

FATTENING AND SLAUGHTER TRAITS OF YOUNG BOARS DEPENDING ON THEIR GROWTH RATE

Jerzy Nowachowicz

Department of Animal Products Evaluation, University of Technology and Life Sciences,
Kordeckiego 20, 85-225 Bydgoszcz, Poland

Abstract

The impact of growth rate on fattening and slaughter traits was examined in 10,818 young boars of the breeds Polish Large White, Polish Landrace, Hampshire, Duroc, Pietrain and synthetic Line 990, performance tested in the Bydgoszcz Breeding Region in 2004–2008. The collective results of all young boars tested in the analysed years showed that animals characterized by high daily weight gain standardized to 180 days of age were younger and achieved higher body weights and higher performance test selection indices compared to animals with low growth rate. The results regarding the impact of growth rate on meat content of the tested young boars were inconsistent and changed over time. The collective results of young boars of all tested breeds revealed that animals characterized by high growth rate had significantly lower meat content compared to pigs with low daily weight gain in the years 2004 and 2005. Opposite trends were stated in 2007 and 2008 when the animals characterized by high daily weight gain had significantly higher body meat content. In 2006 and for the collective results from 2004–2008, the effect of growth rate on meat content was not proved. In the analysed years, young boars with high growth rate had significantly thinner backfat at the P_2 and P_4 sites (except the result from 2004) and thus had lower fat content compared to pigs with low growth rate.

Key words: pigs, young boars, growth rate, fattening and slaughter traits

When improving the domestic pig population it is recommended to use more performance test results that determine breeding value in terms of fattening and slaughter performance. Performance test selection index of pigs depends on daily body weight gain and body meat content estimated based on measurements of P_2 and P_4 backfat thickness and P_4 height of loin eye. In Poland and other countries, selection carried out to increase growth rate through the control of daily weight gain and to increase meat content based on backfat thickness and height of loin eye measurements contributed to the significant progress in genetic value of pigs (McKay, 1990; Cameron and Curran, 1995 b; Bobček et al., 2002; Chen et al., 2003; Różycki, 2004). These many years of breeding work improved the range of daily weight gain,

leading to increases in body protein deposition and meat content, and a decrease in fat content of pigs (Cameron and Curran, 1995 a, b; Fuller et al., 1995). However, the results of some authors suggest an unfavourable impact of high growth rate on slaughter performance of pigs (Kanis, 1988; Urbańczyk et al., 1999; Buczyński et al., 2001; Koczanowski et al., 2001; Milewska and Falkowski, 2001; Kapelański et al., 2002; Michalska et al., 2002; 2003).

The aim of the present research was to determine the effect of growth rate on fattening and slaughter traits of young boars, performance tested in the Bydgoszcz Breeding Region in the years 2004–2008.

Material and methods

A total of 10,818 young boars of the following breeds were investigated: Polish Large White ($n = 3217$), Polish Landrace ($n = 6258$), Hampshire ($n = 88$), Duroc ($n = 694$), Pietrain ($n = 290$) and synthetic Line 990, which was treated as a breed ($n = 271$). Animals were performance tested during 2004–2008 in the Bydgoszcz Breeding Region (Kujawsko-Pomorskie Province) according to current methodology (Eckert and Szyndler-Nędzka, 2005). Depending on the degree of daily weight gain standardized to 180 days of age, young boars of particular breeds were divided into two groups characterized by different growth rate, i.e. low and high daily weight gain in each test year according to the design given in Table 1. The division of animals by daily weight gain resulted from the distribution of traits in the tested population according to the results obtained by young boars of particular breeds in the analysed years.

In the present study, we analysed the collective results of young boars of all the breeds mentioned above, taken into consideration in 2004–2008. Two-factor ANOVA was performed. The analysed factors were growth rate (low and high) and the year (2004–2008) when animals were performance tested, designated as groups 1–5.

