

Results of the application of SEUROP for pig carcass classification in Bulgaria

Jivko Nakev^{1*}, Teodora Popova²

¹*Agricultural Institute-Shumen, Shumen 9700, Bulgaria*

²*Institute of Animal Science-Kostinbrod, Kostinbrod 2232, Bulgaria*

*Corresponding author: jivko_nakev@abv.bg

Abstract

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This article is a review aiming to analyse the results of the application of SEUROP for pig carcasses grading in Bulgaria based on two studies – one carried out in 2009, and the other covering the period from the years 2012 to 2015. The main quality characteristics of the pig carcasses for the examined periods were lean meat percentage (56.01%-56.72%) and average weight of the carcasses (76.80 kg-84.58 kg). Significant differences in the slaughter weight existed within the individual classes of the SEUROP, as the pig carcasses with higher lean meat content had lower weight. The carcass weight in S class was significantly lower when compared with the weights in the E, U, R and O classes. During the years of the research work (2012-2015) there was minor increase of the carcasses in S class, as well as decrease of those in U and R classes by 13.89% and 0.89% respectively. The E class has been increased from 65.45% in 2012 up to 76.49% in 2015. The carcass quality characteristics described in the study did not differ considerably from the ones in the Eastern European countries. The higher lean meat content led to decrease of the fat, affecting the taste of the meat, particularly in the loin and the ham. These parts cover over 40% of the carcass and form considerable part of the incomes. Hence, the role of the market in the determination of the selection criteria for carcass quality could be considered.

Keywords: SEUROP classification; pig carcasses; meat

Introduction

The experience of the countries with developed pig breeding shows that the developing and implementation of modern methods for product classification is very important for its high quality (Machev et al., 1988; De Boer, 1992; Simon et al., 1994; Andreev et al., 2000). SEUROP classification for pig carcasses has been applied in the European Union (EU) for several decades. The main aims for its introduction are harmonisation of the legislation in the EU, implementation of common understanding for the carcass quality, as well as an integrated scale for its determination. The integrated carcass classification system serves as basis of setting an average price for each of the classes. At the same time, the implementation of common understand-

ing of quality helps to attain higher degree of transparency of the market. The application of the grading system in all the Member states makes it possible to compare the prices and the quality of the pig carcasses among the countries, to provide information to the European producers about the place their produce could take on the European market, as well as the possibilities to receive fair price for the quality they offer.

According to the acting regulations in the EU Member states, the content of the lean meat is the ratio between the weight of skeletal muscles which can be separated by knife and the carcass weight. The muscle content has been assessed through validated classification methods that were developed on the basis of statistical evaluation of the results obtained by the measurement on one or more parts of the carcass.

Materials and Methods

It is necessary to mention that the improvement of the system is not universal but each Member state develops the model and monitors its efficiency on the pig population. The correct market relations require maximum accuracy from the system. Its improvement is a constant process including research in the following directions:

- Studies on the production obtained (monitoring) (Čandek-Potokar et al., 2004; Pulkrábek et al., 2003; Vitek et al., 2008; Kvapilík et al., 2009; Pulkrábek et al., 2011; Skrzymowska, 2012);

- Effect of some factors, such as sex, carcass weight, hybrid combination on the prediction value of lean meat in the carcass (Vališ et al., 2009; Vitek et al., 2009, 2012a; Sládek et al., 2010);

- Implementation of new tools (Romvari et al., 2006; Margeta et al., 2007; Vitek et al., 2012b).

