ZOOTECHNICAL AND ECONOMICAL EVALUATION OF PROTEIN CONTENT IN PIG DIETS AND INFLUENCE ON THE CARCASS TRAITS.

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Summary. To achieve the objective and tasks of the research we selected pigs as experimental animals at the training and research farm "Vecauce". Two groups (control and experimental) of pigs were used, each group including 15 Yorkshire x Landrace crossbredd pigs of similar age, sex, live weight and origin. The influence of a low-protein content in the diet was studied during the fattening period, starting from 50 kg up to 100 kg live weight Two kinds of feed were used. From 50 til 80 kg , control pigs were fed mixed feed with 16 % of crude protein, lysine 0.72 % and from 80 kg til 100 kg the controls received a low-protein diet – 14 % with lysine 0.72%. The experimental pigs were fed a low-protein (14 %) diet, lysine 0.75%, methionine+cystine 0.45% with a balanced content of other amino acids throughout experiment. The results showed that low protein diets decreased pig live weight, but the difference was not significant. Feed consumption per 1 kg live weight gain was also a little lower in experimental group. Low – protein content in pig diets did not lead to essential changes in "muscle – eye" area index or fat thickness, except for the amount of lean meat ($p < 0.05$). The morphological composition of the carcass did not showsignificant differences between groups. Economical calculations show that low – protein pig diets decreased the feeding costs about Ls 1.70 for 1 pig and comsumption of crude protein was lowered by 34 g .

Key words: carcass composition, low - protein diets, amino acids, pig.

ZOOTECHNINIS IR EKONOMINIS BALTYMŲ POREIKIS RACIONUOSE IR JŲ ĮTAKA KIAULIŲ GRIAUČIAMS

Santrauka. Šiame tyrime kiaulės kaip eksperimentiniai gyvuliai buvo atrinktos mokomajame tyrimo ūkyje „Vecauce". Sudarytos dvi grupės (kontrolinė ir eksperimentinė) po 15 panašaus amžiaus, lyties, svorio ir kilmės kiaulių. Eksperimentui buvo naudojami mišrūnai (jorkšyrai x landrasai). Mažiausias baltymų kiekio poreikis buvo tiriamas penėjimo metu gyvuliams nuo 50 iki 100 kg kūno masės. Kontrolinės grupės kiaulės, sveriančios 50–80 kg, buvo šeriamos mišriu pašaru, turinčiu 16% baltymų, 0,72% lizino; 80–100 kg kiaulės šertos mažai baltymų turinčiais pašarais (14% baltymų, 0,72% lizino). Eksperimentinės grupės 50–100 kg kiaulės šertos mažai baltymų turinčiu pašaru (14% su 0,75% lizino, 0,45% metionino + cistino). Įvertinus eksperimento rezultatus galima teigti, kad mažai baltymingi pašarai mažino kiaulių kūno masę, tačiau skirtumai yra nežymūs. Eksperimentinėje grupėje pašarų 1 kg priesvorio suvartota taip pat mažiau. Mažo baltymingumo pašarai neturėjo esminio poveikio raumenims ir lašinių storiui ($p<0,05$) bei morfologinei skerdienos struktūrai. Mažai baltymingas pašaras mažino mitybos išlaidas.

Raktažodžiai: griaučiai, mažai baltymingas pašaras, amino rūgštys, kiaulės.

Introduction. A correct and precise administration of nutrients to all categories of pigs is important for optimizing production. It is also essential for minimizing pollution problems from surplus nutrients in pig diets. The health status of pigs and meat quality of slaughtered pigs, may be also significantly influenced by the feed composition.

An optimal protein supply of the pig requires a precise knowledge of: the contents of available essential amino acids in the feed and requirements for amino acids.

Usually protein supply is based on the table values for total contents of amino acids in the feedstuffs, but the content as well as digestibility of amino acids, may vary significantly (Jondreville et.al., 1995). Present practical pig feeding in different countries relies on the recommendations based on empirically determined relationships between common analyses values of amino acids and observed perfomance feeding typical rations in the specific country. This may often lead to suboptimal feeding, particularly when using more alternative feedstuffs. Protein evaluation of feeds based on the crude protein content in the feed, which is calculated from total nitrogen (N) by multiplying the conversion factor 6.25, may lead to a significant overstimation of the protein 30% (Boisen, 1998).

