*Rocz. Nauk. Zoot., T. 46, z. 1 (2019) 11–23*

# DAILY FEED INTAKE AS RELATED TO FATTENING, SLAUGHTER AND MEAT QUALITY PARAMETERS IN PIGS EVALUATED AT TESTING STATIONS

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Study financed from statutory activity, project no. 01-014.1

*The aim of the study was to determine the relationships between daily feed intake and fattening, slaughter and meat quality traits in Polish Landrace pigs, and to estimate correlations between daily feed intake in different fattening periods and selected traits. The study used 122 gilts that originated from nucleus herds and were evaluated at the Pig Performance Testing Station. As a result of the study, the pigs were divided into subgroups according to feed intake capacity. The feed intake capacity of the examined animals was found to be related to the parameters of fattening and slaughter traits. Pigs with the lowest feed intake were characterized by the lowest gains from 30 to 100 kg body weight, but showed the highest efficiency of feed utilization ($P \le 0.01$). This group of animals was also characterized by the best parameters in terms of meatiness and fatness in the carcass and the weight of the most valuable primal cuts ($P \le 0.01$). Statistically significant ($P \le 0.01$) correlations were found between daily feed intake during the whole fattening period and fattening traits, some slaughter traits (weight of loin and ham, mean backfat thickness from 5 measurements, loin eye area, meatiness of primal cuts and carcasses) and $pH_{24}$ in loin.*

Key words: pigs, daily feed intake, fattening, slaughter and meat quality traits

Daily feed intake capacity of pigs is determined by many factors, both environmental and genetic ones. The first group includes microclimate conditions in livestock buildings (temperature, humidity), ventilation, and housing conditions (stocking density, group size, access to feed and water) (Massabie et al., 1997; Pierozan et al., 2016; Silva et al., 2017; Thacker, 2001; Whittemore et al., 2001).

Breed is one of the key determinants of feed intake capacity in pigs (Clutter et al., 1998). Variation in daily feed intake among the breeds raised in Poland reaches up to 20%. Feed intake is highest in Duroc and Line 990, and lowest in the Hampshire and Pietrain breeds. It has been suggested that these breed differences may be due to the size of the digestive tract and differences in its histological structure. However, Raj et al. (2002) reported that despite physiological and histological differences, no differences were observed in digestion capacity examined up to the end of large intestine. Another factor beside the breed, which influences this aspect of behaviour (feed intake capacity) is the individual factor. Within breeds characterized by high daily food intake, many authors observed subpopulations differing in feed intake capacity (Webb, 1989). It was the premise of the present study to identify subpopulations differing in feed intake capacity in the population of Polish Landrace (PL) pigs and to analyse basic fattening, slaughter and meat quality parameters within these groups.

The aim of the present study was to determine the relationship between daily feed intake and fattening, slaughter and meat quality traits of the pigs, as well as to determine correlations between daily feed intake in different fattening periods and selected traits.

## Material and methods

The study used 122 Polish Landrace gilts, which were obtained from the mating of boars and sows in nucleus herds and fattened at the Pig Performance Testing Station (SKURTCh). During control fattening, animals were raised and fed individually in keeping with the feeding regimen used at the testing stations. Control fattening was conducted from 30 kg to the final body of 100 kg. Animals were fed *ad libitum*, and the amounts of feed offered in automatic feeders and feed refusals were recorded daily for each animal. Pigs were weighed at 3-day intervals (or 4 days apart when there was a holiday). For the days between successive weighings, body weight was calculated by interpolation. After reaching the mean final weight of 100 kg, animals were slaughtered and dissected according to SKURTCh methodology (Różycki and Tyra, 2010). Meat quality traits such as pH of loin 45 minutes ($pH_{45}$) and 24 h ($pH_{24}$) postmortem as well as pH of ham 45 minutes and 24 h postmortem were measured with a pH Star CPU device (Matthäus), intramuscular fat content (IMF, as crude fat) by Soxhlet extraction in Soxthern 600 (GERHARD), water holding capacity of the meat by Grau and Hamm (Grau and Hamm, 1952), and colour lightness (L), redness (a*) and yellowness (b*) of loin using a Minolta CR-310 chroma meter.