The results were calculated based on the following statistical model:

$$\hat{y} = u + a_i + b_j + (ab)_{ij} + e_{ijk}$$

where:

u – general average,

a_i – level of growth rate ($i = 1, 2$),

b_j – year of evaluation ($j = 1-5$),

$(ab)_{ij}$ – interaction level of growth rate \times year of evaluation,

e_{ijk} – error.

Statistical calculations were made using the computer program Statistica 8.0 PL (2008). The number of all young boars tested in the analysed years is shown in Table 2.

Table 1. Division of young boars of the tested breeds into groups of different growth rate

Breed	Daily body weight gain of young boars (g) standardized to 180 days of age	
	low	high
year 2004		
Polish Large White	up to 668	from 669
Polish Landrace	up to 673	from 674
Duroc	up to 688	from 689
Pietrain	up to 656	from 657
Line 990	up to 620	from 621
year 2005		
Polish Large White	up to 655	from 656
Polish Landrace	up to 658	from 659
Hampshire	up to 656	from 657
Duroc	up to 698	from 699
Pietrain	up to 680	from 681
Line 990	up to 654	from 655
year 2006		
Polish Large White	up to 643	from 644
Polish Landrace	up to 656	from 657
Hampshire	up to 618	from 619
Duroc	up to 654	from 655
Pietrain	up to 668	from 669
Line 990	up to 620	from 621
year 2007		
Polish Large White	up to 659	from 660
Polish Landrace	up to 667	from 668
Hampshire	up to 688	from 689
Duroc	up to 684	from 685
Pietrain	up to 624	from 625
year 2008		
Polish Large White	up to 639	from 640
Polish Landrace	up to 656	from 657
Hampshire	up to 819	from 820
Duroc	up to 658	from 659
Pietrain	up to 673	from 674

Table 2. Fattening and slaughter traits of the young boars, performance tested in 2004–2008

Traits	Growth rate	Year					Total	Significance of differences between results from analysed years		Inter-action
		2004 1	2005 2	2006 3	2007 4	2008 5		P≤0.05	P≤0.01	
Number (head)		651	2941	2962	2164	2100	10818			
Age on test day (days)	low	173.04 A±11.54	178.10 A±12.68	184.57 A±12.26	187.47 A±13.26	188.08 A±13.81	183.41 A±13.68		1-2,3,4,5; 2-3,4,5; 3-4,5	xx
	high	162.77 B±9.88	166.37 B±10.44	174.62 B±13.16	175.49 B±12.75	171.60 B±13.62	171.23 B±12.99		1-2,3,4,5; 2-3,4,5; 5-3,4	
	total	167.93±11.90	172.18±13.00	179.59±13.66	181.52±14.32	179.93±16.00	177.32±14.66		1-2,3,4,5; 2-3,4,5; 4-3,5	
Body weight on test day (kg)	low	105.18 A±9.97	107.29 A±10.64	111.69 A±11.40	115.24 A±12.03	114.09 A±11.71	111.30 A±11.80	4-5	1-2,3,4,5; 2-3,4,5; 3-4,5	xx
	high	109.89 B±9.63	113.72 B±12.15	121.37 B±13.00	126.93 B±14.69	125.96 B±13.93	120.57 B±14.36		1-2,3,4,5; 2-3,4,5; 3-4,5	
	total	107.53±10.08	110.54±11.87	116.54±13.15	121.05±14.64	119.96±14.16	115.93±13.93	4-5	1-2,3,4,5; 2-3,4,5; 3-4,5	
Daily body weight gain standardized to 180 days of age (g)	low	622.46 A±38.97	607.98 A±39.56	599.38 A±37.74	605.16 A±43.42	596.66 A±41.83	603.72 A±40.80		1-2,3,4,5; 2,4-3,5	xx
	high	715.66 B±48.32	714.43 B±49.71	708.69 B±48.78	734.75 B±57.16	758.40 B±84.63	725.45 B±61.95	1-3	1,2,3-4,5; 4-5	
	total	668.85±64.00	661.77±69.68	654.11±69.93	669.55±82.34	676.68±104.72	664.55±80.34	1-2; 4-5	1-3,5; 2-3,4,5; 3-4,5	
Standardized backfat thickness at P ₂ (mm)	low	10.29 a±2.00	10.04 A±1.80	10.20 A±1.74	9.54 A±1.80	10.46 A±1.82	10.08 A±1.82		1-2,4; 2,3-4,5; 4-5	xx
	high	9.96 b±1.88	9.56 B±1.81	9.59 B±1.88	8.75 B±1.92	8.82 B±2.01	9.29 B±1.94		1-2,3,4,5; 2,3-4,5	
	total	10.13±1.95	9.80±1.83	9.90±1.84	9.15±1.90	9.65±2.08	9.69±1.93	2-5	1-2,3,4,5; 3-4,5; 4-2,5	

