The Effects of L-Lysine HCl when Applied With Early Feed Restriction on Body Weight, Breast Meat Yields and Abdominal Fat of Male Broiler Chickens

(Pengaruh Penambahan L-Lysine HCl dan Pembatasan Pakan Awal terhadap Bobot Badan, Daging Dada dan Lemak Abdomen pada Ayam Broiler Jantan)

Ibnu Hari Sulistyawan and Bambang Hartoyo

Faculty of Animal Science, Jenderal Soedirman University, Purwokerto

Abstract

Penelitian ini bertujuan untuk mengetahui penggunaan penambahan L-lysine HCl dalam pakan yag diterapkan pada pembatasan pakan awal terhadap bobot badan, daging dada dan lemak abdomen pada ayam broiler jantan. Seratus empat puluh empat DOC jantan strain Ross 208 secara random dialokasikan ke dalam 3 perlakuan penambahan L-lysine HCL dan 2 perlakuan pengaturan pemberian pakan. Pakan perlakuan diberikan sampai ayam berumur 35 hari, pembatasan pakan diberikan pada ayam umur 6 sampai dengan 12 hari. Data yang terkumpul dianalisis ragam dengan pola factorial 2 x 3. Analisis ragam menunjukkan baik perlakuan penambahan lysine maupun pengaturan pemberian pakan berpengaruh tidak nyata terhadap semua parameter yang diuji. Namun demikian ada kecenderungan penambahan lysine 1,13% mengasilkan bobot badan dan daging dada yang lebih tinggi serta menurunkan lemak abdomen. Penambahan L-lysine HCl dan pengaturan pemberian pakan tidak menghasilkan interaksi yang nyata terhadap semua parameter. Hal ini berarti pembatasan pakan tidak mempengaruhi kebutuhan lysine secara spesifik pada ayam broiler jantan.

Kata Kunci: Ayam broiler, L-Lysine HCl, Pembatasan Pakan, Bobot Badan, Dada, Lemak Abdomen.

Introduction

Amino acid requirement for growing poultry have been studied and debated for many years. In most studies, "point" estimates of requirement have been determined based on the relationship of performance on the dietary supply of amino acid test. The point at which performance ceases to increase as dietary supply increase is the breakpoint in the relationship and considered to be the requirement (Owens and Pettrigrew, 1989). Accurate requirement estimates for amino acids such as total lysine are critical in attempts to apply the "ideal protein" concept in formulating broiler diets.

Extensive work was done to estimate the lysine requirement of broiler chicks. Research in that decade tended to yield lower estimates of lysine requirements than have been reported more recently. Boomgaardt and Baker, (1973) investigated the requirement for a slow growing non-commercial cross of chick from 14 to 28 days of age using 14.0, 18.5 and 23.0% dietary levels of crude protein levels respectively. This would represent 1.06% of the diet (dry matter) for a 23% crude protein diet.

More recently, Surisdiarto and Fazrrell, (1991) argued rather convincingly that the lysine requirement of modern 0 – 3 week old commercial broilers, that were raised for maximum weight gain and efficiency of feed utilization, may be 1.3% of the diet or more far chicks receiving diets containing 23% crude protein.

Experiments with feed restriction showed that early feed restriction improved feed efficiency without adversely affecting broiler market weight (Plavnik and Hurwirtz, 1985). However, research on supplementation of lysine HCl when applied with early feed restriction in the broiler is very limited. Fontana *et al*., (1992) concluded that protein might be a limiting nutrient during the recovery after a period of restriction. Plavnik and Hurwirtz. (1989) suggested that essential amino acid requirements are higher. in order to maximize growth, in the first few weeks following feed restriction.

Therefore, an experiment with the supplementation of lysine HCl when applied with early feed restriction on body weight, breast meat yield and abdominal fat pad was conducted.

Research Methods

Chickens and Housing

A Total of 144 male broilers, day old chicks (DOC) of the commercial strain, Ross 208, were used. The chicks were wing banded and weighed individually before random placement in the cages. Both the chicks and the treatments were randomly distributed to 24 cages. In the starter period 6 chicks were placed in each cage. At 24 days of age (DOA) 4 chicks per cage were selected randomly and moved to grower cages until 35 DOA.

