

## **Study of Nutrient Requirement of Native Chicken Fed by Free Choice Feeding System at a Grower Phase**

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### **ABSTRACT**

The aim of this study was to determine the basic of nutrient requirement and the performance of native chicken of grower phase (6 to 14 weeks) by free choice feeding system. Ninety-two day old chicks were randomly divided into 4 cages and 23 chicks each. The chicks fed by free choice feeding system with: corn meal, rice brain, soybean meal, fish meal, lime stone, vitamin premix available separately. The parameter collected were feed consumption, nutrient consumption (energy, crude protein, methionine, lysine, calcium, phosphor, crude fiber) and the performance of chicken (body weight and percentage of carcass). The result showed that feed consumption was 2684.36 g/bird/8 weeks; ME 2990.55 kcal/kg; crude protein 15.53%; methionine 0.02%; lysine 0.05%; Ca 1.60%; P 0.60%; and crude fiber 7.30%. The performance of chicks on body weight at 14 weeks was 659.23 g/bird; gain weight 436.95 g/bird/8 weeks; FCR 6.14; carcass weight 388.63 g; and carcass percentage 57.57%. It can be concluded that native chicken was able to fulfill nutrient requirement as same as white or brown layer nutrient requirement based on NRC (1994) except methionine and lysine.

**Keywords:** native chicken, free choice feeding, nutrient consumption, chicken performance

### **INTRODUCTION**

The lack information about nutrient requirement of native chickens was one of causes of native chicken's low growth. A balanced nutrient is important to improve growth at optimal point. Nutrient requirement of native chicken would be more exact to determine by themselves. The study concern on feeding native chicken using free-choice feeding system in order to find basal nutrient requirement for native chicken as a guidance of nutrient requirement at grower phase (6 to 14 weeks). Free choice feeding allows native chickens to fulfill their nutrient requirement for maintenance and development/growth. Free choice feeding is a pattern of feeding by using several feed stuff as source of protein, energy source, mineral and vitamin separately (Fanatico et al., 2013). They are placed in separated feeder inside the cage and chicken can select the feed stuff freely according to their requirement. Based on free choice feeding method, it can be recalculated of nutrient consist of: crude protein, metabolized energy, calcium, phosphor, and crude fiber consumed by the chicken, that was showed the actual basal nutrient requirement of native chicken.

The aim of this study was to find basal nutrient requirement and observe performance of native chicken at a grower phase. The advantage of this study is to provide standard guidance of nutrient requirement of native chicken at a grower phase.

## MATERIALS AND METHODS

This research was conducted in Poultry Laboratory of Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta over 14 weeks. Material of research consisted: 92 birds of native chicken. Feed shift consist of yellow corn meal, rice bran, soybean meal, fish meal, CaCO<sub>3</sub> and vitamin premix. Before using for the experiment all feed stuff nutrient were analyzed for composition of energy, crude protein, calcium, phosphor, amino acid methionine and lysine. The cages used in this research were 4 wire cages (2.0 x 1.0 x 0.5 meter)

**Table 1.** Nutrient composition of feed stuff

Nutrient	Feed Stuff					
	Corn	Rice bran	Fish meal	Soybean meal	CaCO <sub>3</sub>	Vitaminpremix
Dry matter (%) <sup>1</sup>	87.55	88.95	88.45	84.82	0	0
Gross energy (kcal/kg) <sup>2</sup>	3765.53	3933.50	3002.02	4101.90	0	0
Metabolized energy (kcal/kg) <sup>3</sup>	3699.09	2227.92	1570.56	3216.07	0	0
crude protein (%) <sup>1</sup>	9.15	11.06	59.74	54.16	0	0
Extract ether (%) <sup>1</sup>	4.91	8.87	7.28	1.34	0	0
Crude fiber (%) <sup>1</sup>	1.86	15.05	10.11	4.41	0	0
Ash (%) <sup>1</sup>	2.66	10.47	37.15	8.57	0	0
Calcium (%) <sup>4</sup>	1.389	0.531	8.444	2.057	35	0.06
Phosphorus (%) <sup>4</sup>	0.347	0.978	0.775	0.287	0	0
Methionine (%) <sup>5</sup>	0	0.0029	0.0142	0.3353	0	0
Lysine (%) <sup>5</sup>	0.0102	0.0078	0.0150	0.6210	0	0

