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SEUROP BEEF AND PIG CARCASS CLASSIFICATION IN SLOVAKIA: A REVIEW

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ABSTRACT

Carcass classification plays an important role in Europe, as a marketing aid within and among countries and as a mean of increasing the precision of price reporting for administrative purposes. It also provides important information about the quality of the slaughter population. Since carcass classification systems were first introduced over fifty years ago, EU support schemes and the red meat industry have changed considerably. Changes in the SEUROP classification system of beef and pig carcasses also took place in Slovakia. This paper reviews actual system and legislation, as well as definition, categorization, presentation, conformation and fat cover of beef and pig carcasses at the slaughterhouses in Slovakia.

Key words: SEUROP; classification; carcass; beef; pig

INTRODUCTION

Livestock production ranks among the most important sectors in agricultural production from the point of view of preserving and developing agrarian and rural employment. The most crucial in the field of livestock production is pig and cattle farming (Věžník *et al*., 2017). According to Chrastinová *et al*. (2014) livestock production in Slovakia has been showing a decreasing tendency over the long term, which is connected with the economic conditions such as higher cost of livestock breeding, for example. The drop in production is further strongly linked also to the import of products to the local market.

Nowadays, Slovakia is no longer self-sufficient in the production of any kind of meat (Věžník *et al*., 2017). The current consumption of meat (figures of the year 2018) is 64.5 kg per capita, of which beef presents 5.3 kg and pork 35.8 kg (ŠÚ SR, 2019). It is estimated that less than half of this consumption comes from the Slovak Republic.

Nowadays cows represent the most numerous category of slaughtered cattle at abattoirs in Slovakia. In fact, about 43 % of slaughtered cattle are culled cows (31 % dairy cows, 12 % beef cows). Cows are culled for various reasons including age, poor performance, and failure to reproduce (Bahelka *et al*., 2016).

Cows in better body condition, with higher live weight and fatness, are usually selected for export abroad to the countries such as Austria, Hungary, Poland or Turkey. There our farmers make higher profit than in Slovakia. Juvenile male animals of all meat breeds are predominantly exported abroad (Italy, Croatia, Slovenia, Austria, Turkey etc.), therefore, the number of bulls slaughtered in the Slovak slaughterhouses is low. According to Huba *et al*. (2019), if all raised bovine animals were slaughtered at domestic slaughterhouses, this would exceed current domestic beef consumption.

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In such case, Slovakia would be self-sufficient in beef production.

Pork meat is being imported to Slovakia from almost all Europe, but mainly from the neighbouring countries. More than a half of the slaughter pigs are being exported as a result of closing down of numerous important slaughterhouses, e.g. in Lučenec, Rimavská Sobota, Humenné, Zbrojníky or Sereď. At present, there are only smaller slaughterhouses in the towns Myjava, Tešedíkovo or Komárno that operate and which until recently were of local importance only. Most slaughterhouses in Slovakia process meat from foreign production, which is economically more profitable for them (Věžník *et al*., 2017).

Legislation of the classification system for bovine and pig carcasses in Slovakia

In the Slovak Republic the classification of bovine and pig carcasses is currently carried out according to the SEUROP system that has been applied since 2001. Main principles are laid down in the European Parliament and Council Regulation (EU) No 1308/2013 while the Commission Delegated Regulation (EU) 2017/1182 and Commission Implementing Regulation (EU) 2017/1184 provide for more detailed provisions. The last two regulations have brought more flexibility to the system for the member states of the European Union by repealing and replacing the previous Commission Regulation (EC) No 1249/2008.

Currently, member states may decide that the requirements on classification of carcasses of bovine animals, laid down in points A.V and B.II of Annex IV to Regulation (EU) No 1308/2013, shall not be compulsory for slaughterhouses which slaughter less than 150 bovine animals aged eight months or more per week as an annual average. A similar rule may be applied to slaughterhouses slaughtering less than 500 pigs weekly as an annual average.

Member states may decide to apply lower limits for both beef and pig carcass classification, in particular to ensure the representativeness of price recording (Article 2 of the Regulation (EU) 2017/1182) as the rules on meat price recording and informing Commission on prices are essentially linked to the rules on carcass classification (Commission Implementing Regulation (EU) 2017/1185).

