The effect of supplementation of different lysine sources on the performance of weaned pigs from 4 up to 10 weeks of age[1]

Risel Diana H. Likadja[2]

Department of Animal Nutrition and Feedstuff**,** Faculty of Animal Husbandry, Nusa Cendana University Kupang, ENT 85361 Indonesia

ABSTRACT: The experiment was carried out to study the effect of supplementation of 3 lysine sources (toasted soybean, fish meal and L-lysine- HC1) into a maize-base diet for weaning pigs from 4 up to 10 weeks of age. 80 weaned (40 males + 40 females) used were divided into 4 trial diets with 2 replicates. There following 4 trial diets used: diet A (weaning diet) diet B (93.31% maize + 4% vitamin mix: L-Lysine-HCI); diet C (65.46% maize + 30.54% toasted soybean meal + 4% vitamin mix) and diet D (79.95% maize + 16.05% fish meal + 4% vitamin mix). The average of the 3 studied variables (kg feed intake, kg weight gain and kg/kg feed efficiency daily) for each diet were as follows: diet A (0.707; 0.410 and 0.617); diet B (0.288; 0.008 and 0.025); diet C (0.739; 0.368 and 0.561) and diet D (0.378; 0.124 and 0.445). There was a highly significant difference ($p < 0.0001$) between the performance between diet A and diet C groups with diet B and diet D, but not significant difference ($p>0.05$) was found between the diet A and diet C. The conclusions and suggestions drawn are : the corn-toasted soybean meal diet (diet C) is comparable with the standard weaning piglet diet; supplementation fish meal at 16% gives poor performance; supplementation L-lysine-HC1 should be accompanied by fulfillment protein requirements of pigs. Diversification of feedstuffs rich in lysine is a good way of balancing pig diet formulation.

Key words: weaned pig; lysine, corn, toasted soybean, performance.

INTRODUCTION

Pigs do not only have a specific need for protein as such but rather for individual amino acids that needed for both maintenance and growth (Batterham, 1990). Lewis (1991); Baker *et al* (1993) stated that lysine is the first limiting amino acid for pigs. Such reasons are that lysine is required in high amount by pigs; presents in the least amount in the most common pig feeds. Some importances of lysine for pigs are: supporting lean tissue deposition (Riis, 1983) and muscle growth (Close, 1994). In addition, as it in the least amount, Batterham (1994) Close (1994) assured that the requirement for other amino acids is automatically attained after the lysine requirement for pigs is achieved in a diet formulation, and therefore may simplify the calculation diet formulation and minimize wasting feedstuffs. These reasons have been widely used to state lysine as the limiting amino acids in pig's diet formulation (English *et al*, 1988).

This, however, can only be achieved its the supplements used in diet formulation are feedstuff containing other amino acids, otherwise only certain amino acid will be attained whenever a synthetic amino acid is used. It means that supplementation practices in pig's diet formulation can result in difference both in nutrient content of the diet and then performance of pigs. Such reasons are feedstuffs are different in amino acids content and all synthetic amino acids provide certain amino acids (Whittemore, 1993).

Soybean is the well known grain rich in lysine content, widely used in pig's diet and can be assured to provide an adequate balance of amino acids (Whittemore, 1993; Pond *et al*, 1995). In addition, fish meal is known as the most complete and the most balance amino acids content for

[1] The acknowledgments would honorable be addressed to Prof. Henning Staun, DSc. as the Principal supervisor and Hanne Hansen as the second supervisor for this study. Also is addressed to Johanis Ly for all his supports in all steps of the study.

[2] Corresponding author: ellalikadja@yahoo.com

animals (Hollness, 1991). The Danish Feedstuffs Table shows that soybean meal contains 30.9g lysine and 20.6g digestible lysine/Kg DM; fish meal contains 56.1g lysine and 36.6g digestible lysine/Kg DM. L-lysine-HCl is one of the synthetic lysines used widely in pig diets. It contains 780g lysine/kg and 100% digestible lysine (Whittemore, 1993). Bach Knudsen and Jørgensen (1991) reported that supplementing this synthetic lysine into a barley-based pig's diet could increase deposited protein from 37 to 70% and digested protein from 31 to 52% in pigs.

