THE GROWTH PERFORMANCE AND BEHAVIOUR OF PIGS RAISED IN CONVENTIONAL AND ALTERNATIVE SYSTEMS

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Summary. The growth performance and behaviour of intensively raised pigs were compared under conventional (indoor) and alternative (free-range) rearing systems. Three analogous by parentage, age, weight, condition score and gender Norwegian Landrace and Norwegian Landrace x Pietrain crossbred pig groups of 14 animals each were used in the study. The pigs were housed in either indoor pens (Indoor group) or outdoor enclosures (Outdoor 1 and Outdoor 2 groups). The pigs in all groups were given compound feed *ad libitum*. The diet of Outdoor 2 group pigs was additionally supplemented with red clover grass. The rate of stocking in Indoor group was 7 pigs per 9.37 m^2 area pens. Pigs in Outdoor groups were kept in electric wire enclosures of 900 m^2 area each.

The study indicated that the pigs in Outdoor 1 group gained daily on 2.6% less and pigs in Outdoor 2 group gained daily on 5.1% more weight compared to pigs in Indoor group, but the differences were statistically not significant.

The pigs in Outdoor groups consumed daily on 5.6% and 5.2% compound feed less and compound feed consumption per kg gain was on 4.5% and 11.5% lower compared to pigs in Indoor group. In addition, the pigs in Outdoor 2 group used on 7.3% lower amount of compound feed per kg gain compared to pigs in Outdoor 1 group.

The behavioural studies indicated that the pigs in Outdoor groups daily spent more time for rooting, respectively, 100.9 min (461.6%, P=0.014) and 60.9 min (318.3%, P=0.017). In general, the pigs in Outdoor groups were on 278.0% (P=0.005) and 219.2% (P=0.010) more active compared to pigs in Indoor group. The pigs in Outdoor 2 group spent less time for environmental exploration (rooting behaviour) in comparison to pigs in Outdoor 1 group, but the differences were statistically not significant.

Keywords: indoor, outdoor, growth rate, behaviour, red clover.

TRADICINE IR ALTERNATYVIA SISTEMA AUGINTŲ KIAULIŲ PRODUKTYVUMAS BEI ELGSENA

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Santrauka. Tirta intensyviai tradicine ir alternatyvia sistema augintų kiaulių produktyvumas bei elgsena. Tyrimų metu analogų principu pagal kilmę, amžių, svorį, įmitimą ir lytį sudarytos trys Norvegijos landrasų ir Norvegijos landrasų x pjetrenų mišrūnių kiaulių grupės, po 14 gyvulių kiekvienoje. Vienos grupės kiaulės augintos kiaulidėje (tvarto grupė), kitų dviejų – aptvaruose lauke (pirma lauko ir antra lauko grupės). Visų grupių kiaulės iki soties šertos kombinuotaisiais pašarais. Antros lauko grupės kiaulės papildomai gavo raudonųjų dobilų žolės. Kiaulidėje (tradicine sistema) augintos kiaulės laikytos 9,37 m^2 ploto garduose po 7 gyvulius. Abiejų lauke (alternatyvioje sistemoje) augintų grupių kiaulės laikytos 900 m^2 ploto elektros užtvara aptvertuose aptvaruose po 14 gyvulių.

Tyrimų duomenimis, lauke augintos kiaulės, šertos tik kombinuotaisiais pašarais, per parą priaugo 2,6 proc. mažiau, o lauke augintos ir papildomai gavusios žolės – 5,1 proc. daugiau negu augintos tvarte, tačiau skirtumai tarp grupių buvo statistiškai nepatikimi.

Abiejų lauke augintų grupių kiaulės, šertos tik kombinuotaisiais pašarais bei šertos kombinuotaisiais pašarais ir papildomai žole, per parą kombinuotųjų pašarų suėdė atitinkamai 5,6 ir 5,2 proc. mažiau, o kilogramui prieaugio jų sunaudojo atitinkamai 4,5 ir 11,5 proc. mažiau, nei tvarte augintos kiaulės.

Lauke augintos kiaulės, šertos kombinuotaisiais pašarais ir žole, kombinuotųjų pašarų per parą suėdė beveik tiek pat, o kilogramui prieaugio pašarų sunaudojo 7,3 proc. mažiau, negu lauke augintos kiaulės, šertos tik kombinuotaisiais pašarais.