### Statistical analysis

Statistical analysis was performed with analysis of variance using SAS models (SAS Institute, Cary, NC, USA; v. 8.2, 2001). The statistical model used in the calculations was as follows:

$$y_{ij} = \mu + a_i + \beta(a_i) + e_{ij}$$

where:

$y_{ij}$ – individual observations of animals

$\mu$ – overall population mean

$a_i$ – effect of i-th group in terms of feed intake (1,2,3)

$\beta(a_i)$ – covariance with right half-carcass weight (concomitant change)

$e_{ij}$ – error

To examine the effect of feed intake capacity on the individual fattening, slaughter and meat quality parameters, the studied animals were divided into 3 groups according to the mean daily feed intake: group 1 – from 2.38 kg (mean of trait – ½ standard deviation) , group 2 – from 2.39 kg to 2.58 kg (from “mean – ½ standard deviation” to “mean + ½ standard deviation”), group 3 – above 2.58 kg (mean + ½ standard deviation). Differences between the studied experimental groups for individual fattening, slaughter and meat quality traits were estimated at 5% and 1% using Duncan’s multiple range test. Relationships were also estimated between daily feed intake in different age groups and the group of fattening, slaughter, and meat quality traits.

## Results

Table 1 presents data obtained for the effect of daily feed intake on selected fattening traits. Animals with high feed intake showed the highest daily gain (984 g) and differed significantly (P≤0.01) in this respect from animals from the other groups. Also the pigs with the highest daily feed intake during fattening, for which the number of fattening days was smallest, consumed the largest amount of feed (194 kg). Highly significant differences (P≤0.01) occurred only in relation to the first group. Feed conversion (kg feed/kg gain) showed a slightly different pattern. Gilts with high feed intake consumed most feed (2.79 kg) per kg gain, but differed highly significantly (P≤0.01) in relation to the first and second group. Mean feed intake in the successive groups was 2.26 kg, 2.47 kg and 2.73 kg, respectively. The analysis of variance showed that animals from these groups differed highly significantly (P≤0.01) from the other animals, which indicates that the grouping of animals based on daily feed intake was correct.

Table 1. Analysis of the effect of daily feed intake (feed intake capacity) on selected fattening traits.

| Traits | Mean daily feed intake (kg) | | |
|---|---|---|---|
| | up to 2.38 (39) | from 2.39 to 2.58 (48) | above 2.58 (35) |
| No. of fattening days from 30 to 100 kg body weight (kg) | **78.8 A** | **75.1 b** | **71.2 Ab** |
| Daily gain during fattening (g) | **885 A** | **940 B** | **984 AB** |
| Total feed intake during fattening (kg) | **178 A** | **186** | **194 A** |
| Feed conversion (kg feed/kg gain) | **2.57 A** | **2.65 B** | **2.79 AB** |
| Daily feed intake (kg) | **2.26 AC** | **2.47 BC** | **2.73 AB** |
| Body weight at slaughter (kg) | **99.1** | **99.6** | **100** |

*Values with the same letters show significant differences between the groups (**A. B...** = p< 0.01. **a. b. ..** = p<0.05)*

Table 2 shows the mean values of slaughter traits for each group. The highest meatiness was characteristic of the group of gilts with the lowest daily feed intake, for which the meat content of primal cuts was 67.4%, and carcass meat content was 59.2%. This group differed highly significantly (P≤0.01) from the group of gilts with the highest daily feed intake. Differences between these groups were 3.2 and 3.2 percentage points. The analysis of slaughter value traits shows that this was mainly due to the differences in the weight of ham, the cut that has a decisive effect on carcass meatiness. In turn, measurements of backfat thickness indicate that the carcasses of animals with high feed intake had the highest fat content.

The grouping of the pigs characterized by different feed intakes had no effect on meat quality characteristics (Table 3). Statistically significant differences were only observed for pH of loin 24 h postmortem and for yellowness.