Number (head)	651	2941	2962	2164	2100	10818				
Standardized backfat thickness at P ₄ (mm)	low	10.62±1.99	10.19 a±1.76	10.03 A±1.71	9.49 A±1.77	10.25 A±1.93	10.04 A±1.82	3-5	1-2,3,4,5; 4-2,3,5	xx
	high	10.40±1.87	10.07 b±1.75	9.74 B±1.68	8.91 B±1.63	8.84 B±1.73	9.53 B±1.80		1-2,3,4,5; 2-3,4,5; 3-4,5	
	total	10.51±1.93	10.13±1.75	9.88±1.70	9.21±1.73	9.55±1.96	9.79±1.83		1-2,3,4,5; 2-3,4,5; 3-4,5; 4-5	
Standardized height of loin eye at P ₄ (mm)	low	52.14±4.14	52.26 A±4.27	51.95 A±3.93	52.73 A±4.03	53.88 A±3.54	52.58 A±4.04	2-4	1,3-4,5; 5-2,4	xx
	high	52.47±4.71	53.60B±4.18	53.03 B±4.12	54.75 B±4.14	55.34 B±4.03	53.94 B±4.26		1-2,3,4,5; 2-3,4,5; 3-4,5; 4-5	
	total	52.31±4.43	52.94±4.28	52.49±4.06	53.73±4.21	54.60±3.86	53.26±4.21		1-2,4,5; 2-3,4,5; 3-4,5; 4-5	
Standardized body meat content (%)	low	56.97a±2.63	57.71 A±2.34	58.15±2.42	59.32 a±2.43	59.03 A±2.26	58.37±2.49	4-5	1-2,3,4,5; 2-3,4,5; 3-4,5	xx
	high	56.54b±2.33	57.47B±2.14	58.08±2.41	59.55 b±2.50	59.37B±2.26	58.36±2.51		1-2,3,4,5; 2-3,4,5; 3-4,5	
	total	56.76±2.49	57.59±2.24	58.12±2.42	59.43±2.46	59.20±2.26	58.36±2.50		1-2,3,4,5; 2-3,4,5; 3-4,5; 4-5	xx
Performance test selection index (points)	low	92.74 A±9.88	92.83 A±8.71	93.49 A±9.42	98.20 A±10.19	96.03 A±9.50	94.71 A±9.67		1,2,3-4,5; 4-5	
	high	105.32 B±11.13	108.33 B±10.54	109.89 B±10.06	118.74B±13.18	121.66B±16.57	113.21 B±13.64	2-3	1-2,3,4,5; 2,3-4,5; 4-5	
	total	99.00±12.25	100.66±12.39	101.70±12.73	108.40±15.63	108.71±18.59	103.96±15.01	2-3	1-2,3,4,5; 2,3-4,5	

Means in columns within each year marked with different letters differ significantly; capital letters P≤0.01; small letters P≤0.05. xx – interaction significant, P≤0.01.