The aim of this paper is to give a zootechnical and economic evaluation of low protein content in pig diets and influence on the carcass traits of pigs in Latvia.

Material and methods. To achieve the objective and tasks of the research we selected pigs as esperimental animals at the trainining and research farm "Vecauce".

Two groups (control and experimental) of pigs were used, in each group including 15 animals, similar by age, sex, live weight and origin. Experiments involved crossbred animals (Jorkshiras x Landrases). Animals were grouped after separation, according to the principle of fair similarity. Each animal had the individual number. Influence of low-protein content was studied durig the fattening period, starting from 50 kg up to 100 kg live weight Two kinds of feed were used according to the scheme (Table 1). Control group animals from 50 to 80 kg live weight were fed mixed feed with 16 % of crude protein, and animals from 80 kg to 100 kg of live weight received a low=protein diet – 14 %. Experimental group

animals from 50 kg to 100 kg of live weight received a low-protein (14 %) diet with the balanced contents of amino acids all time of the experiment.

Table 1. **Scheme of the experiment**

Indices	Basic feed and additives	
Live weight, kg	50 - 80	80 – 100
Control group	Mixed feed with 16 % protein content	Mixed feed with 14 % protein content
Experimental group	Mixed feed with 14 % protein content plus synthetic lysine 0.18 %	

The feed was produced at the forage production enterprise "Musa". According to a previously prepared recipe, it contained wheat, barley, wheat bran, soy exctracted meal, sunflower extracted meal and vitamin/mineral premix. To control the nutrition quality, the content of crude protein, crude fat, crude fiber, Ca (%), P (%) was determined. Chemical analyses of feed were done at the LUA scientific laboratory of Agromical analyses using the following methods: the content of dry matter was determined drying the samples at 105 ^{0}C untill obtaining a constant weight at three repeated mesure-ments; the amount of crude fat was analysed by the Soxlet method (ether extraction) – BUCHI Extraction syctem B-811; analyses of crude protein were done using the BUCHI Kjeldahe Line B-324 device; the content of crude fibre was determined by the Weende method (ISO 5498 Animal feeding stuffs), concentrations of macro elements (Ca) were determined applying the atom absorption spectrophotometry method; P was determined using the calorimetric method with ammonium molybdate solution (ISO 6491 Animal feeding stuffs) .

Dietary content of ME were calculated on the basis of the composition of the diets.(MJ, kg^{-1}) and content of amino acids calculated used table values.

Animals were fed in groups twice a day. Before starting the experiments and the end of each experimental month the live weight of each animal was individually recorded by weighing animals in the morning before feeding. Basing on the weighing results the following indices were calculated and compared:

1. Average live weight gain per day – in grams;
2. Consunption of feed for the obtaining of 1 kg live weight gain-kg;

Live pigs "muscle-eye" area (cm^2) was measured across the last rib (6 cm from midline). The backfat thickness was measured (mm). Test control was done individually weighing pigs and measuring the indices using the Renco lean-meter (Pedigree standard documents, 1999).

In order to clarify the influence of low-protein diets on the carcass traits, control slaughters were done. The animal carcass was evaluated by comparing the ham weight (kg), backfat thickness across the 6th an 7th rib (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 meat. Numerical values of all the results obtained during experiments were biometrically processed. Statistical analyses were done using the MS Excel mathematical programme (ANOVA) – calculating arithmetical means, standard errors, standard deviations and dispersions.

For the comparision of the obtained results the F-test (to compare dispersions of two clusters) and T-test (to compare arithmetical mean of two clusters) were used.

Results. The analyses of the basic feed for pigs proved that energy concentration calculating per one kg of feed dry matter was sufficient – from 12.5 to 12.8 MJ. Requirement for protein is very important for pigs. In our experiment. amount of crude protein constituted from 13.7 to 16.1 % of feed dry matter, lysine from 0.72 to 0.75 %, methionine+cystine – 0.45%. (Table 2). Although requirement to receive biologically full – value protein through is greater than ruminants , under practical conditions rate – setting and control of amino acids is limited only to the sum of lysine, methionine+cystine , what was ensured for experimental group pigs in right relationships with low- protein content in diets. When formulating pig diets the feed protein should satisfy the requirements for all essential amino acids at the lowest obtainable protein level (Boisen, 1997, 1998). In our experiment threonine and trytophan content was at the near level of requirement and amino acids relationships were right.(Fig.1.,2.,3.).

