces of equipment of the same type by one operator according following plan for measurements with manual classification equipment.The obtained results were evaluated by SAS® Propriety Software Release 6.04, expressed in charts and graphs, while differences among the individual evaluated features were tested by single and multiple analysis of variance.

Carcass No.	Operator						Σ
	Equipment - F1		Equipment - F2		Equipment – F3		
	P1	P2	P1	P2	P1	P2	
1-60	X			X			60
61-120		X	X				60
121-180	X					X	60
181-240		X			X		60
241-300			X			X	60
301-360				X	X		60
Σ							360

P1 - measuring position used for classification, P2 - repeated measuring position

Results and Discussion

The reproducibility results show table 1 and 2. Table 1 shows correlation coefficients between the determined fat depth, muscle depth and lean meat percentage.
Table 1 shows that various instruments can measured without greater problems identical fat depth (r = 0.57-0.97), while lower correlation coefficients were found for muscle depth (0.38-0.78). Following table 2 shows average differences in the determination of fat depth, muscle depth and lean meat percentage between the first and the repeated measurement using various instruments of the same type (F1 – F2 – F3).

It can be seen that the lowest average differences were found for fat depth, which corresponds with the results of Čandek-Potokar (2003). The greatest difference found amounted to 2.25 mm and also other differences were statistically significant. Higher differences were found for muscle depth, namely up to 6.56 mm. These differences in turn lead to different determinations of lean meat percentage. Depending on the instrument used, the differences ranged from – 2.56% to +2.81%. It can also be seen that a significant difference was found for instance between instruments F1 and F2, while almost no difference (statistically insignificant) between instruments F2 and F3. It needs to be stated that for all instruments their function was verified by a calibration roller before the measurement.

Table 1. Correlation coefficients with respect to equipment - sequence.

Equipment (sequence)		fat	muscle	%meat
F1 - F2	Correlation coef.	0.97422	0.70819	0.91888
	Prob	*0.0001*	*0.0001*	*0.0001*
F1 - F3	Correlation coef.	0.77082	0.40317	0.81297
	Prob	*0.0001*	*0.0014*	*0.0001*
F2 - F1	Correlation coef.	0.91552	0.5261	0.67575
	Prob	*0.0001*	*0.0001*	*0.0001*
F2 - F3	Correlation coef.	0.94384	0.76099	0.87615
	Prob	*0.0001*	*0.0001*	*0.0001*
F3 - F1	Correlation coef.	0.57444	0.38993	0.68847
	Prob	*0.0001*	*0.0021*	*0.0001*
F3 - F2	Correlation coef.	0.95239	0.77595	0.91123
	Prob	*0.0001*	*0.0001*	*0.0001*
total	Correlation coef.	0.83729	0.5616	0.70709
	Prob	*0.0001*	*0.0001*	*0.0001*

Table 2. Reproducibility- confirmativeness of differences with respect to equipment (differences of measur-

Fat				
Equipment	Mean	Std Error	T	Prob>|T|
F1 - F2	2.25	0.14	16.087	0.0001
F1 - F3	-1.45	0.36	-4.036	0.0002
F2 - F1	2.03	0.26	7.683	0.0001
F2 - F3	0.32	0.13	2.453	0.0171
F3 - F1	-1.87	0.45	-4.165	0.0001
F3 - F2	0.21	0.15	1.427	0.1591
Muscle				
Equipment	Mean	Std Error	T	Prob>|T|
F1 - F2	-4.6	0.672377	-6.8414	0.0001
F1 - F3	6.566667	1.221365	5.376498	0.0001
F2 - F1	-5.75	0.996782	-5.76857	0.0001
F2 - F3	1.583333	0.549418	2.88184	0.0055
F3 - F1	2.283333	1.123225	2.032838	0.0466
F3 - F2	-0.22414	0.534385	-0.41943	0.6765

%lean meat				
Equipment	Mean	Std Error	T	Prob>|T|
F1 - F2	-2.56667	0.178817	-14.3536	0.0001
F1 - F3	2.816328	0.375194	7.506319	0.0001
F2 - F1	-2.53333	0.452642	-5.59677	0.0001
F2 - F3	-0.02453	0.203983	-0.12023	0.9047
F3 - F1	2.115069	0.343112	6.164363	0.0001
F3 - F2	-0.24081	0.18515	-1.30062	0.1986

Conclusion

From the results concerned of obtained reproducibility one could say that various instruments can provide identical measurements of fat depth without greater problems (r = 0.57-0.97). The performance is worse for muscle depth (0.38-0.78) which causes a fluctuation in the prediction of lean meat percentage with differences ranging from -2.56% to +2.81%.

References

Brøndum,J., Egebo,M., Agerskov,C., Busk,H.: On-line carcass grading with the Autofom ultrasound system. J.Anim.Sci., 76, 1998, 1859-1868.

Busk,H., Olsen,E.V., Brøndum,J. : Determination of lean meat in pig carcasses with the Autofom classification system. Meat Sci., 52, 199, 307-314.

Collewet,G., Bogner,P., Allen,P., Busk,H., Dobrowolsi,A., Olsen,E., Davanel,A.: Determinaton of the lean meat percentage of pig carcasses using magnetic resonance imaging. Meat Sci., 70, 2005, 563-572.

Čandek-Potokar,M.: The accuracy of on-line methods. Eupigclass - Final workshop, Roskilde, Danish meat research institute, 6.10.2003.

Daumas,G., Causer,D., Shodne, T., Schollhammer,E.: Les méthodes de classement des carcasses de porc autorisées en France en 1997. J Res.Porc.France, 30,1998, 1-6.

Engel,B., Walstra,P.: A simple method to increase precision or redukce expense in regression experiments to predict the proportion of lean meat of carcasses. Anim.Prod., 53. 1991, 353-359.

Kien,S., Borzuta,K.: Polish protocol for updating of pig carcass classification methods in 2002. Meat&Fat Research Institute Warsaw, Poznań, 2002, 6.

Nissen,P.M., Busk,H., Oksama,M., Seynaeve,M., Gispert,M., Waltra,P., Hansson,I., Olsen,E.: The estimated accuracy of the EU reference dissection method for pig carcass classification. Meat Sci., 73, 2006, 22- 28.

Olsen,E.V.: The accuracy of the reference for on-line measurements in pig carcass classification. Eupigclass - Final workshop, Roskilde, Danish meat research institute, 6.10.2003.

Pulkrábek,J., Wolf,J. Adamec,T., Fiedler,J., Houška,L., Jakubec,V., Štefunka,F.: Stanovení podílu libového masa u jatečných prasat přístrojem FOM a ZP metodou na podkladě detailních disekcí. ZZ, VÚŽV Praha-Uhříněves, 1992, 26.

Scholz,A., Soffner,P., Littmann,E., Peschke,W., Förster,M.:Genauigkeit der Dualenenergie-Röntgenabsorptiometrie (DXA) zur Ermittlung der Slachtkörperzusammensetzung von Schweinehälften (kalt,30-39 kg) anhand der EU-Referenzzrlegung. Züchtungskunde, 74,5,2002, 376- 391.

Walstra,P., Merkus,G.S.M.: Procedure for assessment of the lean meat percentage as a consequence of the new EU reference dissection method in pig carcass classification. DLO-Research Institute for Anim.Sci. and Health Research Branch, Zeist, 1995, 22, NL.

The study was supported by grants of
MSM 604 607 0901
NAZV QG60045,
G6RD-CT-1999-00127-EUPIGCLASS-project, Brussels.