Results

Table 2 gives the results for fattening and slaughter traits of young boars performance tested in 2004–2008 and the collective results from these years according to low and high growth rate. In the analysed years, young boars characterized by high weight gain standardized to 180 days of age were younger on performance test day compared to animals with low weight gain ($P \leq 0.01$). They achieved significantly higher body weights on performance test day. The differences in daily weight gain standardized to 180 days of age between young boars with high and low growth rate in each analysed year were high and highly significant. In the collective results from 2004–2008 they were 122 g. The tested boars differed significantly in growth traits (age and body weight on the performance test day and daily body weight gain) between particular years when the performance test was done. Data for 2004 (the first year of research) and 2008 (the last year of research) showed a regression in daily weight gain of young boars with low growth rate and an improvement ($P \leq 0.01$) in animals with high growth rate. In the analysed years, the tested young boars with high daily weight gain had significantly thinner P_2 and P_4 backfat, and thus had lower fat content compared to pigs with low growth rate. Statistically significant differences between the groups with different growth rates were not stated only in the year 2004 for P_4 backfat thickness. The differences in P_2 and P_4 backfat thickness of young boars with low and high growth rate (and in collective results) between particular years were confirmed to be highly significant or significant. Standardized loin eye height of young boars performance tested in 2005, 2006, 2007 and 2008 and in the collective results from 2004–2008, which had high growth rate, was significantly ($P < 0.01$) higher compared to pigs with low daily weight gain. In 2004, statistically significant differences were not found for loin eye height between the groups of pigs with different growth rates. There were significant differences ($P < 0.01$; $P < 0.05$) between the results from particular years in the range of standardized loin eye height of young boars with low and high growth rate and in the collective results for both groups of the tested animals. The highest result was observed for 2008. When analysing the impact of the degree of daily weight gain (low or high) on meat content it should be stated that the results in this respect showed variation. The tested young boars with high growth rate had significantly lower meat content compared to animals with low daily weight gain in 2004 ($P \leq 0.05$) and 2005 ($P \leq 0.01$). Opposite trends were stated in 2007 and 2008 when animals with high daily weight gain achieved significantly higher ($P \leq 0.01$) body meat content. In 2006 and in the collective results for 2004–2008, statistically significant differences in meat content between young boars with different growth rates were not proved. Regarding the standardized meat content in particular years in young boars with low and high growth rate and the collective results of both groups of animals, it is seen that the worst results occurred in 2004 with a consistent improvement during the next 3 years, when the highest results of meat content were found in 2007 and 2008. Similar trends may be seen in the range of the performance test selection index, because in 2007 and 2008 young boars with low and high growth rate (and in the collective results of both groups) had the most favourable results. In all the analysed years young boars of the tested

breeds with high growth rate achieved higher ($P \leq 0.01$) performance test selection indices that showed better breeding value compared to pigs with low daily weight gain. In the collective results from 2004–2008, the difference in the performance test selection index between the groups of young boars with low and high growth rate was 18.5 points.

It is worth noting that highly significant interactions emerged for all of the analysed traits between the two factors tested. They show a mutual and strong effect of the tested factors, i.e. the growth rate and the period when performance test was done.

Discussion

In the present paper, the results concerning the impact of growth rate of young boars on meat content were not conclusive. In 2007 and 2008 young boars with high daily weight gain had significantly higher body meat content compared to animals with low growth rate. However, in 2004 and 2005 the tested young boars with high growth rate had lower body meat content compared to animals with low daily weight gain. The results obtained for the above years show an unfavourable effect of high growth rate on the meat content of young boars and are consistent with our earlier studies (Michalska et al., 2002; 2003). Some studies by other authors showed similar trends, suggesting that high daily weight gains did not produce the expected improvement of meat content and led to higher fat content, thus having a negative effect on slaughter value, especially for *ad libitum* feeding (Kanis, 1988; Urbańczyk et al., 1999; Buczyński et al., 2001; Koczanowski et al., 2001; Milewska and Falkowski, 2001; Kapelański et al., 2002; Michalska et al., 2002; 2003). In the present study, in the analysed years young boars with high growth rate had significantly thinner P_2 and P_4 backfat (except the year 2004) and thus had lower fat content compared to pigs with low growth rate. The findings of Cameron et al. (1999) and Gy et al. (1992) suggest that in pigs with genetically determined capacity for protein deposition, high growth rate did not impact on higher fat content. Buczyński et al. (2001) stated that forcing excessively high growth rate may reduce pig production profitability. According to Fandrejewski et al. (2001) there are considerable differences in feed intake among growing pigs, which affects their growth rate, body composition and meat production costs.

