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Possibility of improvement of lean meat content of ham and loin in pigs by selection for growth and feed conversion rate

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The research was carried out using records from the Pig Testing Station of 113 Polish Large White (PLW) and 120 Polish Landrace (PL) gilts with the aim to determine the effects of growth rate and feed conversion ratio on the weight and quality of loin and ham defined as lean meat and fat content. Parametres of the tested cuts were assessed on the basis of weight of cuts, weight of lean meat (lean), weight of subcutaneous fat with skin, and percentage of lean and fat content. Based upon the level of indicators of their fattening performance the animals were divided into three groups. The PL pigs occurred more susceptible to the effect of fattening traits on tissue content and at the same time on the quality of carcass cuts. The interrelation has become apparent between loin parametres of PL pigs and their growth rate and between their ham parametres and feed conversion ratio (per 1 kg gain). In many cases the loin parametres examined differed significantly between breeds. Significantly wider variation as regards the composition of tested carcass cuts was found in PLW than in PL gilts. A trend was noted for the deposition of more fat in carcass cuts of pigs with highest and lowest live weight gain.

KEY WORDS: fattening performance / ham / lean / loin / pigs

The end product, a fattening pig, should be characterized with carcass cuts containing the largest possible lean meat content, adequate proportions of lean meat to fat and good indicators of the meat quality. From the economic point of view the cost of meat production should ensure profit for the producer. When speaking about the quality of carcass and cuts, considered should be not only physical and chemical characteristics of meat (pH, colour, electric conductivity, intramuscular fat content,

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water-holding capacity), but also the tissue distribution in cuts (tissue composition). Fat and lean meat content of cuts and proportions of these tissues determine the value of cuts for processing or sales in an unprocessed form [Blicharski *et al*. 2004]. Therefore, the factors mentioned affect the economic side of production, as they determine the price paid for the fattening pig. Financial profits from fattening pigs are influenced to a large extent by the fattening value of animals *i.e*. their growth rate and feed conversion ratio while the feed cost constitutes about 2/3 of the total cost of production.

Fattening value of pigs is related to their slaughter value. In Poland, improving slaughter traits is achieved on the basis of results obtained with two methods – performance test and post-slaughter test. The performance test method consists of measurements of backfat thickness in two spots and of thickness of the *longissimus dorsi* (LD) muscle, both carried out in pig breeding farms. The post-slaughter test method is used in Pig Testing Stations and involves a series of measurements of individual cuts, including their dissection [Różycki 1996, Eckert and Żak 2008]. Improving slaughter traits by breeding over a number of years as well as large import of the animals to pedigree piggeries influences the fattening value of pigs. The growth rate of animals and their feed conversion ratio change, and this may affect the fat and muscle content of carcass of slaughtered fattening pigs produced on the basis of the pedigree material which undergoes constant selection. Import of animals for national production from various countries where different breeding programmes are followed leads to the increase of variation in fattening and slaughter traits. This gives a chance to observe the influence of different levels of fattening value of pigs on muscle and fat content of carcass and of individual cuts. Breeding programme developed for the PLW and PL pigs in this country precisely determines selection criteria. Reproductive traits rank in the first place, fattening – in the second, and slaughter – in the third place. This is reflected in the model used to estimate cumulative breeding value, in which the share of reproductive traits is 60%, of fattening traits – 24%, and of slaughter traits – 16% [Żak and Różycki 2008].

Loin and ham are considered the best valued cuts. At the same time they constitute a large part of carcass [Virgilli *et al*. 2003, Winiarski *et al*. 2004]. The most desirable fat-to -muscle proportion determines their usefulness for the production of certain products (e.g. traditionally produced hams) for which the high price could be obtained and which are willingly bought. The amount of fat tissue may indirectly inform about the quality of meat in cuts. It is commonly known that a very low fat content of cuts is related to worse taste of pork as a result of generally lower content of intramuscular fat in cuts [Faucitano *et al*. 2003].

The aim of this investigation was to determine the effect of growth rate and feed conversion ratio in fatteners of two most common pig breeds in Poland on the weight and quality of loin and ham as defined by lean meat and by fat content.

