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Differences in the assessment of beef carcasses in EUROP system

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Abstract: *Differences in the assessment of beef carcasses in EUROP system.* Classification of slaughter animals in EUROP system is obligatory for all EU countries. Visual assessment of beef carcasses determines the level of muscle and fat in scales from E to P and from 1 to 5. At the same time beef carcass is classified into one of five categories of cattle for slaughter from A to E. Visual assessment is not fully objective and is fraught with classifier error, which has an impact on the final assessment of the carcass. 2689 beef carcasses were classified in different categories for slaughter. Assessments were performed by three classifiers independently and in the same conditions in the slaughter line. Based on the results of evaluations of beef carcasses were performed statistical analysis. The average value for the conformation was class O, which accounted for 52.66% of all beef carcasses and at a comparable level fat classes 2 and 3 – 39.54, 32.54% respectively, which is characterized by a low content of meat and average fat content in carcase. CV (coefficient of variation) for the SE (standard deviation) in the conformation class was around 3% for the three categories slaughter A, B and E, and D was 2.16%. For the fat class regardless of the category slaughter CV for the SE was three times larger. The results suggest that visual assessment of beef carcasses is not objective and is fraught with error evaluator.

Key words: beef carcass, classification, EUROP system, conformation, fat class

INTRODUCTION

Introduced in 1981, EUROP grid is currently the most popular in the European Union grading system, which allows for visual determination of conformation and fatness of the carcass. The primary purpose of the EUROP is sort carcasses according to their value for further processing and to ensure fair payment to beef producers. Additionally, EUROP method was developed by countries trading within the common EU market to uniform principles and criteria of beef carcasses assessment.

The conformation score ranges from S (superior), used to describe rare double--muscled carcasses, via E (excellent) through to P (poor) and from 1 (low) to 5 (high) for fat cover. Each conformation and fat class is subdivided into low medium and high classes marked as "+" for high, "without indication" for medium and "–" for low, respectively (Commission Regulation 1249/2008).

According to the Polish regulation, all large plants that slaughter over 75 head of cattle and over 200 pigs a week on average during the entire year are obligated to introduce EUROP carcass classification system (Pawelec 2010).

The carcasses are visually evaluated by adequately trained person who has a valid license (Choroszy and Choroszy 2011). The main disadvantage of carcass evaluation by classifiers is subjective assessment of the carcass, which makes this system not fully accurate and objective. Moreover, it is essential for performance recording that the measured phenotype reflects the true genetic value for the animal with minimal variation arising from the assessment method. In response to these issues, there has been a drive to move away from visual classification. The modern assessment systems of carcass grading do not take into account the small differences in the quality of the carcass, which often are the result of breeding improvement directed to improve the cattle conformation (Cegiełka 2013, Wnęk et al. 2014a). Sometimes, the determined by classifier values of the carcass is far away from its true value.

The aim of the study was to determine the differences in beef carcasses evaluation with the EUROP grid by independent classifiers.

MATERIAL AND METHODS

The material for the analysis consisted of 2689 beef carcasses (breed Polish Holstein-Friesian) classified according to EUROP guidelines contained in the Commission Regulation No 1249/2008, including:

- 905 carcasses belonged to A slaughter category (carcasses of castrated males aged from 12 to 24 months);
- 427 carcasses belonged to B slaughter category (carcasses of castrated males animal aged above 24 months);
- 856 carcasses belonged to D slaughter category (carcasses of cows);
- 501 carcasses belonged to E slaughter category (carcasses of other male animal aged above 12 months).

Slaughter and classification were held in a slaughterhouse ECO-BEEF at Węgrzynów. Each carcass was classified by three professional classifiers with valid certificate. Carcass evaluation was processed independently and under the same conditions (including lightening) in slaughterhouses. The carcasses were arranged in random order for each repetition. The unified 5-grade scale of carcass assessment involving fat and conformation evaluation, which has been used by the classifiers is shown in Table 1. The results of the carcasses classification were written on sheets of paper, and then MS Excel database was created. For each of the EUROP grades and slaughter categories coding system presented in Tables 2 and 3 was applied.