Table 2. Analysis of the effect of daily feed intake (feed intake capacity) on selected slaughter traits.

| Traits | Mean daily feed intake (kg) | | |
|---|---|---|---|
| | up to 2.38 (39) | from 2.39 to 2.58 (48) | above 2.58 (35) |
| Weight of right half-carcass (kg) | **38.8** | **39.5** | **38.9** |
| Dressing percentage | **78.5** | **79.1** | **78.4** |
| Weight of loin (kg) | **7.61** | **7.81** | **7.77** |
| Weight of loin backfat with skin (kg) | **1.59** | **1.77** | **1.92** |
| Weight of loin without skin and backfat (kg) | **6.02** | **6.03** | **5.85** |
| Weight of leg (kg) | **10.12 A** | **10.14 B** | **9.77 AB** |
| Weight of knuckle (kg) | **1.29** | **1.30** | **1.28** |
| Weight of ham (kg) | **8.82 A** | **8.83 B** | **8.48 AB** |
| Weight of ham backfat with skin (kg) | **1.29** | **1.37** | **1.41** |
| Weight of backfat and knuckle skin (kg) | **0.220** | **0.220** | **0.226** |
| Weight of leg without backfat and skin (kg) | **8.61 A** | **8.56 B** | **8.13 AB** |
| Mean backfat thickness from 5 measurements (cm) | **1.47 AB** | **1.63 B** | **1.72 A** |
| Loin eye width (cm) | **10.80 A** | **10.51** | **10.49 A** |
| Loin eye height (cm) | **6.80** | **6.77** | **6.72** |
| Loin eye area ($cm^2$) | **54.7 A** | **52.2** | **51.8 A** |
| Backfat thickness at $C_1$ (cm) | **1.18 A** | **1.33** | **1.29 A** |

| | | | |
|---|---|---|---|
| Meat content of primal cuts (%) | **67.4 A** | **65.8** | **64.2 A** |
| Carcass meat content (%) | **59.2 A** | **57.7** | **56.0 A** |

*Values with the same letters show significant differences between the groups (**A. B...** = p< 0.01. **a. b. ..** = p<0.05)*

Table 3. Analysis of the effect of daily feed intake (feed intake capacity) on selected meat quality traits.

| Traits | | Mean daily feed intake (kg) | | |
|---|---|---|---|---|
| | | up to 2.38 (39) | from 2.39 to 2.58 (48) | above 2.58 (35) |
| **loin** | pH 45 min postmortem | **6.41** | **6.34** | **6.31** |
| | pH 24 h postmortem | **5.64 A** | **5.60** | **5.54 A** |
| | intramuscular fat (%) | **1.29** | **1.30** | **1.33** |
| | water holding capacity (%) | **38.5** | **39.3** | **39.2** |
| | colour lightness (L*) | **54.5** | **54.9** | **54.6** |
| | redness (a*) | **17.1** | **16.9** | **17.4** |
| | yellowness (b*) | **2.34 a** | **2.51** | **2.58 a** |
| **ham** | pH 45 min postmortem | **6.37** | **6.33** | **6.32** |
| | pH 24 h postmortem | **5.67** | **5.67** | **5.61** |

*Values with the same letters show significant differences between the groups (**A. B...** = p< 0.01. **a. b. ..** = p<0.05)*

The next stage of the study was to determine the relationship between selected fattening, slaughter and meat quality characteristics and daily feed intake. The results of these analyses are presented in Tables 4-6. The correlations are shown for three periods: I – the first three weeks of fattening (weeks 1-3), II – weeks 4, 5 and 6 of fattening (weeks 4-6), and III – weeks 7 to 9 of fattening (weeks 7-9), and also for the entire fattening period.

