Egypt. Poult. Sci. Vol (31) (III): (489-498)

PROTEIN CONSUMPTION AND EFFICIENCY OF KEDU, ARAB AND THEIR CROSSING CHICKENS FED DIETS WITH DIFFERENT PROTEIN LEVELS

By

L.D. Mahfudz, U. Atmomarsono, D. Sunarti, E. Suprijatna and T.A. Sarjana

Poultry Science Laboratory, Animal Production Study Program Faculty of Animal Agriculture, Diponegoro University Semarang, Indonesia

.Received: **15/06/2011** Accepted: **25/06/2011**

Abstract: *The experiment was aimed to determine protein consumption and efficiency of Kedu, Arab and their cross chickens fed diets with different levels of protein. Seven week-old of Kedu Arab and their cross chickens, were used in this experiment. The experimental birds were devided into 3 groups of chicken based on body weight. The chickens were reared in experimental house containing 27 pens (1 x 0,5 x 0,5 m). Experimantal diets were formulated to contain 16, 18, and 20% protein but having the same calorie (2.800 kcal/kg). The experimental design was Split Plot Design, the main plots were three local chickens (Kedu, Arab and their crossing chickens) and the subplots were protein levels (16, 18 dan 20%). Each treatment contains three replicates of 8 chickens. The parameters measured were protein consumption, nitrogen retention and protein efficiency ration. The result showed that protein consumption was higher at 18 and 20% protein levels. Protein efficiency was higher at 16% protein level, but nitrogen retention was not significantly different among all protein levels. It can be concluded that 16% protein level was the optimal for Kedu, Arab and their cross chickens during the period from 7 to 13 weeks of age.*

Key word: protein level diet, protein consumption and efficiency, kedu, arab and their cross chickens

INTRODUCTION

Kedu chicken is one of the Indonesian local poultry comodity which has a high potency for producing meat and eggs. The nutrient requirements of Kedu chicken especially protein still not determined which have a great impact on productivity. One of the effort to increase egg production of this chicken was by crossing with Arab chicken because it is adapted well with Indonesian environtments and has higher eggs production . Crossing Kedu with Arab chicken still needs some scientific investigations to study the characteristics of the offspring

The main cost of the chicken production is diet being protein is the most expensive nutrient. The quality of protein in terms of quantity and quality of amino acids must be measured for all poultry ingredients as well as the requirement of the chicken's need, so that, the protein diet can be efficiently used by the chicken. The efficiency of protein can be determined from protein consumption, protein efficiency ration and nitrogen retention. The crossing of Kedu with Arab chickens is not documented, so it need to be explored. Based on this fact, this reasearch has been carried out to determine the efficiency of protein and nitrogen retention of Kedu, Arab and their crossing .The benefit of this

research is to give information on optimum protein level required by the chicken and also protein consumption, nitrogen retention and protein efficiency of Kedu, Arab and their crossing chickens.

MATERIALS AND METHOD

The Experiment was carried out from 29Th September to 10 Th November 2007, at Poultry Science Laboratory, Faculty of Animal Science, Diponegoro University, Semarang Indonesia.

Chicken used in this experiment were 216 birds, 7 week- olds of Kedu, Arab and their crossing chickens, each chicken stain was represented by 72 birds (3 categories of 24 birds each) based on body weight as shown in Table 1.

Table 1. Chickens categories based on body weight

Type of Chicken (A)	Body Weight Group		
	Small	Moderate	Big
	g		
Kedu (A1)	299.15 ± 26.27	362.46 ± 19.67	421.62 ± 23.19
Arab (A2)	308.30 ± 12.79	351.61 ± 11.06	420.02 ± 26.86
Kedu X Arab (A3)	264.91 ± 29.92	339.66 ± 28.25	401.85 ± 25.99

The chickens were reared in floor pens (1 x 0.5 x 0.5 m)

The feed ingredients used were rice pollish brand, yellow corn,white pollard, fish meal, soybean meal, meat and bone meal. Experimental diets were formulated to contain 16, 18, and 20% protein levels and with the same energy level 2,800 kcal/kg. The nutritive value of some feedstuff used in this reasearch and feed consumption were recorded in Table 2 and Table 3.