<sup>1</sup>Proximate analysis of Nutrition and Feed Livestock Laboratory, UGM, 2016

<sup>2</sup>Analysis result from Food Study Center and Nutrition Laboratory, UGM, 2016

<sup>3</sup>Calculation result based on Sibbald (1980)

<sup>4</sup>Analysis result from Livestock Nutrition Science Laboratory, UGM, 2016

<sup>5</sup>Analysis result from Organic Chemical Laboratory, UGM, 2016

Chickens were randomly divided into 4 cages, with 25 birds each. Feeding was give using free choice feeding system (each feed stuff in feeder was placed separately, and chickens will feed according the requirement). Feed stuffs were measured in the morning before feeding, and the remaining were measured in the evening while the body weight were measured a week (from week 6 to 14). Parameter observed were: feed consumption, consumption of energy, crude protein, calcium, phosphor, methionine, lysine and crude fiber. The other parameter were body weight gain and both percentage and weight of carcass. The data were analyzed descriptively (mean value) for each parameter observed (Steel and Torrie, 1995).

## RESULTS AND DISCUSSION

### Feed consumption

Native chicken at a grower phase (6 to 14 weeks) showed that mean value of feed consumption was 2648.36 g/bird/8 weeks (Table 2) ranged over 2212.00 to 3301.20 g/bird. This mean value of feed consumption was lower than white leghorn which is 2730 g/bird (NRC, 1994). Based on research of variation level of crude protein on growth native chicken showed that feed consumption was 1801.37 g/bird/6 weeks (Kusnadi et al., 2014).

Feed consumption is the ability of livestock to consume feed for body metabolism process in order to improve growth, activity, and maintain body temperature. Feed consumption is affected by body weight, strain, sex, age, ambient temperature, balanced nutrient, health status, feed formation and preference, stress, and stocking density (Scott et

al., 1982). Free choice feeding system provides chickens to consume feed according to their requirement and physiological status

**Table 2.** Nutrient consumption of native chicken at a grower phase (6 to 14 weeks) fed by free choice feeding system

Variabel	Replication				Total	Average
	1	2	3	4		
Total of feed consumption (g/bird/8 weeks)	2918.72	2212.00	3301.20	2305.52	10737.44	2684.36
Consumption of metabolized energy (kcal/kg)	3000.62	3005.78	2971.67	2984.11	11962.18	2990.55
Consumption of protein (%)	15.56	15.47	15.67	15.42	62.12	15.53
Consumption of methionine (%)	0.02	0.02	0.02	0.02	0.10	0.02
Consumption of lysine (%)	0.05	0.06	0.05	0.05	0.21	0.05
Consumption of calcium (%)	1.61	1.62	1.60	1.60	6.42	1.60
Consumption of phosphor (%)	0.59	0.59	0.60	0.60	5876.79	0.60
Consumption of crude fiber (%)	7.26	7.14	7.46	7.34	29.22	7.30

### Consumption of energy

Based on feed consumption obtained from free choice feeding system, it can be recalculated the level of crude protein, metabolized energy, crude fiber, calcium, phosphor, and amino acid methionine and lysine. Average of metabolized energy consumption on native chickens aged 6 to 14 weeks (grower phase) was  $2990.55 \pm 15.62$  kcal/kg (Table 2) ranged over 2971.67 to 3005.78 kcal/kg. This results was approximate the requirement of brown and white leghorn consumption of energy even required same as NRC (1994) standard recommendation at 2800 to 3200 kcal/kg. This study Iriyanti (2006) by fed chicken at ME level of 2839.20 to 3139.43 kcal/kg improved chickens growth compared to ME level of 3011.17 to 3093.28 kcal/kg.

Consumption of metabolized energy determines the amount of feed consumption. Chicken tends to stop eating when their energy requirement are fulfilled. Free choice feeding system on grower-chicken indicates that chicken will consume feed stuff as much as their requirement, if recalculated will provides information about the actual metabolized energy requirement.

