AMINO ACID REQUIREMENTS OF BROILER CHICKS

Rr Retno Widyani[1], Soeharto Prawirokusumo[2], Nasroedin[2] and Zuprizal[2]

ABSTRACT

This experiment was designed to estimate the amino acid requirements of broiler chicks used a usual ingredient feed stuff in Indonesia. Seven hundred broiler chicks used in 4 experiments, set on 3 experimental factors design consisted of elevations (0 and 600 m above the sea level), season (rainy, dry and intermediate), breeds (Arbor acres and Hubbard). Lysine were used at level 0.68-1.56% and 0.64-1.24%, methionine were used at level 0.27-0.75% and 0.29-0.51%, threonine were used at level 0.51-0.95% and 0.52-0.76% and tryptophan were used at 0.14-0.28% and 0.15-0.23% at starter and finisher periods, respectively. Experimental diets contained 15% crude protein and metabolism energy 2900 kcal/kg at starter period and at finisher period 3200 kcal/kg. Data of growth rate used to see of curve response reached plateau to estimate the lysine and methionine requirements. Data from threonine and tryptophan used by one-way statistical analyzed. The result of this experiment indicated that requirement of lysine were estimated 1.44% and 1.19% based from exponential response curve Y=300+89(1-EXP(-2.2X)) and Y=900+89(1-EXP(-1.485X)), methionine were 0.63% and 0.49% based from exponential response curve Y=282+68(1-EXP(-6.86X-0.27)) and Y=900+80(1-EXP(-3.74X-0.29)) and threonine was 0.84% and 0.695% ($P<0.05$) at starter and finisher periods, respectively. Level of tryptophan in this experiment non significant ($P>0.05$).

Keywords: Requirement, Lysine, Methionine, Threonine, Tryptophan, Broiler chicks

INTRODUCTION

The universe made by God for human life. Human needs nutritious food for the life's work and maintenance. The nutrient content of food namely carbohydrates, protein, fat, vitamins and minerals. Carbohydrates and fat need for the source of energy, protein need for growth cells and vitamins and minerals need for metabolism process.

Plant is producer for human and animal consumption, where animal is the source of protein, which a good amino acid balances. The broiler chicks are the source of animal protein, which the price is cheap. So for increasing the nutrient food for human need increasing performance of the broiler chicks.

The maximum productivity of broiler chicks' reach when the requirement of nutrient is adequat with controlled by feed consumption. The growth of broiler chicks very fast so needs the adequat nutrient especially protein. The advance research of the protein requirement is the ideal protein concept Blair, 1994; Chung, 1994 and Pack, 1996), when the protein requirement explain the amino acid requirement for animal. Chung (1994) stated that the profit ideal protein concept is combination the alternative feed stuff more flexibility for used to keep balanced amino acids.

Feed was 70-80% production cost. The lower protein diet must be done to reach feed cost effectively, but feed formulated with balance amino acid for growth optimum in broiler chicks.

The requirement of amino acid based on recommendation from temperate country may be in the tropical country not match, because on difference climate and air temperature will decrease feed consumption.

[1] Swadaya Gunung Djati University, Jl Pemuda 32, Cirebon 45132, Telp (0231) 236742
[2] Faculty of Animal Husbandry, Gadjah Mada University, Yogyakarta

Data of nutrient content on feed stuff and result of experiment about the requirement of amino acid in Indonesia very limited. This fact introduces the idea of this experiment.

MATERIAL AND METHOD

Bioassay

Seven hundred broiler chicks used in 4 experiments, set on 3 experimental factors design consisted of elevations (0 and 600 m above the sea level), season (rainy, dry and intermediate), breeds (Arbor acres and Hubbard). They were housed in 28 unit litter collective cages (0.5 m x 1 m).

The basal diets were used a usual ingredient feed stuff available in Indonesia. Lysine were used at level 0.68-1.56% and 0.64-1.24%, methionine were used at level 0.27-0.75% and 0.29-0.51%, threonine were used at level 0.51-0.95% and 0.52-0.76% and tryptophan were used at 0.14-0.28% and 0.15-0.23% at starter and finisher periods, respectively. Experimental diets contained 15% crude protein and metabolism energy 2900 kcal/kg at starter period and at finisher period 3200 kcal/kg. Feed and water were consumed *ad libitum*.

Chemical Analysis

Crude fiber, crude protein, fat, ash contents of diets were analyzed using methods described by Association of Official Analytical Chemists (AOAC, 1980). Amino acid contents of diets were measured using an autoanalyzer Hitachi 835 after 24-h acid hydrolysis with 6 M aqueous HCl at 115 °C. Methionine and cystine were determined on samples oxidized with performic acid (Moore, 1963).

Statistical Analysis

The lysine and methionine requirements were estimated from growth rate using a non-linear regression exponential procedure. For lysine, exponential response curves were fitted to the experimental data points using following equation: $Y = A + B(1\text{-}EXP^{-CX})$ and for methionine: $Y = A + B(1\text{-}EXP^{-C(X-D)})$

Y = growth rate of chicks
A = intercept
B = maximum improvement from added lysine or methionine
C = curvature stepness
X = lysine or methionine level on experimental diets (percentage)
D = methionine level at basal diets (percentage)

Tentative value for lysine and methionine requirements was calculated at 95% of maximum response.

Data from threonine and tryptophan used by one-way statistical analyzed.

RESULT

The result of this experiment indicated those experiment factors highly significant at starter and finisher periods. The requirement of lysine and methionine based on exponential equation see in Table 1.

