THE COMPARISON OF EU REFERENCE METHODS FOR THE PREDICTION OF LEAN MEAT CONTENTS IN PIG CARCASSES

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Abstract

The objective of this study was to evaluate the methods of full and simplified carcass dissections used for the prediction of pig carcass lean meat contents in the Czech Republic. A total of 40 commercially fattened pigs (20 gilts and 20 barrows) were included in the experiment. Carcass dissections were performed 24 h *post mortem*. Three different methods were used to estimate carcass lean meat contents and the differences between the methods were analysed. The average weight of left half-carcasses was 44.39 kg. The lean meat contents determined by full detailed dissections (I), simplified dissections (II) and using a new reference method (III) were 56.25, 56.46 and 59.02 %, respectively. The difference between the methods I and II was small and statistically insignificant. However, the average lean meat content determined by the method III differed from those determined by the methods I and II by 2.77 and 2.56 percentage points, respectively. This increased estimate of the lean meat content using the method III is related to a new prediction equation introduced by the European Commission in 2008.

Key Words: Pig; EU – reference dissection; carcass classification; accuracy.

The content of lean meat in pig carcasses is a basic criterion for the calculation of producer prices in EU countries. This content is estimated at the end of slaughter lines using approved classification apparatuses in accordance with the EU legislation. A set of measurements is taken at a well-defined site of the carcass. These measurements are used in prediction equations that are part of the software installed on the approved classification apparatuses. A sufficient statistical reliability of the lean meat prediction is necessary to obtain the authorisation for prediction equations.

Classification methods predicting the lean meat content in the carcass are based on the results of the dissection of a representative sample (n≥120) of pig carcasses and the determination of muscle, fat and bone contents. The original and still valid full dissection method (I) called "the Kulmbach reference method" (Branscheid et al., 1990) is based on the complete tissue separation of a left half-carcass except for head, feet and tail. Full dissections are laborious and time consuming, as 8 to 9 h are necessary to dissect a single half-carcass.

In order to reduce laboriousness but to retain the accuracy of the lean meat content prediction, a simplified dissection method (II) was introduced (Walstra and Merkus, 1996), which was based on the dissection of the most important carcass joints (ham, loin, shoulder, belly with bones and filet) (Commission Regulation (ES) No. 3127/1994). This simplified method was further adjusted (Commision Regulation (ES) No. 1249/2008) and as such it is used as a reference method III in this study. In the Czech Republic, full (I) and simplified (II) dissections were used and described by Pulkrábek et al. (2004 and 2006).

The objective of this study was to determine the lean meat content in selected carcasses using three reference methods and to evaluate the differences observed.

Material and Methods

The carcasses of a total of 40 commercially fattened pigs (20 gilts and 20 barrows) were included in the analysis. Jointing of carcasses was performed in accordance with Walstra and Merkus (1996) 24 h *post mortem*. The weights of different joints were recorded and their proportions of the weight of carcasses were determined.

Three reference methods were applied to estimate the carcass lean meat content. The joints dissected using the full and simplified dissection methods are illustrated in Fig. 1

In the reference method I, the lean meat is defined as the striated muscle tissue without the connective tissue and tendons, and its content was calculated using the equation (1):

$$Y_1 = \frac{y_1}{JUT} * 100$$

Where: Y_1 - carcass lean meat content (%)
Y1 - weight of muscle from dissected joints, i.e. without head and feet (kg)
JUT - carcass weight (kg)

The simplified dissection method is based on the tissue separation in ham, loin, shoulder, belly with bones and filet. The lean meat is defined as the striated muscle tissue

including the connective tissue and tendons. On the basis of the results obtained by simplified dissections, the reference method II and III were used to determine carcass lean meat contents.

The lean meat content determined by the reference method II was calculated using the equation (2):

$$Y_2 = \frac{y_2}{JUT} * 1.3 * 100$$

Where: Y_2 - carcass lean meat content (%)
y2 - weight of muscle from dissected joints (ham, loin, shoulder, belly with bones and filet) (kg)
JUT - carcass weight (kg)

The lean meat content determined by the reference method III was calculated using the equation (3):

$$Y_3 = \frac{y_3}{HMČ - EU} * 0.89 * 10($$

Where: Y_3 - carcass lean meat content (%)
Y3 - weight of muscle from dissected joints (ham, loin, shoulder, belly with bones and filet) (kg)
HMČ - EU - weight of dissected joints (ham, loin, shoulder, belly with bones and filet) (kg)

The estimates of carcass lean meat content obtained by different reference methods were compared using SAS Statistical Package, version 8.2.