Table 2. The chemical analyses of feed ingredients used to formulate experimental diets.

Feedstuff	CP[a] (%)	Fat[a] (%)	Cell[a] (%)	Ca[c] (%)	P[c](%)	ME (Kcal/kg)[c]
Yellow corn	7.07	1.20	4.56	0.04	0.02	3.321
Rice brand	7.47	12.71	13.83	0.20	1.00	2.103
Pollard	16.41	3.47	8.20	0.02[b]	0.68[b]	1.630
Soy cake	44.38	0.12	10.02	0.24	0.57	2.216
Meat bone meal	44.93	6.22	6.53	12.26[b]	4.93[b]	1.923
Fish meal	43.08	2.74	12.58	5.68	3.73	2.830

[a] Results of analysis from, Laboratory of Animal Nutrition, Faculty of Animal Science, Diponeegoro University, Semarang Indonesia

[b] Results of analysis from, Laboratory of Environment and By-product Analysis and Various Comodity, Industrial Affair

[c] Table of Composition Indonesian Feedstuff (Hartadi *et al.*, 1993)

Table 3. The Composition and Nutrition Content of Experimental Diets

Feedstuff	Composition of Experimental Diets		
	P1	P2	P3
	----------%----------		
Yellow corn	58.50	56.70	54.40
Rice brand	10.00	6.50	4.30
Pollard	9.90	9.70	8.50
Soybean By-product	10.00	15.30	24.70
Meat Bone Meal	6.50	6.70	3.00
Fish meal	5.00	5.00	5.00
Top Mix	0.10	0.10	0.10
Total	100.00	100.00	100.00
The Amount of Nutrition of Diets			
ME (Kcal/kg)*	2,802.08	2,802.34	2,802.01
CP (%)**	16.02	18.04	20.03
Fat (%)**	2.86	2.71	2.24
Crude fiber (%)**	6.91	7.06	7.31
Ca (%)**	1.15	1.18	0.74
P (%)**	0.74	0.75	0.57

* ME was calculated from Table of Composition Indonesian Feedstuff (Hartadi *et al.*, 1993).
** Result of calculation based on proximate analysis of feedstuff.
The available P must be calculated and put in the table since the P in the table is total

The Parameters

1. Protein consumption was calculated from feed consumption multiplied by protein percentage in the diet in gram unit
2. Protein efficiency ratio (PER) was calculated from body weight gain (gram) devided by the protein consumption (gram) (Anggorodi, 1995).

$$PER = \frac{\text{Body weight gain (g)}}{\text{Protein consumption (g)}}$$

3. Nitrogen retention (NR) based on Scott *et al.* (1982) as follow :

$$NR\ (g) = N\ diet - (N\ excreta - N\ endogenous) \times \frac{I\ diet}{I\ Excreta}$$

Explanation:

NR = nitrogen retention
N = nitrogen
I = indicator

N diet resulted from analysis of N in the diet

N excreta resulted from N in the faeces analysis collected from 3 days before the end of experiment (Slaughtering of the Chicken)

Statistical Analysis

The statistical model was:

$$Y_{ijk} = \mu + K_k + \alpha_i + \delta_{ik} + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$$

Keterangan :

Y_{ijk} = result of observation of block on-k at level protein on-i from chicken factor and level on-j from level protein.

μ = Mean value

K_k = effects addition from block - k

α_i = effects addition from level i on cicken factor

δ_{ik} = effects of error on level i from chicken and block k , main plot error (error a)

β_j = effect addition from level j of protein.

$(\alpha\beta)_{ij}$ = interaction effects of level i from chicken factor and level j of protein factor

ε_{ijk} = Effects of error of k block get level i chicken factor and level j of protein factor, error of sub plot (error b)

The data were analyzed using Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT), accordance to Steel dan Torrie (1995).

