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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan  
Mob: +92 300 3008585, Fax: +92 41 8815544  
E-mail: editorijps@gmail.com

## The Effect of Earthworm Meal Supplementation in the Diet on Quail's Growth Performance in Attempt to Replace the Usage of Fish Meal

Heni Setyo Prayogi

Faculty of Animal Science, Brawijaya University, Jl. Veteran, Malang, 65141, Indonesia

**Abstract:** This study was conducted to evaluate the effect of supplementation of different level of earthworm meal in the diet on quail's growth performance; feed consumption, Body Weight (BW) gain and feed conversion in attempt to replace the usage of fish meal. One day old quails of both sexes (80) were randomly allotted to 16 groups with 5 quails in each group (4 dietary treatments, 4 replicates). The treatments consisted of; 0% of earthworm meal and 15% of fish meal (control), 5% of earthworm meal and 10% of fish meal, 10% of earthworm meal and 5% of fish meal and 15% of earthworm meal and 0% of fish meal in the diet. Each diet was formulated to have the same content of protein ( $\pm 24.40\%$ ) and calorie ( $\pm 2950$  kcal/kg). The data were statistically analyzed by the One Way of ANOVA and continued by the Duncan's new Multiple Range Test (DMRT) for significant results. The result showed that the feed consumption was decreased due to higher percentage of earthworm and it was significantly different ( $p < 0.01$ ) compared to the control group. However, the BW gain was decrease steeply on the higher percentage of earthworm (15%) or no fish meal in the diet. It was concluded that the supplementation of 10% of earthworm in the diet gave a good growth performance of the quail because it has low feed conversion and high BW gain.

**Key words:** Quail, earthworm meal, fish meal, performance

### INTRODUCTION

Fish meal is a conventional feed stuff which has been used for many years as source of the protein for poultry diet due to the highly nutrition content. However, fish meal also has a nutritional constraint in usage, for example the high content of histamine can cause a defect on the gizzard of the poultry (Miculec *et al.*, 2004). Instead of having the nutritional constraint, the price of fish meal is relatively high because it is consumed not only by animal but also human. Therefore it is necessary to attempt to explore non-conventional raw materials which have high protein content so it does not entirely rely on fish meal.

Earthworm is one of the alternatives that can be used as a substitute, because earthworms have a protein content of 64-76% (Palungkun, 1999). This percentage is larger than fish meal (45%) and meat (51%). Based on the previous research (Resnawati, 2004), It was found that fresh earthworm has a protein content of 61.96%. The proteins contained in the earthworm are composed of essential amino acids and non essential amino acids, therefore, it is excellent when used as poultry feed ingredients.

The potential of earthworms as a source of protein needs to be tested against the birds to determine the extent of its role in feed substances. The previous research done by Resnawati (2004) found that earthworm meal can be used up to 15% because there was no significant effect on the use of 5% and 10%.

This research was conducted to see the effect of earthworm meal, in attempt to replace fish meal in feed mixture, on feed intake, feed conversion and body weight gain of quail starter period. The level of use of

earthworm in this study were 0% (R 0), 5% (R 1), 10% (R 2) and 15% (R 3). Each diet was formulated to have the same content of protein and calorie. Instead of earthworm meal, the feed materials used in the study were consisted of: corn, bran, fish meal, soybean meal, coconut cake, coconut oil and mineral feed supplement.

### MATERIALS AND METHODS

**Earthworm meal preparation:** The earthworm used in this study was the type of *Lumbricus rubellus* with 2-3 months of age produced by PT. Baretta Malang. Before being used as feed material, earthworms were first fasted for 3 h and sacrificed by dipping in 40°C hot water and then the earthworm was oven dried at 45°C until dry before grinding.

**Feed composition and animal trial:** A four iso-caloric and iso-protein feed treatments formulated based on quail requirement (NRC, 1994), with an inclusion level of earthworm: 0% (R0); 5% (R1); 10% (R2) and 15% (R3) as treatment. The feed treatment composition is presented in Table 1. An eighty one day old male quail of PT. Maju Mapan Tbk. purchased from local distributor were used on this study. The research was arranged by completely randomized design and the quails were weighed individually and randomly allotted to plot cage of 4 treatment ration (20 quails each as replication). The average of body weight was  $23.56 \pm 2.2$  gr with a coefficient of variation 9.32%. A battery cages were used, feed and water drinking were provided *ad libitum*.