Table 4. Correlation between daily feed intake in particular control fattening periods and selected fattening traits.

| Traits | weeks 1-3 | weeks 4-6 | weeks 7-9 | weeks 1-9 |
|---|---|---|---|---|
| No. of fattening days from 30 to 100 kg body weight (kg) | **-0.349$^{**}$** | **-0.538$^{**}$** | **-0.287$^{**}$** | **-0.523**** |

| | | | | |
|---|---|---|---|---|
| Daily gain during fattening (g) | 0.368** | 0.540** | 0.287** | 0.564** |
| Feed intake during fattening (kg) | -0.061 | 0.053 | 0.148 | 0.294** |
| Feed conversion (kg feed/kg gain) | -0.092 | 0.078 | 0.127 | 0.285** |

*** highly significant correlations at p< 0.01, * significant at p<0.05*

Table 5. Correlation between daily feed intake in particular control fattening periods and selected slaughter traits.

| Traits | weeks 1-3 | weeks 4-6 | weeks 7-9 | weeks 1-9 |
|---|---|---|---|---|
| Weight of right half-carcass (kg) | 0.098 | -0.056 | 0.059 | 0.024 |
| Dressing percentage | 0.043 | -0.005 | 0.014 | -0.033 |
| Weight of loin (kg) | -0.029 | 0.113 | 0.196* | 0.103 |
| Weight of loin backfat with skin (kg) | 0.167 | 0.308** | 0.329** | 0.304** |
| Weight of loin without skin and backfat (kg) | -0.198* | -0.152 | -0.066 | -0.161 |
| Weight of leg (kg) | -0.023 | -0.324** | -0.162 | -0.303** |
| Weight of knuckle (kg) | -0.032 | -0.135 | -0.054 | -0.061 |
| Weight of ham (kg) | -0.019 | -0.319** | -0.163 | -0.311** |
| Weight of ham backfat with skin (kg) | 0.356** | 0.141 | 0.174 | 0.187* |
| Weight of backfat and knuckle skin (kg) | 0.154 | -0.018 | 0.062 | 0.120 |
| Weight of leg without backfat and skin (kg) | -0.154 | -0.336** | -0.208* | -0.339** |
| Mean backfat thickness from 5 measurements (cm) | 0.288** | 0.291** | 0.367** | 0.339** |
| Loin eye width (cm) | -0.009 | -0.324 | -0.186* | -0.239** |
| Loin eye height (cm) | -0.083 | -0.159 | -0.116 | -0.170 |
| Loin eye area ($cm^2$) | -0.080 | -0.306** | -0.152 | -0.260** |
| Backfat thickness at $C_1$ (cm) | 0.283 | 0.253** | 0.247** | 0.242** |
| Meat content of primal cuts (%) | -0.254** | -0.347** | -0.263** | -0.387** |
| Carcass meat content (%) | -0.255** | -0.377** | -0.271** | -0.413** |

*** highly significant correlations at p< 0.01, * significant at p<0.05*

Table 6. Correlation between daily feed intake in particular control fattening periods and selected meat quality traits.

| Traits | weeks 1-3 | weeks 4-6 | weeks 7-9 | weeks 1-9 |
|---|---|---|---|---|
| l pH 45 min postmortem | 0.059 | -0.122 | -0.282** | -0.154 |

| | | | | | |
|---|---|---|---|---|---|
| oin | pH 24 h postmortem | **0.073** | **-0.322**$^{**}$ | **-0.059** | **-0.247**** |
| | intramuscular fat (%) | **-0.155** | **-0.054** | **-0.052** | **0.009** |
| | water holding capacity of meat (%) | **0.277**$^{**}$ | **0.113** | **0.086** | **0.038** |
| | colour lightness (L*) | **0.188**$^{*}$ | **0.052** | **0.024** | **0.089** |
| | redness (a*) | **0.021** | **0.126** | **0.057** | **0.117** |
| | yellowness (b*) | **0.235**$^{**}$ | **0.192**$^{*}$ | **0.146** | **0.209*** |
| ham | pH 45 min postmortem | **0.037** | **-0.077** | **-0.135** | **-0.062** |
| | pH 24 h postmortem | **0.187**$^{*}$ | **-0.219**$^{*}$ | **-0.083** | **-0.185*** |

