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## SLAUGHTER VALUE OF POLISH LANDRACE FATTENERS FROM FARMS IN CENTRAL-EASTERN POLAND

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**Abstract.** The aim of this work is to evaluate the slaughter value of porkers from individual farms in the same producer group located in central-eastern Poland. The research was conducted on 322 fatteners of the Polish Landrace breed. The research material was classified according to two research factors: supplier and season of the year. One group of fatteners was slaughtered in the autumn (September–October) and the second in spring (April–May). The studied population of fatteners was characterized by high meatiness at an average level of 58% and average hot carcass weight of 89.99 kg. All carcasses were classified as the highest classes of the SEUROP system: 29.81% as class S, 51.86% as class E and 18.32% as class U. A statistically significant influence of supplier was found for hot carcass weight, thickness of the *longissimus dorsi* muscle at M<sub>1</sub>, and slaughtering efficiency. A statistically significant influence of slaughtering season on hot carcass weight and back fat thickness at points S<sub>1</sub> and S<sub>2</sub> was also found. Pigs slaughtered in spring were found to have a lower hot carcass weight and thinner back fat than those slaughtered in autumn. The interaction between supplier and slaughtering season was found to be statistically significant for hot carcass weight, meatiness, thickness of the *longissimus dorsi* at M<sub>2</sub>, and thickness of back fat measured at S<sub>1</sub>. The obtained research results indicate the high slaughter value of porkers kept in individual farms within the same producer group, and that the pork obtained from these pigs meets the requirements set by the meat industry and consumers.

**Key words:** fatteners, supplier, season, meatiness, hot carcass weight.

## INTRODUCTION

The quality of domestic pork raw material has been the subject of interest for both scientists and technologists working for the meat industry for over two decades (Różycki 1998; Grześkowiak 1999; Strzelecki et al. 2001; Koćwin-Podsiadła et al. 2004). This is mainly due to the preferences and requirements of consumers who have turned their attention towards from very lean meat (low intramuscular fat results in meat and meat products with high sensory qualities (Wood et al. 1994; Andersen et al. 2005; Vandendriessche 2008). Many years of work from Polish scientists, breeders and technologists has improved the production and processing of pork and resulted in a significant increase in the meat content of pig carcasses and a reduction in their fatness (Różycki 1998; Blicharski et al. 2004; Koćwin-Podsiadła et al. 2004; Lisiak and Borzuta 2008). The need for systematic improvement in meat (annually about 1%)

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and an increase in the slaughter value of porkers was caused by the introduction and legal sanctioning in 1993 of the objective classification of pig carcasses according to the SEUROP system and rewarding pig producers for meatiness (Dumas and Dhorne 1998; Borzuta 1999; Lisiak et al. 2005; Florek et al. 2006). In addition to meatiness, the weight of slaughtered fatteners also affects the slaughter value. The domestic meat industry prefers slaughter with a higher carcass weight, while maintaining high meatiness (55–58%). Meat from light carcasses is characterized by higher post-mortem meatiness, but it has limited processing usefulness. In Poland, pork meatiness has increased at the same time as the hot carcass weight of pigs slaughtered in meat processing plants. From 2012–2017, the meatiness in carcasses stabilized at a high level (56.5–57.7%) and so did the hot carcass weight (90–92.5 kg). This weight meets the requirements of the domestic meat industry (Lisiak et al. 2005; GUS 2017). Bearing in mind the above, there is a need for a detailed analysis of pig slaughter raw material from smaller individual farms within the same producer group.

The aim of the study is to evaluate the slaughter value of fatteners, depending on the supplier and the season of the year, from individual farms located in central-eastern Poland.

## MATERIAL AND METHODS

The research was conducted on 322 fatteners of the Polish Landrace breed. The animals came from three farms (A, B, C) located in central-eastern Poland, associated with the same producer group. The research material was grouped according to two research factors: supplier and season of the year. The first research group of fatteners was slaughtered in the autumn (from September to October), the second group in the spring (from April to May). In the experiment, the same share of gilts and hogs were taken for each supplier and season. Due to this, gender was eliminated as a factor that could have a significant impact on the slaughter value of fatteners. During the rearing period, the animals were provided with very similar living and feeding conditions. Pigs were fed with mixtures prepared from cereals from their own farm (30% triticale meal, 60% barley grits) and high protein concentrate. Animals were slaughtered using gas stagnation (carbon dioxide) in the same meat factory located 20 km from the farms. Slaughtering was done after a short rest of the animals according to typical technology used in the meat factory. After completing the procedures typical for a meat factory, the evaluation of carcasses was carried out using Ultra-Fom 300 apparatus (SFK Technology) in the following areas:

- percentage meat content in the carcass (meatiness),
- thickness of the *longissimus dorsi* (LD) muscle after the last rib at a distance of 7 cm from the intersection line of carcasses cut into half-carcasses ( $M_1$ ),
- thickness of the LD muscle between the 3rd and 4th ribs counted from the end ( $M_2$ ),
- thickness of the back fat after the last rib at a distance of 7 cm from the intersection line of carcasses cut into half-carcasses ( $S_1$ ),
- thickness of the back fat between the 3rd and 4th ribs counted from the end ( $S_2$ ).

The hot carcass weight was also established on the weighing scales within 35 minutes after slaughter. The results were directly recorded by a computer connected to the Ultra-Fom 300 apparatus with an accuracy of 0.1 kg.

The obtained results were analyzed using the statistical package STATISTICA 12.5 PL (Stat Soft, Tulusa, GK, USA). The influence of supplier (A, B, C), season (autumn, spring) and their interaction (supplier x season) on the results was estimated using a two-factor analysis

of variance in a non-orthogonal system according to the following line model. The level of significance of differences between means was verified using the NIR test (Luszniewicz and Słaby 2001).

## RESULTS AND DISCUSSION

The population of Polish Landrace fatteners analyzed in this study (322 pigs) had an average carcass meatiness level of  $58.11 \pm 3.01\%$ , with a low coefficient of variation – 5.18% (Table 1). The high meat content of the tested pigs was reflected in the SEUROP classification, as all carcasses were classified into the highest classifications of meatiness. 29.81% of carcasses were classified as S, 51.86% carcasses classified as E, and 18.32% carcasses as U (Fig.1).

Table 1. General traits of the research material (n = 322)

Trait	$\bar{X}$	SD	V
Hot carcass weight [kg]	89.99	10.40	11.60
Meatiness [%]	58.11	3.01	5.18
S <sub>1</sub> [mm]	15.91	4.21	26.46
S <sub>2</sub> [mm]	14.57	3.86	26.49
M <sub>1</sub> [mm]	59.29	5.94	10.01
M <sub>2</sub> [mm]	59.79	5.39	9.01

$\bar{X}$  – arithmetic mean, SD – standard deviation, V – coefficient of variation.

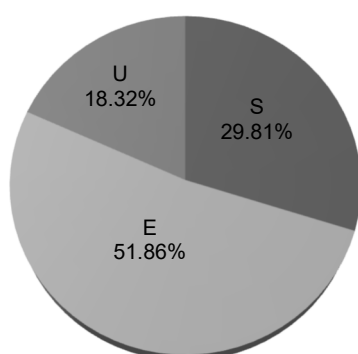


Fig. 1. SEUROP classes of the research material (n = 322)  
S, E, U – classes in SEUROP classification.

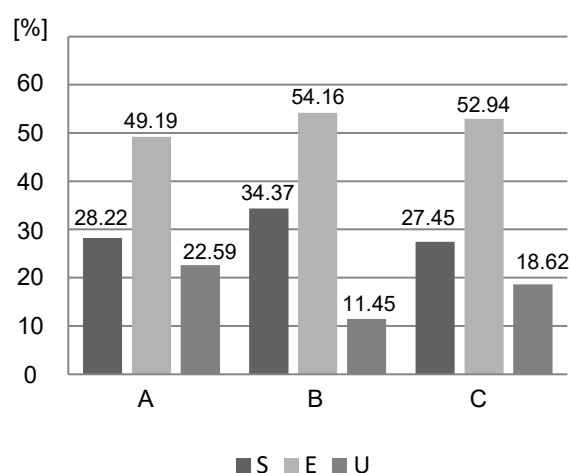


Fig. 2. SEUROP classes for each supplier  
A, B, C – supplier.  
S, E, U – classes in SEUROP classification.

The average meatiness noted in this research was higher (by more than 1%) compared to the average meatiness of fatteners in 2016, which was 57% (Lisiak et al. 2016). Back fat thickness measured at both S<sub>1</sub> and S<sub>2</sub> were characterized by high variability expressed

in the coefficient of variability, i.e.: respectively 26.46% with an average thickness of 15.91 mm for S<sub>1</sub> and 26.49% with an average thickness of 14.57 mm for S<sub>2</sub> was 10% and average thickness 59.29 mm, while at M<sub>2</sub>, the coefficient of variation was 9% and average thickness 59.79 mm (Table 1).

