EFFECT OF DIETARY IDEAL AMINO ACID RATIOS IN COVERED AND HULLESS – BARLEY BASED DIETS ON PIG PERFORMANCE

Lilija Degola
Institute of Agrobiotehnology, Latvian University of Agriculture, LV – 3001, Jelgava, Latvia;
Phone:+371 3005661, fax: +371 3005682, e- mail: Lilija.Degola@llu.lv

Summary. Two groups (control and experimental) of pigs were used to achieve the goal of the research. Each group consisted of 10, totally 40 cross-bred pigs- LW*PJ*LW of similar age, sex, live weight and origin. The effect of covered and hulless-barley based diets on pig performance was studied during the growing-fattening period, starting from 20 kg up to 100 kg live weight. Two kinds of feed were used. Analysing the feed content during the investigation we established that the energy concentration calculating per one kg of feed dry matter was sufficient 12.75 and 13.02 MJ kg. The protein need has also been provided 15.83 and 15.73 % of feed dry matter and digestible protein 144.0 and 158.4 g kg, depending on the age and live weight. The results showed that the inclusion of hulless-barley in pig feed slightly increased the growth of pigs liveweight and decreased the fattening period. The consumption of feed was reduced by 5 %. Economical calculations showed that hulless-barley diets decreased the feeding costs. The pig feed made of hulless – barley has a less costs about 3-4 Ls per ton than the feed made of covered barley.

According to the morphological composition of carcasses there were no significant diferences between the groups. In our experiment pigs were fed full – value and well balanced feed, therefore the indices of the carcases were high.

Key words: covered-barley, hulless-barley, carcass composition, pig nutrition.

NEPAKEIČIAMŲ AMINORŪGŠČIŲ, ESANČIŲ LUKŠTENTUOSE IR NELUKŠTENTUOSE MIEŽIUOSE, ĮTAKA KIAULIŲ PENĖJIMUI

Lilija Degola
Agrobiotechnologijų institutas, Latvijos žemės ūkio universitetas, LV-3001, Jelgava, Latvija;
tel.+371 3005 661, ,faks. +371 3005 682, el. paštas: Lilija.Degola@llu.lv

Santrauka. Tyrimams atlikti sudarytos dvi kaulių grupės (kontrolinė ir eksperimentinė), kiekvienoje po 10 kiaulių, iš viso 40 mišrūnų - LW*PJ*LW. Visos jos buvo panašaus amžiaus, lyties ir kilmės. Eksperimento metu buvo tiriama išlukštentų ir nelukštentų miežių pagrindu sudarytų racionų įtaka kiaulių organizmui augimo ir penėjimo laikotarpiu, pradedant nuo 20 kg ir baigiant 100 kg kūno masės. Kiaulės šertos dviejų tipų pašarais. Tiriant pašarus eksperimento metu nustatyta pakankama energijos koncentracija 1 kilogramui pašaro sausosios medžiagos – 12,75 ir 13,02 MJ. Proteinų taip pat pakako – atitinkamai 15,83 ir 15,73 proc. pašaro sausojoje medžiagoje, o virškinamųjų proteinų, – 144,0 ir 158,4 g/kg, priklausomai nuo gyvulio amžiaus ir kūno masės. Iš tyrimų rezultatų matyti, kad išlukštenti miežiai racione nežymiai padidino kiaulių kūno masę ir sutrumpino penėjimo laikotarpį. Pašaro sunaudota 5 proc. mažiau. Ekonominiai skaičiavimai parodė, kad tokie miežiai sumažino šėrimo išlaidas. Pašarai kiaulėms, pagaminti su nelukštentais miežiais kainavo maždaug 3-4 Ls už toną pigiau, negu pagaminti iš išlukštentų miežių.

Skerdenų morfologinėje struktūroje tarp abiejų kiaulių grupių jokių statistiškai patikimų skirtumų nepastebėjome. Eksperimento metu kiaulės buvo šeriamos visaverčiais subalansuotais pašarais, taigi skerdenų rodikliai buvo geri.

Raktažodžiai: nelukštenti miežiai, išlukštenti miežiai, skerdenų sudėtis, kiaulių mityba.

Introduction. Barley is not just barley. There is a tremendous amount of variability in the type of barley available for use in swine production. Barley can be either two – rowed or six – rowed, covered or hulless, awned or awnless.

Hullessness is mentioned as one of the desirable characteristics of forage barley, because it has been formed that the hulless- barley has a significant higher content of digestible energy than covered barley. It is mainly connected with the reduced NCP (no-starch polysaccharide) content in hulless barley, because a large part of them is located in hulls. While estimating the morfological and chemical parameters of barley grains, it has been formed that only the hulleness influence considerably the digestible energy content (Newman, 1992, Bhatty, Rossnagel,1981).

The aim of this paper is to give zootechnical and economic evalution of covered and hulless-barley based diets on pig performance.