RESULT AND DISCUSSION

The Effects of Treatments on Body Weight

The research result was shown in Table 4, average body weight of Kedu, Arab and their cross chickens ranged between 626.25 – 752.00 g/bird or average 690.33 g/bird. This result showed that protein level and chicken strain did not affect to body weight (P>0.05)

Table 4. The Average Body Weight

Chicken	Protein Levels of Diet			Average
	16%	18%	20%	
	(g/bird)			
Kedu	597.50	671.75	727.50	665.58
Arab	626.25	678.75	670.75	658.58
Cross	743.25	746.25	752.00	745.17
Average	655.33	698.92	716.75	690.33

This research used chicken at same age and also the same characteristict, i.e : dual porpuse chickens, the activity and nutritional requirements were also expected to be the same. It caused the growth of chicken to be same. Ensminger (1980), Anggorodi (1995) and Bozkurt, *et al.* (2006) reported that body weight of chicken effected by strain, age, diet and environment.

The effects of Treatments on Protein Consumption

Based on research results, the protein consumption was shown in Table 5. Protein consumption of Kedu, Arab and their cross chickens ranged between 7.09 – 10.38 g/bird or average of 8,81g/bird . The average protein consumption was higher for Kedu chicken at 20% protein level and lower for cross chicken with 16% protein level

Table 5. The Average Protein Consumption

Chicken	Protein Levels of Diet			Average
	16%	18%	20%	
	(g/bird/day)			
Kedu	7.09	9.52	10.38	8.99
Arab	7.68	8.87	9.87	8.80
Cross	7.22	8.52	10.14	8.63
Average	7.33^{C}	8.97^{B}	10.13^{A}	8.81

The statistical analysis shows that there were no significant (P>0,05) differences between strain of the chicken and protein levels. The results also showed that protein consumption was not affected by chicken strain.

This results showed that the protein level strongly affected protein consumption (P<0,01), but chicken strain did not affect protein consumption (P>0,05). This research used chickens at same age and also the same characteristict, i.e : dual porpuse chickens, the activity and nutritional requirements were also expected to be the same. Anggorodi (1995), Bozkurt, *et al.* (2006) and Kamizono *et al.* (2010) reported that diet consumption directly effected protein consumption, and the effects depend on body weight and age of poultry, perhaps environment, growth and physiological status, energy and protein of the diet, also health status of the chicken.

Based on statistical analysis, protein consumption of Kedu, Arab and their cross chickens was higly siginificant (P<0,01) and affected by protein levels.. Protein consumption at 20% protein level in the diet was increased significantly (P<0, 01) compared to 18% or 16% protein levels. These results indicated that 20% protein level diet gave benefit on protein consumption of Kedu, Arab and their cross chickens. Clark *et al.* (1982) and Lin, C.S. and S.H. Chiang (2010) said that protein consumption was affected by protein levels of diet, at the same energy level, increasing protein level increased protein consumption.

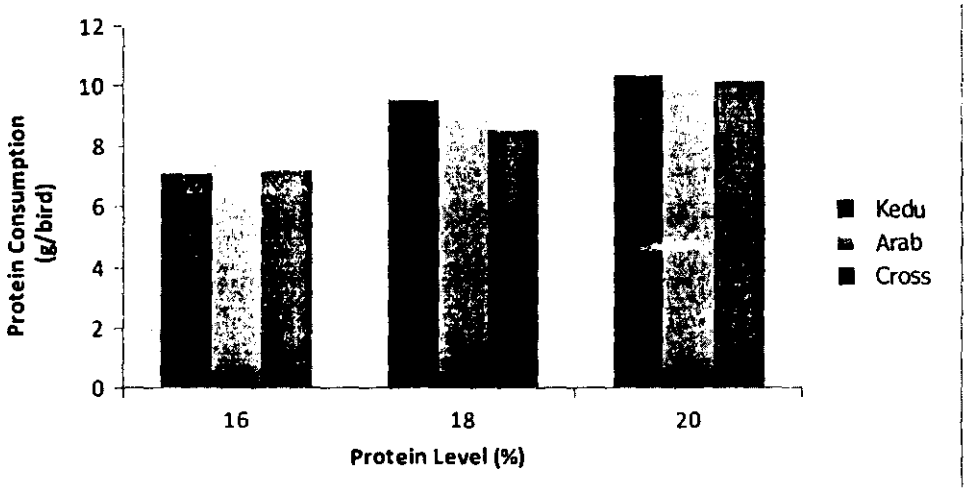


Illustration 1. Protein Consumption of Kedu, Arab and Their Cross Chickens at 16, 18 and 20% Protein Level.