Elgsenos tyrimų duomenimis, lauke augintos kiaulės, šertos tik kombinuotaisiais pašarais arba šertos kombinuotaisiais pašarais ir papildomai žole, atitinkamai 100,9 min. (461,6 proc.; p=0,014) ir 60,9 min. (318 proc.; p=0,017) laiko kniso ilgiau, negu augintos tvarte. Iš viso abiejų lauke augintų grupių kiaulės atitinkamai 278,0 (p=0,005) ir 219,2 proc. (p=0,010) ilgiau buvo aktyvios. Lauke augintos grupės kiaulės, šertos kombinuotaisiais pašarais ir papildomai žole, mažiau laiko kniso negu kiaulės, šertos tik kombinuotaisiais pašarais, tačiau nustatyti skirtumai tarp grupių buvo statistiškai nepatikimi.

Raktažodžiai: tvartas, laukas, augimo sparta, elgsena, raudonieji dobilai.

Introduction. In the recent decades of the overpast century pigs were continuously confined to a limited space for economical and health reasons, resulting in the production of considerable quantities of meat. Although confinement housing of pigs allows optimal thermal conditions to be maintained (Hayne et al., 2000), but increases their aggressiveness and stress susceptibility (Beattie et al., 2000) and restricts the biological and etiological demands of animals (Hötzel at al., 2004). Nowadays consumers have become more interested in buying products from animal that are kept in welfare friendly systems. Therefore, in the current period studies are aimed at developing pig production systems which will meet requirements of animal health and welfare, but will not affect the intensity of production and quality of pork. A noticeable change from conventional or indoor to alternative housing systems is that pigs are kept outdoors. From animal welfare viewpoint, outdoor housing of pigs is more favourable and perceived to be more animal friendly (Gentry and McGlone, 2003; Watson et al., 2003). Outdoor pigs are offered a lot of space and environmental diversity (Lebret, 2008), and have the possibility to express their natural behaviour (Barton Gade, 2002). Plentiful space and fresh air can reduce infection pressure (Edwards, 2005) and pigs reared outdoors enjoy better health (Vaclavkova and Bečkova, 2008). Ingestion of herbage and soil by pigs at pasture can make a substantial contribution to the energy, amino acid, mineral and micronutrient requirements (Edwards, 2003). However, there are few scientific studies of outdoor growing of pigs. Equally, different researchers indicated contradictory results of pig performance. Some of the authors, such as Stern et al. (2003) reported that daily weight gain were higher for pigs outdoors than indoors during year one, but were similar for year two. Gentry et al. (2002, 2004) also indicated, that in mild climates pigs outdoors may grow faster or similarly to pigs indoors during warm months, but gain:feed ratio for pigs finished outdoors compared to pigs finished indoors was lower. However, Sather et al. (1997), Micklich et. al. (2002), Hoffman et al. (2003) found that free-range reared pigs had a slower growth rate than confinement reared pigs. However, the interest in outdoor raising of pigs is stimulated by the possibility to take the market niche for higher quality production including the ecological one (McGlone, 2001). Therefore it could have had influence on outdoor growing of pigs becoming a matter of greater interest in some countries, especially Europe and North America (Honeyman et al., 2006).

Pigs of local breeds are more suitable for outdoor growing. However, local pig breeds have worse carcass qualities and, therefore, are most often pushed out by hybrid pigs of specialized breeds that are adapted to the intensive pig growing systems and characterized by lean carcasses, high feed consumption efficiency and growth intensity (Kelly et al., 2007).

As outdoor raising of pigs is spreading, the question arises what influence different raising conditions have on intensively raised highly-muscled pigs. Therefore, the aim of this study was to investigate the growth and behaviour of highly muscled pigs that were kept in two contrasting - indoor and outdoor (free-range) – housing systems and fed balanced compound feed *ad libitum*.

Material and methods. The study with 42 Norwegian Landrace and Norwegian Landrace x Pietrain crossbred pigs from three months of age till the end of fattening was carried out at the Institute of Animal Science of Veterinary Academy of Lithuanian University of Health Science. The pigs were allotted to three (Indoor, Outdoor 1 and Outdoor 2) analogous by parentage, age, weight, condition score and gender groups of 14 animals each.

