

Use of automatic system for pig feed consumption control

L. Paura* and D. Jonkus

Latvia University of Agriculture, Faculty of Agriculture, Institute of Agrobiotechnology,
Liela str. 2, LV-3001, Jelgava, Latvia

*Correspondence: liga.paura@llu.lv

Abstract. The aim of this study was to analyse average daily gain and feed conversion ratio, and to estimate daily gain and feed conversion ratio during the pig fattening period. 100 pigs from the same herd were housed in pens of around 10–15 animals and fed ad libitum with one single-place electronic feeder. Average on-test weight and off-test weight were 34.8 kg and 119 kg, respectively. Average daily gain, average daily feed intake and feed conversion ratio were computed. During investigation the average daily gain was 0.788 kg, the daily feed intake was 2.25 kg and feed conversion ratio was 2.86 kg. The differences in investigated traits between male and female pigs were significant. Generally, male pigs had greater off-test weight (+7.3 kg, $p < 0.05$), average daily gain (+0.037 kg, $p < 0.1$) and feed conversion ratio (+0.13 kg) in the fattening period. Average daily gain and feed conversion ratio were also calculated based on 100 kg off-test weight. If pigs will be fattening till 100 kg, than daily feed conversion ratio decreased and is 2.25 kg, but average daily gain increased and is 0.840 kg. The average fattening duration when pig has 100 kg off-test weight was 154.8 days. Phenotypic correlations between production and feeding traits were calculated. Correlation between average daily gain and feed conversion ratio was moderate negative ($r = -0.542$), pigs with higher average daily gain had better feed conversion ratio.

Key words: growth traits, feed intake, FCR, pigs.

INTRODUCTION

Pig selection program in Latvia is focused on production traits such as test daily gain, lifetime daily gain, and backfat thickness, whereas in pig selection program of different countries is paid more attention to production costs and the efficiency of conversion of feed.

Two maternal breeds – Landrace and Yorkshire and two paternal breeds – Pietrain and Duroc – are used in the pig breeding programme in Latvia. In the breeding goals for the maternal breed is put more attention on maternal traits (Paura et al., 2014). Paternal breeds' selection is focused on production traits. Many of the pigs on commercial farms are crossbred pigs.

Profitability in commercial pork production is determined not only by daily gain and backfat thickness, but also by lean growth rates and levels of feed intake and feed conversion ratio (FCR). There are many factors that influence feed intake and FCR. FCR are associated with breed, sex effect, and feed and management system.

According to Canadian Swine Improvement Program investigation Duroc and Yorkshire pigs grew faster than Landrace, with a difference of about 15 g d⁻¹, but there

was not significant differences in feed intake and feed efficiency among breeds (CCSI report, 2007). Differences in pigs grow performance and FCR were found between barrow and female pigs. The barrows' grow performance and daily feed intake were higher, and lower feed efficiency or FCR than in female pigs (Latorre et al., 2003; Quiniou et al., 2010). Coffey et al. (1995) concluded, that gilts consumed 10 to 12% less feed and were about 4% more efficient in converting feed to body weight gain.

The aim of this study was to analyse grow performance and FCR during the fattening period of crossbred pigs used for commercial pork production in Latvia and to compare grow performance and FCR of barrow (males pigs) and female pigs.

MATERIALS AND METHODS

Data for this study included 100 pigs from the same herd. The performance test is carried out with Landrace x Pietrain and Landrace x Jorkshir x Pietrain crossbreds. Individual piglet weight at weaning was recorded. Piglets were weaned at 28 days of age and 70–77 days of age were allocated to tests. 10 till 12 pigs from one or two litters were grouped in one group into batches. Groups were held in pens with a single-place electronic feeder and fed ad libitum with the same feed composition.

Weight and feed intake were measured one time per week on each pig during a test period. Individual feed intake, weight and FCR were recorded when a pig visited single-place electronic feeder (Pig performance station, Holland). The Pig performance station consists of two parts: a feed through with weighing unit for the feed and a separate weighing unit for the pig. The pig-weighing platform can be easily adjusted to the size of the pig and the system has enough capacity for 15 pigs to feed.