Material and methods. The experiments carried out in the pig farm SIA PF Vecauce in which there was a sufficiently large animal number for selecting and completing the pig groups similar according to their origin, sex, liveweight and age. Cross-bred animals – LW*PJ*LW (special line for fattening) are used. The number of pigs in one group 10, total number of animals which included in experiment were 40. The experimental time from February 15 till May 20 – 104 days was supposed as variant 1, and the time from February 21 till June 11- 111days – was variant 2. Such completion of pig groups used because there was not a sufficient number of pigs for the experiment in the farm at the same time.

The holding conditions were observed and were up to the requirements of pig holding regulations as regards to the necessary area (0.6 -0.8 m^2 for one fattening pig depending on the age and liveweight) and the indices of microclimate.

The experiment took place according to a definite scheme (Table 1).

Table 1. **Scheme of the trial**

Pig group	Kind of feed
Control group	Mixed feed with covered barley
Experimental group	Mixed feed with hulless barley

Each group of pigs received a definite amount of mixed feed; the daily ration from 2.3 – 3.0 kg per an animal depending on its age and live weight. The feed was fed from automatic feeding equipment in groups, the necessary amount was calculated before hand, by weighing the amount of feed to be filled in and by recording this amount of feed every day in the data registration list.

The effect of feed was studied during the periods of pig growing and fattening from the weaning till the reaching of live weight of 95 – 105 kg. One and the same rearer fed and tended the pigs for the whole period of the experiment. The drinking water was accessible from the automatic drinking equipments. The chemical feed composition was tested in the laboratory according to the conventional methods.

In order to clarify the influence of covered and hulless-barley based diets on the carcass traits, control slaughters were done. The animal carcass was evaluated by comparing the ham weiht (kg), backfat thickness (mm), muscle-eye area (cm^2.

Estimation of economical data were carried out by recording the amount and value of the consumed feed and additives, the obtained live weight gains and marketing prices of feed. Numerical values of all the results obtained during eksperiments were biometrically processed. Statistical analyses were done using the MS Excel mathematical programme (ANOVA)- calculating arithmetical means, Standard errors, Standard deviations and dispersions.

Results. The basis of pig feeding rationing is the optimum amount of dry matter and the concentration of all feed nutrients in the dry matter. The provision of energy in the dry matter must be comformable with the growth of the live weight to be expected. It is from 9.5 – 14 MJ kg. Analysing the feed in our investigation we established that the energy concentration calculating per one kg of feed dry matter was sufficient – from 12.75 – 13.02 MJ kg. Requirement for protein is very important for pigs. The protein need has also been provided from 15.83 – 15.73 %. of feed dry matter and digestible protein from 144.0 – 158.4 g kg, depending on the age and live weight. The pigs need the biologically full – value protein because of specific processes of digestion and the strukture of the alimentary tract. Therefore, it is necessary to provide all essential amino acids (lysine, methionine, cysteine, tryptohan, treonine and others) in the feed, which provided in this experiment, including in the feed composition hulless–barley, having a better proportion in protein of these aminoacids (Degola,Beļicka, 2005).

Table 2. **Growth intensity of pigs in variant 1**

Indices	Groups	
	Control	Experimental
Average inital weight, kg	21.3 ± 0.33	22.4 ± 0.57
Average live weight at the end of experiment, kg	98.9 ± 0.52	108.4 ± 0.51
Live weight gain 104 days, kg	77.6 ± 0.55	86 ± 0.71
Average daily live weight gain, g	746	834
% against control group	100.0	110.8
Fattening period,days	170	161

Table 3. **Growth intensity of pigs in variant 2**

Indices	Groups	
	Control	Experimental
Average inital weight, kg	22.3 ± 0.51	21.3 ± 0.37
Average live weight at the end of experiment, kg	97.5 ± 0.43	100.5 ± 0.93*
Live weight gain 111 days, kg	75.2 ± 0.72	79.2 ± 0.87*
Average daily live weight gain, g	677	714
% against control group	100	105.3
Fattening period,days	178	175

*$P < 0.05$

The effect of covered and hulless-barley feed on the growth parametres of pig is presented in Tables 2 and 3. As mentioned in the methods of the experiment, the group of pigs were selected in two periods (2. variants).

The experimental group had a larger live weight at the end of trial of 9.5 kg than the control group, although differences were not significant (Table 2). The hulless-barley in feed also increased the average daily gain of pigs more 10.8%, but it may be considered only as a tendency.

Somewhat different results were obtained in variant 2. (Table 3).

In variant 2 the daily gain of pigs was comparatively lower, according 69 and 120 g in the control and experimental groups than in variant 1. It could be explained with the piglet development after the birth till the live weight of 20 kg, when their development is affected by the health of the sow, its feeding, of the sow lactation, which effect the growing intensity of piglets in their next period of life. Although the daily gain of pigs was lower than in variant 1, but differences were significantly between control and experimental group ($P<0.05$). It shows that the inclusion of hulless- barley in pig feed significantly increases the growth of live weight of pigs in this variant.