### Consumption of crude protein

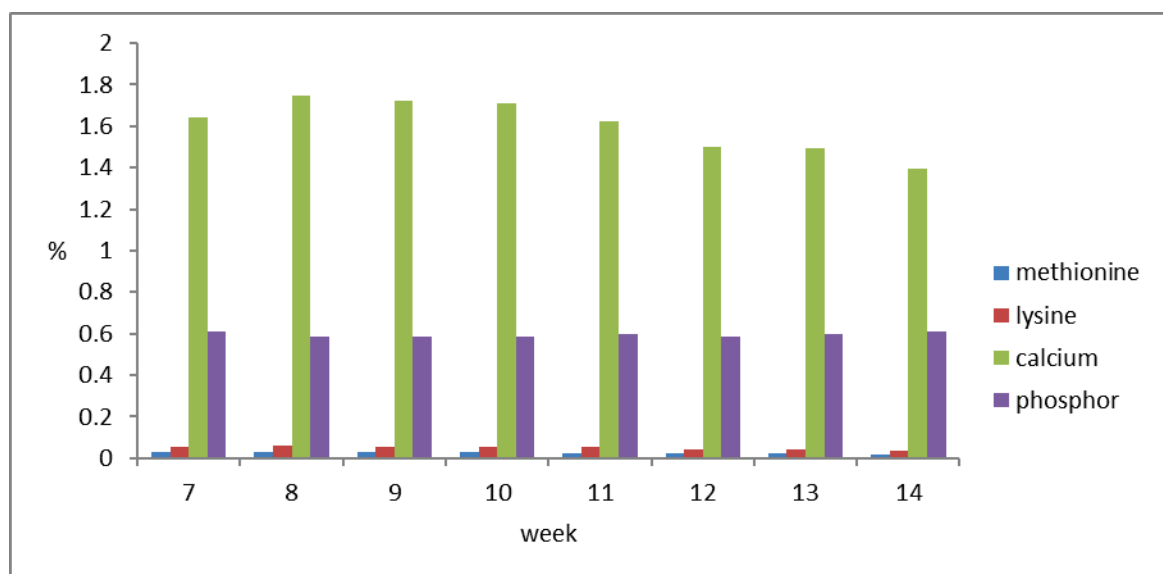
Average of crude protein consumption of native chicken aged 6 to 14 weeks was  $15.53 \pm 0.11\%$  (Table 2) ranged over 15.42 to 15.67%. This result was lower than crude protein requirement based on NRC (1994) on white leghorn at 16% and brown leghorn at 15%. This study Mahardika et al. (2013) showed that native chicken at grower and pullet phase crude protein consumption is 16.73%.

Proteins were required to maintain life carrying cell functions and productivity, such as muscle growth, fat, bone, egg, and seminal fluid/semen (Lesson and Summer, 1991). Protein requirement was equal to amino acid requirement since protein cannot be absorbed directly but have to digested by enzymes become amino acids. Protein requirement was affected by age/ growth phase and feed energy/protein ratio. Low protein feed result to protein deficiency on chicken then impact to slow growth, but high protein result to inefficient production. Protein requirement on starter phase will be higher than grower phase or pullet phase.

### Consumption of methionine

Average of methionine consumption on native chicken aged 6 to 14 weeks was 0.02% (Table 2). This result 8% was much smaller than the recommendation from NRC (1994) for white leghorn was 0.25%. The average methionine consumption on native chicken at a grower phase can be showed in Figure 1.

Methionine is one of the essential amino acids containing sulphur. This amino acid was a critical amino acid for poultry and strongly have to be available in feed. The amino acid methionine is also one of component for body's protein, whereas the proteins in each tissue differ by the amino acid content (Scott et al., 1982). Amino acid methionine is require not only for chicken growth but also for feed efficiency.