In accordance with national Slovak legislation principally represented by the basic Act No 491/2001 Coll. all slaughterhouses slaughtering bovines and/or pigs are obliged to classify carcasses of bovine animals aged eight months or more and pig carcasses. It is not mandatory to classify carcasses of bovine animals and pigs which are intended for own consumption in Slovakia. The detailed rules providing for the functioning of the system are laid down in the Decrees No 205/2007 Coll. and No 206/2007 Coll. The mentioned national legislation is currently a subject of an amendment preparation aimed at adapting the rules to the objective situation in Slovakia.

As regards involved authorities and institutions, the national rules on beef and pig carcass classification are laid down by the Ministry of Agriculture and Rural Development of the Slovak Republic, in addition to adopting legislation, also responsible for designation of the inspection body and issuing classifier's licences.

The State Veterinary and Food Administration of the Slovak Republic is designated by the Ministry as a competent authority in charge of inspections in slaughterhouses including the application of penalties.

The Agrarian Market Information of Slovakia (AMIS) is a part of the Agricultural Paying Agency and is responsible for price collection, analysis and notifications to European Commission. As a part of its activity, the Agricultural Paying Agency conducts inspections on price reporting on-the-spot.

Member States shall ensure that classification is carried out by qualified classifiers, who have obtained a licence for this purpose. The licence may be replaced by an approval granted by the Member State, where such approval corresponds to recognition of a qualification.

In the Slovak Republic, classification is currently performed by slaughterhouse operators and by one independent company.

The National Agricultural and Food Centre – Research Institute for Animal Production in Nitra is responsible for classifiers' training and examination. The classifier course takes two days. One day is reserved for the theoretical part at the Institute followed by a written test. The next day is dedicated to practical training followed by an exam at a slaughterhouse.

The results of the examination are transmitted to the Ministry that issues licences for classifiers. The validity of the licence is 5 years, renewable after passing a new examination. A refresh workshop on carcass classification is held on a yearly basis.

The National Agricultural and Food Centre – Research Institute for Animal Production in Nitra also provides scientific support to the Ministry on carcass classification issues.

Beef carcass classification

Cattle breeding in Slovakia has a long tradition. According to the data provided by The Breeding Services of Slovak Republic, s.e., the total bovine population in Slovakia was 453 133 heads in 2018 (191 975 cows). Approximately 65 % of the total cow's population was represented by dairy cows (the rest by suckler cows). The most numerous cattle breed in Slovakia is Holstein, followed by Simmental-Fleckvieh, Charolais and Limousine. First two breeds are considered to be dairy or dual-purpose, while Charolais and Limousine are typical beef breeds.

Cattle reared in temperate climates are of a type distinct from the humped cattle of the tropics, which were previously considered to be a different species. But even within the temperate zone, cattle are inherently very variable, their obvious phenotypic variation encompassing size, shape and coat colour. This is primarily due to the variety of breeds that have originated are also important factors although gender and husbandry. These, plus variation in age at slaughter, confer much variability on their carcasses, which not only vary in size and shape but also, quite obviously, in fatness. So, when animals or carcasses began to be traded for meat (as opposed to being slaughtered consumed at home), there was a need to discriminate between them (Lazzaroni *et al*., 2007).

Also the works of some domestic authors (Páleník *et al*., 1984; Chrenek, 1987) point to certain differences among the categories of cattle bred in Slovakia (Nosáľ *et al*., 1997).

In the past, the purchase of bovine animals took place in a live state, based on weight and subjective determination of the forage. If the animals for slaughter (except calves) were not fasted 12 hours prior to delivery, a feed rate of up to 5 % and for excessively fed animals up to 8 % of the live weight of the animal were applied. To estimate tissue representation in the carcass, classifiers had to take into account the development of the individual lots with respect to their breeding, gender, age and others. The advantage of this method of buying slaughtered animals was the modesty of the technical equipment and the speed of sale. The disadvantage was the lower accuracy of the determination of the purchase weight and the class of quality, which led to disputes between the trading parties. Disputes between supplier and customer were solved by control slaughters (Guzmická, 2010).