TABLE 1. Description of the EUROP conformation and fat evaluation system

Conformation class	Carcase quality	Fat class	Fat cover
E	excellent	1	low
U	very good	2	slight
R	good	3	average
O	fair	4	high
P	poor	5	very high

Presented average $\overline{x}$ describes the arithmetic average of three independent classifications. The experimental data were evaluated by running ANOVA on IBM SPSS 21 (Statistical Product and Service Solution) according to following statistical model

TABLE 2. Coding system of conformation and fat class of beef carcasses

Conformation	E	E =	E–	E+	Fat class	1	1 =	1–	1+
Numerical value	1	1.75	1.5	1.25	Numerical value	1	1.75	1.5	1.25
Conformation	U	U =	U–	U+	Fat class	2	2 =	2–	2+
Numerical value	2	2.75	2.5	2.25	Numerical value	2	2.75	2.5	2.25
Conformation	R	R =	R–	R+	Fat class	3	3 =	3–	3+
Numerical value	3	3.75	3.5	3.25	Numerical value	3	3.75	3.5	3.25
Conformation	O	O =	O–	O+	Fat class	4	4 =	4–	4+
Numerical value	4	4.75	4.5	4.25	Numerical value	4	4.75	4.5	4.25
Conformation	P	P =	P–	P+	Fat class	5	5 =	5–	5+
Numerical value	5	5.75	5.5	5.25	Numerical value	5	5.75	5.5	5.25

TABLE 3. Coding system of categories slaughter beef carcass

Categories slaughter	Numerical value
A – carcasses of castrated male animal aged from 12 to less than 24 months	1
B – carcasses of castrated male animal aged above 24 months	2
D – carcasses of female animal that has calved	3
E – carcasses of other male animal aged above 12 months	4

$$Y_{ij} = \mu + A_i + e_j$$

where:

Y_{ij} – dependent variable;
μ – overall mean;
A_i – effect of slaughter category (i = = 1–4, Table 3);
e_j – residual error.

Any significant differences were present among the means at a 95.0% confidence level. The analysis of distribution of EUROP grading differences was performed by non-parametric chi-square test.

RESULTS AND DISCUSSION

The results of conformation and fatness grading are presented in Table 4. The most frequent assessment of the conformation was the class O and in the 2 and 3 in fatness (independently of age or sex). Figures 1 and 2 show the percentage of carcasses in the various categories of conformation and fatness. The largest share of the carcasses were in the O – 52.66% (for conformation) and categories 2 and 3 – 39.57 and 32.54% (for fatness) respectively. These carcasses were characterized by low quantity of meat and average fat content (Guzek et al. 2013). Beef production in Poland

TABLE 4. Statistical parameters of evaluations for carcasses fatness and conformation

Factor	$\bar{x}$ conformation	$\bar{x}$ fatness
$\bar{x}$	4.58	3.07
Me	4.67	2.92
D_0	4.75	2.75
SE	0.735	0.962

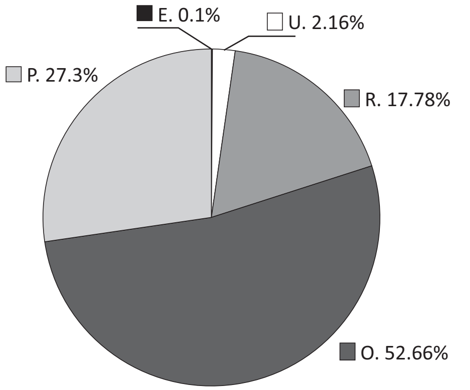

FIGURE 1. Percentage of carcasses in the various conformation categories

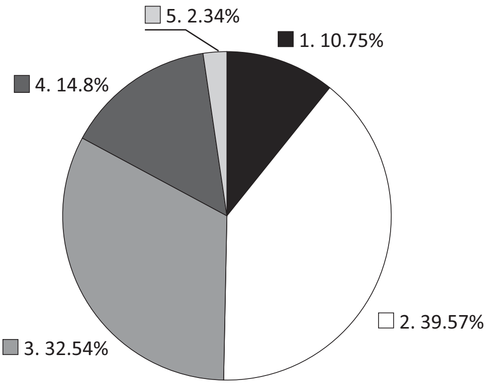

FIGURE 2. Percentage share of carcasses in the various categories of fatness

is mostly based on dairy breeds (Pilarczyk and Wójcik 2007, Litwińczuk and Grodzki 2014). Contribution of breeding beef cattle to animal production is minimal – currently less than 1% of the whole cattle population. Black-and-White cattle crossed with Holstein-Friesians were the basic breed – over 85% in the structure of beef production in Poland (Węglarz 2010). Consequently, in Polish grading system, dominates class "O" – which consists more than 60% of all classified carcasses (Seredyn 2006). Therefore, our beef producers do not have a strong argument in prices negotiations.