Material and methods

The study was performed in the Pig Testing Station of the National Research Institute for Animal Production on 113 Polish Large White (PLW) and 120 Polish Landrace (PL) fattening gilts. The animals were kept and fed in accordance with the rules established in Pig Testing Stations in Poland and then slaughtered at the body weight of about 100 kg. After 24-hour cooling at 4°C the left carcass-sides were dismantled in accordance with the method of Walstra and Merkus [1995]. Loins and hams were precisely dissected in order to separate muscle, fat and bones. The data on the fattening value of the tested pigs came from the records kept by the Testing Station. Statistical evaluation of results aimed at determining the effect of growth rate (daily body live weight gain from 25 to 100 kg) and feed conversion ratio (per kg of body gain) on the quality of loin and ham. The quality of tested cuts was assessed on the basis of their weight, weight of their lean meat, weight of their subcutaneous fat with skin as well as lean meat content (%) and fat content (%) of cut.

The animals were divided into groups according to the level of fattening parametres considered during testing. As regards the growth rate the animals were divided into three groups depending on their mean daily gain during fattening: > 950 g (group 1), 800-950 g (group 2) and < 800 g (group 3). Division of animals into three groups was also done depending on the feed conversion ratio (kg feed / kg gain): >3.2 kg (group 1), 2.8-3.2 kg (group 2) and < 2.8 kg (group 3). Statistical analysis of the test results was carried out with the application of SAS procedure [SAS 1999-2001]. Differences between groups within breeds and between breeds within groups were tested based upon the Duncan test.

Results and discussion

The loin parametres in PLW and PL gilts are presented in the Table 1. No significant differences between breed means were identified. Mean weight of loin was identical in

Table 1. Means and their standard deviations (SD) **for traits of loin** in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait	Mean	SD	Min.	Max.
PLW (n=113)				
weight of loin(kg)	7.71	0.56	6.25	9.25
lean meat content of loin (%)	57.78	4.96	45.29	69.33
fat content (incl. skin) of loin (%)	20.09	4.69	10.74	34.16
lean meat weight of loin (kg)	4.45	0.44	3.22	5.60
fat weight (incl. skin) of loin (kg)	1.87	0.47	0.90	3.70
PL (n=120)				
weight of loin(kg)	7.71	0.47	6.47	9.06
lean meat content of loin (%)	59.60	3.72	50.18	68.34
fat content (incl. skin) of loin (%)	18.97	3.62	12.58	30.78
lean meat weight of loin (kg)	4.59	0.39	3.66	5.69
fat weight (incl. skin) of loin (kg)	1.76	0.35	1.05	2.95

Table 2. Means and their standard deviations (SD) **for selected traits of loin** across groups of **daily gain** in the test conducted from 25 to 100 kg live weight in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait		Daily live weight gain over the test (g)		
		>950	800-950	<800
PLW		(n=11)	(n=73)	(n=29)
weight of loin (kg)	mean	7.62**	7.80	7.53
	SD	0.47	0.53	0.64
lean meat content of loin (%)	mean	56.92	57.68*	58.37
	SD	3.20	5.08	5.24
fat content (incl. skin) of loin (%)	mean	20.81	20.39	19.07
	SD	4.69	4.58	4.94
lean meat weight of loin (kg)	mean	4.34**	4.49**	4.39
	SD	0.33	0.43	0.50
fat weight (incl. skin) of loin (kg)	mean	1.87	1.92	1.73
	SD	0.40	0.49	0.46
PL		(n=12)	(n=86)	(n=22)
weight of loin (kg)	mean	7.80**^{a}	7.72	7.64^{a}
	SD	0.62	0.46	0.43
lean meat content of loin (%)	mean	58.71	59.76*	59.44
	SD	3.30	3.74	3.96
fat content (incl. skin) of loin (%)	mean	20.78	18.90	18.30
	SD	3.08	3.60	3.80
lean meat weight of loin (kg)	mean	4.58**	4.61**	4.54
	SD	0.43	0.38	0.40
fat weight (incl. skin) of loin (kg)	mean	1.94$^{a.b}$	1.75^{a}	1.68^{b}
	SD	0.33	0.35	0.34

*, **Interbreed differences significant at P≤0.05 and P≤0.01, respectively.
$^{ab...}$Within breed differences significant at P≤0.05.

gilts of both breeds. However, PLW showed higher fat content of loin than PL. PLW gilts presented wider variation of traits as reflected by higher standard deviations.

