

Electronic Journal of Polish Agricultural Universities is the very first Polish scientific journal published exclusively on the Internet, founded on January 1, 1998 by the following agricultural universities and higher schools of agriculture: University of Technology and Agriculture of Bydgoszcz, Agricultural University of Cracow, Agricultural University of Lublin, Agricultural University of Poznan, Higher School of Agriculture and Teacher Training Siedlce, Agricultural University of Szczecin, and Agricultural University of Wroclaw.



**ELECTRONIC
JOURNAL
OF POLISH
AGRICULTURAL
UNIVERSITIES**

**2003
Volume 6
Issue 2
Series
ANIMAL
HUSBANDRY**

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JACYNO E., PIETRUSZKA A., CZARNECKI R., ELZANOWSKI CZ. 2003. RELATIONSHIPS BETWEEN THE FATTENING TRAITS AND THE SLAUGHTER TRAITS AND MEAT CHEMICAL COMPOSITION IN PIGS *Electronic Journal of Polish Agricultural Universities*, Animal Husbandry, Volume 6, Issue 2.

Available Online <http://www.ejpau.media.pl>

RELATIONSHIPS BETWEEN THE FATTENING TRAITS AND THE SLAUGHTER TRAITS AND MEAT CHEMICAL COMPOSITION IN PIGS

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[ABSTRACT](#)
[INTRODUCTION](#)
[MATERIALS AND METHODS](#)
[RESULTS AND DISCUSSION](#)
[CONCLUSIONS](#)
[REFERENCES](#)

ABSTRACT

The objective of the study was to determine relationships between the fattening traits and the slaughter traits and chemical composition of meat in fatteners, hybrids after boars of high-meat breeds. The study was carried out on 80 fatteners (40 gilts and 40 barrows) fed with rationed mixture.

Significant positive correlation was found between daily gains of body weight and eye muscle area ($r=0.31^{**}$), basic cuts weight ($r=0.29^{**}$), ham weight ($r=0.33^{**}$) and carcass meat percentage ($r=0.32^{**}$). Low and negative correlations occurred between daily gains and backfat thickness. Feed intake, as well as that of digestible protein and metabolic energy per 1 kg gain was significantly negatively correlated ($p\leq 0.01$) with meatiness traits and significantly positively correlated with backfat thickness.

It was found, the coefficients of correlation between the gains and the content of nutrients in meat were low and non-significant.

Key words: fatteners, fattening value, slaughter value, chemical composition of meat.

INTRODUCTION

Daily gains of body weight in pigs fed with standardized feeding system depend in the first place on protein daily deposition [4, 5, 7]. There are high correlations ($r>0.9$) between the quantity of protein deposited in pig organisms and the meat content in carcass [10].

Ad libitum feeding of young pigs (to 70 kg body weight) increases the gains of body weight without excessive fatness [8, 18]. On the other hand, in older pigs, even in those with high genetic potential, the increased gains are accompanied by deterioration of carcass quality [8, 15].

Feed intake per 1 kg body weight gain is the smaller, the greater is the amount of lean meat in the carcass of fattener [5, 13, 20, 21]. According to Fandrejewski [7] the rate of protein daily deposition in growing pigs influences the feed conversion the most of all factors.

It was found [2, 14], that the increase of body weight gains and pig meatiness affects the decrease of intramuscular fat in meat, whereas it is of no effect on the content of water, protein and mineral components. It has negative effect on meat sensory properties, as savoriness, tenderness and juiciness are positively correlated with the amount of intramuscular fat [3, 6, 16, 23].

The aim of the present study was to determine the relationships between the daily gains and feed conversion and the slaughter traits as well as between the daily gains and the chemical composition of *m. longissimus dorsi* in meat type fatteners fed with standardized feeding system.

MATERIALS AND METHODS

Study material consisted of 80 fatteners, hybrids after boars of meat breeds: Belgian Landrace, Hampshire x Pietrain, Pietrain and Polish Large White. The experimental group had equal numbers of fatteners in respect of origin and sex. The fatteners were kept in individual pens without straw and fed with a standardized food ration. During the whole fattening period (23-100 kg body weight), one type of granulated feed mixture was used. Chemical composition of the mixture and its feeding value are given in [Table 1](#). The growth rate in pigs and the feed intake per 1 kg body weight gain were controlled individually as well.

Table 1. Nutritive value of complete feed mixture

Chemical composition (%)	Mixture
Dry matter	88.4
Ash	4.54
Organic matter	83.9
Crude protein	16.9
Crude fat	2.32
Crude fibre	4.12
N-free extract	60.5
In 1 kg of mixture	
Metabolisable energy (MJ)	12.30
Digestible protein (g)	137.00
Lysine (g)	8.65
Methionine+cystine (g)	5.50
Ca (g)	7.78
P total (g)	7.26

The experiment was closed by the slaughtering, when the animals reached 100 kg body weight. Carcass slaughter evaluation was performed according to the methods used at Polish Pig Testing Stations [17]. During the slaughter, samples of *m. longissimus dorsi* were collected for chemical analysis from the region between lumbar vertebrae 1 and 4.