The pigs of all groups were fed *ad libitum* on home-made compound feed. The diet of Outdoor 2 group pigs was additionally supplemented with red clover grass. The composition and nutritive value of the compound feed and grass are indicated in Tables 1 and 2, respectively. The animals had the access to the grass from additionally fitted feed-trough of 1.0 m length. Water was provided by water nipples for the pigs in all groups.

Table 1. **Composition of compound feeds**

	Period	
	Growing	Finishing
Barley, %	50.45	61.58
Triticale, %	-	30
Wheat, %	11	-
Maize, %	20	-
Soybean oilmeal, %	14	6
Vegetable oil, %	1.6	-
Limestone, %	1.4	1.35
Monocalcium phosphate, %	0.4	0.07
Organic acid "Bioproplus", %	0.15	-
Premix „Unimix Growers", %	1	-
Premix "Unimix Finishers", %	-	1

Table 2. **Chemical composition and nutritive value of feeds**

Analytical data/kg feed	Compound feed		Red clover grass
	Period		
	Growing	Finishing	
Dry matter, kg	0.896	0.902	0.211
Metabolizable energy, MJ	13.1	12.4	2.3
Crude protein, g	167.3	144.1	41.4
Lysine, g	7.5	5.2	1.8
Methionine, g	2.1	1.7	0.3
Threonine, g	5.9	5.0	1.7
Fibre, g	46.0	58.2	43.2
Calcium, g	10.5	9.2	4.2
Phosphorus, g	3.6	3.5	0.6

The Indoor group pigs were raised in a pigsty in pens of 9.37 m^2 area. The stocking rate was 7 pigs per pen with 1.34 m^2 concrete floor area per animal and 0.69 m^2 of lying area covered with rubber mats. Outdoor 1 and Outdoor 2 group pigs were kept in electric wire enclosures of 900 m^2 area each. The enclosures were fitted with pig houses of 9.1 m^2 area, sheds of 10 m^2 area and rain protected feeding areas of 6.3 m^2.

The pens and the enclosures were equipped with troughs for pig feeding. The space allotted per pig was 0.40 m of the trough length.

The pigs were placed in the pigsty and outdoors in June. The trial was completed in October.

During the trial all the feeds were weighed daily individually for each pen indoors and enclosure outdoors before feeding. The feed allowance was adjusted according to the feed intake. Grass residues were weighed prior to every following feeding. The chemical composition and nutritive value of the feeds were analysed according to the standard methods (AOAC, 1990) at the Analytical laboratory of the Institute of Animal Science.

Air temperature and relative air humidity were recorded using LogTag Humidity&Temperature Recorder (NAXO-8).

Growth intensity at different growing periods was determined by individual weighing of pigs before a.m. feeding at the start of the trial, every month during the trial and at the end of the trial.

The behaviour of pigs was followed with one's eyes on three occasions per group every 15 minutes during the 24-h period from 6.00 hours every month. The observations contemporaneously were recorded by one observer. The behaviour patterns according to ethograms given in Table 3 were observed.

Table 3. **Definitions of behavioural parameters for scan sampling**

Behaviour parameters	Description
Inactive	
Lying	Pig is lying onto side or onto belly
Sitting	Pig is sitting on the rump. Forelegs are stretched straight
Standing	Pig is standing onto all legs
Active	
Walking	Pig is walking
Running	Pig is running
Rooting	Pig is trying to root on the floor indoors or into the soil
Aggression	Pig is showing of aggression with another pig
Nutrition	
Eating compound feed, grass, drinking	Pig is eating or chewing compound feed or grass from trough in feeding area
	Water nipple is in mouth of pigs
Other	
Playing	Pig is jumping, running, carrying grass or stones
Comfort	Pig is rubbing body against wall of pen, houses and feeders, pole of shades or stretching
Elimination	Defecating or urinating

The results are expressed as mean values ± standard deviation. Statistical analyses were performed with the use of software Statistica (Data Analysis Software System, Version 7.0; StatSoft, Inc., Tulsa, OK, USA). All the differences quoted in the text are significant at $P \leq 0.05$ unless stated otherwise.