FCR represents the proportion of food that is converted into the meat. FCR was calculated for week periods and over a set period as daily feed intake and average daily gain ratio. Average daily gain and daily feed intake were calculated for week periods and a test period. Average daily gain was calculated as the total weight in week or test period divided by the number of days. Average daily feed intake was calculated as the total amount of recorded feed intake divided by the number of the days. Average daily gain and FCR were also calculated based on 100 kg off-test weight. In total 1500 individual visits were recorded. Test period was 98–112 days. In the end of the test period, when the pigs reached in average 120 kg, ultrasound backfat thickness was measured.

The investigation data were processed using a program *R*. For comparison of investigation traits between sexes the *t-test* was used.

RESULTS AND DISCUSSION

Phenotypic description of traits

Average on-test weight and off-test weight were 34.8 kg and 119 kg, respectively. During investigation the average daily gain was 0.788 kg, the daily feed intake was 2.25 kg and feed conversion ratio was 2.86 kg (Table 1).

The results show the crossbreed animals' daily feed intake for the testing period was in range from 1.62 to 2.93 kg d⁻¹ with variation 14.88%. In Baumung et al. (2006) study was reported the average daily feed intake during the fattening period from 30 kg live weight up to 106 or 110 kg Landrace animals showed the highest feed intake per

test day – 2.35 kg d⁻¹. The highest Landrace daily feed intake results followed by Large White (2.29 kg d⁻¹) and Pietrain (1.72 kg d⁻¹) and differences between breeds were detected.

Table 1. Summary statistics for grow performance and feed efficiency traits ($n = 100$)

Traits	<i>Min</i>	<i>Max</i>	\bar{x}	<i>S</i>	<i>S, %</i>
On-test weight, kg	20.5	54.5	34.84	8.02	23.03
Off-test weight, kg	88.5	144	119.00	10.13	8.52
Daily gain, kg d ⁻¹	0.509	1.010	0.788	0.114	14.56
Feed intake, kg	170.3	306.4	237.08	31.60	13.33
Daily feed intake, kg d ⁻¹	1.62	2.93	2.25	0.34	14.88
Feed conversion ratio	2.29	3.83	2.86	0.33	11.54
Back fat thickness, mm	7	23	14.2	3.5	24.82

Analysis of the traits by sex

The male and female pigs were grouped into one pen and during the fattening period there were differences by sex.

The differences in investigated traits between male and female pigs were significant. Male pigs had higher off-test weight (+7.3 kg, $p < 0.05$), average daily gain (+0.037 kg d⁻¹, $p < 0.1$) and backfat thickness (+2.5 mm, $p < 0.05$) in the fattening period. Generally, male pigs had higher daily gain in the fattening period; they also ate more feed (2.32 kg d⁻¹) and tended to have poorer FCR than female pigs. The female pigs are characterized by lower traits variation than male pigs' traits (Table 2).

Table 2. Analysis of production and feed efficiency traits by sex

Traits	Male		Female		<i>p-value</i>
	\bar{x}	<i>S</i>	\bar{x}	<i>S</i>	
On-test weight, kg	35.23	8.30	34.83	7.49	0.838
Off-test weight, kg	122.04	9.43	116.26	8.72	0.011
Daily gain, g d ⁻¹	0.809	0.111	0.764	0.106	0.098
Feed intake, kg	243.30	32.37	231.22	28.64	0.109
Daily feed intake, kg d ⁻¹	2.32	0.34	2.19	0.30	0.108
Feed conversion ratio	2.92	0.34	2.79	0.31	0.106
Back fat thickness, mm	15.4	3.6	12.9	2.6	0.003

According to the investigation of O'Connell et al. (2006) the average daily gain, when weight ranges from 80 to 100 kg, was 0.882 kg d⁻¹ for male and 0.750 kg d⁻¹ for female pigs, which corresponds to the average FCR – 2.92 kg and 3.30 kg, respectively. In different study considered to have separate diets for females, which have lower requirements for protein and amino acids at heavier weights (O'Connell et al. 2005, 2006) and is appropriate to keep separate male and female pigs during fattening period. When sex segregation was not practiced (mixed-sex pens), FCR was around 3.8% poorer (Agostini et al. 2014).