**Data collection and analysis:** The chicks were reared for 5 weeks and weighted individually every week to

Table 1: Composition of feed treatment

Feedstuff	R0	R1	R2	R3
Rice bran	10.00	10.00	10.00	10.00
Yellow corn	47.00	46.20	46.20	46.20
CaCO <sub>3</sub>	0.00	0.80	1.20	1.40
Soybean meal	22.00	22.00	22.00	22.00
Fish meal	15.00	10.00	5.00	0.00
NaCl	0.20	0.20	0.20	0.20
Coconut oil	0.60	0.60	0.20	0.00
Premix*	0.50	0.50	0.50	0.50
Earthworm meal	0.00	5.00	10.00	15.00
Coconut expeller	4.70	4.70	4.70	4.70
Total	100.00	100.00	100.00	100.00
<b>Nutrient content (% DM), calculation based</b>				
ME (kcal/kg)	2942.00	2950.00	2951.00	2968.00
Crude protein (%)	24.47	24.40	24.40	24.40
Crude fat (%)	4.05	4.24	4.07	4.09
Crude fiber (%)	3.42	3.45	3.50	3.55
Ca (%)	0.81	0.96	0.95	0.85
P (%)	0.62	0.53	0.43	0.34
<b>Amino acids (%)</b>				
Arginine	1.72	1.75	1.78	1.81
Sistine	0.43	0.50	0.56	0.63
Glisson	1.46	1.37	1.29	1.20
Histidine	0.64	0.64	0.65	0.65
Isoleucine	1.37	1.31	1.26	1.21
Leucine	1.73	1.72	1.71	1.69
Lysin	1.62	1.58	1.52	1.48
Methionine	0.54	0.56	0.58	0.60
Phenylalanine	1.26	1.24	1.22	1.20
Threonine	1.07	1.08	1.10	1.12
Trypsin	0.32	0.52	0.71	0.90
Tyrosine	0.74	0.70	0.67	0.64
Valalin	1.34	1.32	1.29	1.27
<b>Lab. Analysis**</b>				
Protein (%)	30.09	30.39	31.09	30.76
Lemak (%)	6.89	7.21	6.27	6.88
Serat Kasar (%)	5.54	4.83	5.61	6.33
BK	89.33	89.74	89.35	89.27

\*Top Mix produced by Medion Bandung.

\*\*The Results of chemical analysis in animal Nutrition laboratory, Faculty of Animal Husbandry University of Brawijaya

Table 2: The proportion of amino acids for quail age 2-4 week to lysin (lysin = 100)

Amino Acids (%)	Required*	The proportion of amino acids to lysin			
		R0	R1	R2	R3
Arg	96	106	111	117	122
Cys	19	27	31	37	42
Gly	69	90	87	85	81
His	28	39	41	43	44
Isol	75	84	83	83	82
Leu	130	107	109	112	114
Lis	100	100	100	100	100
Met	38	33	35	38	40
Fenil	74	78	78	80	81
Thre	78	66	69	72	76
Trip	17	20	33	47	61
Tir	65	46	45	44	43
Val	73	83	83	85	86

\*NRC (1994)

measure body weight gain, feed consumption and conversion. All the data collected was analyzed by completely random design analysis and the significant

differences were tested by Least Significant Different (LSD) test (Yitnosumarto, 1993).

Based on amino acid content on the prepared feed, it was obtained a proportion of amino acids to lysine for quail as given in Table 2.

## RESULTS AND DISCUSSION

The effect of earthworm supplementation in dietary due to the quail's performance; feed consumption, body weight gain and feed conversion was presented in Table 3.

Based on the statistical data analysis, it was found that the substitution of earthworm meal in the dietary significantly ( $p < 0.05$ ) affected the feed consumption, Body weight gain and feed conversion of quail age 2-5 week.

**Feed consumption:** Based on average feed consumption data (presented in Table 3), it shows that the use of 15% earthworm meal can reduce feed intake and based on the statistical data analysis, it was found that R0 (no substitution of earthworm meal) was significantly different from R1, R2 and R3 which uses 5%, 10% and 15% of earthworm meal substitution respectively. However, the least significant different test showed that there was no different of feed consumption between the use of 15% (R3) compared to the use of 10% (R2) and 5% (R1). This means that substitution of earthworm in dietary raring from 5-15% give the same effect to the feed consumption.