Definitions of terms

"Carcass" means the whole body of a slaughtered bovine animal as presented after bleeding, evisceration and skinning. Half-carcass means the product obtained by separating the carcass symmetrically through the middle of each cervical, dorsal, lumbar and sacral vertebra and through the middle of the sternum and the ischiopubic symphysis.

Carcass presentation

Carcass presentation means preparing the carcasses for classification and further marketing. Without prejudice to points A. IV, B.III and C.IV of Annex IV to Regulation (EU) No 1308/2013, no fat, muscle or other tissue may be removed from the carcass before weighing, classifying and marking, except for cases when veterinary requirements are applied.

Carcasses of bovine animals aged less than eight months shall be presented in accordance with point A.IV of Annex IV to Regulation (EU) No 1308/2013 and without:

a) thin skirt
b) thick skirt.

Carcasses of bovine animals aged eight months or more shall be presented without:

a) kidneys
b) kidney fat
c) pelvic fat
d) thin skirt
e) thick skirt
f) the tail
g) the spinal cord
h) cod fat
i) fat on the inside of topside
j) jugular vein and the adjacent fat.

Carcass categories

Determination of the carcass categories is defined by Regulation No 1308/2013 Annex IV A. The bovine carcasses shall be divided into the six categories (Table 1). Classification of category V (calves) is not mandatory in the Slovak Republic.

Carcass classification

The classification system is defined as that involving the identification of the animal, the dressing specification, the weighing, the assessment on conformation and fatness (under the SEUROP grid), the documentation of the attributes and related price reporting issues.

Carcass classification gives an estimation of the quantity of meat in the important parts such as round, back, shoulder and fat in/on the carcass. Figure 1 shows three major carcass parts (rump, back, shoulder).

Classification and weighing of a carcass shall take place not later than one hour after the animal has been struck.

Table 1. Identification and description of the bovine carcass categories

Identification	Description
V	carcasses of animals aged to less than 8 months
Z	carcasses of animals aged from 8 months to less than 12 months
A	carcasses of uncastrated male animals aged from 12 months to less than 24 months
B	carcasses of uncastrated male animals aged from 24 months
C	carcasses of castrated male animals aged from 12 months
D	carcasses of female animals that have calved
E	carcasses of other female animals aged from 12 months

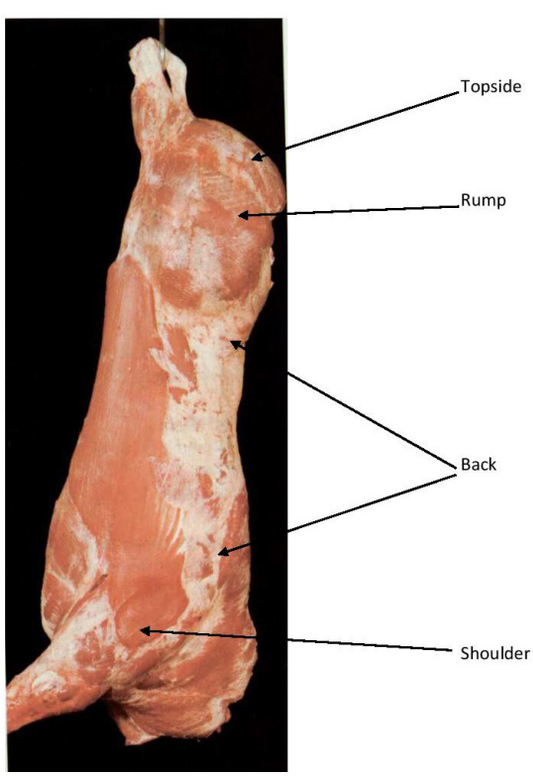

Figure 1. The major carcass parts

As already mentioned, Union scales for the classification of carcasses shall apply in accordance with, respectively, points A and B of Annex IV in the beef and veal sector as regards carcasses of bovine animals aged eight months or more (Regulation (EU) No 1308/2013, Part II, Title I, Chapter I, Section I, Article 10).