In a study conducted by Antosik and Koćwin-Podsiadła (2010) on 2851 fatteners from mass populations, the average thickness of back fat was 13.00 mm at S<sub>1</sub>, 12.2 mm at S<sub>2</sub>, and average LD muscle thickness around 61 mm at M<sub>1</sub>. In turn, Zybert et al. (2015) in their analysis of 9000 fatteners from mass populations, recorded an average thickness of back fat at points S<sub>1</sub> and S<sub>2</sub> as respectively 15.3 mm and 15.32 mm and an average LD thickness at points M<sub>1</sub> and M<sub>2</sub> as respectively 58.22 mm and 57.75 mm. In summary, in our study, the thickness of the LD muscle, i.e. a feature closely related to musculature, took intermediate values between the studies by Antosik and Koćwin (2010) and Zybert et al. (2015). The first authors obtained a higher thickness of the LD muscle and the second a lower compared to our study.

In this research, slaughtering efficiency was  $78.19 \pm 7.14\%$  with a coefficient of variation of 9.13%. This is consistent with the slaughtering efficiency found in other studies, which ranges from 75–85% (Weatherup et al. 1998; Zybert et al. 2001; Koćwin-Podsiadła et al. 2004).

Table 2. Influence of the research factors (supplier and season) on traits of the research material

Trait	Research factor		Interaction (supplier x season of the year)
	supplier	season of the year	
Hot carcass weight [kg]	46.37 **	57.61 **	13.39 **
Meatiness [%]	1.0 ns.	3.0 ns.	4.80 *
S <sub>1</sub> [mm]	0.56 ns.	8.09 *	2.12 ns.
S <sub>2</sub> [mm]	1.57 ns.	7.79 *	6.75 *
M <sub>1</sub> [mm]	5.04 *	1.10 ns.	3.01 ns.
M <sub>2</sub> [mm]	1.18 ns.	0.61 ns.	3.83 *
Slaughter value [%]	7.64 *	1.15 ns.	1.71 ns.

\*\* statistically significant  $p \leq 0.01$ , \* statistically significant  $p \leq 0.05$ , ns. – not statistically significant.

The two-factor analysis of variance in a non-orthogonal system showed a statistically significant (at  $p \leq 0.05$ ) or highly statistically significant (at  $p \leq 0.01$ ) interaction between the first research factor (the supplier) and the hot carcass weight, LD muscle thickness measured at M<sub>1</sub> and slaughtering efficiency. The relationship between the second research factor (season) and the hot carcass weight and back fat thickness at S<sub>1</sub> and S<sub>2</sub> was found to be significant at  $p \leq 0.01$  and  $p \leq 0.05$ , respectively. The interaction between the two research factors (supplier and season) was found to have a significant influence on hot carcass weight, meatiness, back fat thickness and LD muscle thickness measured at point 2 (S<sub>2</sub> and M<sub>2</sub>) (Table 2). When analyzing each supplier separately, there was no statistically significant difference in the meatiness of the carcass from each supplier. The highest meatiness was found in carcasses from supplier B ( $58.32 \pm 2.83\%$ ), then supplier A ( $57.77 \pm 3.12\%$ ) and finally

supplier C ( $57.99 \pm 3.00\%$ ) (Table 3). The SEUROP classes for carcasses from each supplier are a reflection of the above-described trend. Supplier B had the largest percentage of carcasses with the highest meatiness (classified as S) and the lowest percentage of carcasses in the U class (Fig. 2). Group A had a statistically significantly lower LD muscle thickness measured at point M<sub>1</sub> by 2.5 mm ( $58.21 \pm 6.59$  mm compared to  $60.67 \pm 5.30$  mm) in relation to group B. The LD muscle thickness at M<sub>1</sub> in group C fell between the values from groups A and B ( $59.30 \pm 5.43$  mm). Hot carcass weight was found to differ significantly among suppliers. Group B had the lowest hot carcass weight of  $84.03 \pm 7.44$  kg, then group C at  $89.23 \text{ kg} \pm 9.70$  kg followed by group A at  $95.13 \pm 10.31$  kg (Table 3).

