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Department of Animal Keeping and Breeding, Faculty of Agricultural Sciences in Zamość
University of Life Sciences in Lublin,
e-mail: bogdan.szostak@up.lublin.pl

BOGDAN SZOSTAK

Evaluation of lean meat content in pigs obtained from different producers

Ocena mięsności tusz wieprzowych pochodzących od różnych producentów

Summary. The aim of the study was to evaluate the quality of pig carcasses in terms of their lean meat content, based on the example of pigs obtained from various producers in the south-eastern part of the Lublin voivodeship. The study was carried out in the Wrębiak-Witkowski meat processing plant (Zakład Przetwórstwa Mięsnego Wrębiak-Witkowski Sp. z o.o.) in Tomaszów Lubelski, Poland. Half-carcasses are classified according to the EUROP system using a CGM (Capteur Gras/Maigre) apparatus by Sydel, operated by authorized and trained personnel. The lean meat content of the pigs obtained from different producers was characterized on the basis of the arithmetic mean (x), standard deviation (SD) and coefficient of variance (V%). The percentage distribution of each of the classes S, E, U, R, O, and P in the carcasses was analysed as well. Despite the high degree of genetic variation in pigs obtained from different producers, the average lean meat content observed in the study, ranging from 56.6 to 58.3%, can be assessed as very good, exceeding that obtained for the total pig population in Poland and approaching European standards. The high percentage of carcasses in classes S and E (93%) indicates that breeding is proceeding in a positive direction and that suitable breeds have been selected for commercial cross-breeding.

Key words: lean meat, pig, carcass

INTRODUCTION

In recent years a substantial increase has been observed in the lean meat content of slaughter pigs, which according to Koćwin-Podsiadła and Krzęcio [2005] is the result of intensive selection in herds and of commercial cross-breeding using imported breeds with high meat content. Genetic factors are one of the main elements determining the slaughter value of pigs as raw material for production of meat and meat products. Using appropriate genetic selection, a visible or even dramatic increase in lean meat content can be obtained in

a relatively short time. Optimization of nutrition is then sufficient to stabilize and further improve this level of meat content [Borzuta *et al.* 2007]. On the other hand, improper use of foreign breeds in commercial production, particularly Piétrain and Belgian Landrace, leads to deterioration in pork quality, due to the *RYR1* gene possessed by these pigs [Kurył 1998]. For this reason Danish breeders do not use the Piétrain breed for pork production, but have achieved excellent results based on four-breed crosses using a Yorkshire × Landrace sows and a Duroc × Hampshire boars [Borzuta *et al.* 2007]. Taking advantage of the experience of foreign producers, Polish producers have also begun to implement effective four-breed cross-breeding patterns which do not include Piétrains [Blicharski and Hammermeister 2006]. A study by Borzuta *et al.* [2010] showed that hybrids produced using F_1 sows obtained from mating Polish Large White with Polish Landrace and F_1 boars obtained from mating Hampshire with Duroc had high lean meat content exceeding 58%.

For many years the slaughter value of carcasses and the quality of pork meat have been a subject of interest for both scientists and technology specialists at processing plants [Strzelecki *et al.* 2001, Stasiak *et al.* 2005, Cebulska *et al.* 2010, Sieczkowska *et al.* 2010, Atanassova *et al.* 2013]. Around the turn of the 21st century, a rapid increase in lean meat content took place in the Polish pig population, attaining a level of about 55%. This was linked to the implementation of objective, instrument-based classification of carcasses under the EUROP system and to the practice of paying suppliers based on this classification [Borzuta and Lisiak 2011]. In 1994 the slaughter performance of pigs classified at control stations was as follows for individual breeds: Polish Large White – 50.65%, Polish Landrace – 51.5%, Pulawska – 48.4%, Duroc – 52.3%, Line 990 – 53.4% and Piétrain – 64.1%. Monitoring of slaughter value conducted by the Ministry of Agriculture and Rural Development determined that the average lean meat content for Polish pig carcasses in the first half of 2009 was 54.5%.

Pigs produced in south-eastern Poland are characterized by substantial genetic variation. They include purebred animals, two-, three- and four-breed crosses, and hybrid products of unknown ancestry. Such high genetic diversity makes it difficult to produce a standardized meat product. The aim of the study was to evaluate the quality of pig carcasses in terms of their lean meat content, based on the example of pigs obtained from various producers in the south-eastern part of the Lublin voivodeship.