Carcass conformation

Table 2 and Figure 2 show criteria for classification of bovine carcasses in regard to conformation into the six classes (S, E, U, R, O, P). Member States of the EU may use subclasses for conformation: S+, S-, E+, E-, U+, U-, R+, R-, O+, O-, P+, P-. In the Slovak Republic the subclasses for conformation are not used.

Fat cover

Table 3 and Figure 3 show criteria for classification of bovine carcasses in regard to fat cover of the major carcass parts on the outside and fat cover of the thoracis cavity into the five classes (1, 2, 3, 4, 5). Member States of the EU may use subclasses for fat cover (1+, 1-, 2+, 2-, 3+, 3-, 4+, 4-, 5+, 5-). In the Slovak Republic the subclasses for fat cover are not used.

Table 2. Classification of bovine carcasses in regard to conformation

Class	Description	Additional provisions	
S (Superior)	• all profiles extremely convex • exceptional muscle development • double muscled carcass type	Round Back Shoulder	• very highly rounded double-muscled • visibly separated seams • topside spreads very markedly over the symphysis pelvis • very wide and very thick up to the shoulder • rump very rounded • very highly rounded
E (Excellent)	• all profiles convex to superconvex • exceptional muscle development	Round Back Shoulder	• very rounded topside spreads markedly over the symphysis pelvis • wide and very thick up to the shoulder • rump very rounded • very rounded
U (Very good)	• profiles on the whole convex • very good muscle development	Round Back Shoulder	• topside spreads over the symphysis pelvis • wide and thick up to the shoulder • rump rounded • very rounded
R (Good)	• profiles on the whole straight good muscle development	Round Back Shoulder	• well developed • topside and rump slightly rounded • still thick, but less wide at the shoulder • fairly well developed
O (Fair)	• profiles straight to concave • average muscle development	Round Back Shoulder	• average development to lacking development • average thickness to lacking thickness; rump straight profile • average development to almost flat
P (Poor)	• all profiles concave to very concave • poor muscle development	Round Back Shoulder	• poorly developed • narrow with bones visible • flat with bones visible