The period of fattening in both variant were shorter in experimentals groups, which means less feeding and holding costs when the hulless barley is included in the feed.

The feed consumption was larger for the experimental pig group in variant 1., but calculating the feed consumption per 1 kg of live weight gain it was 5% lower (Table 4).

Table 4. **Feed conversation in variant 1 in 104 trial days**

Indices	Groups	
	Control	Experimental
Mixed feed, kg	220.3	232.6
Feed consumption per 1 kg live weight gain, kg	2.84	2.7
Comparison with control group,%	100	95

The feed consumption in variant 2 was more 15.4 and 5.1 kg , accordinally in the control and experimental pig group, than in variant 1(Table5), it may be explained with a longer experimental period (111 days). The feed consumption per 1 kg of live weight was also larger, because of less growth of live weight during the period, but estimating in percent the consumption of feed, it was same as in variant 1-5 % less (Table 5).

Table 5. **Feed conversation in variant 2 in 111 trial days**

Indices	Groups	
	Control	Experimental
Mixed feed, kg	235.7	237.7
Feed consumption per 1 kg live weight gain, kg	3.13	3.0
Comparison with control group, %	100	95.8

Table 6. **Costs of feed per 1 pig**

Indices	Variant 1		Variant 2	
	Control group	Experimental group	Control group	Experimental group
Mixed Feed, Ls	31.28	32.22	33.47	32.92
On 1 kg live weight gain,Ls	0.40	0.37	0.44	0.42

Table 7. **Indices of carcases**

Indices	Variant 1		Variant 2	
	Control group	Experimental group	Control group	Experimental group
Carcass weight, kg	62.1 ± 1.11	68.5 ± 1.96*	63.1 ± 1.72	66.3 ± 2.67
Carcass yield, %	63	63	65	66
Ham weight,kg	11.0	12.1	11.5	12.0
Backfat thickness , mm	12	11	13	13
Muscle-eye area,cm^2	36.0	39.6	36.1	38.7

*P< 0.05

Economical calculations of the research show that hulless-barley diets decreased the feeding costs (Table 6). The pig feed made of hulless – barley has a less costs about 3-4 Ls per ton than the feed made of covered barley.

According to the morphological composition of carcasses there were no significant diferences between the groups, except the mass of the carcass of pigs, which received the hulless – barley (variant 1), but, if calculated by percent of carcass, was similar - 63%. Carcass percent of different cross-bred pigs usually is a high, in this experiment from 63-66%. Its depending on the choice of the breed and the feeding of pigs. In our experiment pigs were fed full – value and well balanced feed, therefore the indicēs of the carcases were high in both variants (Table 7).

Discussion and conclusion. Covered and hulless-barley based diets did not affected pig growth performance, feed consumption and carcass composition significantly. The results was a slightly higher in pig groups which received hulless- barley based diets.

The same results were also found in the experiments earlier when feeding diets contained hulless- barley and covered barley. Swine producers should ass that pigs fed hulless barley diets will perform the same or slightly better as that pigs consuming diets containing normal varieties of barley (Richards, 2002). The other trial results indicated that feeding hulless-barley diets with supplemental amino acids minimises the excreation of both faecal dry matter and N with no adverse effect on the performance of lean- genotype pigs (Raja R.Grandhi, 2001). In western Canada, hulless–barley is commonly used in swine diets because of its relatively high energy, protein and amino acid content which can reduce cost of protein supplements in diets. A low proportion of hulls in hulless-barley compared to covered barley results in less manure dry matter output, which is an important environmental benefit. The faecal dry matter excreation can be reduced up to 30 % by feeding hulless-barley based diets compared to regular barley diets.(Raja R.Grandhi,2001).

In the other experiments, the average daily gain and feed intake of pigs fed hulless barley diet was not significantly different from that of pigs fed hulled barley. However, the feed conversion efficiency of pigs given hulless barley was significantly better than of pigs given hulled barley (feed:gain 3.13 and 3.30) (Thacker et. al,1988).

References

1. Degola L., Beļicka I. Hulless – barley for nutrition of hig breeding value pig. In:XI Baltic Animal Breeding and Genetics conference. Palanga, May 2005. P. 202–206.
2. Bhatty R. S., Rossnagel B. G. Nutritional requirements in feed barley. In: Proceedings of the Fourth International Barley Genetic Symposium. Edinburgh. 1981. P. 341–347.
3. Newman C. W., Newman R. K. Nutritional aspects of barley seed structure and composition. In: Barley: Genetics, Biochemistry, Molecur Biology and Biotechnology, Shewry P.R.(ed) CAB International, P. 351–368.
4. Grandhi R. R. Effect of suplemental phytase and ideal dietary amino acid ratios in covered and hulless- barley based diets on pig performance and excreation of phosforus and nitrogen in manure. Can. J. Anim. Sci:81;115–124.
5. Thacker P. A., Bell J. M., Classen g.l., Campbell, and Rossnagel B.G. The Nutritive value of hulless barley for swine. Anim.Feed Sci.Tech. 19:191–196.