In conclusion, in the analysed years the young boars of the tested breeds characterized by high growth rate were younger and achieved higher body weight on performance test day compared to animals with low daily weight gain. The tested young boars with high daily weight gain had significantly thinner P_2 or P_4 backfat (except the year 2004) and thus had lower fat content compared to pigs with low growth rate. The results regarding the impact of growth rate on meat content of the young boars of different breeds were not consistent and changed over time. Animals characterized by high growth rate achieved lower meat content compared to pigs with lower daily weight gain in the years 2004 and 2005. However, opposite trends

were stated in 2007 and 2008 when animals with high daily weight gain achieved significantly higher body meat content. Regarding the standardized meat content in particular years in young boars with low and high growth rate and the collective results for both groups of animals, it is seen that the worst results occurred in 2004 with a consistent improvement during the next 3 years, when the highest results of meat content were found in 2007 and 2008. Similar trends may be seen in the range of the performance test selection index, because in 2007 and 2008 young boars with low and high growth rate (and in the collective results of both groups) had the most favourable results. In all the analysed years young boars of the tested breeds with high growth rate had higher performance test selection indices that showed better breeding value compared to pigs with low daily weight gain.

References

- Bobček B., Řeháček P., Flak P., Kováč L., Mlynek J. (2002). Comparison of production traits of Large White and White Meaty pig breeds for 1996 to 2001 in Slovakia. *Czech J. Anim. Sci.*, 47 (11): 451–459.
- Buczyński J.T., Fajfer E., Panek A., Szulc K. (2001). Correlations between fattening and slaughter traits measured live after the first and second phase of rearing Polish Large White breeding gilts. *Ann. Anim. Sci., Suppl.*, 1: 31–36.
- Cameron N.D., Curran M.K. (1995 a). Genotype with feeding regime interaction in pigs divergently selected for components of efficient lean growth rate. *Anim. Sci.*, 61: 123–132.
- Cameron N.D., Curran M.K. (1995 b). Responses in carcass composition to divergent selection for components of efficient lean growth rate in pigs. *Anim. Sci.*, 61: 347–359.
- Cameron N.D., Penman J.C., Fiskén A.C., Nute G.R., Perry A.M., Wood J.D. (1999). Genotype with nutrition interactions for carcass composition and meat quality in pig genotypes selected for components of efficient lean growth rate. *Anim. Sci.*, 69: 69–80.
- Chen P., Baas T.J., Dekkers J.C.M., Koehler K.J., Mabry J.W. (2003). Evaluation of strategies for selection for lean growth rate in pigs. *J. Anim. Sci.*, 81: 1150–1157.
- Fandrejewski H., Raj S., Weremko D., Skiba G. (2001). Voluntary food intake of growing pigs from sire lines. (In Polish). *Zesz. Nauk. AR Wrocław*, 405: 53–61.
- Fuller M.F., Franklin M.F., McWilliam R., Pennie K. (1995). The responses of growing pigs, of different sex and genotype, to dietary energy and protein. *Anim. Sci.*, 60: 291–298.
- Gy Y., Schinckel A.P., Martin T.G. (1992). Growth, development and carcass composition in five genotypes of swine. *J. Anim. Sci.*, 70: 1719–1726.
- Kanis E. (1988). Effect of average daily food intake on production performance in growing pigs. *Anim. Prod.*, 46: 111–122.
- Kapelański W., Rak B., Grajewska S., Bocian M. (2002). Growth rate and slaughter carcass value in pigs of Złotnicka Spotted, Polish Landrace and Pietrain breeds. (In Polish). *Rocz. Nauk. Zoot.*, 29, 1: 33–40.
- Koczanowski J., Migdał W., Kłoczek Cz., Tuz R. (2001). The effects of growth rate during two fattening periods on carcass quality of fattening pigs fed *ad libitum*. *Ann. Anim. Sci., Suppl.*, 1: 119–123.
- McKay R.M. (1990). Responses to index selection for reduced backfat thickness and increased growth rate in swine. *Can. J. Anim. Sci.*, 70: 973–977.
- Michalska G., Nowachowicz J., Chojnacki Z., Bucek T., Wasilewski P.D. (2002). The impact of growth rate on the results of performance testing of Polish Large White pigs. *Ann. Anim. Sci., Suppl.*, 2: 63–66.
- Michalska G., Nowachowicz J., Chojnacki Z., Wasilewski P.D., Bucek T. (2003). The impact of value of daily gains of body weight on meat content of pigs of different breeds. *Acta Sci. Pol., Zoot.*, 2 (2): 77–84.