From chart 1, it appears that the use of earthworm meal can reduce the amount of feed consumption of quail. According to Wahyu (1985), feed intake is influenced by breed of the bird, production phase and the environmental conditions (including feed nutrition especially the energy content). The decrease in feed consumption is mainly due to amino acid content that is not balanced among feed treatments. On this study, the decrease in feed consumption is mainly due to amino acid content of feed that is not balanced. Based on proportion of amino acids to lysin (Table 2), the content of arginine, cysteine and tryptophan tend to increase while the amino acids of glycine and tyrosine tended to decline by the increased of earthworm meal level in the diet. Burman and Burgess (1986), stated that an imbalance of some amino acids will change the pattern of amino acid concentrations in the body, when the concentration of amino acid changes, then decreased appetite consequently decreased feed consumption. According to Soeharjono *et al.* (2002), low digestibility of the feed will be consumed in small amounts because the digestive tract takes longer time to empty, so the nutrients which can be absorbed and utilized by the body becomes less. However, feed with high digestibility will become easier to be absorbed by the digestive tract, thus it can accelerate metabolism process and the use of energy for metabolism which indeed can increase feed consumption (Hill, 1985).

Table 3: The average of feed consumption, body weight gain and feed conversion

Treatment	Feed consumption (g/day)	Body weight gain (g)	Feed conversion
R0	11.53±0.17 <sup>a</sup>	3.71±0.15 <sup>b</sup>	3.11±0.13 <sup>a</sup>
R1	9.53±0.06 <sup>b</sup>	3.59±0.09 <sup>b</sup>	2.66±0.08 <sup>b</sup>
R2	9.83±0.25 <sup>b</sup>	3.67±0.14 <sup>b</sup>	2.68±0.11 <sup>b</sup>
R3	9.14±0.27 <sup>b</sup>	3.00±0.34 <sup>a</sup>	3.08±0.32 <sup>a</sup>
ANOVA	*	*	*

\*Significantly different ( $p < 0.05$ ). Value in the same column with different superscripts are significantly different ( $p < 0.05$ )

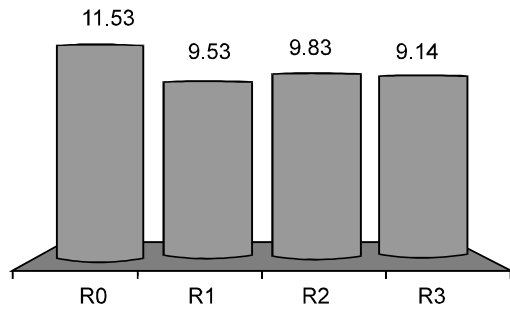


Chart 1: The average of feed consumption of quails male 2-4 weeks (g/head/day)

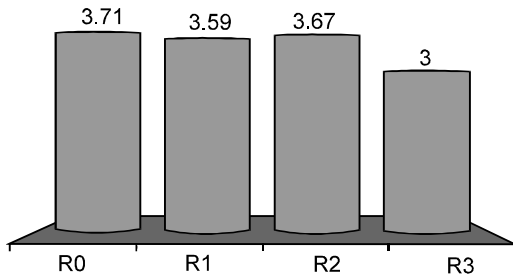


Chart 2: The average of Body weight gain of quails male 2-4 weeks (g/head/day)

**Body weight gain:** Based on statistical data analysis result, (Table 3), the use of earthworm meal 0%, 5%, 10% and 15% give significantly affect ( $p < 0.1$ ) to growth of quails male 2-4 weeks of age. There was a trend that body weight gains tend to decrease by the increase of earthworm meal substitution. However, the least significant different test showed that there was no different effect between the use of earthworm meal in 0%, 5% and 10% in the diet, but the use of 15% gave a significantly effect compare to the other treatment. This suggests that the higher usage of earthworms in feed can cause a decrease in body weight of quail, see chart 2 for detail. The decrease in body weight gain is due to a decrease in feed intake which describe previously in feed consumption. This is in line with the statement of Siregar *et al.* (1989), if the feed consumption is decrease, the energy and protein consumption is also low, so the bird can't grow normally and ultimately decreased the body weight gain.

**Feed conversion:** Statistical data analysis result, (Table 3), shows that feed conversion was significantly different ( $p < 0.1$ ) among the treatments. Based on the LSD test, it was found that there was no difference between R0 and R3, but it was significantly different to R1 and R2. This finding suggested that the feed conversion between the use of 0% and 15% of earthworm meal have the same feed conversion.

However, it was higher when compared it with the use of 5% or 10%. In other words, the usage of 5% and 10% of earthworm meal provide better feed conversion.

**Conclusion:** The use of 10% earthworm meal gives the best results compared with the other treatments because it has low feed conversion and higher body weight gain.

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