Table 5 presents the correlation coefficients between the fatness and conformation evaluations. The objective assessment depends on human judgment, which can be subjective, and inconsistent (Allen and Finnerty 2000, Wnęk et al. 2014b). Differences in the assessment of fat classes were more frequent than for the carcass conformation ($P \leq 0.05$). Carcass evaluation affects its economic value and therefore precision and repeatability of carcass grading is necessary.

TABLE 5. The correlation coefficients between the evaluations carcass fatness and conformation

Fatness	Conformation		
	$\bar{x}$	SE	Me
$\bar{x}$	–0.28	1.5**	–0.24
SE	–1.94**	0.32	–1.92*
Me	–0.34	–0.07	–0.31

* significance at $P \leq 0.05$; **significance at $P \leq 0.01$.

Figures 3, 4, 5 and 6 present the percentage of carcasses according to the slaughter category and carcass conformation. For conformation class E only three carcasses were classified and the rest were classified in slaughter category A. In the class P the majority were carcasses in slaughter category D – carcasses of adult female, characterized by low dressing percentage. Figure 7, 8, 9, 10 and 11 present the percentage of carcasses according to the slaughter category and fat classes. In the slaughter category D was the majority were carcasses with high fatness. Dairy cows are of poorer quality livestock (Rycombel 2004).