**Figure 1.** Graph of consumption of methionine, lysine, calcium and phosphorus of native chicken at a grower phase (6 to 14 weeks) during rearing

### Consumption of lysine

Average of lysine consumption on native chicken aged 6 to 14 weeks showed mean value at 0.05% (Table 2). This result was much smaller that is only about 8.33% of NRC (1994) recommendation for white leghorn aged 6 to 14 weeks is 0.60%. The average of lysine consumption on native chicken at a grower phase can be showed in Figure 1.

Lysine as growth function had another functions, one of them is to help calcium absorption process in order to form bone or skeletal thereby increasing muscle mass (Si et al., 2001). Lysine is an essential amino acid and very critical on the body of chicken. This amino acid is a limiting amino acid since its availability in the feed is limited, especially in most of plant-feed stuff. Lysine is used in protein synthesis and plays role to provide energy, bone growth, and muscle formation. Lysine is a precursor of carnitine biosynthesis, in which carnitine stimulates the  $\beta$ -oxidation process from long chain fatty acid that occur in mitochondria. The addition of lysine in feed is expected to increase the formation of carnitine, thus increasing  $\beta$ -oxidation process on body fat which lower the level of fat and cholesterol of meat.

### Consumption of calcium

Average or calcium consumption mean value of native chicken aged 6 to 14 weeks was  $1.60 \pm 0.01\%$  (Table 2) ranged over 1.60 to 1.62%. Average of calcium consumption each

week was range over 1.40 to 1.75% (Figure 1). This result was higher than NRC (1994) recommendation for white leghorn aged 6 to 14 weeks at 0.80%. Calcium is an important mineral in a physiological process of livestock. Lack of calcium in the feed leads to a physiological disorder process known as miner deficiency. Mineral deficiency occurs in chicken livestock include: slow growth, decline of feed consumption, high basal metabolic rate, decrease of sensitivity and activity, osteoporosis, an abnormal behavior of walking, sensitive to internal bleeding, an increase of amount of urine, decrease of life power, thinning eggshells and decrease of egg production, tetanus, decline of appetite, animals chewing wood, bone and stone, and rough-hair growth (Scott et al., 1982).

### **Consumption of phosphor**

Average consumption of phosphor on native chicken aged 6 to 14 weeks (mean value) was  $0.60 \pm 0.01\%$  (Table 2) ranged over 0.59 to 0.60%. Average of phosphor consumption each week was range over 0.59 to 0.61% (Figure 1). This result was higher than NRC (1994) recommendation for white leghorn aged 6 to 14 weeks at 0.35%.

Phosphor is a mineral in which co-work with calcium to form bone and eggshell. Phosphor requirement in starter phase is higher than grower or pullet and production phases. Phosphor and calcium were co-work with vitamin D. Insufficiency of vitamin D will disrupt absorption of phosphor and calcium which is cannot absorb entirely and utilized by chicken body. In the starter phase, inadequacy of calcium and phosphor requirement will impact to slow growth and correlated to the low of body weight gain.

### **Consumption of crude fiber**

Crude fiber consumption (mean value) on native chicken aged 6 to 14 weeks was  $7.30 \pm 0.13\%$  (Table 2) ranged over 7.14 to 7.46%. This result was higher than NRC (1994) recommendation for white leghorn aged 6 to 14 weeks at 5%. Crude fiber cannot be digested by chickens since they have no cellulose enzyme. This addition still needed by chickens in small quantities as a bulky to facilitate excretion of excreta.

### **Body weight gain**

Average of body weight on native chicken at a grower phase fed by free choice feeding was  $670.48 \pm 83.85$  g/bird at week 14 with body weight gain at  $436.95 \pm 83.38$  g/bird/8 weeks (Table 3). The result of body weight in this study was lower than the finding of Creswell and Gunawan (1982) which reported about 708.00 g/bird by intensive treatment. On the other hand, body weight gain based on NRC (1994) recommendation on white leghorn and brown leghorn aged 14 weeks was 1100 and 1240 g/bird, respectively. The development of native chicken's body weight (mean value) aged 6 to 14 weeks is shown in Figure 2.