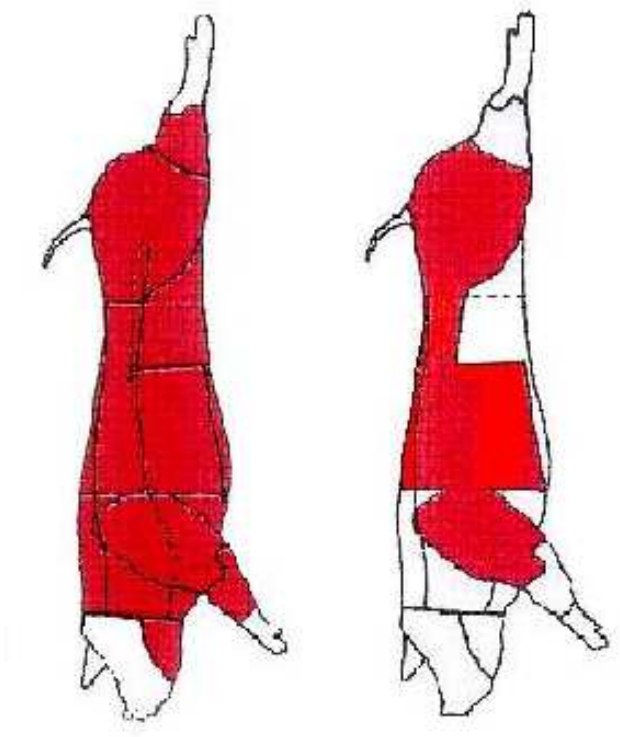
Results and Discussion

Average weights and proportions of different carcass joints are given in Table 1. The average weight of left half-carcasses 44.39 kg (s = 5.458) was in the middle of the interval preferred for the entire carcass weight (80 to 100 kg). The results are in agreement with the values reported in the Classification Annual Report (Ročenka, 2011). Also, similar carcass weights were observed in smaller pig groups analysed in different tests of fattening performance and carcass value (Stupka et al., 2008; Vítek et al., 2008).

The average weight and proportion of main carcass joints (EU) were 28.9 kg (s = 3.675) and 65.45 % (s = 1.385). It is important to obtain an accurate value of this parameter, as it is used as the denominator of the method III lean meat content equation.

The results of detailed joint dissections using the three reference methods are given in Tables 2, 3 and 4 showing the lean meat contents as affected by the weight of carcasses, gender and quality class.

Figure 1: Joints dissected using the full (I) and simplified (II) dissection methods



(I) (II)

Table 1. Carcass composition (n = 40)

Joint	Weight (kg)		Proportion of carcass weight (%)	
	$\bar{x}$	s	$\bar{x}$	s
Ham*	11.28	1.400	25.42	0.957
Loin*	7.52	1.074	16.93	1.161
Shoulder*	5.51	0.728	12.41	0.630
Belly with bones*	4.17	0.663	9.37	0.731
Filet	0.55	0.101	1.24	0.153
Neck*	4.63	0.668	10.42	0.776
Head	2.14	0.244	4.83	0.342
Jowl	1.29	0.224	2.90	0.307
Fore knuckle	0.90	0.105	2.05	0.148
Fore foot	0.33	0.034	0.76	0.067
Hind knuckle	1.32	0.170	2.99	0.244
Hind foot	0.64	0.074	1.46	0.124
Tip of belly	1.78	0.336	4.01	0.528
Belly without bones	1.55	0.298	3.49	0.498
Groin	0.77	0.167	1.72	0.263
Left half-carcass	44.39	5.458	-	-
HMČ – EU sum	28.94	3.675	65.45	1.385

* including subcutaneous fat and skin

Table 2. Carcass lean meat contents determined by different dissection methods as affected by carcass weight

Carcass weight (kg)	Number of carcasses		Carcass lean meat content (%)					
	n	%	Method I		Method II		Method III	
			$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
60 - 79.9	9	22.5	57.31[a]	3.615	57.92[a]	3.715	60.17[a]	4.400
80 – 99.9	25	62.5	55.84[a]	4.199	55.86[a]	4.145	58.72[b]	3.871
100 – 120	6	15.0	56.39[a]	1.736	56.75[a]	1.922	58.54[a]	2.127
60 - 120	40	100 %	56.25[a]	3.844	56.46[a]	3.888	59.02 [b]	3.846

[a, b] Means indicated with different symbols are significantly different (P< 0.05).