MATERIAL AND METHODS

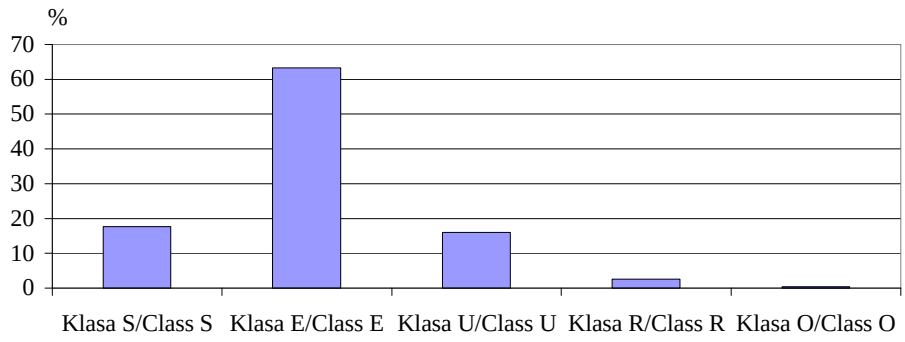
The study was carried out in the Wrębiak-Witkowski meat processing plant (Zakład Przetwórstwa Mięsnego Wrębiak-Witkowski Sp. z o.o.) in Tomaszów Lubelski, Poland. The plant has been subject to classification of pig carcasses since 2005. It employs two experts authorized to determine the quality of pig carcasses. Half-carcasses are classified according to the EUROP system using a CGM (Capteur Gras/Maigre) apparatus by Sydel, operated by authorized and trained personnel. The CGM is a hand-held device equipped with an optical probe that determines the thickness of the loin muscle and the fat layer by measuring the light reflected in the probe. The device determines the lean meat content of the carcass, i.e. the ratio of the total mass of the striated muscles to the mass of the carcass, which is weighed no later than 45 minutes after the animal is stunned.

The material for analysis consisted of pig carcasses weighing 80–90 kg. The pigs were obtained from four contractors in the south-eastern region of the Lublin voivodeship (from the villages of Lipowiec, Dęby, Szarowola and Gorajec). Supply of raw material (pigs) to the meat processing plant in Tomaszów Lubelski is based on continuous cooperation with the contractors. This allows for continuous, regular and planned supply of the raw material. The group of suppliers is quite diverse, which is characteristic of the Lublin voivodeship, where small-scale farms with low livestock density are prevalent. Predominant among suppliers are specialized pig farms, mixed farms (arable + livestock) and small farmers, mainly from the counties of Tomaszów Lubelski, Biłgoraj and Zamość.

The lean meat content of the pigs obtained from different producers was characterized based on arithmetic mean (x), standard deviation (SD) and coefficient of variance (V%). The percentage distribution of each of the classes S, E, U, R, O, and P in the carcasses was analysed as well.

RESULTS AND DISCUSSION

Table 1 presents the results characterizing the average lean meat content of the pigs obtained from the four contractors. The average lean meat content for all of the carcasses included in the study (543) was over 57%. This is a very good result, exceeding the average lean meat content of pigs slaughtered in Poland. Borzuta *et al.* [2010], in a comparative study of slaughter values of commercially produced four- and two-breed crosses of pigs, noted lean meat content of 58% in four-breed crosses and 52% in two-breed crosses. When Antosik and Koćwin-Podsiadła [2010] analysed the total Polish population of pigs, they obtained similar results to ours for the percentage content of meat in the carcasses – 57.96 ±2.57%. Sieczkowska *et al*. [2010] also observed lean meat content of 58% in a population of pigs of four breeds. Graph 1 illustrates the percentage distribution of carcasses in each class. The greatest number of carcasses were included in class E. A substantial percentage were assigned to the highest class S, with lean meat content exceeding 60%. Other authors have obtained similar percentages of carcasses in classes S and E, with lean meat content exceeding 80% [Antosik *et al.* 2010].