Growing conditions of pigs in our investigations were in conformity to the Lithuanian animal care, management and operation legislation (No 8-500, 06/11/0997) and the Requirements for the protection of animals used for experiment and other scientific purposes (No B1-639, 18/12/2008) also EU Directive 86/609/EEC on the protection of animals used for experimental and other scientific purposes and EC recommendations on guidelines for the accommodation and care of animals used for experimental and other scientific purposes (2007/526 EC requirements).

Results. The analysis of the environmental parameters indicated that the average air temperature and relative air humidity in the growing and the finishing periods indoors were 18.7 ± 0.2°C and 82.3 ± 0.6%; 12.4 ± 0.2°C and 83.0 ± 0.6%, outdoors – 17.8 ± 0.3°C and 75.7 ± 1.2%; 8.6 ± 0.3°C and 85.1 ± 1.0% respectively. The average air temperature and relative air humidity during the trial indoors were 15.8±0.3°C and 82.6 ± 0.4%, outdoors - 13.5±0.5°C and 80.0 ± 0.9% respectively.

The lowest average daily air temperature and relative air humidity in the growing, finishing periods and during the whole trial indoors were 18.0±0.2°C and 77.5±0.7%, 11.7±0.2°C and 79.3±0.6%, 15.1±0.3°C and 78.4±0.3%, outdoors - 12.5±0.4°C and 56.8±1.8%, 5.2±0.3°C and 67.5±1.6%, 9.1±0.4°C and 61.7±1.3% respectively. Correspondingly, the highest average daily air temperature and relative air humidity in the growing, finishing periods and during the whole trial indoors were 19.6±0.2°C and 86.4±0.6%, 13.4±0.2°C and 86.5±0.5%, and 16.7±0.3°C and 86.4±0.4%, outdoors - 23.9±0.5°C and 90.5±0.7%, 12.5±0.4°C and 97.3±0.7%, 18.6±0.7°C and 93.6±0.6% respectively.

In the growing period Outdoor 1 group pigs gained daily 17.4% (P=0.040) less, in the finishing period – 21.6% (P=0.010) more weight than Indoor 1 group pigs, however, during the whole trial, Outdoor 1 group pigs gained daily on the average 2.6% less weight, but the differences were statistically insignificant (Table 4). Outdoor 2 group pigs that were offered grass in the growing period gained daily 5.5% (P=0.472) less, but in the finishing period these pigs gained daily 27.8% (P=0.001) more weight than Indoor group pigs. During the whole trial, Outdoor 2 group pigs gained daily on the average 5.1% more weight than Indoor group pigs, but the differences were also statistically insignificant.

Table 4. **Pig growth data**

Item	Groups					
	Indoor		Outdoor 1		Outdoor 2	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Growing period: Initial live weight, kg	27.64	3.94	27.68	2.95	27.64	3.76
Final live weight, kg	74.57	11.23	66.39	11.79	71.24	11.99
Growth rate, kg/d	0.760[a]	0.140	0.628[b]	0.174	0.718	0.144
Finishing period: Final live weight, kg	106.92	7.68	103.95	17.93	102.91	17.71
Growth rate, kg/d	0.763[e,g]	0.155	0.928[f]	0.149	0.975[h]	0.145
Growing-finishing period: Growth rate, kg/d	0.764	0.101	0.744	0.143	0.803	0.114
Number of feeding days per pig	104.6[a]	8.9	102.1[c]	15.5	92.6[b,d]	18.6

Within rows, means with different letters (a, b), (c, d), (e, f) and (g, h) are significantly different at P=0.040, 0.017, 0.010, 0.001, respectively

Although Outdoor 2 group pigs that were offered grass in the growing period gained daily 14.3%, in the finishing period - 5.1%, during whole trial – 7.9% more weight than Outdoor 1 group pigs, however, the differences between the groups were statistically insignificant (Table 4). Besides, the experimental pigs reached the slaughter weight 9.5 days (P=0.017) earlier.

Because feed consumption was recorded by pen indoors and enclosure outdoors, average daily feed consumption and feed efficiency were estimated by group of pigs. Compared with Indoor group pigs, Outdoor 1 and Outdoor 2 group pigs in the growing period consumed daily 13.0% and 8.3% less compound feed, respectively, whereas the feed consumption per kg gain was 4.6% higher in Outdoor 1 group and 4.2% lower in Outdoor 2 group. In this period the consumption of grass per pig in Outdoor 2 group amounted to only 0.18 kg (0.04 kg DM/d) or 1.8% of the total organic matter (Table 5).