Wahju (1997), Yamamoto *et al.* (2004) and Anjun, M.S. and A.S. Chaudhry. (2010) reported that, high consumption of the diet will be followed by high protein consumption. This result clearly showed that protein levels strongly affected by protein consumption of Kedu, Arab and it's crossing chickens in this experiment. Average protein consumption from three strains of chickens at different protein levels was shown at Illustration 1. The Illustration 1 showed that increasing protein levels resulted in increased protein consumption of the chickens.

The Effects of Treatments on Protein Efficiency Ratio (PER)

Effects of treatments on protein efficiency ratio (PER) from each treatment were shown in Tabel 6.

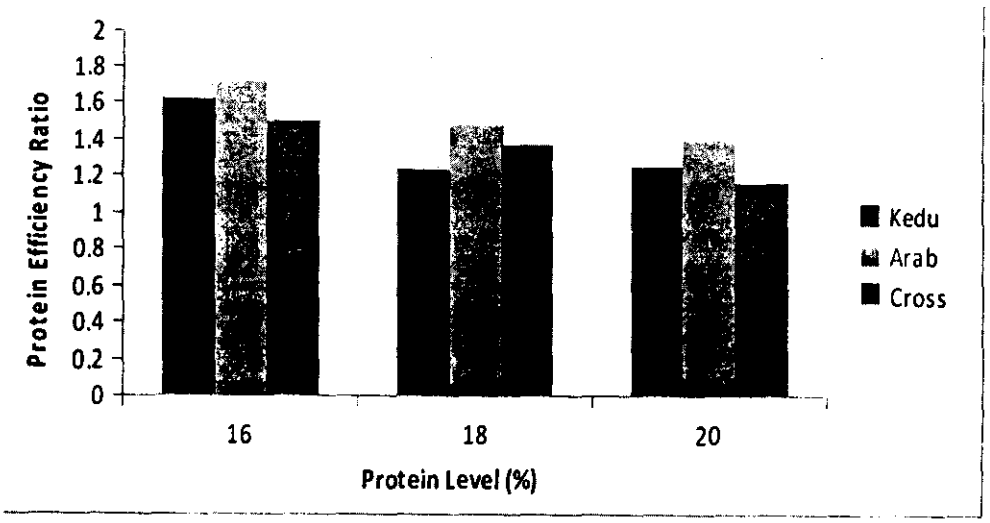
Table 6. Average Protein Efficiency Ratio (PER) of different treatments.

Chicken Strain	Protein Level Diet			Average
	16%	18%	20%	
	(g/bird/day)			
Kedu	1.62	1.24	1.25	1.37
Arab	1.72	1.48	1.39	1.53
Cross	1.50	1.37	1.16	1.34
Average	1.61[a]	1.36[b]	1.27[b]	1.41

There were no differences in protein efficiency ratio among Kedu Chicken, Arab Chicken and their cross chickens. However, increasing protein levels from 16% to 18 or 20% decreased PER significantly. These results showed that there were no correlation between chicken strain and protein efficiency ratio. These results suggested that effect of protein level on protein efficiency ratio did not depend on strain of chicken, or in another word that type of chicken strain had not affect on protein efficiency ratio. Hence, chicken strains had similar protein efficiency ratio (PER). Kartini (1995) showed that local chickens at 4 weeks of age had higher protein efficiency ratio i.e. 1.60, however, at 6 and 12 weeks of age protein efficiency were 1.31 and 1.43, respectively.