*** highly significant correlations at p< 0.01, * significant at p<0.05*

## Discussion

Division of the animals into groups differing in daily feed intake showed this trait to be related to the other fattening traits. This is indicated by the significant ($P \leq 0.05$) or highly significant differences ($P \leq 0.01$) between the groups. Analysis of the selected indicators of fattening performance in the studied group of PL pigs showed the highest rate of growth in the group with highest feed intake (above 2.58 kg). These animals reached the slaughter weight of 100 kg around 8 days earlier than the group of animals with lowest feed intake (below 2.4 kg), but when considering the entire fattening period they consumed most feed (almost 20 kg more feed compared to the former group). As a result, the animals with high feed intake had the poorest feed conversion efficiency. According to Fandrejewski (1997), increased feed intake always has a negative effect on feed conversion, which is particularly evident in pigs later in the fattening period. This is due, among others, to individual limitations related to the capacity for body protein deposition. Moreover, the cost of body protein deposition increases with increasing body weight of the animals (Fandrejewski, 1992). Therefore, long-term selection of the pigs for meatiness with the application of conventional methods gave preference to animals with higher capacity for protein deposition, which reduced their feed intake capacity (Webb and Curran, 1986).

The increased feed intake observed in our study in some of the experimental animals could result in partly unfavourable slaughter parameters. The half-carcasses of pigs with higher feed intake were characterized by noticeably poorer slaughter parameters (weight of leg and ham, weight of ham without backfat and skin, loin eye width and area, meat content of primal cuts, carcass meat content) compared to the half-carcasses of animals with lowest feed intake. Furthermore, the carcasses of these animals had the highest fat content of all the experimental groups. Just as for fattening parameters, these results point to reduced efficiency of feed conversion into the observed increase in fat-free matter in the group of animals with high feed intake. Similar observations were made by Fandrejewski and Skiba (1996) in a study in which pigs fed *ad libitum* consumed an average of 15% more feed per day, had 11% higher daily weight gains and reached slaughter weight 7 days before the animals receiving rationed feeding. However, this increased feed intake did not translate into highest deposition of meat tissue in the carcass.

The findings of Falkowski (1997) indicate that the higher growth rate of *ad libitum* fed animals translates into poorer feed conversion. However, the meat from such fatteners has a higher content of intramuscular fat (IMF), which results in better sensory parameters (tenderness, juiciness) of the meat compared to fatteners with low rate of growth. No such relationship was observed in our study. The lack of the differences in the level of IMF was also observed by Nowachowicz et al. (2009) for a group of Polish Large White pigs differing in growth rate. The lack of such an effect is probably associated with low slaughter weight, in particular with genetic changes in the pig population in the deposition rate of meat and adipose tissue resulting from directional selection for carcass meatiness. According to Schwab et al. (2007), the current pig genotype is characterized by a high potential for meat tissue deposition when compared to the pig genotype twenty years ago. Unfortunately, according to the above authors, this rate of change is not accompanied by the rate of change in deposition of intramuscular fat. As a result, current pigs reach slaughter weight quickly but show a low IMF level.

Selection efficiency for a trait, which is measured by breeding progress, depends, among others, on the number of traits considered in selection. Therefore, in practice efforts are made to reduce the number of traits by choosing only one trait out of the group of correlated traits. Our study showed that daily feed intake is correlated more with the number of fattening days ($r_P$= -0.523) and daily gain ($r_P$=0.564) than with feed intake during fattening and feed conversion. These relationships confirmed the above-mentioned unfavourable correlations between feed intake and the group of economically important fattening traits. This is because by bringing about an increase in the level of feed intake in the population undergoing improvement, negative selection will be carried out for increased feed intake during fattening ($r_P$= 0.294) and for feed conversion efficiency ($r_P$= 0.285). It should be highlighted that this pattern takes place throughout fattening. This is indicated by the correlations calculated for weeks 1-3, 4-6 and 7-9 of fattening. According to Fandrejewski et al. (2001), daily feed intake is positively and significantly correlated with the amount of feed consumed per pig ($r_P$=0.97). A large majority of researchers reported lower correlation coefficients between daily feed intake and daily gains, similar to our results, and the phenotypic correlations observed by them were lower than their genetic equivalents (Cai et al., 2008; Do et al., 2013; Hoque et al., 2007; Suzuki et al., 2005). Thus, when selecting for growth rate and using the effect of indirect selection, one should expect a considerably higher genetic progress for this trait (feed intake) than the observed phenotypic effect. However, when considering the above correlation values and analysing the current breeding programme for the national nucleus population of pigs, in which the index of growth rate (daily gains) was assigned low weights, especially in the case of maternal breeds (such as Polish Landrace), one cannot expect a considerable improvement of feed intake in the population being improved.