Table 3. Influence of supplier on traits of the research material

Trait	Supplier		
	A n = 124	B n = 96	C n = 102
Hot carcass weight [kg]	95.13C $\pm 10.31$	84.03A $\pm 7.44$	89.23B $\pm 9.70$
Meatiness [%]	57.77 $\pm 3.12$	58.32 $\pm 2.83$	57.99 $\pm 3.00$
S <sub>1</sub> [mm]	16.20 $\pm 4.70$	15.61 $\pm 3.91$	15.81 $\pm 3.86$
S <sub>2</sub> [mm]	14.34 $\pm 3.76$	14.28 $\pm 3.91$	15.13 $\pm 3.90$
M <sub>1</sub> [mm]	58.21b $\pm 6.59$	60.67a $\pm 5.30$	59.30ab $\pm 5.43$
M <sub>2</sub> [mm]	59.28 $\pm 5.96$	60.29 $\pm 4.81$	59.94 $\pm 5.17$
Slaughter value [%]	76.21b $\pm 7.15$	79.61a $\pm 7.29$	79.08b $\pm 6.49$

ABC – average value between groups differs significantly statistically  $p \leq 0.01$ .

ab – average value between groups differs significantly statistically  $p \leq 0.05$ .

$\pm$  – standard deviation (SD).

This study noted a widespread tendency that an increase in hot carcass weight was accompanied by a decrease in meatiness and an increase in thickness of back fat. The above trend has also been found by many other researchers (Łyczyński et al. 2000; Zybert et al. 2001, 2005; Antosik and Koćwin-Podsiadła 2010; Antosik et al. 2010). In the studies by Antosik and Koćwin-Podsiadła (2010) conducted on mass populations of pigs, it was shown that an increase in hot carcass weight by 10 kg (from 80 kg to 90 kg) contributed to a decrease in meatiness in the carcass by 2.8%. Zybert et al. (2001), in a study on fatteners, found that a carcass weighing over 85 kg contributed to a reduction in meatiness by 4.3%. However, for lightweight pigs (hot carcass weight up to 75 kg), no loss of meatiness was noted. Similarly, to the results quoted above, Łyczyński et al. (2000) observed that fatteners whose carcass weight was higher than 90 kg had a statistically significantly lower meatiness and higher thickness of back fat compared to those whose weight was lower than 90 kg. Examining the influence of the second research factor (season of the year) on the traits of the research material statistically confirmed differences for hot carcass weight and back fat thickness at S<sub>1</sub> and S<sub>2</sub>. Pigs slaughtered in spring (regardless of the supplier) were characterized by a lower hot carcass weight compared to those slaughtered in autumn by about 7.5 kg ( $86.09 \pm 8.45$  kg compared to  $93.58 \pm 10.73$  kg) and lower back fat thickness at point S<sub>1</sub> by approx. 1.30 mm ( $15.23 \pm 4.10$  mm compared to  $16.52 \pm 4.29$  mm) and at point S<sub>2</sub> by approx. 1.02 mm

( $14.04 \pm 3.85$  mm compared to  $15.06 \pm 3.80$  mm). The season did not provide a statistically significant difference in meatiness. However, a tendency was noted that meatiness was 1% higher in fatteners slaughtered in spring, i.e. fatteners about 7.5 kg lighter than fatteners slaughtered in autumn (Table 4).

Table 4. Influence of season of the year on traits of the research material

Trait	Season of the year	
	autumn n = 168	spring n = 154
Hot carcass weight [kg]	93.58B $\pm 10.73$	86.09A $\pm 8.45$
Meatiness [%]	57.58 $\pm 2.94$	58.47 $\pm 3.01$
S <sub>1</sub> [mm]	16.52b $\pm 4.29$	15.23a $\pm 4.10$
S <sub>2</sub> [mm]	15.06b $\pm 3.80$	14.04a $\pm 3.85$
M <sub>1</sub> [mm]	59.01 $\pm 5.58$	59.60 $\pm 6.31$
M <sub>2</sub> [mm]	59.62 $\pm 5.14$	59.98 $\pm 5.67$
Slaughter value [%]	77.68 $\pm 7.04$	78.61 $\pm 7.26$

Explanations see Table 3.