statistical analysis showed that chicken fed 16% protein level had significantly ($P<0,05$) higher protein efficiency ratio than those fed 18 or 20% protein level diet. These results explained that 16% protein level resulted better protein efficiency ratio than 18 and 20% protein levels. So, Kedu, Arab and their cross chickens may need 16% protein level in the diet for maximum performance. Anggorodi (1995), Yamomoto *et al.* (2007) and Wu *et al.* (2007) found that increasing PER will increase protein diet used by chicken. Wahju (1997), Wu *et al.* (2007) and Anjun, M.S. and A.S. Chaudhry (2010) reported that higher level protein diet, resulted in protein efficiency. Illustration 2. showed protein efficiency ratio (PER) of Kedu, Arab and their cross chickens.

he



Ilustration 2. Average Protein Efficiency Ratio (PER)

Effects of Treatment on Nitrogen Retention (NR)

Effect of treatments on Nitrogen retention of Kedu, Arab and their Cross chickens are shown at Tabel 7.

Table 7. Nitrogen Retention of Kedu, Arab and It's Cross Chickens at 16, 18 and 20% Protein Levels.

Chickens	Protein Levels Diet			Average
	16%	18%	20%	
	(g/bird/day)			
Kedu	0.90	0.90	0.91	0.90
Arab	0.85	0.88	0.94	0.89
Cross	0.84	0.99	0.96	0.93
Average	0.86	0.92	0.93	0.91

Average nitrogen retention of Kedu, Arab and their Cross fed diet with different protein levels was not significantly different (P>0,05). These results showed that three strains of chickens had similar nitrogen retention. Atmomarsono (2000), Wu *et al.* (2007) and Hayashi *et al.* (2009) reported that NR on Cross Chicken of local chicken and layer chicken were between 0,94-1,43 g/bird/day. Nitrogen retention from the three strains of chicken was similar indicating that protein requirement of these chickens was similar. Maynard dan Loosli (1969), Hayashi *et al.* (2009) and Anjun, M.S. and A.S. Chaudhry. (2010) found that nitrogen retention of the same characteristic chickens were same. Wizna dan Maria (1997), Wu *et al.* (2007) and Hayashi *et al.* (2009) reported that, nitrogen retention is depend on the protein quality is protein quality poor, more nitrogen will be excreted in the feces, in contrast, if protein quality is good small amount nitrogen will be found in the feces. So, nitrogen retention also affected by protein quality.

Statitistical analysis showed that effects of three protein levels and three chickens strain did not significantly (P>0,05) affected nitrogen retention. These results may be caused by the same energy level diet and chicken ages. Wahju (1997), Kamizono *et al.* (2010) and Lin, C.S. and S.H. Chiang (2010), reported that the amount of diet consumed by chicken, depend on the amount of energy level in the diet, and level of nitrogen retention depend on nitrogen consumption and metabolisable energy in the diet.

The researchers must present the Table of body weight for groups of birds fed different protein levels

Conclusion

Protein level for Kedu, Arab and Their cross chickens from 7 to 13 weeks of age was 16% in the diet for maximum body weight and protein efficiency.

Acknowledgement

Deep thanks to **Dr. Yahya Eid**, Department of Poultry Production, Faculty of Agriculture, Kafrelsheikh University 33516 - Kafr El-Sheikh, EGYPT, for revising this manuscript.

REFERENCES

Agromedia. 2005. *Beternak Ayam Kampung Petelur. Agromedia Pustaka, Jakarta.*

Anggorodi, R. 1995. *Ilmu Makanan Ternak Umum. Cetakan V, Gramedia Pustaka Utama, Jakarta.*

Anjun, M.S. and A.S. Chaudhry. 2010. *Using Enzymes and Organic Acids In Broiler Diets. Japan Poultry Science Association. J. of Poultry Sci. 47(2): 97 - 105*

Blakely, J. dan D. H. Bade. 1994. *Ilmu Peternakan. Gadjah Mada University Press, Yogyakarta (Translated by B. Srigandono).*

Boorman, K. N. 1980. *Dietary Constrain on Nitrogen Retention. Dalam : P. J. Buttery and Lindsay (Eds). Protein Deposition in Animal. Academics Press, London. Hal 147-164*