However, fish meal, soybean meal and L-lysine-HCl can only be used in limited quantities. Raw soybean is known to have high levels of antinutritional factors, of which trypsin inhibitor is the main one (Liptrap and Hogberg, 1991). These antinutrients inhibit protein digestion by inhibiting the activity of trypsin in small intestine resulting in reduction digestible protein for growth. In addition, the problem with fish meal is more related to its effect of carcass quality, as Payne (1990) reported that a fishy taste occurred when the pig is fed a high fish meal in the diet. Therefore, Lewis (1991) concerns that an excess of methionine occurs when pigs are supplemented with high fish meal in the diet as it contains high methionine and pigs are particularly sensitive to excess methionine. In relation to use L-lysine-HCl in pig's diet, Bach Knudsen and Jørgensen (1991) reported that supplementing sow with 3% L-lysine-HCl of the diet DM reduced daily weight gain although there was no any toxicity symptom.

Objectives.- The objective of the study is to evaluate the effect of supplementation of different lysine sources on the performance of weaned pigs from 4 up to 10 weeks of age.

MATERIALS AND METHODS

80 weaned (4 weeks of age) pigs with similar initial body weight were used in study. The piglets were divided into 4 treatment groups consisting of 20 (10 males + 10 females) piglets per group. They were randomly allotted fed 4 treatment diets in weaning pens during first 3 weeks and then moved into grower pens during the second three weeks of study. The 4 treatment diets allotted are as follows: basal diet (weaning diet); diet I (basal diet containing 2.69%); diet II (basal diet containing 30.54% toasted soybean meal) and diet IV (basal diet containing 16.05% fish meal), as shown in Table 1. Diet and water were provided *ad libitum*.

Table 1. Nutrient composition of the treatment diets

	Diets (100 kg)			
Componenets	Basal diet	Diet I	Diet II	Diet III
Maize meal (kg)	--	93.31	65.46	79.95
L-lysine-HCl	--	2.69	--	--
Soybean meal (kg)	-	--	30.54	--
Fish meal (g)	--	--	--	16.05
Premix (kg)	--	4	4	4
Nutrients		/100% DM		
DM	87.00	86.00	87.00	88.00
CP	21.10	11.49	22.63	20.45
Fat	6.00	3.88	2.68	3.78
CF	3.00	1.38	3.89	1.73
Amino acids		g/kg DM		
Lysine	13.30	11.52	14.26	15.58
methinine	4.10	2.40	3.57	5.18
Cystine	3.20	2.19	3.54	2.57
trytophan	2.50	0.75	2.38	1.58
minerals		% DM		
Ca + P	1.00 + 0.8	0.72 + 0.71	0.93 + 0,85	1.40 + 1.54

There were 3 variables studied: daily feed intake (g), daily body weight gain (g) and feed efficiency (g weight gain/g intake). Data were analyzed using analysis of variance of completely randomized design models.

RESULTS AND DISCUSSIONS

The average of variables studied (feed intake, daily body weight gain and feed efficiency) are presented in Table 2,3 and 4.

Table 2. Average feed intake (fi) of each piglet group during 42 days (g)

Replicate	Basal diet	Diet I	Diet II	Diet III	Average
1	708	286	744	371	527
2	706	290	734	386	532
average	707 [a]	288 [c]	739 [a]	378 [b]	530

[a,b,c] Means with different superscripts indicate difference (P<0.05)

Statistically analysis indicate that there were significant differences (p<0.05) among treatment groups. It showed that basal diet and diet II groups were significantly higher than diet I and diet III, also diet III was significantly higher than diet I in average daily feed intake. Low palatability as a result of high L-lysine-HCl inclusion (diet I) and fish meal (diet III) in these diets is the main suspected influencing factor included. These results have impact on daily body weight gain as shown in Table 3.

Table 3. Average daily weight gain (dwg) of each piglet group during 42 days (g)

Replicate	Basal diet	Diet I	Diet II	Diet III	Average
1	409	9	363	121	226
2	410	7	374	126	229
average	410[a]	8[c]	368[a]	124[b]	228

[a,b,c] Means with different superscripts indicate significant difference (P<0.05)

Statistical analysis showed there were significant differences among piglet treatment groups in average daily weight gain. It showed that piglets in diet I group have the significant lowest daily body weight gain than all other 3 diet groups. Except to diet I group, diet III group performed lower average daily body weight gain compared to basal diet and diet II groups. Lower in crude protein and lysine content and poorer balance in amino acids (Table 1) are such suspected factors influencing these results. As Table 1 shows that diet I was the lowest in both crude protein (11.49%) and lysine (11.52g/kg) content which were assumed to bellow the requirement (>13%) of piglets in this age. These consequently result in significantly lower daily body weight by those two piglet groups.