The relationship between the growth rate and loin parametres is presented in Table 2. No significant effect of the daily live weight gain on the tissue composition in the PLW loin was noted. Animals with the lowest live weight gain tended to deposit less fat than the remaining two groups. In case of PL gilts a statistically significant influence of the growth rate on the lean and fat content occurred. The fastest growing PLW pigs differed from the PL pigs in the weight of loin and lean meat content of loin. In both cases differences were highly significant. When analysing the tissue content of loin of pigs from group 2 (gain 800-950 g) a significant differences between breeds were noted in the weight of lean meat as well as significant differences in lean meat content of cut.

Feed conversion occurred significantly related to the weight of loin in PLW and highly significantly to the lean meat weight of PL pigs (Tab. 3). The differences ($P<0.05$) in the tissue content of loin between the breeds for the weight of loin (group 1 and 3) and lean meat content (group 1 and 3) were identified. Highly significant interbreed differences were identified within all groups as regards the weight of lean meat in loin.

Table 3. Means and their standard deviations (SD) **for selected traits of loin** across groups of **feed conversion ratio** in the test conducted from 25 to 100 kg live weight in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait		Feed conversion ratio (kg feed/kg live weight gain)		
		>3.2	2.8-3.2	<2.8
PLW		(n=35)	(n=62)	(n=16)
weight of loin (kg)	mean	7.53*	7.79	7.83*
	SD	0.66	0.41	0.74
lean meat content of loin (%)	mean	57.31*	58.40	56.41*
	SD	5.15	4.25	6.76
fat content (incl. skin) of loin (%)	mean	20.58	19.64	20.75
	SD	4.90	4.08	6.33
lean meat weight of loin (kg)	mean	4.31**[a]	4.55**[ab]	4.39**[b]
	SD	0.39	0.40	0.41
fat weight (incl. skin) of loin (kg)	mean	1.87	1.83	2.01
	SD	0.47	0.39	0.74
PL		(n=48)	(n=56)	(n=16)
weight of loin (kg)	mean	7.61*	7.74	7.88*
	SD	0.51	0.40	0.51
lean meat content of loin (%)	mean	59.45*	59.60	60.00*
	SD	4.07	3.66	2.93
fat content (incl. skin) of loin (%)	mean	19.28	18.81	18.62
	SD	4.02	3.63	2.13
lean meat weight of loin (kg)	mean	4.52**	4.62**	4.73**
	SD	0.40	0.37	0.40
fat weight (incl. skin) of loin (kg)	mean	1.74	1.77	1.77
	SD	0.39	0.34	0.27

*, **Interbreed differences significant at $P\leq0.05$ and $P\leq0.01$, respectively.
[ab]... Intrabreed differences significant at $P\leq0.05$.

Ham was the second of cuts tested. Comparison of the results of analyses was analogous to loin test results. Comparison of means of particular ham parametres between breeds showed significant differences to occur in the cut weight and in its lean meat weight (Tab. 4).The results of PLW gilts were higher. Standard deviations of traits of the PLW ham were, in most cases, considerably higher when compared to those of PL gilts.

Table 4. Means and their standard deviations (SD) **for traits of ham** in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait	Mean	SD	Min.	Max.
PLW (n=113)				
weight of ham (kg)	8.32**	0.49	6.98	10.13
lean meat content of ham (%)	76.62	3.28	67.58	84.25
fat content (incl. skin) of ham (%)	14.50	3.25	8.08	24.58
lean meat weight of ham (kg)	6.38*	0.52	5.14	8.13
fat weight (incl. skin) of ham (kg)	1.20	0.26	0.72	2.07
PL (n=120)				
weight of ham (kg)	8.11**	0.49	7.71	10.94
lean meat content of ham (%)	76.88	2.42	69.79	82.92
fat content (incl. skin) of ham (%)	14.36	2.29	8.72	21.38
lean meat weight of ham (kg)	6.24*	0.48	4.76	7.67
fat weight (incl. skin) of ham (kg)	1.16	0.18	0.75	1.68

*P≤0.05; **P≤0.01.