Broiler chicks need the individual essential amino acid depends on strain, age, sex (Burke, 1992; Thomas and Bossard, 1982), physiological status (Scheele *et al.*, 1992), the kinds of production and environment (Chung, 1994). Many factors make the experiment for requirement of amino acid difficult on the individual situation. So this research done on the difference condition in Indonesia. The conditions are difference season, elevation and strain broiler chicks.

The source of amino acid on feedstuff must be know to formulate feed adequate, because some feed stuff very limited on one or more kinds of amino acid. In this situation, amino acid synthesis will be use as supplementation feed on poultry agribusiness (Fancher, 1987 and Jensen and Mendonca Jr, 1988). The using of crystalline amino acid can increasing flexibility feed stuff and can controlling environment pollution. Schutte (1994) stated that nitrogen is the once of contamination seriously for the environment. Excess nitrogen results the toxic ammonia. Decrease total N excretion in the low protein diet, will decrease environment pollution (Gatel and Grosjean, 1992) and decrease respiration syndrome in the chicks (Chung, 1994).

Table 1. The amino acid requirement of broiler chicks at starter and finisher periods

Period	Amino acid	Exponential equation	Value of Y95% max (g)	Requirement (%)
Starter	Lysine	Y=300+89(1-EXP(-2.2X))	385	1.44
Finisher	Lysine	Y=900+89(1-EXP(-1.495X))	982	1.19
Starter	Methionine	Y=282+68(1-EXP(-6.86X-0.27))	349	0.63
Finisher	Methionine	Y=900+80(1-EXP(-3.74X-0.29))	970	0.49
Starter	Threonine			0.84
Finisher	Threonine			0.695
Starter	Triptophane			0.14-0.28
Finisher	Triptophane			0.15-0.23

Performance of broiler chicks based on growth feed consumption and feed conversion. Growth can measure by differences of body weight at the different time. The problem of used body weight was instability of tractus digestivus content weight any time and any experimental treatment. The range of tractus digestivus weight is 30-50 g/kg body weight (Gous, 1986).

Result of research by Hakansson *et al.*, (1978) indicated that at the growth, the content of water decreased, the content of fat increased and the content of ash fixed. At the growing chicks, very difficult to predict the level of difference bodies weight and feed consumption in the different condition. Differences chemist component at the growth namely protein, ash, water and fat. Meat, bone, fat and organ visceral in the body will be change and so anatomy structure such as head, neck, wing ect.

Growth model used to estimate the requirement of amino acid. The requirement of amino acid is the minimum amount of amino acid, which consumed by animal to reach the maximum performance. The idea of growth model based on concept philosophies "ideal curve" and than biologist develop to regressi exponential curve from more 294 title of mathematics model on decade 1/2 century since 1937 to 1985 (Tjiptohardjono, 1997). The selection with many condition and test, the Gompertz model was made at 1825 decided the valid model, because the prediction value the same as the observation value, so this model used in this experiment to estimate the lysine and methionine requirements.

The exponential regression equation to estimate the lysine requirement from RPAN (1993) and equation to estimate the methionine requirement from Schutte and Pack (1995). The equations were develop from Gompertz growth model, but this equation can not be used to estimate the requirement of threonine and tryptophane, because this value in plateau region.

REFERENCES

Blair. 1994. The ideal protein concept: Accounting for amino acid availability. *Feed International*, 15(10):18-25.

Burke, W.H. 1992. Sex difference in incubation length and hatching weights of broiler chicks. *Poultry International*, 71(11):1936-1938.

Chung, T.K. 1995. Amino acid nutrition with special emphasis on threonine. *Technical Bulletin ASA, FT30*:1-11.

Fancher, B.I. 1987. Use of synthetics amino acid in finishing diets for broiler. *Proceedings of Georgia Nutrition Conference of Feed Industry* :18-20.

Gatel, F. and F. Grosjean. 1992. Effect of protein content of the diet on nitrogen excretion by pigs. *J. Livest. Prod. Sci.*, 31:109-120.

Gous, R.M. 1986. *Measurement of response in nutritional experiments.* In: Nutrient requirements of poultry and

nutritional research. Ed: Fisher, C and K.N. Boorman. Poultry Science Symposium. Butterworth. England: 41-59.

Hakanson, J., S. Errickson and S.A. Svenson. 1978. The influence of energy level on chemical composition of tissues and on the energy and protein utilization by broiler chicks. *Swedish University of Agricultural Science Report* :59.

Jensen, L.S. and C.X. Mendonca Jr. 1988. Amino acid nutrition of broiler during the grower period. *Proceedings of Georgia Nutrition Conference*:77-83.

Pack, M. 1996. Ideal protein in broiler. *Poultry International, 35(5)*:54-64.

RPAN (Rhone Poulenc Animal Nutrition). 1993. *Rhodimet Nutrition Guide*. Rhone Poulenc. Franche.

Schelle C.W., E. Decuypere, P.F.G. Vereijken and F.J.G. Schreurs. 1992. Ascites in broilers. Disturbance in the hormonal regulation of metabolite rate and fat metabolism. *J. Poult. Sci., 71(12)*:1971-1984.

Schutte, J.B. 1994. Controlling nitrogen pollution practical application of free amino acids in poultry diet. *Feed Mix, 2(4)*:29-31.

Schutte, J.B. and M. Pack. 1995. Sulfur amino acid requirement of broiler chicks from fourteen to thirty-eight days of age. 1. Performance and carcass yield. *J. Poult. Sci., 74*:480-487.

Thomas, O.P. and E.H. Bossard. 1982. Amino acid requirement for broiler males and females. *Proceeding of Maryland Nutrition Conference for Feed Manufacturers*:34-38.

Tjiptohardjono, B.I. 1997. Growth model penelitian unggas di akhir abad ini. *Poultry Indonesia, 205*:13-15.