The cages were placed in 2 units, with 12 cages in each unit. They were placed in three levels with four cages in each level. The size of each cage was 50 X 50 X 50 cm. The lighting in the cages were continues with a 10 watt light bulb and 60 watt heating bulb. Each cage had an automatic water supply through nipples (2 nipples in each cage). The ambient temperature was 29^0 - 32^0 C in the first three weeks and gradually reduced to approximately 23^0 afterward until the end of experiment.

Dietary Treatments, and Design Experiments

A mash powder basal ration was formulated to contain 18.50% crude protein and 3029 ME Kcal/Kg. Ingredients and chemical compositions of the diets are given in Table 1.

Table 1. Ingredients and chemical composition analyzed of the experimental diets (%)

Nutriens	Diets		
	Lys 1	Lys 2	Lys 3
Ingredients:			
Maize	66.45	66.35	66.25
Soy Bean Oil Meal	24.50	24.5	24.50
Meat and Bone Meal	5.00	5.00	5.00
Soy Bean Oil	2.50	2.50	2.50
Calcium Carbonate, $CaCO_3$	1.10	1.10	1.10
L-Lysine HCl	0.07	0.17	0.27
Beta Avitren 90	0.25	0.25	0.25
Analyzed :			
Dry Matter	90.23	89.85	89.91
Crude Protein	18.00	18.06	18.50
Ether Extract	6.47	6.28	6.56
Crude Fiber	3.12	3.28	3.08
Ash	10.71	9016	9.05
Lysine	1.04	1.09	1.45
Met. Energy (Kcal/kg)	2886.15	3053.40	3001.00

The lysine of the basal diet was formulated to meet the lysine requirement (1.10% from diet) as stated by NRC 1994.The daily energy allowance during the restriction period was calculated as Energy intake (Kcal ME/day) = 1.5 X BW $^{0.67}$, where BW was the body weight in grams at the beginning of the restriction period, modified from and Plavnik Hurwirtz Hurwirtz, (1988), intended to support maintenance only. The period of restriction was 6 days from the sixth day to day twelve and was followed by ad libitum feeding to the age of 35 days. During the experiment the broiler chicks not restricted were fed ad libitum.

The experimental design was a 3 X 2 factorial randomized design. The first factor was 3 levels of lysine, and the second factor was 2 feeding regimens (ad libitum and restricted) Each treatment had four replicates. The dietary treatments are as follow :

1. Diet containing 1.10% L-Lysine HCl
2. As diet 1 + 0.1% Lysine HCl
3. As diet 1 + 0.2% Lysine HCl

Treatments were supplemented with lysine HCl to provide 1.10% (Lys 1), 1.20% (Lys 2), and 1.30% (Lys 3) in the diet respectively.

The chickens were weighed individually at the beginning of the experiment and at the end of every six days thereafter. Feed consumption was recorded for each cage (group) at the same time as weighing. The lysine intake was calculated by multiplying the feed amount by the percent lysine in the diets. Feed conversion was calculated as the amount feed to gain ratio per cage per six days. Mortality were monitored daily.

At the end of experiment, the chickens were weighed individually (body weight at 35 days), all chicken were killed for determining breast meat yield and abdominal fat pad. Parameters used in this research were body weight, breast meat yield and abdominal fat pad. Body weight and breast meat weight was calculated per unit of body weight (at 35 days). Abdominal fat including adipose tissue around the gizzard were removed and weighed and calculated per unit of body weight

Statistical Analysis

Treatments effects were analyzed using The GLM procedure (The SAS Institute, 1988). Duncan's Multiple Range test was applied to compare means among the treatments.