Bozkurt, M., M. Cabuk and A. Alcicek. 2006. *The Effect of Microbial Phytase in Broiler Grower Diets Containing Low. Phosphorus, Energy and Protein. International Journal Published by Japan Poultry Science Association. J. of Poultry Sci. 43(1): 29 – 34.*

Clark, L. E., R. M. Gous and T. R. Morris. 1982. *Response of broiler chickens to well balance protein mixture. Br. Poultry Sci. 23 : 433-446.*

Crampton, E. W. and L. E. Harris. 1969. *Applied Animal Nutrition. 2nd Ed. W. H. Freeman Company, San Fransisco.*

Creswell, D. C. dan B. Gunawan. 1982. *Pertumbuhan badan dan produksi telur dari 5 strain ayam sayur pada sistem peternakan intensif. Proc. Seminar Peternakan. Puslitbang Peternakan, Bogor. Hal. 236-240.*

Ensminger, M.E., J. E. Old Field and W.W. Hainnman. 1980. *Feed and Nutrition. The Ensminger Company, Clovis.*

Hartadi, H., S. Reksohadiprodjo dan A.D. Tillman. 1993. *Table Komposisi Pakan untuk Indonesia. Gadjah Mada University Press, Yogyakarta.*

Hayashi, K., M. Maeda, K. Kitahara. T. Tagoyama and A. Ohtsuka. 2009. *Effect of Shochu Distillery By-product on Productivity and Meat Quality in Broiler. Nihon Chikusan Gakkaiho. 80 (1): 35-39.*

Iskandar, S. 2005. *Pertumbuhan dan perkembangan ayam silangan Kedu x Arab pada dua sistem pemberian ransum. JITV 10 (4): 253-259.*

Iskandar, S. dan Y. Saepudin. 2005. *Ayam Cemani. (http://balitnak.litbang.deptan.co.id/). Akses data : Selasa 17 April 2007.*

Jarmani, S. N, Dharsana, R, Nataamijaya, A. G. 1999. *Kemungkinan usaha budidaya "Ayam Buras" hasil persilangan dari ayam jantan lokal (Pelung dan Bangkok) dengan ayam betina ras sebagai penghasil daging. J. Pengembangan Peternakan Tropis (J. of Trop. Anim. Develop) 26 : 111-115.*

Jull, M. A. 1972. *Poultry Husbandry. 3rd Ed., McGraw Hill Book Company Inc., New York.*

Kamizono T., K. Nakashima, A. Ohtsuka and K. Hayashi. 2010. *Effects of Feeding Hexane-Extracts of a Shochu Distillery By-product on Skeletal Muscle Protein Degradation in Broiler Chicken. Biosci. Biotechnol. Biochem. 74 (1): 92 - 95*

Kartasudjana, R. 2001. *Performan ayam buras periode pertumbuhan dengan berbagai tingkat protein hewani dan nabati. J. Pengembangan Peternakan*

Tropis (J. of Trop. Anim. Develop). 36 : 121-125.

Kartini, T. 1995. *Pengaruh Imbangan Protein Ransum terhadap terhadap Penampilan Ayam Buras selama Periode Pertumbuhan. Seminar Nasional Sains dan Teknologi. J. Peternakan. 2: 228-232.*

Kholis, S. dan M. Sitanggang. 2002. *Ayam Arab dan Poncin Petelur Unggul. Agromedia Pustaka, Jakarta.*

Lin, C.S. And S.H. Chiang. 2010. *Effect of sn-2 Saturated Fatty Acids in Dietary Triglycerides on Fatty Acid and Calcium Digestibility and Leg Abnormalities in Broiler Chickens. International Journal Published by Japan Poultry Science Association. J. of Poultry Sci. 47(2): 156 – 162.*

Lubis, D. A. 1992. *Ilmu Makanan Ternak Umum. PT Pembangunan, Jakarta.*

Maynard, L. A., J. K. Looslie, H. F. Hlintz and R. G. Warner. 1979. *Animal Nutrition. 2nd Ed. The English Language Book Society Longman, London.*

Minkema, D. 1993. *Dasar Genetika dalam Pembudidayaan Ternak. Cetakan II, Penerbit Bharatara, Jakarta. (Rewrite by Z. B. Tafal).*