Table 5. Means and their standard deviations (SD) **for selected traits of ham** across groups of **daily gain** in the test conducted from 25 to 100 kg live weight in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait		Daily live weight gain over the test (g)		
		>950	800-950	<800
PLW		(n=11)	(n=73)	(n=29)
weight of ham (kg)	mean	8.54	8.29	8.29
	SD	0.74	0.47	0.42
lean meat content of ham (%)	mean	76.41	76.40	77.22
	SD	2.64	3.26	3.58
fat content (incl. skin) of ham (%)	mean	14.52	14.76	13.86
	SD	2.83	3.26	3.38
lean meat weight of ham (kg)	mean	6.53	6.34	6.41
	SD	0.60	0.50	0.53
fat weight (incl. skin) of ham (kg)	mean	1.24	1.22	1.14
	SD	0.27	0.26	0.26
PL		(n=12)	(n=86)	(n=22)
weight of ham (kg)	mean	7.95	8.13	8.11
	SD	0.31	0.51	0.52
lean meat content of ham (%)	mean	76.77	76.99	76.48
	SD	2.36	2.35	2.66
fat content (incl. skin) of ham (%)	mean	14.60	14.29	14.51
	SD	2.48	2.19	2.66
lean meat weight of ham (kg)	mean	6.10	6.27	6.21
	SD	0.38	0.48	0.54
fat weight (incl. skin) of ham (kg)	mean	1.16	1.16	1.17
	SD	0.19	0.18	0.19

No significant differences among means.

Completed statistical analysis of growth rate (Tab. 5) impact on ham tissue composition did not prove significance of differences both intra- and interbreeds. Higher standard deviations were observed for the majority of analysed ham qualities for the PLW gilts, which is in accordance with observations concerning loin. Higher weight of ham and meat content of ham were observed in the present study for fast growing pigs of this breed. However, differences between groups were not found significant. Slightly different relations were reported by Hicks *et al*. [1998]. In LW pigs they estimated negative genetic correlation coefficient (-0.17) between daily growth and meat content of ham. However, the relationship was not found significant.

The influence of feed conversion (kg feed / kg live weight gain) was most marked on tissue composition of ham in the PLW gilts (Tab. 6). The weight of ham was largest in animals which consumed least feed / kg gain. The difference between these animals and pigs with the highest (*i.e*. the worst) feed conversion ratio was significant.

Table 6. Means and their standard deviations (SD) **for selected traits of ham** across groups of **feed conversion ratio** in the test conducted from 25 to 100 kg live weight in Polish Large White (PLW) and Polish Landrace (PL) gilts

Trait		Feed conversion ratio (kg feed/kg gain		
		>3.2	2.8-3.2	<2.8
PLW		(n=35)	(n=62)	(n=16)
weight of ham (kg)	mean	8.25*	8.30*	8.55
	SD	0.42	0.47	0.64
lean meat content of ham (%)	mean	76.39	76.98	75.75
	SD	3.63	2.88	3.93
fat content (incl. skin) of ham (%)	mean	14.75	14.15	15.31
	SD	3.64	2.80	3.95
lean meat weight of ham (kg)	mean	6.31	6.39	6.49
	SD	0.53	0.46	0.68
fat weight (incl. skin) of ham (kg)	mean	1.21	1.17	1.30
	SD	0.27	0.24	0.31
PL		(n=48)	(n=56)	(n=16)
weight of ham (kg)	mean	7.89*^{AB}	8.23*^{A}	8.37^{B}
	SD	0.46	0.44	0.53
lean meat content of ham (%)	mean	76.70	77.31	75.88
	SD	2.51	2.40	1.96
fat content (incl. skin) of ham (%)	mean	14.48	13.99	15.30
	SD	2.32	2.37	1.65
lean meat weight of ham (kg)	mean	6.06^{A}	6.36^{A}	6.35
	SD	0.49	0.45	0.41
fat weight (incl. skin) of ham (kg)	mean	1.14	1.15	1.28
	SD	0.17	0.19	0.17

*Interbreed differences significant at P≤0.05.
^{AB}Intergroup differences significant at P≤0.01.

Significant were also differences in mean weight of ham in PL gilts between groups 1 and 2. The mean weight of lean meat in ham among PL pigs varied between groups 1 and 2 at the level of $P<0.01$.

During examination of the differences in ham tissue composition between breeds it was noted that the difference in weight of ham between PLW and PL gilts was specially high within the group in which the animals consumed most feed / kg gain, and within the middle group 2.