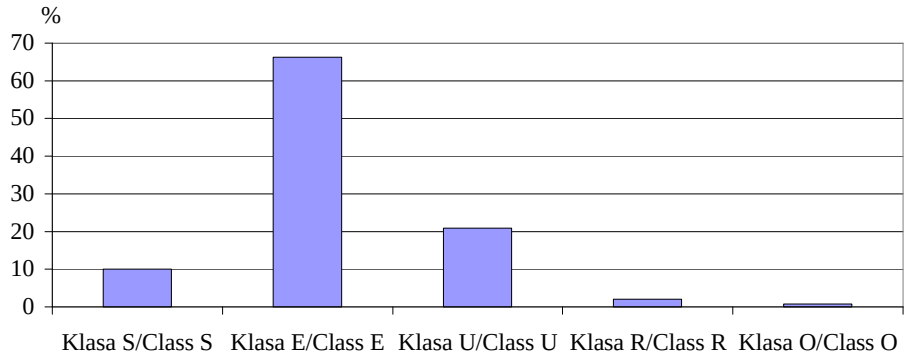


Graph 1. Percentage distribution of carcasses in each SEUROP class
Wykres 1. Procentowy rozkład tusz w poszczególnych klasach SEUROP

Table 1. Average lean meat content for all evaluated carcasses
Tabela 1. Średnia mięsność wszystkich ocenianych tusz

Class Klasy	Number of carcases Liczba tusz	Arithmetical mean Średnia arytmetyczna	Standard deviation Odchylenie standardowe	Coefficient of variability (%) Współczynnik zmienności
S	96	61.1	1.1	1.7
E	344	57.4	1.4	2.4
U	87	53.4	1.2	2.3
R	14	49.1	0.9	1.8
O	2	43.3	0.1	0.3
Total/Razem	543	57.2	3.0	5.3

The lean meat content in pigs obtained from contractor (producer) I is presented in Table 2. The average lean meat content in all of the carcasses evaluated (249) was 56.6%. The percentage of carcasses in each class is illustrated in Graph 2, which shows the high percentage of carcasses in class E.

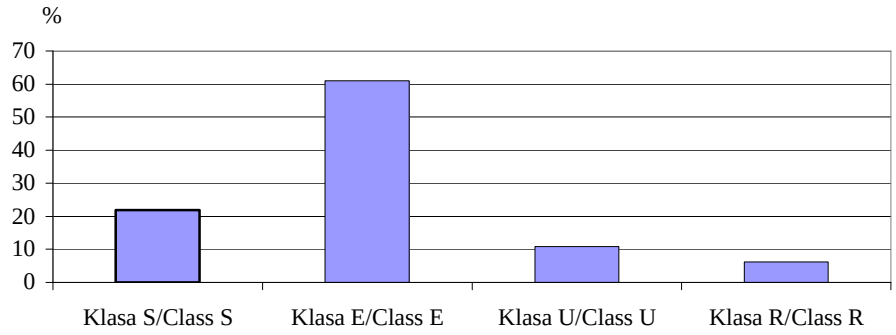


Graph 2. Percentage distribution in each SEUROP class for pigs from contractor I
Wykres 2. Procentowy rozkład tusz w poszczególnych klasach SEUROP pochodzących od kontrahenta I

Table 2. Lean meat content in pigs obtained from contractor I
Tabela 2. Średnia mięsność tuczników pochodzących od kontrahenta I

Class Klasy	Number of carcases Liczba tusz	Arithmetical mean Średnia arytmetyczna	Standard deviation Odchylenie standardowe	Coefficient of variability (%) Współczynnik zmien-ności
S	25	61.1	0.8	1.4
E	165	57.3	1.4	2.4
U	52	53.2	1.3	2.5
R	5	49.5	0.5	0.9
O	2	43.3	0.1	0.3
Total/Razem	249	56.6	3.0	5.3

The data presented in Table 3 show the lean meat content in pigs obtained from contractor II. The average lean meat content in all the carcasses was very high, at 57.0%. The highest percentage of carcasses from this supplier were included in class E, with lean meat content averaging 57.6%. A relatively large number of carcasses were assigned to class S, with average lean meat content exceeding 61%. The percentage of carcasses from producer II in each SEUROP class is illustrated in Graph 3**.**