Zybert et al. (2015) in their studies on mass raw material studied the influence of slaughtering season on basic slaughter characteristics. They reported a statistically significant effect of slaughter season on hot carcass weight, meatiness, back fat thickness measured at S<sub>1</sub> and S<sub>2</sub>, and LD muscle thickness at points M<sub>1</sub> and M<sub>2</sub>. In their study, it was found that heavier pigs were slaughtered during the winter and spring, and the lightest ones in the summer. The authors also found the highest percentage (69.4%) of the most valuable carcasses (classes S and E) in fatteners weighing no more than 76 kg in winter. Antosik et al. (2010), in studies on fatteners from the mass population, found a statistically significant influence of season on hot carcass weight, meatiness, back fat thickness measured at point S<sub>2</sub> and LD thickness at point M<sub>1</sub>. Pigs slaughtered in autumn had the highest meat content of 58.50%, the thinnest back fat at 11.55 mm and the thickest LD muscle measured at M<sub>1</sub> (62.24 mm) compared to the remaining seasons of spring, summer and winter. In turn, hot carcass weight was uniform in the autumn and winter seasons in relation to the spring and summer seasons (winter – 86.6 kg, autumn – 85.65 kg, against spring – 83.40 kg and summer – 84.2 kg). Gardzińska et al. (2002), in studies on landrace x (duroc x pietrain) crossbred fatteners, found a significant decrease in the meatiness and a significant increase in back fat thickness of pigs whose weight on slaughter day exceeded 120 kg compared to fatteners of lower weights.

## CONCLUSIONS

The analyzed population of Polish Landrace fatteners had high meatiness (average level of 58%), and high average hot carcass weight (about 90 kg). All analyzed carcasses were classified as the highest meat classes: S, E and U. The influence of supplier on hot carcass

weight, LD thickness at  $M_1$ , and slaughtering efficiency; and the influence of the season on hot carcass weight and back fat thickness at points  $S_1$  and  $S_2$  were found to be statistically significant. Pigs slaughtered in spring had a lower hot carcass weight and thinner back fat compared to those slaughtered in autumn. The interaction of supplier and season was also found to have a statistically significant influence on hot carcass weight, meatiness, back fat thickness measured at  $S_1$ , and LD muscle thickness at  $M_2$ . The obtained research results indicate the high slaughter value of porkers kept in individual farms within the same producer group, and the pork obtained from these pigs meets the requirements set by the meat industry and consumers.

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## WARTOŚĆ RZEŻNA TUCZNIKÓW RASY POLSKIEJ BIAŁEJ ZWISŁOUCHEJ POCHODZĄCYCH Z GOSPODARSTW ŚRODKOWO-WSCHODNIEJ POLSKI

**Streszczenie.** Celem niniejszej pracy jest ocena wartości rzeźnej tuczników pochodzących z indywidualnych gospodarstw rolnych zrzeszonych w grupie producenckiej zlokalizowanej w środkowo-wschodniej Polsce. Badania przeprowadzono na 322 tucznikach rasy polskiej białej zwisłouchej (PBZ). Materiał doświadczalny sklasyfikowano, uwzględniając 2 czynniki badawcze: dostawcę i porę roku. Tuczniaki z I grupy badawczej ubijano na jesieni w miesiącach wrzesień–październik, a tuczniaki z II grupy badawczej – wiosną w miesiącach kwiecień–maj. Badana populacja tuczników charakteryzowała się wysoką mięsnością – na poziomie 58% oraz masą



tuszy ciepłej 89,99 kg. Wszystkie tusze tuczników zostały zakwalifikowane do najwyższych klas w systemie SEUROP – odpowiednio: 29,81% do klasy S, 51,86% do klasy E i 18,32% do klasy U. Udowodniono statystycznie wpływ dostawcy na masę tuszy ciepłej, grubość mięśnia *longissimus dorsi* w punkcie M<sub>1</sub>, wydajność rzeźną oraz wpływ sezonu uboju na masę tuszy ciepłej i grubość słoniny w punktach S<sub>1</sub> i S<sub>2</sub>. W wyniku przeprowadzonych badań stwierdzono, że tuczniaki, których uboju dokonano wiosną, odznaczały się mniejszą masą tuszy ciepłej i cieńszą słoniną. Wykazano współdziałanie obydwu czynników badawczych, tj. dostawcy surowca rzeźnego i sezonu uboju, w przypadku masy tuszy ciepłej, mięsności, mięśnia LD mierzonego w punkcie M<sub>2</sub>, grubości słoniny mierzonej w punkcie S<sub>1</sub>. Otrzymane wyniki badań wskazują na dużą wartość rzeźną tuczników utrzymywanych w indywidualnych gospodarstwach rolnych zrzeszonych w grupy producenckie; wieprzowina pozyskana od tych świń spełnia wymagania stawiane przez przemysł mięsny i konsumentów.

**Słowa kluczowe:** tuczniaki, dostawca, sezon, mięsność, masa tuszy ciepłej.