- Milewska W., Falkowski J. (2001). Analysis of results alive assesment in boars breed and F1 on the territory of Regional Breeding Station in Olsztyn in the years 1995–1998. (In Polish). *Zesz. Nauk. AR Wrocław*, 405: 181–188.
- Rózycki M. (2004). Genetic changes and their effect on utility of pigs. (In Polish). *Prace Mat. Zoot., Zesz. Specj.*, 15: 9–18.
- Urbańczyk J., Hanczakowska E., Świątkiewicz M. (1999). Effect of genotype on some biochemical indices of blood, growth performance and carcass traits in pigs. (In Polish). *Zesz. Nauk. AR Kraków*, 352: 277–284.

Accepted for printing 21 VI 2011

JERZY NOWACHOWICZ

Kształtowanie się cech tucznych i rzeźnych knurków w zależności od ich tempa wzrostu

STRESZCZENIE

Badano wpływ tempa wzrostu na kształtowanie się cech tucznych i rzeźnych u 10 818 knurków następujących ras: wielkiej białej polskiej, polskiej białej zwisłouchej, Hampshire, Duroc i Pietrain oraz syntetycznej linii 990, ocenianych przyżyciowo w bydgoskim okręgu hodowlanym w latach 2004–2008. W łącznym zestawieniu wyników wszystkich badanych knurków w analizowanych latach zwierzęta charakteryzujące się wysokim przyrostem dobowym masy ciała standaryzowanym na 180. dzień życia były młodsze i osiągnęły większą masę ciała oraz wyższy indeks selekcyjny oceny przyżyciowej od zwierząt o niskim tempie wzrostu. Wyniki dotyczące wpływu tempa wzrostu na kształtowanie się mięsności badanych knurków nie były jednoznaczne i zmieniały się w czasie. W łącznym zestawieniu wyników knurków wszystkich badanych ras zwierzęta charakteryzujące się wysokim tempem wzrostu uzyskały istotnie mniejszą mięsność w porównaniu ze świniami o niskim przyroście dobowym masy ciała w latach 2004 i 2005. Odwrotne tendencje stwierdzono natomiast w 2007 i 2008 r., kiedy to zwierzęta odznaczające się wysokim przyrostem dobowym masy ciała uzyskały istotnie większą zawartość mięsa w ciele. W 2006 r. i w łącznym zestawieniu wyników z lat 2004–2008 nie udowodniono wpływu tempa wzrostu na kształtowanie się mięsności. W analizowanych latach knurki o wysokim tempie wzrostu wykazywały istotnie cieńszą słoninę w punktach P_2 i P_4 (za wyjątkiem wyniku z 2004 r.), a więc charakteryzowały się mniejszym otłuszczeniem od swni o niskim tempie wzrostu.