In the finishing period Outdoor 1 and Outdoor 2 group pigs consumed daily 3.0 and 4.0% more compound feed respectively, but the feed consumption per kg gain was 15.5 and 19.3% lower than that of the Indoor group pigs. The intake of grass in this period in Outdoor 2 group pigs amounted to 0.5 kg (0.11 kg DM/d) or 3.1% of total organic matter.

Table 5. **Feed consumption**

Item	Groups		
	Indoor	Outdoor 1	Outdoor 2
Feed consumption per kg gain, kg:			
Growing period			
compound feed	2.85	2.98	2.73
grass			0.25
Finishing period			
compound feed	3.94	3.33	3.18
grass			0.51
Growing-finishing period			
compound feed	3.30	3.15	2.92
grass			0.36
Daily feed consumption per pig, kg:			
Growing period			
compound feed	2.16	1.88	1.98
grass			0.18
Finishing period			
compound feed	3.00	3.09	3.12
grass			0.50
Growing-finishing period			
compound feed	2.50	2.36	2.37
grass			0.29

During the whole trial Outdoor 1 and Outdoor 2 group pigs consumed daily 5.6 and 5.2% less compound feed and feed consumption per kg gain was 4.5 and 11.5%, respectively, lower than that of the Indoor group pigs. The intake of grass in Outdoor 2 group pigs was 0.29 kg or 2.4% of the total organic matter.

Compared with Outdoor 1 group pigs, Outdoor 2 group pigs in the growing, finishing periods and the entire trial consumed daily 5.3, 1.0% more and almost the same amount of compound feed, but the feed consumption per kg gain was 8.4, 4.5 and 7.3%, respectively, lower.

During the behaviour studies the average air temperature indoors was 16.5±0.8°C, outdoors - 13.6±3.9°C and the relative air humidity indoors was 80.0±2.3%, outdoors - 76.4±17.6%.

The main behavioural inactivity elements that were affected by rearing environment are presented in Figure 1. The time for lying was almost the same for the pigs in all groups, however, Outdoor 1 and Outdoor 2 group pigs spent 59.9% (P=0.010) and 55.8% (P=0.023), respectively, less time sitting and also Outdoor 2 group pigs spent 76.7% (P=0.046) less time standing than Indoor group pigs. There were no significant differences between the Outdoor group pigs regarding various inactivity behaviour elements. Generally, as compared with Indoor group pigs Outdoor 1 and Outdoor 2 group pigs 6.0% (P=0.028) and 5.9% (P=0.000) less time spent, respectively, for inactivity behaviour.