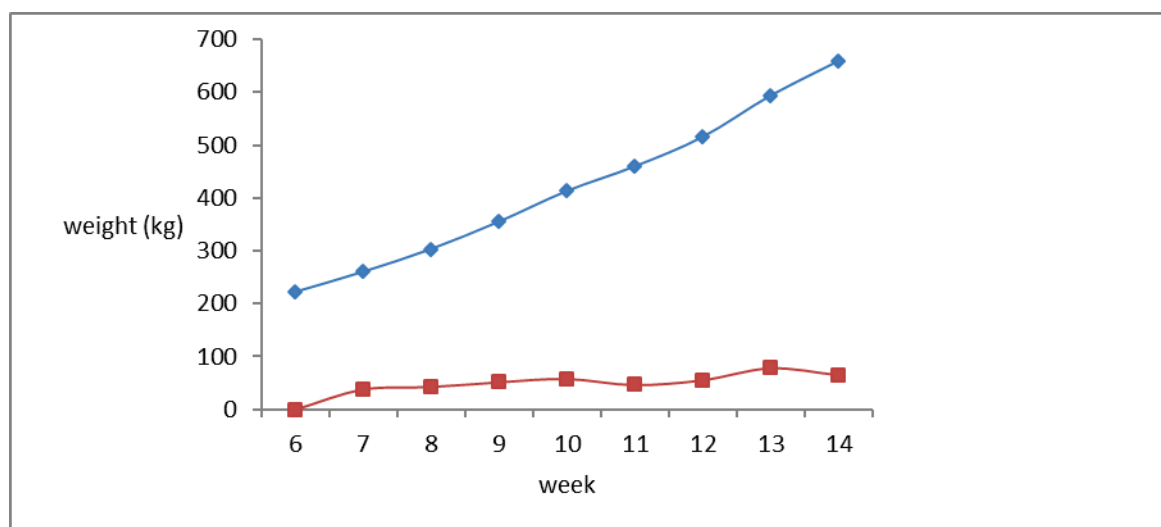
### **Feed conversion**

Average of feed conversion of native chicken aged 6 to 14 weeks was  $6.14 \pm 0.11$  with range over 6.02 to 6.28. This feed conversion result was higher than the finding of Zainuddin et al. (2000) which reported at 5.85, and NRC (1994) recommendation on white leghorn aged 14 weeks showed feed conversion ratio was 2.62.

Feed conversion is the ratio between feed consumption to body weight gain or egg production. The lower feed conversion value, become better feed efficiency. Several factors that affect feed conversion are: breed, strain, management, diseases, and feed (Ensminger, 1992).

**Table 3.** Performance of native chicken at a grower phase (6 to 14 weeks) fed by free choice feeding system

Variabel	Replication				Total	Average
	1	2	3	4		
Live weight 14 weeks (g/bird)	700.05	594.00	757.67	585.19	2636.91	659.23
Body weight gain (g/bird/8 weeks)	478.57	367.54	534.28	367.41	1747.80	436.95
Feed conversion	6.10	6.02	6.18	6.28	24.57	6.14
Carcass weight (g)	404.50	371.00	441.50	337.50	1554.50	388.63
Percentage of carcass (%)	57.47	56.69	57.83	56.91	230.30	57.57



**Figure 2.** Graph of body weight and body weight gain of native chicken at a grower phase (6 to 14 weeks) during rearing

### Weight and percentage of carcass

Carcass weight and percentage of carcass (mean value) of native chicken aged 14 weeks was  $388.63 \pm 44.62$  g/bird and  $57.57 \pm 0.69$  % (shown in Table 3). Percentage of carcass on native chicken aged 14 weeks improved to 2.73 % compared to the starter phase.

### CONCLUSIONS

Based on this research it can be concluded that: Native chicken at a grower phase (6 to 14 weeks) required nutrient of: metabolized energy 2990.55 kcal/kg, crude protein 15.53%, methionine 0.02%, lysine 0.05%, calcium 1.60% and phosphor 0.60%, and crude fiber 7.30% and resulted of body weight 659.23 g/bird, feed conversion 6.14, and carcass percentage was 57.57%; Nutrient formulated by cafeteria system resulted requirement for native chicken approximately the standard of white and brown laying hen by NRC (1994), except amino acid methionine and lysine.

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