In the recent years, the selection of the pigs is oriented towards increase of the lean meat percentage and considerable decrease of the intramuscular fat as well as the fat deposition in the carcass as a whole (Marinova et al., 2015). The meat obtained from such animals displays dramatically low intramuscular fat content. The latter is an important trait determining the juiciness and tenderness of the meat, as it was found that these characteristics have been considerably improved when the intramuscular fat increases. Besides the improvement of the two sensory traits, mentioned above, the content of the intramuscular fat is important in regard to the nutritional and healthy value of the meat. Pork has been known to have approximately 35% saturated fatty acids (Popova et al., 2016), which is lower than the levels found in lamb – 47% (Popova, 2014). It is known that some of the saturated fatty acids in particular myristic (C14:0) and palmitic (C16:0) are hypercholesterolemic. Bellizzi et al. (1994) reported strong relationship between the content of C14:0 and the cardiovascular diseases, and according to Fernandez and West (2005) this fatty acid is hypercholesterolemic through its direct stimulation for low density lipoprotein (LDL) synthesis in the liver. It has been reported that the dietary intake of C16:0 also increases the levels of plasma cholesterol, although this relationship has been much stronger for C14:0. According to Yu et al. (1995), C14:0 has the potential to increase 5 to 6 times the levels of plasma cholesterol when compared to C16:0. On the other hand, the stearic acid (C18:0) is “neutral” since it does not affect LDL or high density lipoproteins (HDL) (Kris-Etherton et al., 2005; Mensink, 2005).

With this review we are aiming to analyse the results of the SEUROP application for pig carcass classification in Bulgaria. The implementation of the grading system has two phases.

Development of prediction models and regulations

The first research works on the application of the SEUROP system commenced in the mid 90-ies in Bulgaria. In a study with 120 scalded carcasses, Katsarov et al. (1996) proposed the following regression equation for determination of lean meat percentage for Ultra FOM:

$$Y = 57.25126 - 0.111593x_1 + 0.105844x_2 - 0.4455956x_3,$$

where:

Y – lean meat percentage;

x_1 – backfat thickness (including skin), measured at 7 cm laterally above the last rib измерена (mm);

x_2 – depth of *m. Longissimus dorsi* measured at x_1 ;

x_3 – backfat thickness (including skin) measured 7 cm laterally between 3rd and 4th last ribs (mm).

Machev and Valchev (2001) reported that the back fat thickness and the depth of *m. Longissimus dorsi* measured in different locations correlate with the lean meat content in the carcass. The authors considered that the classification of the back fat thickness in L_2 (distance between the cranial end of the *Gluteus medius* muscle and the edge of the vertebral canal) according to the State standard 838 – 80 might be replaced by the determination of lean meat percentage according to the SEUROP system through the following equations: I. ZP method

$$\% \text{ LM} = 44.4128 + 26.0429 \frac{L_2}{F},$$

where:

L_2 – backfat thickness at L_2 (mm);

F – depth of *m. Longissimus dorsi*, measured from the cranial end of *m. Gluteus medius* to the dorsal end of the vertebral canal.

FOM method

$$\% \text{ LM} = 58.35 - 0.75027S_2 + 0.21181F_2,$$

where:

S_2 – backfat thickness at the last rib (7cm);

F_2 – depth of *m. Longissimus dorsi* at S_2 .

Marinova et al. (2002) developed a Manual for classification of live animals, sheep, beef and pig carcasses applying SEUROP. The authors proposed the following equation for the lean meat percentage in the pig carcass:

$$Y = 48.785 - 0.386x_1 - 0.215x_2 + 0.226x_3,$$

where:

Y – lean meat percentage in the carcass;

x_1 – back fat thickness (including skin), measured at 8 cm laterally at the level of the last rib (mm);

x_2 – back fat thickness (including skin), measured 6 cm laterally between 3rd and 4th rib (mm);

x_3 – depth of *m. Longissimus dorsi* at x_2 (mm).

Since 18.07.2005 in Bulgaria there has been Regulation № 21/14.05.2004 of the Ministry of Agriculture and Foods (State gazette, 52/18.07.2004) for classification of pig carcasses according to the (S) EUROP system, applying the above mentioned equation (Marinova et al., 2002) for the Hennessy Grading Probe (HGP) device.

With decision of the Commission from 28.07.2008 (2008/676 EO) the classification of pig carcasses in Bulgaria is done using Ultra FOM 200 device. This makes it necessary to change the legislation in the Regulation № 15 of the Ministry of Agriculture from 08.05.2009 (State gazette, 37/19.05.2009), to achieve full synchronization with the EU legislation. According this regulation, the pig carcass classification is done using Ultra FOM 200, and the lean meat content is calculated using as follows:

$$Y = 67.13 - 0.3284x_1 - 0.3725x_2 + 0.01515x_3,$$

where:

Y – lean meat content (%);

x_1 – thickness of the backfat with skin, measured at 7 cm from the midline of the carcass, between 3rd and 4th last lumbar vertebra (mm);

x_2 – thickness of the backfat with skin, measured at 7 cm from the midline of the carcass, between 3rd and 4th last rib;

x_3 – depth of *m. Longissimus dorsi* measured in x_2 .