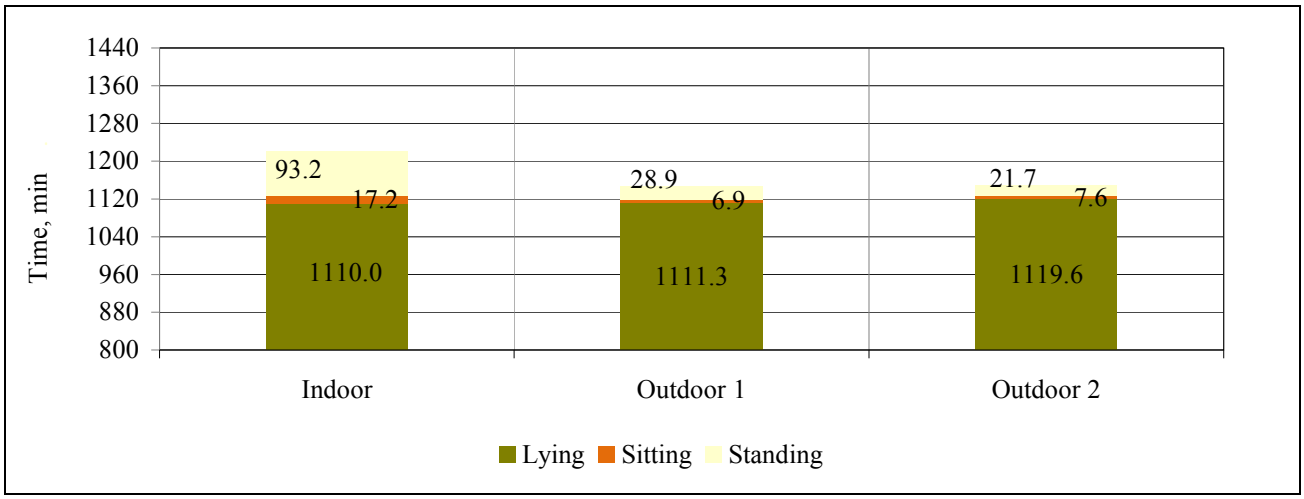

Fig. 1. **Inactivity behaviour of pigs** (min)

The activity behavioural studies indicated that the pigs housed outdoors were more active than the pigs housed indoors (Fig. 2). Outdoor 1 and Outdoor 2 group pigs spent, respectively, 100.9 min (461.6%, P=0.014) and 60.9 min (318.3%, P=0.017) more time rooting. Also Outdoor 1 and Outdoor 2 group pigs showed more walking and running behaviour than Indoor group pigs, however the differences between the indoor and outdoor housed pigs were insignificant. There were no significant differences between the Outdoor group pigs regarding various activity behaviour elements. In general Outdoor 1 and Outdoor 2 group pigs were, respectively, 278.0% (P=0,005) and 219.2% (P=0,010) more active than Indoor group pigs. There were no significant differences between the groups regarding aggressiveness, nutrition and other behavioural elements, however, in comparison with Indoor group pigs both Outdoor groups pigs spent somewhat less time for eating and drinking (Fig. 3).

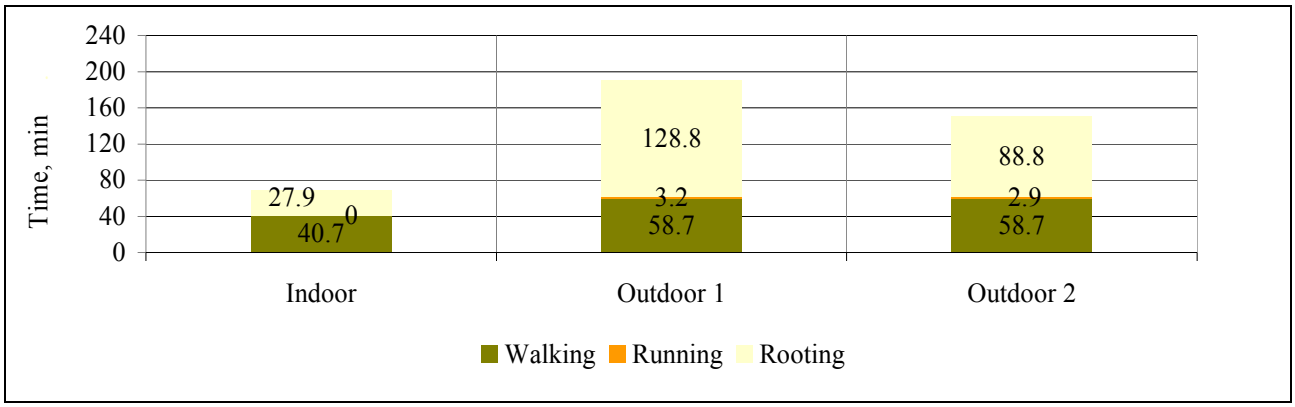

Fig. 2. **Activity behaviour of pigs** (min)