Mulyono, S. 1999. *Memelihara Ayam Buras Berorientasi Agribisnis. Penebar Swadaya, Jakarta.*

Parakkasi, A. 1990. *Ilmu Gizi dan Makanan Ternak Monogastrik. Penerbit Angkasa, Bandung.*

Patrick, H. and P. J. Schaible. 1980. *Poultry Feeds and Nutrition. 2nd Ed., Avi Publishing Company Inc., New York.*

Poultry Indonesia. 2005. *Khasanah Unggas Khas Indonesia. Edisi Desember. Poultry Indonesia. 308:14-23.*

Sarwono, B. 2004. *Ayam Arab dan Petelur Unggul. Penebar Swadaya, Jakarta.*

Scott, M. L., M.C. Nesheim and R. J. Young. 1982. *Nutrition of The Chicken. 2nd Ed., M.L. Scott and Associates, Ithaca, New York.*

Steel, R. G. D. dan J. H. Torrie. 1995. *Prinsip dan Prosedur Statistika Suatu Pendekatan Biometrik. Cetakan IV, Gramedia Pustaka Utama, Jakarta. (Trnaslated by B. Sumantri).*

Subiharta, Mulyanto dan B. Utomo. 1994. *Analisis Ekonomi dari Skala Usaha Ayam Buras pada Tiga Sistem Pemeliharaan di Pedesaan. J. Ilmiah Penelitian Ternak. 2 : 15 -24.*

Suci, D.M., E. Mursyida, T. Setianah dan R. Mutia. 2005. *Program pemberian makanan berdasarkan kebutuhan protein dan energi pada setiap fase pertumbuhan ayam poncin. Media Peternakan. J. Ilmu Pengetahuan Teknologi Peternakan. 28 (2) : 70-76.*

Sukamto, B. 1996. *Kebutuhan Energi dan Protein Berdasarkan Effisiensi Penggunaan Protein Terhadap Performans Ayam Kedu. Univ. Padjajaran, Bandung. (Disertasi Doktor)*

Suprijatna, E., U. Atmomarsono, dan R. Kartasudjana. 2005. *Ilmu Dasar Ternak Unggas. Cetakan I. Penebar Swadaya, Jakarta.*

Sukardi dan M. Mufti. 1989. *Penampilan prestasi ayam buras di kabupaten banyumas dan pengembangannya. Proc. Seminar Nasional tentang Unggas Lokal II. Semarang, Hal : 95-97.*

Tillman, A. D, S. Prawiro Kusumo, S. Reksohadiprodjo, H. Hartadi dan S. Lebdosoekojo. 1991. *Ilmu Makanan Ternak Dasar. Cetakan V, Gadjah Mada University Press, Yogyakarta.*

Triharyanto, B. 2001. *Beternak Ayam Arab. Kanisius, Yogyakarta.*

Wahju, J. 1997. *Ilmu Nutrisi Unggas. Gadjah Mada University Press, Yogyakarta.*

Wu, G., P. Gunawardana, M.M. Bryant, R.A. Voitle and D.A. Roland, Sr. 2007. *Effects of Dietary Energy and Protein on Performance, Egg Coposition, Egg Solids, Egg Quality and Profits of Hy-Line W-36 Hens During Phase 3. International Journal Published by Japan Poultry Science Association. J. of Poultry Sci. 44(1): 52 – 57.*

Yamamoto M., F. Saleh and K. Hayashi. 2004. *A Fermentation Method to Dray and Convert Shochu Distillery By-product to a Source of Protein and Enzymes. International Journal Published by Japan Poultry Science Association. J. of Poultry Sci. 41: 275 – 280.*

Yamamoto M., F. Saleh, M. Tahir, A. Ohtsuka and K. Hayashi. 2007. *The Effect of Koji-feed (Fermented Shochu Distillery By-product) on the Growth Performance and Nutrient Metabolizability in Broiler. International Journal Published by Japan Poultry Science Association. J. of Poultry Sci. 44: 291 – 296.*