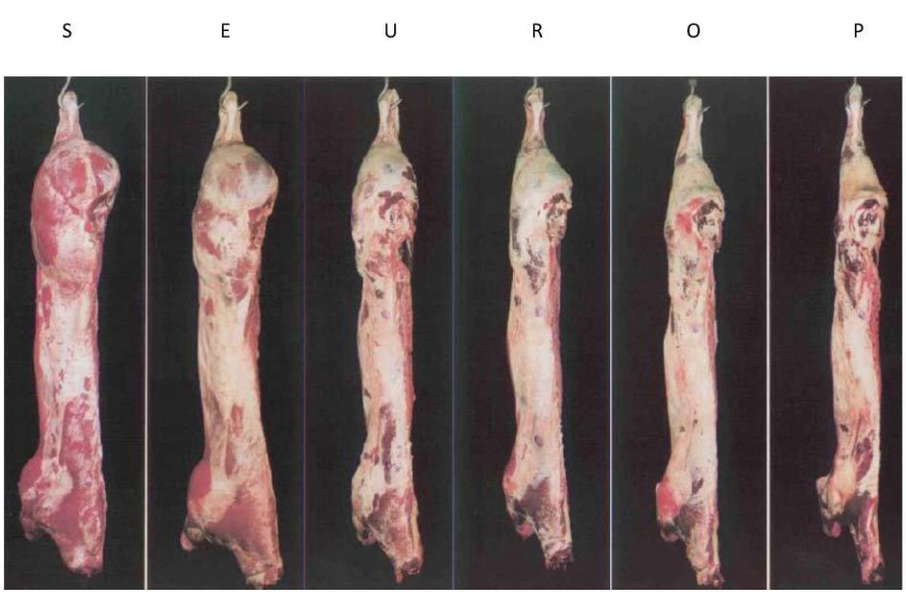

Figure 2. Degree of conformation

Table 3. Classification of bovine carcasses in regard to fat cover

Class	Description	Additional provisions
1 (Low)	• no up to low fat cover	• no fat within the thoracic cavity
2 (Slight)	• slight fat cover, flesh visible almost everywhere	• within the thoracic cavity the muscle is clearly visible between the ribs
3 (Average)	• flesh with the exception of the round and shoulder, almost everywhere covered with fat • slight deposits of fat in the thoracic cavity	• within the thoracic cavity the muscle is still visible between the ribs
4 (High)	• flesh covered with fat, but on the round and shoulder still partly visible, some distinctive fat deposits in the thoracic cavity	• he seams of fat on the round are prominent • within the thoracic cavity the muscle between the ribs may be infiltrated with fat
5 (Very high)	• entire carcass covered with fat • heavy deposits in the thoracic cavity	• the round is almost covered with fat, so that the seams of fat are no longer clearly visible • within the thoracic cavity the muscle between the ribs infiltrated with fat

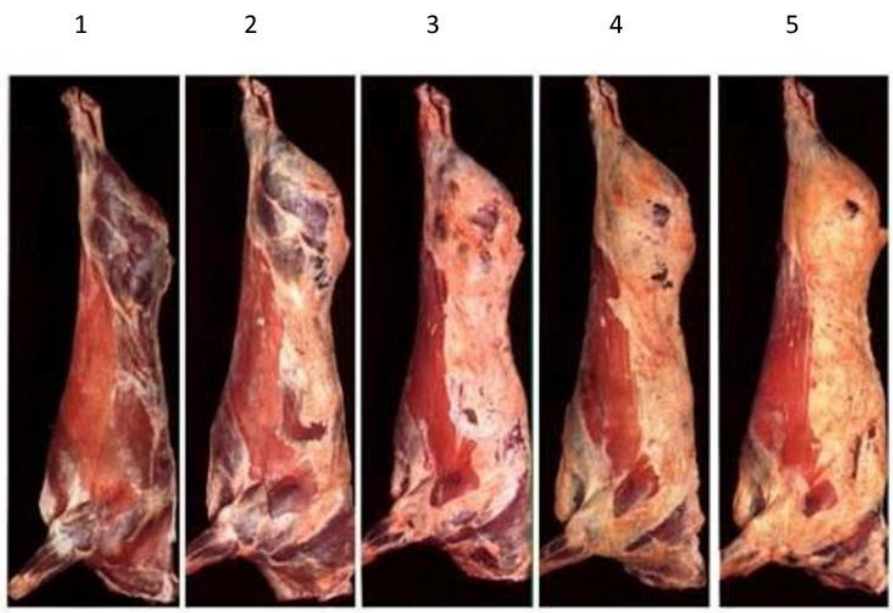

Figure 3. Degree of fat cover

Carcass identification (marking)

Identification and marking of the carcass shall take place no later than one hour after the animal has been struck. It is not allowed to remove marking before boning. In the Slovak Republic the marking is obligatory for all slaughterhouses. The identification of the carcasses shall be carried out by means of a mark indicating the category and the class of conformation and fat cover. This marking shall be carried out by stamping on the outside surface of the carcass using an indelible and non-toxic ink following a method approved by the competent authorities. The letters and figures must be no less than two centimetres in height. The marks shall

be applied on the hindquarters on the striploin at the level of the fourth lumbar vertebra and on the forequarters, on the brisket between 10 and 30 centimetres from the cut edge of the sternum. Marking can be also carried out by the use of labels under the following conditions:

a) the labels may be kept and attached only in the approved establishments which slaughter the animals; they must be of a size no less than 50 cm^2;
b) the labels must indicate an approval number of the slaughterhouse, the identification or slaughter number of the animal, the date of slaughter, the weight of the carcass;
c) all the indications must be perfectly legible and no alterations shall be permitted except if they are clearly marked on the label and carried out under the supervision of and the practical conditions determined by the competent authorities;
d) the labels must be tamper-proof, tear-resistant and firmly attached to each quarter in the places defined above.

Pig carcass classification

Definitions of terms

"Carcass" means the body of a slaughtered pig, bled and eviscerated, whole or divided down the mid-line.