The content of nutrients in mixture and meat samples was determined with standard methods [1], and the amino acids with AAA-400 amino acid automatic analyzer of Czech production.

Relationships between the traits of fattening value and those of slaughter value and the content of meat nutrients were determined basing on the calculated coefficients of rectilinear correlation of first degree.

RESULTS AND DISCUSSION

Production results (Table 2) point to the high rate of growth in the examined pigs. Mean daily gain of body weight amounted to 778 g, and the maximum value of it exceeded even 920 g. The basic measure of fattening performance is feed conversion per 1 kg body weight gain. In this respect, the fatteners used in the study also obtained very good results. They intake 2.69 kg feed, 363 g digestible protein and 32.3 MJ metabolic energy per 1 kg body weight gain, and these were considerably smaller than those obtained in other studies for meat type pigs fed with rationed way [11, 19].

Table 2. Fattening and slaughter traits and chemical composition *m. longissimus dorsi*, average values standard deviation

Specification	\bar{x}	$\pm S$
Daily body weight gains (g day ⁻¹)	778	62.9
Intake per 1kg gain:		
- mixture (kg)	2.69	0.04
- digestible protein (g)	363	30.5
- metabolisable energy (MJ)	32.2	273
Backfat thickness (cm)		
- over shoulder	3.33	0.52
- mid-back	2.02	0.48
- over loin I	2.39	0.53
- over loin II	1.72	0.58
- over loin III	2.35	0.62
Average of 5 measurements (cm)	2.36	0.46
Backfat thickness in C ₁ point (cm)	1.76	0.42
Are of loin eye (cm ²)	42.8	6.01
Meat content in basic cuts (kg)	18.8	2.14
Hind ham without backfat and skin (kg)	7.20	0.82
Loin without backfat (kg)	5.16	0.47
Meat in carcass (%)	50.6	4.63
In <i>m. longissimus dorsi</i> (in 100g fresh tissue)		
- dry matter (g)	24.68	0.38
- ash (g)	1.19	0.12
- crude protein (g)	19.83	0.98
- intramuscular fat (g)	1.76	0.36

Meatiness indices (eye muscle area, basic cuts meat weight, ham and loin weights) and backfat thickness (average of 5 measurements and in point C₁) point to well-developed musculature and not very large fatness of carcasses in experimental pigs. Mean meat content in carcass amounted to approximately 51%, and the maximum value even to 61%.

The content of nutrients in *m. longissimus dorsi* in the examined fatteners was similar to the values found by Barowicz et al. [2] in the meat of 990 line fatteners.

Significant ($p \leq 0.01$) positive correlation was found (Table 3) in the examined pigs between daily gains of body weight and the area of eye muscle ($r=0.31$), the weight of basic cuts ($r=0.29$), the weight of ham ($r=0.33$), and the meat percentage in carcass ($r=0.32$). On the other hand, the backfat thickness decreased slightly with the increase of body weight gains, significant coefficient of correlation ($r=-0.23$) being found only for the backfat thickness over loin III. More direct negative correlation ($r=-0.35^*$) occurred between daily gains and the backfat thickness over eye muscle region in point C₁.

Table 3. Correlation coefficients between fattening and slaughter traits of pigs

Traits	Daily body weight gain	Intake per 1 kg gain		
		mixture	digestible protein	metabolisable energy
Backfat thickness				
- over shoulder	-0.09	0.25*	0.26*	0.26*
- mid-back	-0.11	0.30**	0.33**	0.32*
- over loin I	-0.21	0.38**	0.40**	0.40**
- over loin II	-0.02	0.23*	0.24*	0.24*
- over loin III	-0.23**	0.40**	0.42**	0.42**
Average of 5 measurements	-0.21	0.41**	0.43**	0.43**
Backfat thickness in C ₁ point	-0.35**	0.53**	0.55**	0.54**
Are of loin eye	0.31**	-0.44**	-0.46**	-0.45
Meat content in basic cuts	0.29**	0.48**	-0.49**	-0.49
Hind ham without backfat and skin	0.33*	0.49**	-0.50**	-0.49
Loin without backfat	0.17	0.24*	-0.25**	-0.25*
Meat in carcass	0.32**	0.49**	-0.52**	-0.51**

Significant level at: * $p \leq 0.05$; ** $p \leq 0.01$.

The correlations obtained in the present study corroborate the findings of other authors [5, 13], who also found significant correlations ($p \leq 0.01$) in high-meat pigs between carcass meat percentage and body weight daily gains, whereas low and negative correlations between the backfat thickness and the gains.