The research presented here proved that the analysed fattening traits – growth rate and feed conversion – have larger influence on the tissue composition of loin than on ham. This influence may be examined from different sides. The first is the quality of cuts. During selection and breeding in pedigree piggeries, attention is very often paid to lean meat content only. It should be remembered, however, that it relates negatively to the fat content of cuts. On the other hand, there is a positive relationship between subcutaneous and intermuscular and intramuscular fat content. The shortage of the latter has been observed for many years now, whilst its level and composition determine the sensory parametres of meat and its products thus determining its tast [Enser 2004, Orzechowska 2004, Suzuki *et al*. 2005]. In this study the pigs with high carcass yield had the highest fat content in loin and ham. Hence it may be concluded that their meat contained the highest level of intramuscular fat and therefore its taste was best. This conclusion might be supported by the results of Łyczyński *et al*. [2001] who reported notably higher and significant interrelations between the growth rate and intramuscular fat content. The content of the latter was 1.83% for fast growing whilst for slow growing pigs – 1.37%. Many authors emphasise that selection oriented at the improvement of lean meat content of cuts requires caution, as the quantity usually correlates negatively with quality. Some authors point out the feasibility of decreasing the risk of deterioration of pork meat quality resulting from the direct selection oriented at the improvement of lean meat content. Sonesson *et al*. [1998] and Orzechowska [2005] claim that better effects as regards maintaining high quality of meat whilst the lean meat content is being increased can be achieved by selection oriented not at the improvement of lean meat content of carcass but at decrease of subcutaneous fat content. The procedures in question may be supported by tendencies observed in relation to the influence of fattening factors on fat and muscle content of cuts. Therefore, during animal selection it is important to pay attention to the level of these traits and to the genetic correlations observed between fattening and slaughter traits. Van Wijk *et al*. [2005] point at genetic correlations between the growth rate of pigs and the backfat thickness at $r_G = 0.27$, whilst between feed conversion and ham weight and loin weight at $r_G = 0.39$ and $r_G = -0.18$, respectively. Oh *et al*. [2005] claim that the genetic correlation between daily live weight gain and backfat thickness is very low ($r_G = 0.03$). Similar results were reported by Hicks *et al*. [1998] who estimated the coefficient of genetic correlation between the said traits at $r_G = 0.06$. The positive relationships mentioned above between the growth rate and fat content of the dorsal part of pigs' body correspond with tendencies observed in this report in relation to the

fat content of loin. Gilts with high growth rate showed higher fat content of carcass cuts.

Another factor with a positive impact on the increase of intramuscular fat content and therefore on improving the sensory parametres of porcine meat may be the increase of final live weight of fatteners, simultaneously with their slaughter age, as it was demonstrated by Candek-Potokar *et al*. [1998]. It may, however, result in lowering of the other sensory parametres and thus influence another aspect of fattening – its economy. Costs of feeding constitute about 2/3 of total costs of producing fattening pigs. Therefore, they have substantial impact on the final economic value of the production of livestock for slaughter. As a result, selection aiming at improvement of growth rate and feed conversion seems purposeful. However, as shown in the tables presented here, the reaction of animals to such breeding, the result of which is an increase in lean meat and fat content of carcass cuts should be taken into consideration, as excessive increase of growth rate may result in considerable increase of fat content, especially of the loin. In this study, such tendency was observed particularly in PL gilts.

The analysis of the influence of fattening traits on the lean meat and fat content of loin and ham proved that there was a number of significant interbreed differences. This applies first of all to loin. When compared to PLW, loins of PL gilts showed generally higher lean meat content and lower fat content irrespective of the fattening parametre considered, the interbreed differences being significant. The length of carcass and loin was not taken into consideration in the testing. It is known that PL have slightly longer trunk and are more slender than PLW pigs. Thus, the interbreed differences found in this study could partly be related to that trait. When comparing the tissue composition of ham between breeds in relation to the fattening parametres, the only significant difference was identified in the effect of feed conversion on ham weight. Lean meat and fat contents of ham from gilts of both breeds, irrespective of the fattening trait, were almost identical. When analysing means for particular parametres of loin and ham and comparing them between breeds it should be noted that in most cases standard deviations regarding PLW were markedly higher than those of PL gilts (Tab. 1-6). Such a phenomenon might explain why in some countries a parent line and paternal line have been distinguished within the PLW breed. Presumably the import of animals from different countries where selection is followed on the basis of diverse breeding programmes has a significant impact on increasing population variation. The import, however, applies to both breeds considered in this report. Therefore, it can be presumed that when the PLW pigs are imported for national breeding programme they are selected from populations similar in their utility to paternal lines. It may be true because during the selection of animals more attention is often paid to lean meat content than to reproductive traits even if parental material is bought.