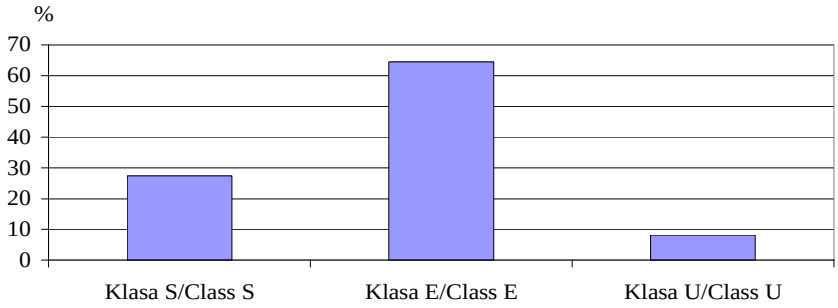


Graph 3. Percentage distribution in each SEUROP class for pigs from contractor II
Wykres 3. Procentowy rozkład tusz w poszczególnych klasach SEUROP pochodzących od kontrahenta II

Table 3. Lean meat content in pigs obtained from contractor II
Tabela 3. Średnia mięsność tuczników pochodzących od kontrahenta II

Class Klasy	Number of carcases Liczba tusz	Arithmetical mean Średnia arytmetyczna	Standard deviation Odchylenie standardowe	Coefficient of variability (%) Współczynnik zmienności
S	14	61.1	1.3	2.1
E	39	57.6	1.4	2.4
U	7	53.0	1.0	2.0
R	4	48.1	1.0	2.1
Total Razem	64	57.3	3.5	6.1

The meat content of pigs from contractor III is presented in Table 4. The lean meat percentage in the pigs purchased from this producer was even higher than in the case of producers I and II, averaging 58.3%. The percentage of carcasses in each class is illustrated in Graph 4. The high lean meat content observed in the carcasses (58.3%) was reflected in their distribution among the EUROP grid classes. Over 28% of carcasses were assigned to the highest class, i.e. S, and about 65% to class E. There were no carcasses in classes O or P.



Graph 4. Percentage distribution in each SEUROP class for pigs from contractor III
Wykres 4. Procentowy rozkład tusz w poszczególnych klasach SEUROP pochodzących od kontrahenta III

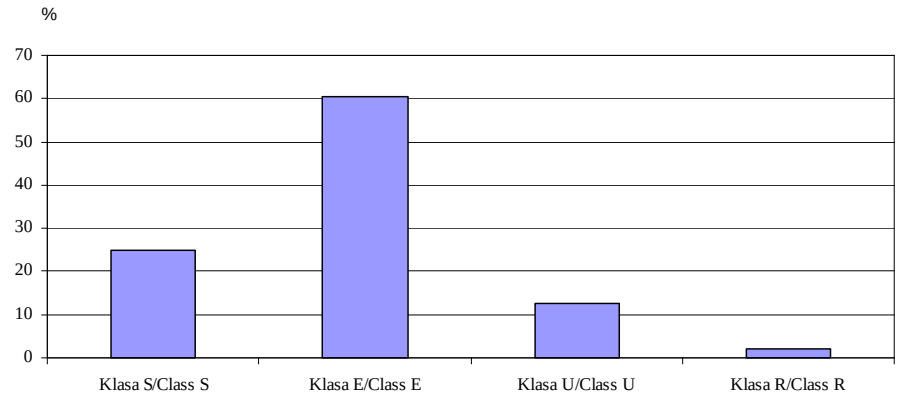
Table 4. Lean meat content in pigs obtained from contractor III
Tabela 4. Średnia mięsność tuczników pochodzących od kontrahenta III

Class Klasy	Number of carcases Liczba tusz	Arithmetical mean Średnia arytmetyczna	Standard deviation Odchylenie stan- dardowe	Coefficient of variability (%) Współczynnik zmienności
S	17	61.0	1.0	1.5
E	40	57.7	1.4	2.5
U	5	53.9	1.4	2.6
Total Razem	62	58.3	2.3	4.0