Results and Discussion

What is the effect of the SEUROP classification in Bulgaria?

Table 1. Quality of pig carcasses in Bulgaria

Class	n	Lean meat,%			Carcass weight, kg		
		Mean	E	C	Mean	E	C
S	5 098	61.01	0.03	2.06	72.60	1.12	8.64
E	77 092	57.29	0.01	2.03	76.39	0.04	12.39
U	17 836	53.37	0.02	2.27	79.60	0.10	13.78
R	738	48.36	0.09	2.34	80.09	0.47	12.71
O	7	44.17	0.74	1.97	82.62	5.31	14.06
Total	100 762	56.72	0.01	3.96	76.80	0.04	12.69

Source: Nakev, 2010

Table 2. Weight and lean meat content in pig carcasses classified by SEUROP

Items	Mean	n	E	Carcass weight, kg			Lean meat,%			
				C	t-test	Mean	E	C		
Class	1	S	3055	78.35	0.18	9.92	1-[2;3;4;5]*** 2-[3;4;5]*** 3-[4;5]***	61.41	0.04	2.27
	2	E	128867	83.60	0.03	10.11		56.91	0.01	2.09
	3	U	53077	87.15	0.04	9.68		53.70	0.01	2.07
	4	R	1182	92.88	0.30	10.10		48.82	0.06	2.21
	5	O	30	93.66	1.96	10.71		43.31	0.62	3.41
Total			186211	84.59	0.02	10.23	56.01	0.01	3.69	

*** P < 0.001; Source: Nakev and Nikolova (2017)

Nakev (2010) studied the lean meat percentage in the carcasses of 100 762 finished pigs from 54 farms, slaughtered in 6 abattoirs in 2009. He reported that the average lean meat percentage in the sample was 56.72 %, while the carcass weight was 76.80 kg. Class E formed 76.51%, followed by class U -17.70% and S-5.05%. (Table 1)

For description of the structure of pork production, the producers have been divided into “small” up to 1 000 carcasses (n = 33) and “large” more than 1 000 carcasses (n = 21). The large producers sold 92 444 finished pigs which constituted 91.74% of the sample. The average lean meat percentage was 56.68 %, while the carcass weight was 77.22 kg. The carcasses graded as S class formed 4.59% whereas those in E and U classes were respectively 76.46% and 12.37%. The pig carcasses of the small producers graded in class S, E and U were respectively 10.18%; 77.01% and 12.37% of the sample. The pigs had 57.09% lean meat with the weight of the carcass 72.12 kg.

According to the results, the small size producers have sold higher percentage of carcasses classified as S (5.59%) and E (0.54%), and lean meat percentage (0.41%; P < 0.001) when compared to the big producers. The production of farms with more than 1000 pigs displayed higher carcass weight (5.10 kg; P < 0.001) in comparison to the small size farms.

Nakev & Nikolova (2017) studied some quality traits of pig carcasses (n = 186 211) obtained from a total of 8 pig breeding enterprises in the Eastern part of Bulgaria (Shumen, Varna, Burgas and Russe regions) that were slaughtered in the period 2012-2015. The results are shown in Table 2.

Significant differences in regard to the carcass weight existed between the classes. The carcasses with higher lean meat content had lower weight ($P < 0.001$). The weight of the carcasses in S class was 78.35 kg, which is 5.25 kg, 8.80 kg, 14.53 kg and 15.31 kg lower, respectively in comparison to E, U, R and O classes ($P < 0.001$).