Carcass presentation

Carcasses shall be presented without tongue, bristles, hooves, genital organs, flare fat, kidneys and diaphragm.

Carcass classification

In the process of breeding and production of high performing types of pigs (daily gain above 1000 g, reaching slaughter weight at 150 days of age), determination of the lean meat content in the pig's carcass is important. Precise determination of the lean meat content then enables fair monetization of the fattening pigs and remuneration of the breeders for their production of meat line pigs with low production costs (Demo *et al*., 2013).

Currently, multiple methods are utilized to estimate the lean meat content and the development of evaluation system progress at a dynamic rate with the equipment constantly improving. Objective classification determines the lean meat content in a carcass utilizing auxiliary indicators, which are the anatomic dimensions of the carcass. These are primarily the muscle thickness, resp. last rib fat thickness or lumbar region fat thickness, which display sufficiently close relation to the lean meat content. These parameters are easy and quick to measure and they do not require a dissection of the carcass, which would determine the lean meat content most accurately. However, a detailed dissection is demanding for time, manpower and finances as it requires high level of skill and compliance to a strict procedure.

In the EU countries, slaughter pigs are sorted into classes of quality based on the estimated total lean meat content using the SEUROP system, which uses information input (fat thickness, resp. the thickness of the muscle in the designated measuring sites). These are measured 6-8 cm (depending on the carcass weight) to the side of the central cut. Systems used to determine the lean meat content are categorized as follows (from the simplest to the most complex):

- mechanic, optic and optoelectronic rulers
- incision probes (e.g. Fat-O-Meater, Hennesy Grading Probe, Pork Grader, etc.)
- ultrasound probes (e.g. CSB Ultra Meater, US-Porkitron, Ultra-FOM)
- apparatuses on the base of electromagnetic resonance (EMS), resp. tomography (CT)
- fully automatic apparatuses on the base of digital imaging, which create ultrasound images (e.g. AUTOFOM)

As mentioned above, in EU legislation the detailed rules on classification of pig carcasses are laid down in the Delegated Commission Regulation (EU) 2017/1182 and Implementing Commission Regulation (EU) 2017/1184. In the conditions of Slovakia, the evaluation of quality and structure of pig carcass is additionally regulated by the Commission Decision No 2009/622/EC and Decree No. 205/2007 Coll. Since 2001 SEUROP has been the required classification system and permitted are two methods of lean meat content determination.

At slaughterhouses that slaughter less than 100 pigs per week on average, classification is done using two points – manual method using ruler (so-called ZP method from German 'Zwei Punkte'). Fat thickness, resp. muscle thickness in the lumbar region of the pig carcass is measured. Muscle thickness (M) is measured as the minimal muscle depth between the anterior extremity of the *musculus*

gluteus medius and the dorsal part of the medullar canal. Fat thickness is measured at the site of the thinnest fat layer over the *musculus gluteus medius*. The location and method of measuring is presented in Figure 4.

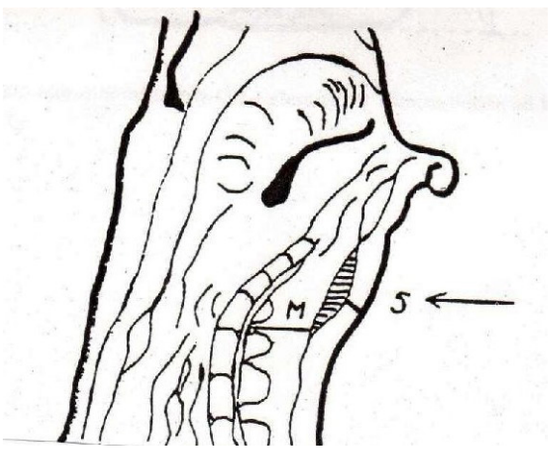

Figure 4. The location and method of measuring fat thickness

At slaughterhouses that slaughter more than 100 pigs per week on average, the lean meat content is in the Slovak Republic determined using machine equipment. In particular, it is the incision apparatus FOM, or ultrasound ULTRAFOM. The scheme of measurement locations is presented in Figure 5.