Table 5 presents the average lean meat content for the pigs from contractor IV. Analysis of the data shows that these carcasses had very high lean meat content – 57.8%. Graph 5 illustrates the very high percentage of carcasses (60%) in class E, with average lean meat content of over 57.6%. More than 25% of the carcasses evaluated were included in class S. Scientific research, as well as practical experience, has shown that production based on breeds that are genetically resistant or in which few individuals possess the stress susceptibility gene, such as Polish Large White, Duroc, Polish Landrace, or hybrids of these breeds, makes it possible to obtain raw material with a relatively small proportion of PSE meat. The level of PSE meat in the raw material supplied in the most recent period was fairly low in the Polish pig population, at about 4% [Koćwin-Podsiadła *et al*. 2003, Borzuta *et al.* 2007]. An increase in the amount of meat in the carcass is often associated with a deterioration in its quality and technological suitability. This underscores the importance of proper selection of animals for cross-breeding for the purpose of meat production.

Table 5. Lean meat content in pigs obtained from contractor IV
Tabela 5. Średnia mięsność tuczników pochodzących od kontrahenta IV

Class Klasy	Number of carcases Liczba tusz	Arithmetical mean Średnia arytmetyczna	Standard deviation Odchylenie stan- dardowe	Coefficient of variability (%) Współczynnik zmienności
S	34	61.2	1.2	2.0
E	82	57.6	1.4	2.5
U	17	53.5	1.0	1.8
R	3	49.5	0.1	0.2
Total Razem	136	57.8	2.9	5.0



Graph 5. Percentage distribution in each SEUROP class for pigs from contractor IV
Wykres 5. Procentowy rozkład tusz w poszczególnych klasach SEUROP pochodzących od kontrahenta IV

RESUME AND CONCLUSION

The group of suppliers of pigs to the production plant in Tomaszów Lubelski is highly varied. This is characteristic of the Lublin voivodeships, where small-scale farms with low livestock density are prevalent. Predominant among suppliers are specialized pig farms, mixed farms (arable + livestock) and small farmers, mainly from the counties of Tomaszów Lubelski, Biłgoraj and Zamość. Direct purchase of slaughter animals from producers meets 80% of the demand for this raw material, which to a large extent ensures continuity of supply and prices that are beneficial to both parties. The relatively short distances separating the pig producers from the slaughterhouse (max. 40–50 km) are not a source of difficulty in transporting the animals.

Despite the high genetic variation in the pigs from different contractors, the lean meat content of the pigs can be assessed as very good. The fact that over 93% of the carcasses were assigned to classes S and E indicates that in terms of lean meat content we are approaching the results obtained in the leading EU countries. This is undoubtedly due in part to obligatory classification of carcasses in the EUROP system, owing to which pig producers are paid according to lean mean content. This has induced pig breeders to seek out breeding material of high genetic quality, which ensures, among other traits, a high percentage of meat in the carcass. Often, however, increases in the amount of meat in the carcass are associated with deterioration in its quality and technological suitability. For this reason, evaluation of carcass quality should take into account many other traits in addition to meat content, such as pH, colour, intramuscular fat content, etc.

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Streszczenie. Celem pracy była ocena stanu jakościowego surowca wieprzowego w zakresie mięsności na przykładzie tuczników pochodzących od różnych producentów z południowowschodniej części województwa lubelskiego. Badania przeprowadzono w Zakładzie Przetwórstwa Mięsnego Wrębiak-Witkowski Sp. z o.o. w Tomaszowie Lubelskim. Klasyfikacja półtusz wieprzowych prowadzona jest tam według systemu EUROP za pomocą urządzenia CGM firmy Sydel. Charakterystykę mięsności tusz pochodzących od różnych producentów oparto na średniej arytmetycznej (x), odchyleniu standardowym (SD) i współczynniku zmienności (V%). Analizowano również procentowy rozkład tusz w poszczególnych klasach: S, E, U, R, O, P. Pomimo dużego zróżnicowania materiału genetycznego występującego u poszczególnych kontrahentów odnotowaną w niniejszej pracy średnią mięsność tuczników, wahającą się w przedziale 56,6–58,3%, można ocenić jako bardzo dobrą, przewyższającą mięsność uzyskiwaną w krajowym pogłowiu masowym i zbliżającą się do standardów europejskich. Wysoki udział tusz w klasach S i E (93%) świadczy o prawidłowym kierunku pracy hodowlanej i odpowiednim doborze ras w krzyżowaniu towarowym świń.

Słowa kluczowe: zawartość mięsa, świnie, tusze