Table 2. **Nutrient content in diets fed to faltening pig**

Indices	Control group		Experimental group
Live weight, kg	50 – 80	80 – 100	50 – 100
Dry matter, %	86.5	85.5	85.5
Crude protein, %	16.1	13.7	14.0
Crude fat, %	2.3	2.2	2.4
Crude fibre, %	5.3	5.3	4.9
Ca, %	0.76	0.75	0.79
P, %	0.60	0.58	0.57
ME, MJ kg^{-1}	12.8	12.6	12.5

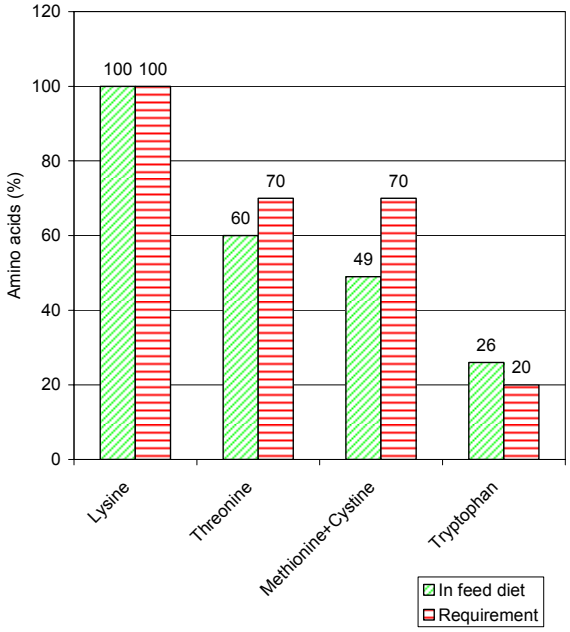

Fig.1. **Amino acids relationships (%) in control group pig diets (pig liveweight 50 -80 kg)**

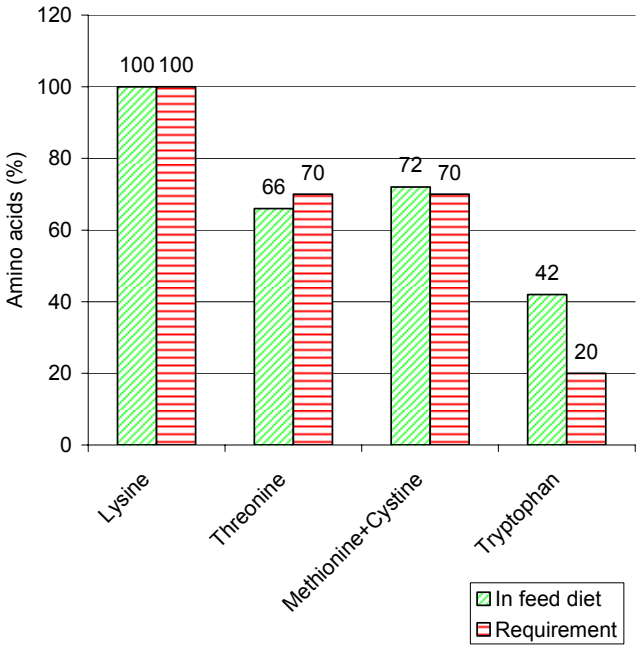

Fig. 2. **Amino acids relationships (%) in control group pig diets (pig liveweight 80-100 kg)**

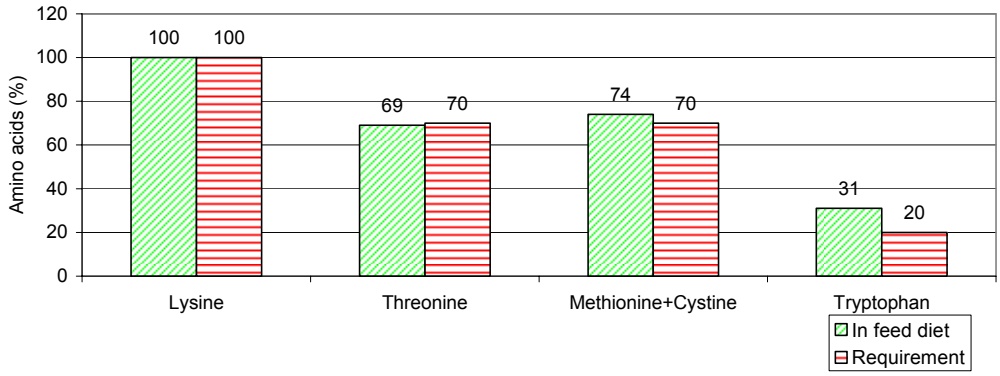

Fig.3. **Amino acids relationships (%) in experimental group pig diets(pig liveweight 50-100 kg)**