The purpose of the analyses presented here has been establishing whether it is possible to use additional fattening parametres which are easy to observe during the selection oriented at the improvement of carcass parametres and especially at the improvement of tissue composition of loin and ham [Buczyński *et al*. 2001; Wiseman

et al. 2007]. The results of own research show that possibilities in question are limited and the result will not always be satisfactory. Ultrasound techniques have been applied to assess the pig slaughter value for many years. Among other things, they are used to measure backfat and *longissimus dorsi* muscle thickness. As regards carcass fattness, promising results are also obtained using solutions so far applied in human medicine [Morlein *et al*. 2005]. In their research, the authors employed the ultrasonography technique to estimate the intramuscular fat content (positively correlated with total fat content of carcass) in living animals and in carcasses. Positive results of such assessment as well as low costs and mobility of equipment raise hopes that it will be easier and more common to estimate carcass quality in live animals.

To sum up it might be stated that the PL gilts are more susceptible to the effect of fattening traits on tissue content and on the quality of carcass cuts than are gilts of PLW breed. Clearly, in PL gilts the interrelation between loin parametres and growth rate and between ham parametres and feed conversion (kg feed / kg body weight gain) have become apparent. The loin parametres in question differ significantly in many cases between breeds Significantly wider variation occurs in the tested carcass cuts of the PLW gilts. Tissue composition of ham is insignificantly influenced by the fattening value. A tendency for accumulation of more fat in carcass cuts of pigs with highest and lowest body gain has been noted.

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Możliwości poprawy umięśnienia szynki i polędwicy świń przez selekcję na tempo wzrostu i wykorzystanie paszy

S t r e s z c z e n i e

Badania zmierzały do określenia wpływu tempa wzrostu oraz wykorzystania paszy przez tuczniki na masę ich polędwicy i szynki oraz na jakość tych wyrębów wyrażoną zawartością w nich mięsa i tłuszczu. Materiał stanowiło 113 loszek rasy wbp i 120 loszek rasy pbz tuczonych do 100 kg masy ciała w Stacji Kontroli Użytkowości Rzeźnej Trzody Chlewnej. Rozbiór lewych półtusz wykonano wg Walstry-Merkusa. Polędwice i szynki poddano dysekcji szczegółowej. Parametry badanego wyrębu określano na podstawie masy wyrębu, masy w nim mięsa i tłuszczu ze skórą oraz zawartości (%) mięsa i tłuszczu. Zwierzęta podzielono na trzy grupy w zależności od poziomu uzyskanych przez nie parametrów tucznych, tzn. przyrostów dobowych masy ciała (1) oraz wykorzystania paszy na przyrost (2). Tempo wzrostu i zużycie paszy na 1 kg przyrostu w większym stopniu wpływały na skład tkankowy polędwicy, a w mniejszym na skład tkankowy szynki. Polędwice świń rasy pbz w porównaniu z wbp charakteryzowały się ogólnie wyższą zawartością mięsa i mniejszą zawartością tłuszczu, niezależnie od wpływającego na te cechy parametru tucznego. Bardziej podatne na wpływ parametrów tucznych na skład tkankowy badanych wyrębów okazały się świnie rasy pbz. Najwyraźniej uwidoczniła się zależność jakości polędwicy świń pbz od tempa wzrostu, a ich szynki od zużycia paszy na 1 kg przyrostu. Pod względem parametrów polędwicy loszki badanych ras różniły się od siebie w wielu przypadkach istotnie. W obrębie składu badanych wyrębów obserwowano znacznie większą zmienność wśród loszek rasy wbp niż pbz. Zauważono tendencję do odkładania większej ilości tłuszczu w wyrębach świń o najwyższych i najniższych przyrostach dobowych masy ciała.