Analysis of the traits during the fattening period

Pig fattening started when pigs were 70–77 days old and the length of the fattening period depended on the intensity of pigs' growth and it was 98–112 days. In the end of fattening period pigs were minimum 168 and maximum 182 days old.

Pigs' average daily weight gain and food consumption ratio during the fattening period given in Fig. 1.

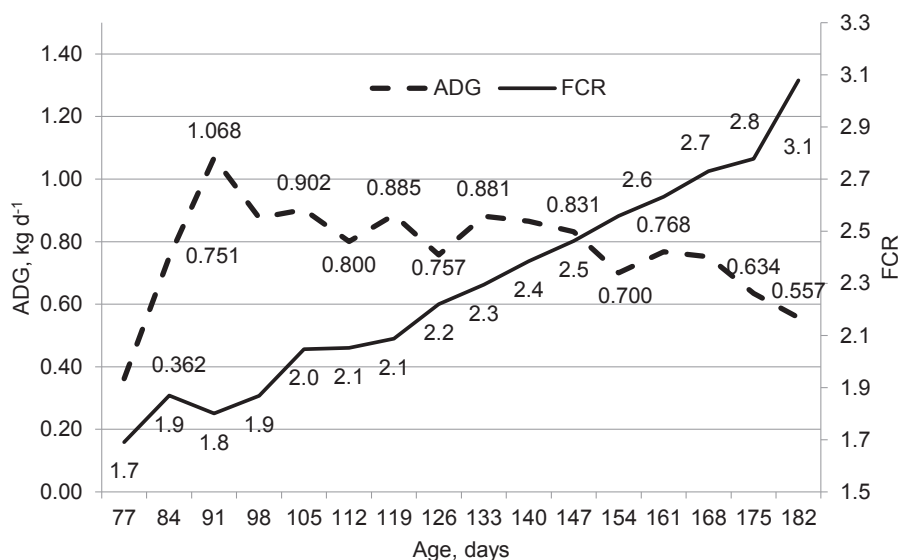


Figure 1. Average daily gain (ADG) and FCR during the fattening period.

In the first week of fattening, when pigs was 70–77 days old, the average daily weight gain was only 0.362 kg d⁻¹ and was the lowest in the whole fattening period. It can be explained by the stress during adaptation period.

The higher average daily weight gain pigs showed in the 3rd fattening week and it was 1.068 kg d⁻¹. During the fattening period average daily weight gain was variable and in the end of fattening period when pigs was 175–182 days old it was significantly decreased till 0.557 kg d⁻¹.

The amount of feed consumed per day is highly influenced by age and live weight of animals (Baumung et al., 2006). High feed intakes in the finishing stage of fattening will improve the average daily gain – almost fat gain, which results in a higher feed conversion ratio and giving a higher feed cost per kg gain and less desirable carcass (Geurts & Hazzledine, 2011).

In our study the FCR increased during fattening period and in the last five weeks of the fattening period increased and reached 3.08. FCR increased with the age of the pig. This indicates that a slow fattening is not profitable, because the food consumption increased. Pigs were fattened till 120 kg of average live weight (Fig. 2). 154 days old pigs reached 102.2 kg the average live weight with average FCR 2.56.

Phenotypic correlation between average daily gain and feed conversion ratio was moderate negative ($r = -0.542$), pigs with higher average daily gain had better feed conversion ratio.