As with fattening traits, in the case of slaughter parameters the estimated correlation values and their direction confirm the above mentioned undesirable effect of the feed intake of the studied animals on this group of traits. These correlations were consistent for most of the analysed indicators over the whole fattening period and in different periods of fattening. In general, increasing the feed intake of improved animals will cause a reduction in the parameters of carcass meatiness and carcass cuts, as evidenced by significant and negative correlations between these traits (weight of leg, weight of ham, loin eye width and area, meat content of primal cuts, carcass meat content). In the same way, this direction of selection will have consequences in terms of increased carcass fatness, as evidenced by significant and positive correlations between these traits (weight of loin backfat with skin, weight of ham backfat, mean backfat thickness from five measurements, C1 backfat thickness). Relevant literature data confirm the trend of the effect of feed intake on this group of traits, which was observed in the present study, but the magnitude of these correlations is slightly higher. Cai et al. (2008) obtained slightly higher correlation coefficients between daily feed intake and backfat thickness than in our study ($r_G$ = 0.57 and $r_P$ = 0.49), but these correlations were lower than the correlations with daily gain (the same as in our study). Even higher genetic and phenotypic correlations were estimated by Johnson et al. (1999) between daily feed intake and backfat thickness ($r_G$ = 0.64 and $r_P$ = 0.57). In turn, Do et al. (2013) demonstrated differences in the correlations estimated between these traits depending on the studied pig population ($r_G$ = 0.29 and $r_P$ = 0.34 for Duroc; $r_G$ = 0.41 and $r_P$ = 0.58 for Landrace; $r_G$ = 0.68 and $r_P$ = 0.62 for Yorkshire). Analogous direction and impact as in our study, were reported by Suzuki et al. (2005) between loin eye area and feed intake ($r_G$ = -0.42; $r_P$ = -0.22).

In the case of meat quality parameters, no significant relationships with daily feed intake were noted. The only significant, but relatively low, correlations were observed between daily feed intake and loin pH measured 24 h postmortem and yellowness (b*) of loin. Genetic relationships between the analogous combinations of traits, at a comparable level to ours (from $r_G$ = 0.19 to $r_G$ = 0.35) were reported by Gilbert et al. (2007). The most important indicator of meat quality from the consumer's point of view is the intramuscular fat (IMF) content of meat, because its level influences a number of parameters associated with subjective assessment of the consumed meat and meat preparations, such as juiciness, tenderness and taste (Enser, 2004). Our study failed to show the relationship of this parameter with daily feed intake of pigs. Similar conclusions were made by Cai et al. (2008), who obtained phenotypic correlations of $r_P$ = 0.08 between these traits. This does not mean that modern breeds of pig have completely lost the ability to deposit intramuscular fat in response to increased feed intake. Probably this predisposition is breed specific, which is supported by the results of research in this area performed by Suzuki et al. (2005) for Duroc animals ($r_G$ = 0.33; $r_P$ = 0.48).

These aspects provide evidence that selection for increased feed intake, despite a few improvements in terms of fattening indicators during the whole fattening period, may prove undesirable from an economic and breeding viewpoint (high feed costs, poorer feed conversion, lower slaughter parameters of the carcasses and carcass cuts, no effect on qualitative parameters of the meat). Hermesch et al. (2003) found a group of traits responsible for growth rate and meatiness parameters to be antagonistic towards economically important traits, which include daily feed intake. These observations are confirmed by the low and undesirable phenotypic correlations observed between daily feed intake and the analysed group of traits, which reduces the possibility of improving this indicator through indirect selection.