Table 4. Average feed efficiency of each piglet group during 42 days (g dwg/g fi)

Replicate	Basal diet	Diet I	Diet II	Diet III	Average
1	592	13	552	377	384
2	642	37	571	513	441
average	617[a]	25[c]	561[a]	445[b]	412

[a,b,c] Means with different superscripts indicate significant difference (P<0.05)

Statistical analysis result found that there were significant differences among treatment groups in feed efficiency. This was assumed as a linearly relationship impact of daily feed intake with daily body weight gain. It because as Table 4 shows, feed efficiency performances tended to linearly follow the figures of both daily feed intake daily body weight gain, that was feed efficiency of piglets fed diet I is the lowest and of piglets fed diet III is lower than of piglet fed basal diet and diet II.

CONCLUSIONS

Feeding corn-toasted soybean meal is comparable with standardized weaned pig diets and could be practiced in reducing feed cost. Supplementation of L-lysine-HCl would be beneficial for piglets if it is accompanied with balancing-at least- the 4 first deficient essential amino acid (lysine, threonine, cystine and tryptophan) and supplementing nitrogen source to fulfill protein requirement. Supplementing weaned pigs with high fish meal (>16%) into a corn-base diets is not a beneficial way.

Diversifying containing natural lysine-feedstuffs would be the best way of balancing pig diet formulation.

LITERATURE CITED

Bach Knudsen. K.E., (1991). Break down of polysaccharides in animal feeds. In Digestive Physiology in Pigs. Proceeding Vageningen, Netherlands, 60 - 75.

Baker, D.H. D.J. Hahn and T.K. Chung., 1993. Nutrition and growth; The Concept and application of an ideal protein for swine growth. In Growth of pig: ed. By Hollis, G.R. CAB International 133 – 139.

Batterham, E.S., 1990. Diet specification for pigs. In Pig rations: Assessment and Formulation. Proceeding 132. Refresher Course for Veterinarians. Published by Post Graduate Committee in Vet. Sci. University of Sydney. 10 – 25.

Batterham, E.S., 1994. Protein and energy relationship for growing pigs. In Principle of Pig Science. Edited by D.J.A. Cole., J. Wiseman and M.A. Varley, 1994. Nottingham Press. 107-121.

Close, W.H., 1994. Feeding new genotypes : Establishing amino acids/energy requirements. In Principle of Pig Science. Edited by D.J.A. Cole., J. Wiseman and M.A. Varley, 1994. Nottingham Press. 123 – 129.

English, P.R. V.R. Fowler, S. Baxter and B. Schmith., 1993. The Growing and Finishing Pig : Improving Efficiency 1st ed. Farming Press Book. UK. 30-224

Holness, D.H., 1991. Pig-The Tropical Agriculturalist 1st ed CTA. McMillan Education Ltd. London and Bassingstoke. 35 – 56

Lewis, J.A., 1991. Amino Acid. In Swine Nutrition. Edited by E. Miller, R. Ulrey and D.E. Lewis. Published by Butterworth-Heineman. USA. 147 – 164.

Liptrap, D.O. and M.G. Hogberg., 1991. Physical forms of Feed : Feed Processing and feeder design and operation. In Swine Nutrition. Edited by E. Miller, R. Ulrey and D.E. Lewis. Published by Butterworth-Heineman. USA. 373 – 397.

Payne, W.J.A., 1990. An Introduction to Animal Husbandry in the Tropics. Longman Scientific and Technical. New York 648-653.

Pond, W.G., D.G. Church and K.R. Pond., 1995. Basic Animal and Feeding 4th ed. John Wiley and Sons; Singapore. 37-47.

Riis, P.M., 1983. The pools of lysine constituent and product. In World Anim. Sci. Vol. 3. Edited by P.M. Riis. Dynamic Biochemistry of Animal Production. Elsevier Publisher B.V. Amsterdam. 75-102.

Whittemore, C., 1993. The Science and Practice of Pig Production. Longman Scientific & Technical. UK. 304 – 322.