Result And Discussion

Effect of Lysine on Chick Performance

Table 2 summarizes the collected performance data. The results fluctuated slightly. Lysine level 3 resulted in higher body weight and breast meat weight than those of Lys 1 and Lys 2. In addition, there was reduced abdominal fat with increasing lysine level in the diet. Nevertheless, statistically, there were no significant effects of lysine supplementation and feeding regimens on all parameters tested. The results of this experiment suggest that supplementation of lysine in low protein and low energy diets (below recommended; NRC, 1994) especially in the starter period may not be sufficient to optimize performance. This might be due to a lack of energy intake and the nutrients. The low energy intake probably causes a reduced rate of synthesis of protein. Maruyuma et a., (1978) reported that the rate of protein degradation was more sensitive than that of protein synthesis in response to deficiencies in dietary energy and total nitrogen. Therefore, the increasing level of lysine in the diets did not significantly increase body weight at 35 days. Roeder and Broderick (1981) showed that supplementation of gluten with lysine and threonine altered both synthesis and breakdown of muscle protein. Their data indicate that energy intake plays a critical role in control of protein turnover.

Table 2. Effect of lysine supplementation and feeding regimen on body weight, breast meat weight, abdominal fat weight (g), and chemical composition of breast meat (%).

	BW At 35 day	Breast Meat	Abdom. Fat	Breast Meat (CP)	Breast Meat (CF)	Breast Meat (Ash)
Level of lysine :						
Lysine 1	852.01	100.33	7.35	23.09	1.53	4.17
Lysine 2	824.11	95.65	7.02	23.13	1.62	4.22
Lysine 3	898.14	111.44	6.66	23.29	1.61	4.27
P	0.1976 NS	0.0621 NS	0.7758 NS	0.8453 NS	0.8878 NS	0.6824 NS
Feeding Regimen :						
Ad Lib.	872.50	103.06	7.69	23.25	1.66	4.28
Restrict.	843.28	101.75	6.33	23.09	1.51	4.16
P	0.5256 NS	0.8291 NS	0.1778 NS	0.6139 NS	0.3467 NS	0.2446 NS
Interaction	0.4747 NS	0.6460 NS	0.8778 NS	0.5854 NS	0.1213 NS	0.3340 NS

CP : Crude Protein; CF : Crude Fat; P : Probability; NS : Non Significant

Table 2 summarizes the chemical composition of breast meat. The result of crude protein, crude fat and ash of breast meat were not significantly affected by lysine levels. However, there was a tendency that increasing lysine in the diet increased percentage of crude protein of breast meat on a wet basis analysis and increased percentage of ash of breast meat in the dry matter. The result for crude fat of breast meat on wet basis analysis fluctuated slightly.

Result presented in Table 2 showed that increasing level of lysine in the diet tended to increase the ratio of breast meat to body weight. Increasing the level of lysine in the diet had no significant influence on the proportion of abdominal fat, although it reduced total abdominal fat.

Although increasing level of lysine in the diets had no significant effect on breast meat weight, the diet lys 3 resulted in 11 percent more breast meat than diet lysine 1 and the probability that the differences were significant that close to the chosen significant level (P=0.0621). This mean that a slight effect of lysine on breast meat yield was seen. The significance of the results were in agreement with Holsheimer and Ruesink (1993) and Moran *et al.*, (1990) who reported that increasing lysine in the grower diet did not significantly increase breast meat yield. However, the other study by Hickling *et al.*, (1990) found that increasing lysine in the diet significantly improved breast meat yield.

The different results between this recent study and Hickling *et al.*, (1990) were they supplemented diets both by lysine and methionine together. However, when lysine alone up to concentrations of 14.2 and 11.8 g/kg in the starter and finisher diets respectively had no effect on breast meat yields. The chosen differences among the three lysine levels were 0.1 percent of the diet in each level. These differences were probably not large enough to result in a statistically significant response on breast meat yield. This might be because only three levels of lysine were used and the increase was too small. Another reason is that in the first three week the crude protein content in the diet is low. Summers *et al.*, (1988) reported that total breast meat yields were significantly reduced when comparing 23 – 20% versus 17% un-supplemented protein diets.

The present study also showed that the efficiency of the supplementation of lysine did not significantly improve. This might be also due to lack of energy in the diet. Sika and Layman (1995) concluded that in a cereal based diet deficient in lysine, supplementation of protein or lysine was not beneficial when energy was limited.