According Fandrejewski and Skiba [9], the daily gain of body weight is more influenced by daily protein deposition in pig organisms than by fat deposition. These authors found, that deposition of 1 g protein in pig organisms increased their body weight gain by 4.6 g, whereas deposition of 1 g fat was an equivalent to 1 g only.

The coefficients of correlation determined between the feed intake, and that of digestible protein and metabolic energy per 1 kg gain and the meatiness traits and the backfat thickness (Table 3) indicate, that fatteners with better musculature and smaller fatness were of significantly better feed conversion ($p \leq 0.01$) per 1 kg body weight gain. Thus, the results of other authors [12, 22] has been confirmed, that pigs intake much less feed for production of muscle tissue than for that of fat tissue.

Positive coefficients of correlation between the amount of meat in carcass of meat type pigs and the feed intake per 1 kg gain were found as well by Demo et al. [5]. Correlations given by these authors were higher than those showed in the present study.

Table 4. Correlation coefficients between daily body weight gain and content of chemical components in *m. longissimus dorsi*

Components	Daily body weight gain
Dry matter	-0.124
Ash	0.027
Crude protein	0.023
Intramuscular fat	-0.094

It should be stressed, that proportional meat content and also the value of particular meatiness traits in the examined pigs were more correlated with feed conversion than with daily gain of body weight. Fandrejewski [7] found, that feed conversion is influenced the most by the amount of protein deposited in pig organisms.

The coefficients of correlation presented in Table 4 show no significant relationships between daily body weight gains and the content of nutrients in meat. Negative and low correlation between daily gains and intramuscular fat content ($r = -0.094$) indicate, that the increase of growth rate in pigs will not have negative effect on sensory properties of meat. Cameron [3] and Meyer [16] obtained the other results.

CONCLUSIONS

1. Fatteners, that are characterised by thinner backfat and better carcass musculature, obtain higher daily gains of body weight and have better feed conversion.
2. Meatiness traits in pigs are more correlated with feed conversion than with daily gains of body weight.
3. The increase of growth rate and meatiness in pigs not decreased essentially the intramuscular fat content, responsible for sensory properties of meat.