Table 3. Carcass lean meat contents determined by different dissection methods as affected by gender

Gender	Number of carcasses		Carcass lean meat content (%)					
	n	%	Method I		Method II		Method III	
			$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Gilts	20	50.0	57.88[a]	2.718	58.01[a]	2.725	60.87[b]	2.483
Barrows	20	50.0	54.62[a]	4.103	54.91[a]	4.241	57.16[a]	4.068
Total	40	100	56.25[a]	3.844	56.46[a]	3.888	59.02[b]	3.846

[a, b] Means indicated with different symbols are significantly different (P< 0.05).

Table 4. Carcass lean meat contents determined by different dissection methods as affected by quality grade

Quality grade	Number of carcasses		Carcass lean meat content (%)					
	n	%	Method I		Method II		Method III	
			$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
S	5	12.5	61.72[a]	0.974	64.41[a]	0.612	63.40[b]	0.921
E	23	57.5	57.47[a]	1.342	57.82[a]	1.612	60.43[b]	1.884
U	9	22.5	53.12[a]	1.635	53.18[a]	2.141	55.97[b]	1.978
R	3	7.5	47.22[a]	1.189	47.58[a]	1.026	49.99[b]	0.553
S – R	40	100	56.25[a]	3.844	56.46[a]	3.888	59.02[b]	3.846

[a, b] Means indicated with different symbols are significantly different (P< 0.05).

The differences between the methods I and II were small and statistically insignificant. However, the average lean meat content determined by the method III differed from those determined by the methods I and II (P<0.05) regardless the categorisation of carcasses (weight, gender, quality grade). The average lean meat contents of all carcasses were 56.25 (s = 3.844) and 56.46 (s = 3.888) %, respectively, when the methods I (full dissection) and II (simplified dissection) were used. This is in agreement with the average carcass lean meat content in the Czech Republic (Ročenka, 2011). The difference between the two methods was 0.21 percentage points. When the lean meat content determined by the method I is equal 100 %, the content obtained by the method II would be 100.37 %. This small and insignificant difference is probably due to the fact that 9 smaller carcass joints were not dissected into separate tissues (Branscheid et al., 2004). The authors also stress less time consumption of this method as well as less carcass damage done. Also, the method II has been previously assessed as a dissection method used for pig carcass classification (Nissen et al., 2006) and the results obtained were similar to those in our study.

However, the average lean meat content determined by the method III (59.02 %; s = 3.846) differed from those determined by the methods I and II by 2.77 and 2.56 percentage points, respectively. This increased estimate of the lean meat content using the method III is related to a new prediction equation introduced by the European Commission for all member states in 2008, which replaced the equation used for the method II.

It can be expected that the use of regression equations currently being developed in the Czech Republic for the prediction of pig carcass lean meat contents based on the method III will result in a similar lean meat content increase as reported in the present study.

Conclusion

Pig carcasses (n = 40) were assessed with the aim to determine their lean meat content using three different reference dissection methods. The average lean meat contents determined using full dissections (method I), simplified dissections (method II) and new reference dissections (method III) were 56.25, 56.46 and 59.02 %, respectively. It was confirmed that the use of regression equations currently being developed in the Czech Republic for the prediction of pig carcass lean meat contents, which are based on the method III, can be expected to result in a similar lean meat content increase as found in the present study.

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Nařízení Komise (ES) č. 1249/2008 ze dne 10.prosince 2008, kterým se stanoví prováděcí pravidla pro zavádění klasifikačních stupnic Společenství pro jatečně upravená těla skotu, prasat a ovcí a pro ohlašování jejich cen

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