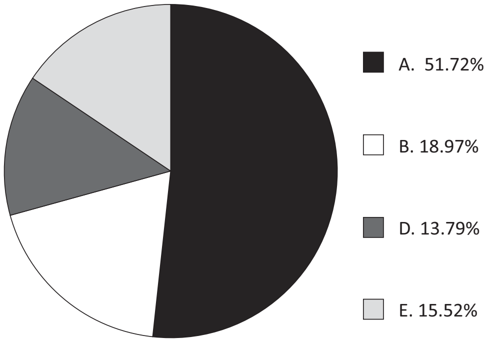

FIGURE 3. The percentage of the carcasses in the conformation U

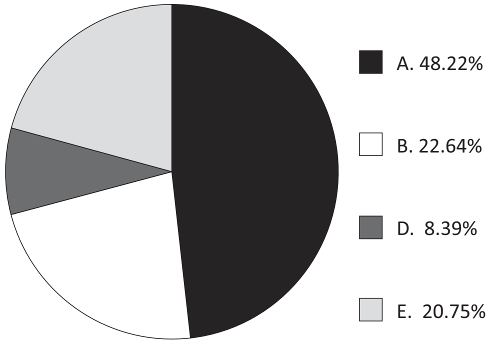

FIGURE 4. The percentage of the carcasses in the conformation R

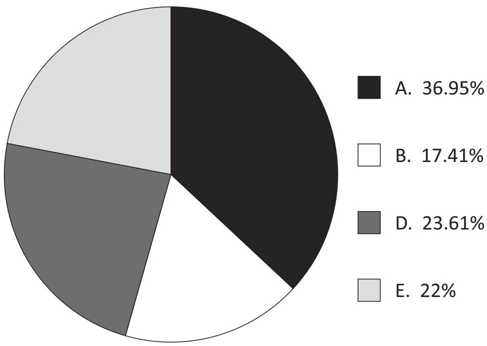

FIGURE 5. The percentage of the carcasses in the conformation O

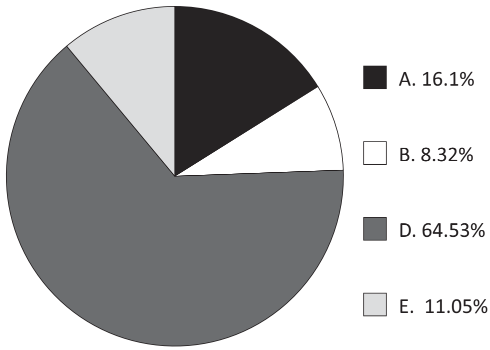

FIGURE 6. The percentage of the carcasses in the conformation P

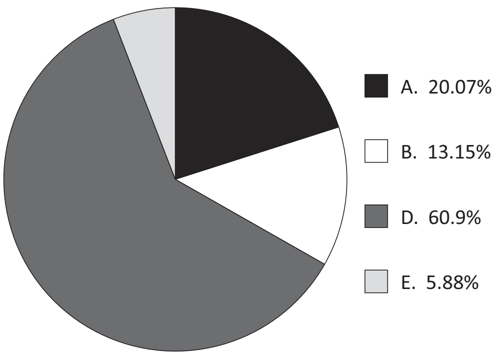

FIGURE 7. The percentage of the carcasses in the fatness 1

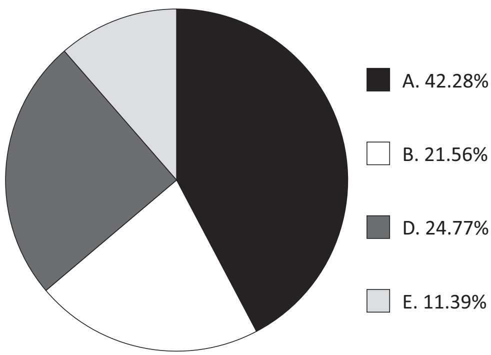

FIGURE 8. The percentage of the carcasses in the fatness 2

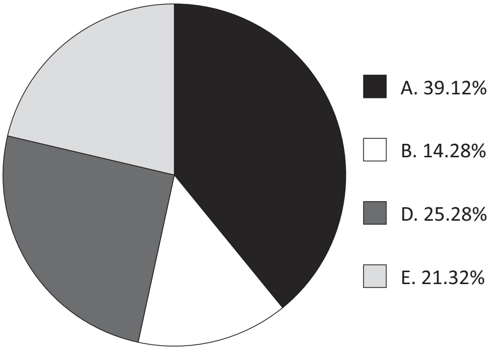

FIGURE 9. The percentage of the carcasses in the fatness 3

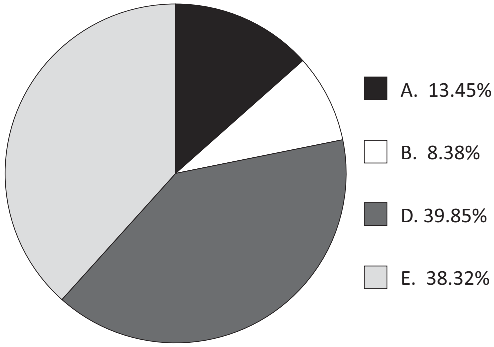

FIGURE 10. The percentage of the carcasses in the fatness 4

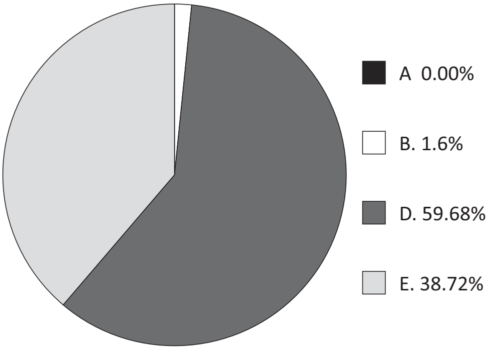

FIGURE 11. The percentage of the carcasses in the fatness 5

Conformation and fatness grades largely depends on the age and sex of animals for slaughter (Raesa et al. 2003, Bureš et al. 2006, Mach et al. 2008). Tables 6 and 7 presents an effect of slaughter category on the results of EUROP evaluation for conformation and fatness. In category slaughter 3 – D – carcasses of cows, average grade was 5.03 which was an equivalent of P class, characterized by the lowest level of conformation (Pawelec 2010). The CV for the SE is more than three times higher in fat assessments in relation to muscle assessments independently of slaughter category. Also, SE was higher in fat classes than conformation class, irrespective of slaughter category. Fat can be deposited not only in the subcutaneous tissue, but also between muscle fibers––intramuscular fat and carcass evaluation is based on the profiles of the carcass. Therefore, such an assessment is usually

TABLE 6. Effect of slaughter category on the results of assessments for conformation