REFERENCES

1. AOAC 1990. Official methods of analysis. Association of Official Analytical Chemists. Inc., Arlington, Wirginia, 1141.
2. Barowicz T., Pietras M., Pieszka M., 1997. Wpływ tempa wzrostu na jakość tusz i skład chemiczny mięsa tuczników linii 990 (w: Aktualne problemy w produkcji trzody chlewnej) [Effect of growth rate on carcass quality and chemical composition of pork of 990 line fatteners (in: Current Problems in Swine Production)]. Mat. konf. Olsztyn 7 May 1997. ART, Olsztyn, 78 [in Polish].
3. Cameron, N. D., 1990. Genetic and phenotypic parameters for carcass traits, meat and eating quality traits in pigs. Livest. Prod. Sci. 26, 119-135.
4. Chabiera K., Kotarbińska M., Raj S., Fandrejewski H., Weremko D., 1994. Wpływ pobrania energii metabolicznej i lizyny na przyrosty dzienne i chemiczny skład ciała rosnących świń (w: Współczesne zasady żywienia świń) [Effect of intake of metabolizable energy and lysine on the performance and chemical body composition of growing pigs (in: Current rules of pigs nutrition)]. Mat. konf., Jabłonna 30-31 May 1994. IFiZZ PAN, Jabłonna 38-41 [in Polish].
5. Demo P., Letkovičová M., Hetény L., 1993. Analýza vzťahov medzi ukazovateľmi výkrmnosti, jatočnej hodnoty a kvality mäsa hybridných ošipanych. Živoč. Vyr. 38, 1, 21-30.
6. De Vol, D. L., Mc Keith F. K., Bechtel, P. J., Novakofski, J., Shanks, R. D., Carr, T. R., 1988. Variation in composition and palatability traits and relationship between muscle characteristics and palatability in a random sample of pork carcasses. J. Anim. Sci. 66, 385-395.
7. Fandrejewski H., 1993. Energetyczne podstawy wykorzystania paszy przez rosnące loszki [Energetic aspects of feed efficiency in growing gilts]. Rozpr. IFiZZ, Jabłonna, 1-58 [in Polish].
8. Fandrejewski H., Malowany K., Raj S., 1993. Wpływ zróżnicowanego żywienia świń na wykorzystanie paszy i mięsność tuszy [Influence on nutrition on feed utilization and carcass meatiness in pigs]. Zesz. Nauk. Prz. Hod. PTZ, Warszawa, 9, 182-187 [in Polish].
9. Fandrejewski H., Skiba G., 1996. Wpływ masy ciała przed ubojem na proporcje białka do tłuszczu w ciele tuczników żywionych według norm (w: Genetyczne i środowiskowe uwarunkowania wartości rzeźnej i jakości mięsa zwierząt) [Influence of body weight before slaughter on protein proportion to fat in body of fatteners feeding according the norms (in: Genetic and environmental conditions of slaughter value and meat quality of animals)]. Konf. międzynarodowa, Lublin 13-14 June 1996. AR, Lublin, 69-73 [in Polish].
10. Fandrejewski H., 2002. Żywienie świń-osiągnięcia i oczekiwania (w: Zastosowanie osiągnięć naukowych z zakresu genetyki, rozrodu i żywienia w nowoczesnej produkcji świń) [Nutrition of pig: achievement and desideration (in: Application of scientific achievements in genetics, reproduction and feeding in modern pig production)]. Mat. konf. Bydgoszcz, 18-20 September 2002. ATR, Bydgoszcz, 63-74 [in Polish].
11. Flis M., Sobotka W., Zduńczyk Z., 1997. Wpływ łubinu białego odmiany Bardo na wyniki tuczu świń. (w: Współczesne zasady żywienia świń (2)) [The effect of white lupine seed-meal cv. Bardo on pig performance. (in: Current rules of pigs nutrition (2))]. Mat. konf., Jabłonna 3-4 June 1997. IFiZZ PAN, Jabłonna 80-84 [in Polish].
12. Henkel D., 1985. Futteraufwand-ein Merkmal. Die Mühle und Mischfuttertechnik 122, 24, 325-328.
13. Hennebach H., Lengerken G., Pfeiffer H., 1987. Untersuchungen zur Futteraufnahme bei Mastschweinene. Tierzucht 2, 77-79.
14. Jacyno E., Delecka A., Delikator B., Pietruszka A., Kawęcka M., 1997. Tłuszcz śródmięśniowy mięśnia najdłuższego grzbietu różnych grup genetycznych świń (w: Aktualne problemy w produkcji trzody chlewnej) [Intramuscular fat of various genetic groups of pigs (in: Current Problems in Swine Production)]. Mat. konf., Olsztyn 7 May 1997. ART, Olsztyn, 100 [in Polish].
15. Kapelański W., Rak B., Grajewska S., Bocian M., 2002. Tempo wzrostu a wartość rzeźna tuszy świń rasy złotnickiej pstrej, polskiej białej zwiślouchej i pietrian [Growth rate and slaughter carcass value In pigs of Złotnicka Spotted, Polish Landrace and Pietrain breeds]. Roczn. Nauk. Zootech. 29, 1, 33-40 [in Polish].
16. Meyer E., 1991. Technische und sensorische Bewertung der Fleischbeschaffenheit praktischer Mehrfachkreuzungen und Hybriden unter besonderer Berücksichtigung des intramuskulären Fettgehaltes. Dissertation, University of Göttingen.
17. Rózycki, M., 1996. Results of pigs tested at pig testing stations. Report on pig breeding in Poland. Inst. Zootech. Kraków, 66-93.
18. Skiba G., Fandrejewski H., Raj S., Weremko D., 1997. Wpływ jakości paszy i systemu żywienia na skład chemiczny przyrostów dziennych u świń (w: Współczesne zasady żywienia świń (2)) [Effect of food quality and feeding level on chemical composition of body gain in pigs (in: Current rules of pigs nutrition (2))]. Mat. konf., Jabłonna 3-4 June 1997. IFiZZ PAN, Jabłonna 141-144 [in Polish].
19. Sokół J., Sawosz E., Iniański R., Chachułowa J., 1994. Wyniki tuczu trzech typów mieszańców świń przy zróżnicowanym poziomie białka i energii w dawkach (w: Współczesne zasady żywienia świń) [The fattening

- results of three types of crossbreed pigs under differentiated level of protein and energy in the diets (in: Current rules of pigs nutrition)]. Mat. konf., Jabłonna 30-31 May 1994. IFiZZ PAN, Jabłonna 34-37 [in Polish].
20. Stiewe H., 1986. Futteraufnahme und Futtermittelverwertung. Die richtigen Tiere zur Mast einstellen. Schweinez. U. Schweinemast 34, 10, 308-310.
 21. Tribler G., 1986. Züchterische Aspekte der Futtermittelverwertung beim Schwein. Z. Der Humboldt-Universität, Berlin, 35, 4.
 22. Webb A.J., King W. B., 1983. Selection for improved food conversion ratio on ad libitum group feeding in pigs. Anim. Prod. 37, 375-385.
 23. Wood J. D., Brown S. N., Nute G. R., Whittington F. M., Perry A. M., Johnson S. P., Enser M. B., 1996. Effects of breed, feed level and conditioning time on the tenderness of pork. Meat Sci. 44, 105-112.
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