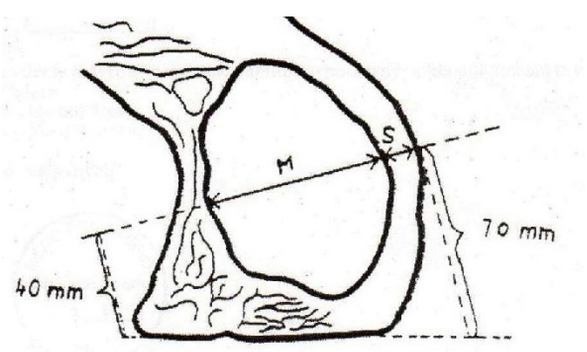

Figure 5. The scheme of measurement locations using ultrasound ULTRAFOM

The muscle depth (M) and fat thickness (S) are measured 70 mm from the central cut between the second and third to last ribs, both in a single incision. The FOM apparatus records values of each tissue's thickness during the removal of the probe; ultrasound apparatus ULTRAFOM records when the ultrasound transducer is put in contact with the carcass.

All methods for prediction of lean meat percentage use regression equations according to the methodology developed by Walstra *et al*. (1996) and Causeur *et al*. (2003). On each apparatus, a regression equation is installed, based on which the total lean meat content is calculated – the slaughter carcasses are sorted into quality classes based on weight, sex and lean meat content (Table 4, Table 5).

Table 4. Quality classes of slaughter pigs with taking-over weight between 60 and 120 kg, which are subject to classification

Class	Lean Meat Content (%)
S	60 and above
E	55 – 59.9
U	50 – 54.9
R	45 – 49.9
O	40 – 44.9
P	under 40

Table 5. Quality classes of slaughter pigs not subject to classification according to Point 1

Class	Characteristic
N	Carcasses with take-over weight through 59.9 kg
T	Carcass with take-over weight above 120 kg
Z	Meaty sows and incisors
H	Thin sows and incisors
K	Boars and cryptorchids

Carcass identification (marking)

The marking of pig carcasses shall be carried out on the skin of the hind leg or the front of the thigh of each carcass, the letters and numbers being at least 20 mm in height. The pig carcass shall be indicated immediately after classification with a harmless, non-washable and indelible colour.

The marking of pig carcasses may be replaced by a label of at least 5 x 10 cm. In addition to the quality and weight classes, the label shall include the classifier identification number, slaughterhouse number, animal identification number, breeder number and date of slaughter.

CONCLUSION

In the Slovak Republic SEUROP system has been used since 2001. Over the years it has undergone several legislative and practical changes and is currently under preparation to amend the above national legislation in relation to the EU rules in force.

In the sector of the beef carcass classification, consideration should be given to the use of subclasses for the most commonly occurring major conformation classes (O, P). Only main classes are used for conformation and fat cover classes. Due to the productive structure of the country, mainly small slaughterhouses are involved in the system. No slaughterhouses out of 62 active approved bovine slaughterhouses in Slovakia have, on average, weekly performance above 150 bovines aged 8 months or more per week. The small number of carcasses is also a problem when considering training of classifiers and the final practical examination. It depends on the carcass availability for the specific training day. Culled dairy cows are a prevailing category of slaughter bovines in the slaughterhouses.

In the sector of pig carcass classification, there is a trend to support diversification of production and utilization of automatized technologies to estimate the lean meat content. Attention will be focused not only on the total lean meat content of the carcass but also the share of meat on particular parts of the carcass and included in the evaluation of pigs will be also meat quality parameters. Breeding strategies and methods of classification will target uniformity of slaughter pigs, in which the lean meat content of the carcases will be high and within a narrow range. Already growing in popularity are the opinions that classification will have to take into account not only the total lean meat content but also meat quality parameters. It will be necessary to develop standardized methods to measure drip losses, pH, tenderness, colour and other parameters. In Slovakia, we are hearing also calls for less pressure to breed for high lean meat content as this is often accompanied by occurrences of abnormalities in the meat quality and worse parameters of culinary utilization of pork (juiciness, delicacy, tenderness). These topical questions will also need to be sufficiently answered in evaluating quality of pig carcasses and their monetisation.

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