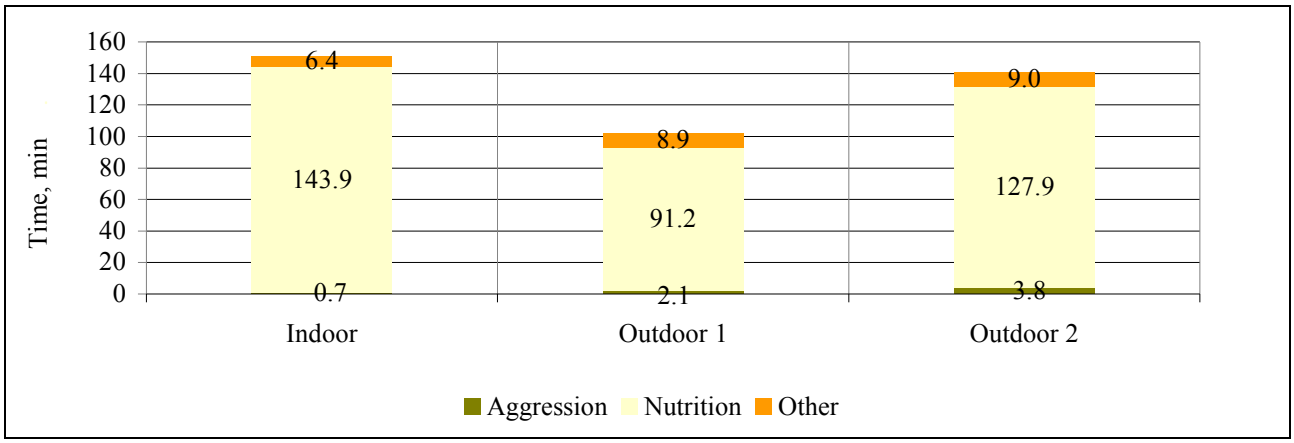

Fig 3. **Aggression, nutrition and other behaviour elements of pigs** (min)

Discussion. There have been many controversial studies considering the production of pigs raised outdoors compared to pigs raised indoors. Some authors such as Gentry et al. (2002; 2004), indicated that pigs born and reared outdoors had a higher average daily gain and at the end of finishing period were heavier than pigs born and reared indoors. Kelly et al. (2007), who compared pig housing on pasture with a simple shelter and housing in indoor straw bedded accommodation with free access to an outdoor area, pointed out that the growth rate did not differ between the housing systems. However, Sather et al. (1997) referred that pigs grown in confinement pens grew significantly faster in summer and winter seasons than those in outdoor lots. Enfält et. al. (1997) indicated that pigs reared outdoors in 50000 m^2 area as a single group had a significantly lower average daily gain than conventionally housed pigs. In our investigation the growth rate obtained in Outdoor groups pigs did not differ significantly from Indoor group pigs. Outdoor 1 group pigs grew slightly slower, Outdoor 2 group pigs – 5.1% faster. However, growth of pigs in the growing and finishing periods between Indoor and Outdoor groups was uneven. In the growing period Outdoor 1 and Outdoor 2 group pigs gained daily 17.4% (P=0.040) and 5.5% (P=0.472) respectively less, in the finishing period respectively 21.6% (P=0.010) and 27.8% (P=0.001) more weight than Indoor group pigs. Partly our findings agree with those of Lahrmann et al. (2004) who indicated that outdoor housed pigs grew faster than those housed conventionally in weaning and fattening periods. In their study Lebret et al. (2002) pointed out that pigs reared indoors at an ambient temperature of 24°C gained daily on the average 9% more weight than pigs reared outdoors at an ambient temperature of 26.0°C. In our research the highest average daily air temperature in the growing period indoors was 19.6°C, outdoors - 23,9°C and that also might have influenced 17.4 (P=0.040) – 5.5% (P=0.472) slower growth of pigs reared outdoors in the growing period. Hoffman et al. (2003) pointed out that not only growth rate but also average daily feed intake and consumption feed per kg gain for free range pigs were lower in comparison with conventionally housed pigs. Strudsholm and Hermansen (2005) in their research found that outdoor reared and fed *ad libitum* with concentrates throughout the growing period pigs did not affect the growth rate but consumed more feed per kg gain compared to indoor reared pigs. The results from our study showed that during the growing period Outdoor 1 and Outdoor 2 group pigs consumed daily 13.0% and 8.3% less compound feed respectively, however the feed consumption per kg gain was 4.6% higher in Outdoor 1 group pigs and 4.2% lower in Outdoor 2 group pigs in comparison with the Indoor group pigs. In the finishing period Outdoor 1 and Outdoor 2 group pigs consumed daily 3.0 and 4.0% more compound feed respectively, but the feed consumption per kg gain was 15.5 and 19.3% lower than that of the Indoor group pigs. During the whole trial Outdoor 1 and Outdoor 2 group pigs consumed daily less compound feed and feed consumption per kg gain was lower than that in the Indoor group pigs. Conversely to our findings, Gentry et al. (2004), Stern et. al. (2003) pointed that pigs reared outdoors grew faster, had higher average daily feed intake and consumed more feed per kg gain.