During the years of the study when classified according to the lean meat content, there was insignificant increase of the carcasses in class S and decrease of those in U and R respectively by 13.89% and 0.89%. Class E increase from 65.45% in 2012 to 76.49% in 2015 (Fig. 1)

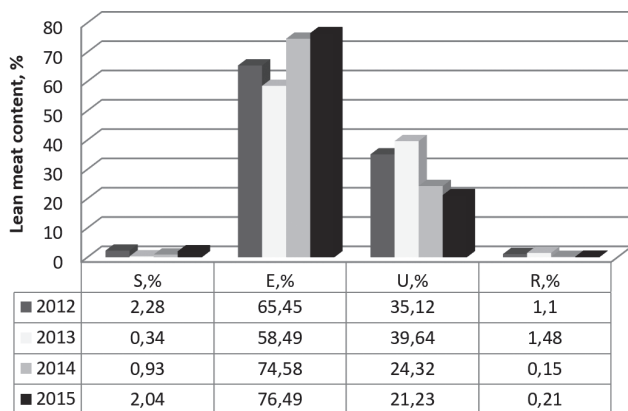


Fig. 1. Carcass distribution in the different classes according to the lean meat content

Our results differ from those of Pulkrábek et al. (2011) and Čandek-Potokar et al. (2004). The differences are due to the low percentage of carcasses classified as S in the studied sample.

On the other hand, the quality characteristics of the carcasses that was reported above were not different to a great extent from those in Eastern Europe (Čandek-Potokar, 2004), Skrzyszowska (2012), Kvapilík et al. (2009). Both monitoring studies showed that the percentage of the carcasses classified in S class in Bulgaria is considerably lower when compared to the data of Čandek-Potokar et al. (2004), Castryck (2007), Pulkrábek et al. (2011).

Effect of the increase of the lean meat content in the carcass on its quality characteristics

In recent years, the modern breeds reached the peak of their biological potential in regard to the lean meat percentage through dramatic decrease of fats (subcutaneous, intra- and intermuscular) in the carcass. The intramuscular fat is essential for the sensory quality of pork as its content in the meat related to the healthy diet is still being de-

bated. While for many years meat marbling has improved its taste and tenderness, at the end of the XX century the increasing concerns about the animal fats in the human diet are the reason to accept policies towards reducing fats. The studies in Bulgaria confirm the global trend towards decrease of the fat in pork. According to Dimov et al. (1986) the fat content in the meat of four hybrids varied between 3.29% and 4.22%. Later, in a study on the chemical composition of three and four-way hybrids, Shostak et al. (1993) found that the percentage of intramuscular fat was 4.18% in the three-way and 4.03% in the four-way hybrids. Angelov & Apostolov (1995) reported that the fat content of the meat of male and female Duroc pigs was respectively 6.00% and 6.52%. The studies in recent years show significant decrease of the fat content in *m. Longissimus lumborum et thoracis*. While studying of hybrid pigs with participation of Danube White breed, Nakev et al. (2005) reported fat content of 3.28%-3.29% in the meat. Furthermore, in trials with crossbred pigs aiming to develop high performance synthetic boars and hybrids, Slanev et al. (2006) determined intermuscular fat percent within the range of 2.72% to 2.85%. In another study, Nakev et al. (2017) examined the quality of meat in two crossbreeds with participation of Large White (LW), Landrace (L), Pietrain (P) and Duroc (D) reared in industrial conditions. The amount of the intramuscular fat in $(L \times LW) \times P$ and $(L \times D) \times P$ was respectively 2.42 and 2.99%. During the study, the producers told about existing problems with the sales of some valuable carcass parts. This indicates that the increase of the lean meat content in the pigs reduces the levels of the fat that are unacceptable by the consumers. This is especially visible in the loin (*m. Longissimus thoracis*) and the ham as well. These parts constitute over 40% of the carcass and also a considerable part of the revenue.

Conclusions

The results of both monitoring studies showed that the quality characteristics of the pig carcasses obtained in Bulgaria did not differ from those in the Eastern European countries but defer to those in Western Europe. We consider this due to the maturity of the pig breeders in Bulgaria, carefully using the Pietrain breed in the crossbreeding schemes.

The increase of the lean meat percentage in the carcass led to decrease in the fat content influencing negatively the sensory characteristics of the meat. In this regard, we believe that the market will intervene in the determination of the selection criteria for the carcass quality.

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