The results of the performed analyses demonstrated that Polish Landrace animals, which is the most popular pig breed in Poland, show variation in daily feed intake. This means that this breed can be divided into subgroups (subpopulations) of animals differing in feed intake capacity. Feed intake capacity of the studied animals was found to be related to fattening parameters. Animals with highest feed intake showed the highest rate of growth and required less time to reach slaughter weight. In the group of animals with high daily feed intake, undesirable relationships with some slaughter parameters were noticed. The half-carcasses of these animals were characterized by lower weight of leg and ham, lower weight of ham without backfat and skin, smaller loin eye width and area, lower meat content of primal cuts, and lower carcass meat content compared to the half-carcasses from animals with lowest feed intake. Moreover, the carcasses of these animals had the highest fat content. This was also confirmed by the correlations between these traits. The feed intake level in the analysed animals had no substantial effect on the quality of the obtained raw meat, as reflected in several physicochemical indicators.

## References

Cai W., Casey D.S., Dekkers J.C. (2008). Selection response and genetic parameters for residual feed intake in Yorkshire swine. J. Anim. Sci., 86: 287-298.

Clutter A.C., Jiang R., McCann J.P., Buchanan D.S. (1998). Plasma cholecytokinin–8 in pigs with divergent genetic potential for feed intake and growth. Domest. Anim. Endocrinol., 15: 9–21.

Do D.N., Strathe A.B., Jensen J., Mark T., Kadarmideen H.N. (2013). Genetic parameters for different measures of feed efficiency and related traits in boars of three pig breeds. J. Anim. Sci., 91(9): 4069–4079.

Enser M. (2004). The role of fatty acid in meat flavor. Proceedings of the British Society of Animal Science, Mat. Międzyn. Konf., Kraków, 14-15.10.2004 r., s. 10-13.

Falkowski J. (1997). Możliwość poprawy jakości mięsa poprzez czynniki genetyczne i żywieniowe. Współczesne zasady żywienia świń. Mat. Konf. Nauk., 3-4 czerwca 1997, PAN, Jabłonna, s. 40-46.

Fandrejewski H. (1992). Energetyczne podstawy wykorzystania paszy przez rosnące loszki. Rozpr. hab., Wyd. Wł. IFŻZw. w Jabłonnie, ss. 58.

Fandrejewski H., Skiba G. (1996). Wpływ systemu żywienia loszek na dokładność oceny ich wartości rzeźnej. Zeszyty Naukowe. Przegl. hodowl., 26: 111-117.

Fandrejewski H. (1997). Zagadnienia związane z wykorzystaniem paszy przez świnie. Współczesne zasady żywienia świń. Mat. Konf. Nauk., 3-4.06.1997, PAN, Jabłonna, s. 47-57.

Fandrejewski H., Raj S., Weremko D., Skiba G. (2001). Zagadnienie apetytu u rosnących świń z linii ojcowskich. Zesz. Nauk. AR Wrocław, 405: 53-61.

Gilbert H., Bidanel J.P., Gruand J., Caritez J.C., Billon Y., Guillouet P., Lagant H., Noblet J., Sellier P. (2007). Genetic parameters for residual feed intake in growing pigs, with emphasis on genetic relationships with carcass and meat quality traits. J. Anim. Sci., 85: 3182-3188.

Grau R., Hamm R. (1952). Eine einfache Methode zur Bestimmung der Wasserbindung in Fleisch. Fleischwirt., 32(12): 295-297.

Hermesch S., Kanis E., Eissen J.J. (2003). Economic weights for feed intake in the growing pig derived from a growth model and an economic model. J. Anim. Sci., 81: 895-903.

Hoque M.A., Kadowaki H., Shibata T., Oikawa T., Suzuki K. (2007). Genetic parameters for measures of the efficiency of gain of boars and the genetic relationships with its component traits in Duroc pigs. J. Anim. Sci., 85: 1873-1879.

Johnson Z.B., Chewning J.J., Nugent R.A. (1999). Genetic parameters for production traits and measures of residual feed intake in large white swine. J. Anim. Sci., 77: 1679-1685.

Massabie P., Granier R., Le Devidich J. (1997). Effects of environmental conditions on the performance of growing-finishing pigs. Proc. 5th Int. Symp. Livestock Environment, 2: 1010–1016.

Nowachowicz J., Michalska G., Wasilewski P.D., Bucek T. (2009). Zawartość mięsa i tłuszczu oraz jakość mięsa świń rasy wielkiej białej polskiej o zróżnicowanym tempie wzrostu. Journal Central European Agriculture, 10(1): 73-78.