Some researchers have reported different effects of roughage on the performance of weanling, growing and finishing pigs. Already in 1963 Bowden and Clarke indicated that pigs receiving fresh-cut forage gained faster than pigs in drylot without grass or pigs on pasture. Martin et al. (2007) pointed out that feeding suckling piglets until 4 weeks of age on feeds containing more than 5% of high-quality low fibre Lucerne had a negative effect on their growth, however, later on up to 10% increased amount of Lucerne had no influence on the growth of piglets. Also Bikker et al. (2006) suggested that including 4.5% sugar beet pulp had no effect on the growth performance of weanling pigs. Collectively, these results indicate that several different types of fibre can be successfully fed to weanling pigs at levels between 5 and 10% without depressing growth performance. Weber et al. (2008) also indicated that diet supplementation with 7.5% distillers dried grains with soluble, soybean hulls and dried citrus pulp had no effects on growth performance. In our experiment on pigs, diet supplementation with clover resulted in insignificantly higher weight gains of pigs. However pigs that were fed grass consumed less

feed per kg gain.

Carlson et al. (1999) indicated that growing pigs of 40 to 70 kg weight can consume from 830 to 2298 g (0.16-0.44 kg DM/per day) of cut grass-clover fresh weight herbage. However, Edwards (2003) referring to Guillermo and Riart indicated that pigs of the similar weight (30-70 kg) consumed in the summer time only 0.04 kg grass (DM basis) when their access to concentrate was *ad libitum.* The results from our study also show that in the growing period (25-60 kg weight) Outdoor 2 group pigs consumed daily 0.18 kg fresh cut clover grass or 0.04 kg on a dry matter basis. This accounted for 2.4% of the total organic matter. Edwards (2003) quoted Mowat et al. (2001) who indicated that the herbage intake was 4% of the total organic material intake when the pigs of 50 to 60 kg weight were fed concentrates *ad libitum*. Our study indicated that in the finishing period the intake of grass had improved insignificantly and was 0.5 kg (0.11 kg DM basis) per pig. During the whole experimental period the average daily intake of grass per pig was much lower, i.e. 0.29 kg fresh-cut clover grass (0.061 kg DM basis). Also this result is much lower than that indicated by Danielsen et al. (2000) who pointed out that growing pigs (27-100 kg live weight) given the normal level of supplementary concentrate (*semi ad libitum*) consumed 0.8 kg fresh cut grass-clover herbage/day or about 0.15 kg DM/day.

As indicated by Høøk Presto et al. (2008), outdoor system pigs are more active than indoor system ones. Our results also demonstrated that pigs housed outdoors were more active than pigs housed indoors. The findings of Robert et al. (1993) indicated that roughages positively affected pigs by increasing their motivation to explore and forage. Our study indicated that the frequency of rooting was lower and that of eating higher for the pigs that had access to clover. The frequency of rooting was found to be higher for the pigs without additional feeding of clover. Thus, it can be conducted that the pigs with no access to grass spent more time for exploration and search for feed while those offered grass were calmer and spent more time eating. In the treatment of Høøk Presto et al. (2009) pigs were housed indoors with an access to a concrete outdoor run, where hay, grass silage and crop barley silage were given *ad libitum* in hedges. Pigs given hay, grass silage or whole crop barley silage were more active than those without the access to roughage. By increasing the time spent for eating, roughage can occupy the pigs and most likely reduce stress and contribute to less aggressive behaviours between individuals (Petersen et al., 1995; Beattie et al., 2000; Olsen, 2001; Høøk Presto et al., 2008). In our study, Outdoor 2 group pigs fed diets containing grass showed lower activity and spent 40.2% (P=0.052) more time eating, but no data was found confirming lower number of conflicts between the pigs of this group.

Conclusions. The results from our investigations indicate that outdoor (free-range) housed and fed *ad libitum* compound feed pigs had similar average growth rate as indoor pigs and slightly lower feed intake per kg gain.

The pigs in the free-range system were more active, performed more rooting behaviours. The pigs fed compound feed and additionally clover grass spent less time for environmental exploration (rooting behaviour) than those that receive only compound feed, but the differences were statistically insignificant.

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