Evaluating the increase in pig live weight during the experiment, it is seen that low – protein diets decreased pig live weight, but differences were not significant (Table 3). Feed consumption per 1 kg of live weight gain was also a little lower in experimental group.

Low – protein content in pig diets has not led to essential changes in indices of "muscle – eye" area and fat thickness, except the amount of lean meat ($P < 0.05$; Table 4).

Table 3. **Growth intensity of pigs (n = 15)**

Indices	Control group	Experimental group
Average initial weight, kg	51.3 ± 2.60	52.7 ± 0.57
Average live weight at the end of the experiment, kg	96.6 ± 1.47	95.2 ± 0.95
Average daily live weight gain, g	795.0 ± 0.02	746.0 ± 0.01
Feed consumption per 1 kg live weight gain, kg	3.40	3.35

Table 4. **Meat guality of fattening pigs (n = 15)**

Group	Live weight, kg	" Muscle – eye" area, cm^2	Amount of lean, %	Fat thickness, mm
Control	96.6 ± 1.47	47.7 ± 0.98	51.6 ± 0.54	18.5 ± 0.49
Experimental	95.2 ± 0.95	49.3 ± 0.98	53.9 ± 0.70*	18.1± 0.62

* $p < 0.05$

Morphological composition of the carcass showed no considerable differences between groups (Table 5).

Economical calculations of the research show that low – protein pig diets decreased the feeding costs by about Ls 1.70 per 1 pig, and comsumption of protein was lower by 34 g (Table 6).

Table 5. **Morphological composition of the carcass (n = 3)**

Indices	Control group	Experimental group
Live weight before slaughter, kg	100.0 ± 2.87	98.3 ± 1.64
Carcass weight, kg	77.8 ± 1.30	75.8 ± 1.26
Carcass (%)	77.8 ± 5.10	77.1 ± 1.23
Carcass length, cm	93.0± 1.15	94.2 ± 0.60
Backfat thickness, mm	21.0 ± 0.51	20.8 ± 0.75
"Muscle – eye" ara, cm^2	46.1 ± 1.28	46.9 ± 1.47
Ham weight, kg	11.7 ± 0.26	11.9 ± 0.18

Table 6. **Economical estimation of the feeding low-protein diets**

Indices	Control group	Experimental group
Feed consumption per 1 kg live weight, kg	3.40	3.35
Consumption of ME for 1 kg live weight gain, MJ	42.1	41.9
Consumption of crude protein for 1 kg live weight gain , g	510	476
Feed cost for 1 pig in experiment, Ls	14.63	12.93

Discussion and conclusion. Pig growth performance and feed consumption was not significantly affected by dietary protein level as pigs were fed the lowest dietary protein level (14%). Similar results were also found in the experiment earlier when feeding diets contained 14% and 0.65%, 12% and 0.65% 12% and 0.61% of crude protein and lysine respectively. All three diets contained similar amounts of other nutrients. The average daily gain and feed efficiency of pigs fed these 3 diets were:0.53 and 4.21: 0.50 and 4.57: 0.53 and 4.14, respectively. These results indicated that pigs fed either 12% or 14% crude protein had no significant differences for daily gain provided the amount of lysine was maintained at the same level.(Zamora et.al.,1987) The other research showed that during the growing and the overall growing – finishing period, daily gain, feed intake were not affected by low protein content in diets (P>0.10; Tuitoek et.,al. 1997, Edmonds et., al. 1998). In our ezperiment we got similar results.

Pork quality was better in experimental group. Pigs in this group had backfat thickness about 0.4 mm lower, and lean meat – 2.3% higher than control group pigs . Economical calculations also showed benefit in feed costs. Feed for experimental groups was about Ls 1.70 – for one pig cheaper than for that in the control groups.

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