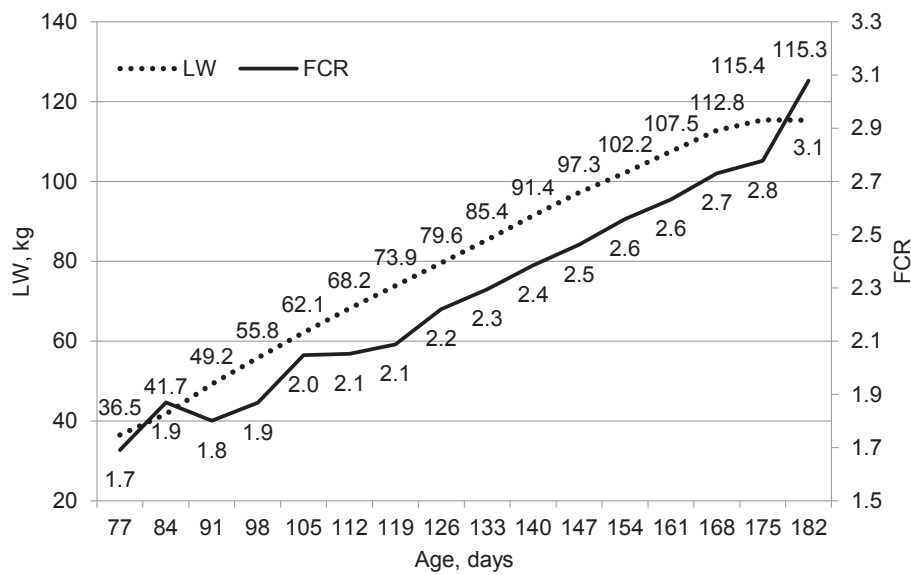


Figure 2. Average live weight (LW) and FCR during the fattening period.

Average daily gain and feed conversion ratio were also calculated based on 100 kg off-test weight. If pigs will be fattening till 100 kg, than daily feed conversion ratio decreased and is 2.25, but average daily gain increased and is 0.840 kg d⁻¹. The 100 kg off-test weight pigs reached when they were 154.8 days old.

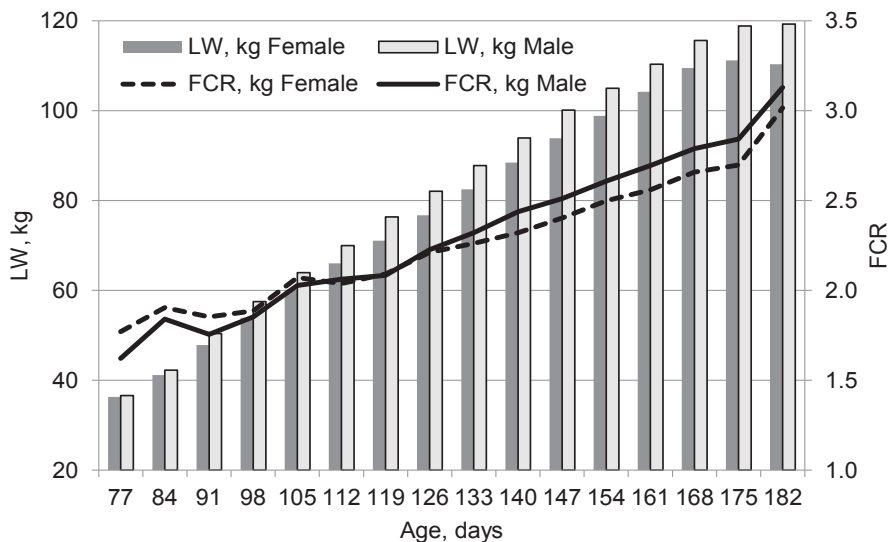


Figure 3. Average live weight (LW) and FCR during the fattening period by sex.

The average live weight and FCR in the first part of fattening period was not differing between female and male pigs (Fig. 3). A clear difference for average live weight and FCR between sexes ($p < 0.05$) was detected starting from the 70th day of fattening period, when pigs were 147 days old. Male animals showed higher live weight and higher FCR.

According to investigations carried out by Moore et al. (2012), pigs from 20 to 50 kg live weight, entire males had a similar average daily gain, lower feed intake and better feed gain ratio, but from 50 to 100 kg live weight, entire males had a higher average daily gain, similar feed intake and improved feed gain ratio compared with females.