Pierozan C.R., Agostini P.S., Gasa J., Novais1 A.K., Dias1 C.P., Santos R.S.K., Pereira Jr M., Nagi J.G., Alves J.B., Silva C.A. (2016). Factors affecting the daily feed intake and feed conversion ratio of pigs in grow-finishing units: the case of a company. Porcine Health Management, 2: 1-8. DOI 10.1186/s40813-016-0023-4

Raj S., Weremko D., Skiba G., Fandrejewski H. (2002). Wpływ rasy świń na strawność energii. Mat. konf. XXXI Sesji Żywieniowej KNZ-PAN, Wrocław, 11-12.06.2002, s. 91.

Różycki M., Tyra M. (2010). Metodyka oceny wartości tucznej i rzeźnej świń przeprowadzana w Stacjach Kontroli Użytkowości Rzeźnej Trzody Chlewnej (SKURTCh). Wyd. Wł. Instytut Zootechniki PIB, Kraków, XXVIII: 93-117.

SAS Institute Inc. (2001). The SAS System for Windows. Release 8.2. SAS Inst. Inc, Cary NC, USA.

Schwab C. R., Baas T. J., Stalder K. J., Mabry J. W. (2007). Deposition rates and accretion patterns of intramuscular fat, loin muscle area, and backfat of Duroc pigs sired by boars from two time periods. J. Anim. Sci., 85(6): 1540-6.

Silva C.A., Agostini, P.S., Dias, C.P., Callegari, M.A., Santos, R.K.S., Novais, A.K., Pierozan C.R., Gasa Gasó J. (2017). Characterization and influence of production factors on growing and finishing pig farms in Brazilian cooperatives. R. Bras. Zootec., 46(3): 264-272.

Suzuki K., Kadowaki H., Shibata T., Uchida H., Nishida A. (2005). Selection for daily gain, loin-eye area, backfat thickness and intramuscular fat based on desired gains over seven generations of Duroc pigs. Livest. Prod. Sci., 97: 193-202.

Thacker P.A. (2001). Water in swine nutrition. W: Swine Nutrition. Lewis A. J. i Southern L. L. red. 2nd ed. CRC Press, New York, 381–398

Webb A.J., Curran M.K. (1986). Selection regime by production system interaction in pig improvement: A review of possible causes and solutions. Livest. Prod. Sci., 14: 41-54.

Webb, A. (1989). Genetics of food intake in the pig. BSAP Occasional Publication, 13: 41-50.

Whittemore C.T., Green D.M., Knap P.W. (2001). Technical review of the energy and protein requirements of growing pigs: food intake. Anim. Sci., 73: 3–17.

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## DAILY FEED INTAKE AS RELATED TO FATTENING, SLAUGHTER AND MEAT QUALITY PARAMETERS IN PIG EVALUATED AT TESTING STATION

### SUMMARY

The aim of the study was to determine the relationships between daily feed intake and fattening, slaughter and meat quality traits in Polish Landrace pigs, and to estimate correlations between daily feed intake in different fattening periods and selected traits. The study used 122 gilts that originated from nucleus herds and were evaluated at the Pig Performance Testing Station. As a result of the study, the pigs were divided into subgroups according to feed intake capacity. The feed intake capacity of the examined animals was found to be related to the parameters of fattening and slaughter traits. Pigs with the lowest feed intake were characterized by the lowest gains from 30 to 100 kg body weight, but showed the highest efficiency of feed utilization ($P \leq 0.01$). This group of animals was also characterized by the best parameters in terms of meatiness and fatness in the carcass and the weight of the most valuable primal cuts ($P \leq 0.01$). Statistically significant ($P \leq 0.01$) correlations were found between daily feed intake during the whole fattening period and fattening traits, some slaughter traits (weight of loin and ham, mean backfat thickness from 5 measurements, loin eye area, meatiness of primal cuts and carcasses) and $pH_{24}$ in loin.

Key words: pigs, daily feed intake, fattening, slaughter and meat quality traits