The ability of increased dietary lysine to decrease abdominal fat has been reported by Sibbald and Wolynetz (1986) and Holsheimer and Ruesink (1993). The current study showed that levels of lysine had no significant effects on abdominal fat. However, there were tendencies that abdominal fat in both the factual and relative amounts were reduced by increasing levels of lysine in the diets. These results were in agreement with Moran *et al.*, (1990); and Moran and Bilgilli (1990). In contrast, Renden *et al.*, (1994) found that supplementation lysine during grower and finisher periods reduced the proportion of abdominal fat significantly. The differences in results between Renden's study and the recent study might be because they used diets with provided sufficient protein and energy requirements in each production phase. In fact, in Renden's study the proportion of breast meat increased significantly with increasing lysine in the diets so that logically the percentage of abdominal fat would have to decreased.

Failure to show a significant increasing in breast meat protein and decreasing breast meat fat might be due to the fact that only three levels of lysine were used and hence the differences were not enough to demonstrate alteration in both breast meat protein and fat.

These results agreed with Summers *et al.*, (1988) who found no difference in broiler meat yield when diets were supplemented with methionine and lysine. Increasing lysine in the diets tended to increase the breast meat ash of broiler chickens.

Effect of Feeding Regimens on Chick Performance

At the end of experiment, body weight, breast meat and abdominal fat of the restricted chicks were relative similar than that of the ad libitum chicks (Table 2). Although, at the end of the restriction period, body weight was significantly reduced. Feeding regimens had no significant effect on collected performance data. No significant interaction effects between lysine levels and feeding regimens were found for these parameters.

The results of the effects of two feeding regimens on the performances of broilers at the end of the experiment are presented in Table 2. These results demonstrated that no significant differences in overall responses (Body, weight, breast meat weight, and abdominal fat) were seen between the restricted and ad libitum groups when the 6-day restriction period was applied from 6 to 12 days. This indicates that at the end of experiment, early feed restriction lead only to a slight compensatory growth in broiler chickens.

The recent study confirms the study of Calvert *et al.*, (1989) in showing no change in body weight when early feed restriction was applied and their data were based on performances from 21 to 56 days of age. Summers *et al.*, (1990) reported that broilers which were fed restrictively from 7 to 14 days of age had similar weight at 42 days of age.

There was no interaction between level of L-lysine HCl and feeding regimens for overall responses. This probably means that supplementation of L-lysine HCl gave similar responses to chick fed ad libitum and those in the restricted groups. This was caused by the low increment of lysine in the diets. This study was not in agreement with Fontana *et al.*, (1992) who found significant interactions between dietary protein and feeding regimens. These interactions indicated that broilers subjected to early restriction could utilize a higher level of protein (26 versus 21%) after the resumption of ad libitum feeding than unrestricted groups. The different results between the recent study and Fontana's study were likely related to the higher level of protein in the diets used in Fontana's study. Therefore, when provided with a diet with increased level of protein, the restricted broilers were able to exhibit an accelerated rate of growth relative to the control.

The amounts of abdominal fat were reduced, whether expressed as the absolute amount or percentage of body weight at 41 days, although a significant level was not found. The current results support findings reported by Pinchasov and Jensen (1989) and Fontana *et al.*, (1993) who found no significant differences for abdominal fat pad between early restricted and ad libitum birds at 49 days old. However, they are not in agreement with those of Plavnik and Hurwitz (1985)), who reported a reduced significance in the size of abdominal fat pads at 52 and 56 days old in broiler that were restricted an early age compared with ad libitum counterparts. It appears that the expected responses of the broiler chickens to feed restriction, and it is probable that strain of broiler chickens, type of regimen used to restrict intake, and age affect the response to feed restriction (Scheideler and Baughman, 1993).

Conclusion

Supplemental lysine up to 1.3% together with feed restriction application in the diet for male broiler chickens resulted in similar body weight, breast meat yield and abdominal fat content. Using mash form of feed caused lower body weight and breast meat weight than normal condition.

Lysine might not be the first limiting factor when broiler chickens have an early feed restriction application. Its mean that early feed restriction does not have a specific lysine requirement.

Further research on feed restriction is needed with higher levels of lysine in the diets, given with sufficient energy and using pellet form of feed.

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