In the current study the live weight of male pigs in the end of fattening period was 8.9 kg greater ($p < 0.05$) and their feed conversion ratio was 0.11 poorer than female pigs.

CONCLUSIONS

The results of this study showed, that crossbred pigs from 35 to 120 kg live weight had the average daily gain 0.788 kg d⁻¹, the daily feed intake 2.25 kg and feed conversion ratio 2.86. Male pigs had higher daily gain in the whole fattening period; they also ate more feed and had higher FCR than female pigs. Male and female pigs had differences in FCR, because they were kept in mixed groups or the same differences would have been observed if pigs will be keeping separate. Male pigs showed higher live weight and the higher FCR starting from the 70th day of fattening period, when pigs were 147 days old. It is concluded, if pigs will be fattening till 100 kg, than whole fattening period daily feed conversion ratio decreased from 2.86 to 2.25, but average daily gain increased from 0.788 kg d⁻¹ to 0.840 kg d⁻¹.

ACKNOWLEDGEMENTS. Financial support for the research project was provided by Latvia Ministry of Agriculture. We thank herd manager A. Kokts for providing the data.

REFERENCES

- Agostini, P.S., Fahey, A.G., Manzanilla, E.G., O'Doherty, J.V., De Blas, C. & Gasa, J. 2014. Management factors affecting mortality feed intake and feed conversion ratio of grow-fattening pigs. *Animal* **8**, 1312–1318.
- Baumung, R., Lercher, G., Willam, A. & Sölkner, J. 2006. Feed intake behaviour of different pig breeds during performance testing on station. *Arch Tierzucht* **49**, 77–88.
- Coffey, R.D., Parker, G.R. & Laurent, K.M. 1995. Feeding Growing-Finishing Pigs to Maximize Lean Growth Rate. *Online publications ASC-147*, 1–6.
<http://www2.ca.uky.edu/agc/pubs/asc/asc147/asc147.pdf> Accessed 26.01.2016.
- Effect of breed and sex on growth, carcass and meat quality traits. CCSI, 2007
http://www.ccsi.ca/Reports/Reports_2007/Effect_of_breed_and_sex_on_growth,_carcass_and_meat_quality_traits.pdf. Accessed 25.01.2016.
- Geurts, J. & Hazzledine, M. 2011. Factors influencing feed conversion in the finisher barn. *Western Hog Journal*. <http://www.prairieswine.com/factors-influencing-feed-conversion-in-the-finisher-barn/> Accessed 18.01.2016.

- Latorre, M.A., Lázaro, R., Gracia, M.I, Nieto, M. & Mateos, G.G. 2003. Effect of sex and terminal sire genotype on performance, carcass characteristics, and meat quality of pigs slaughtered at 117 kg body weight. *Meat Science* **65**, 1369-1377.
- Moore, K.L., Mullan, B.P., Campbell, R.G. & Kim, J.C. 2012. The response of entire male and female pigs from 20 to 100-kg liveweight to dietary available lysine. *Animal Production Science* **53**, 67–74.
- O’Connell, M.K., Lynch, P.B. & O’Doherty, I.V. 2006. Determination of the optimum lysine concentration for boars and gilts penned in pairs and in groups in the weight range 60 to 100 kg. *Animal Science* **82**, 65–73.
- O’Connell, M.K., Lynch, P.B. & O’Doherty, J.V. 2005. A comparison between feeding a single diet or phase feeding a series of diets, with either the same or reduced crude protein content, to growing finishing pigs. *Animal Science* **81**, 297–303.
- Paura, L., Jonkus, D. & Permanickis, U. 2014. Genetic Parameters and Genetic Gain for the Reproduction Traits in Latvian Landrace and Yorkshire Sows Populations. *Animal and Veterinary Sciences* **6**, 184–188.
- Quiniou, N., Courboulay, V., Salaün, Y. & Chevillon, P. 2010. Impact of the non castration of male pigs on growth performance and behaviour – comparison with barrows and gilts. In: *61st Annual Meeting of the European Association for Animal Production*. EAAP, Heraklion, pp. 1–7 (in Greece).