Factor	Categories slaughter											
	1			2			3			4		
	N	$\bar{x}$	SE	N	$\bar{x}$	SE	N	$\bar{x}$	SE	N	$\bar{x}$	SE
$\bar{x}$	905	4.33	0.231	427	4.36	0.327	856	5.03	0.218	501	4.45	0.292
SE	905	0.14	0.064	427	0.12	0.117	856	0.1	0.059	501	0.14	0.009
Me	905	4.33	0.237	427	4.37	0.337	856	5.04	0.224	501	4.47	0.298
CV (%)	905	3.38	0.157	427	3.03	0.3	856	2.16	0.125	501	3.41	0.221

TABLE 7. Effect of slaughter category on the results of assessments for fatness

Factor	Categories slaughter											
	1			2			3			4		
	N	$\bar{x}$	SE	N	$\bar{x}$	SE	N	$\bar{x}$	SE	N	$\bar{x}$	SE
$\bar{x}$	905	2.92	0.713	427	2.87	0.788	856	3.04	1.155	501	3.58	0.951
SE	905	0.26	0.301	427	0.23	0.286	856	0.21	0.282	501	0.25	0.314
Me	905	2.95	0.757	427	2.87	0.822	856	3.07	1.167	501	3.61	0.978
CV (%)	905	9.7	11.933	427	8.82	11.557	856	7.81	11.051	501	7.59	10.085

fraught with some error. Lack of precision and accuracy in the classification of carcasses can be also caused by classifier fatigue, abnormal color of fat, or/and fat thickness that accompanies with high percentage of muscle tissue (Craigie et al. 2012, Cegiełka 2013).

CONCLUSIONS

Improving the competitiveness and profitability of Polish beef production requires an increase in the supply of good beef quality livestock, mainly terminal crossbreeds (Jasiorowski 2003, Seredyn 2006). An important factor in the beef cattle herds is selection of appropriate breed, which should be dependent on production system, nutrition and knowledge of the breeder (Przysucha et al. 2007). Crossbreeding dairy breeds with beef breeds is the most suitable method for improving beef livestock quality (Węglarz 1997, Trela et al. 2002, Voříšková et al. 2002, Bartoń et al. 2005). An important factor in the growth of consumer satisfaction, as well as the supply of beef would be to improve the precision and accuracy of the evaluation beef carcasses and automated technologies of objective grading systems offers such opportunity. The objective grading system has the ability to accurate carcass grading on the basis of properties and market requirements, depending on software and system calibration (Craigie et al. 2012). In practice, a visual assessment of the EUROP system performs only one person, so it is not fully representative.

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Streszczenie: *Różnice w ocenie tusz wołowych w systemie EUROP.* Klasyfikacja tusz zwierząt rzeźnych w systemie EUROP jest obowiązkowa dla wszystkich państw UE. Wizualna ocena tusz wołowych określa poziom umięśnienia oraz otłuszczenia w pięciostopniowych skalach od E do P i od 1 do 5. Jednocześnie każda tusza wołowa klasyfikowana jest do jednej z pięciu kategorii bydła rzeźnego od A do E. Niestety wizualna ocena nie jest w pełni obiektywna i jest obarczona błędem oceniającego, co ma wpływ na ostateczną ocenę tuszy. Sklasyfikowano 2689 tusz wołowych w różnych kategoriach rzeźnych. Ocen dokonywało trzech klasyfikatorów niezależnie od siebie i w tych samych warunkach panujących na linii ubojowej. Na podstawie uzyskanych ocen dokonano analizy statystycznej. Najczęściej występującą klasą umięśnienia była klasa O, co stanowiło 52,66% wszystkich sklasyfikowanych tusz. W klasie otłuszczenia były to na porównywalnym poziomie dwie klasy: 2 i 3 – 39,57 i 32,54%, co charakteryzuje tusze o małej zawartości mięsa i średniej zawartości tłuszczu. CV dla SE wynosił dla klasy umięśnienia około 3% dla trzech kategorii rzeźnych: A, B i E, a dla D wynosił 2,16%. Dla klasy otłuszczenia niezależnie od kategorii rzeźnej CV w przypadku SE był trzy razy większy. Otrzymane wyniki sugerują, że wizualna ocena tusz wołowych nie jest obiektywna i jest obarczona błędem oceniającego.

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