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The Effect of Moringa Leaf Powder (*Moringa oleifera L*) in the Diet on the Production Performance of Quail Eggs (*Coturnix coturnix japonica*)

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Abstract

This study aims to evaluate the effect of Moringa leaf powder (*Moringa oleifera* L) in the diet on the performance of quail egg production. This research was conducted for 8 weeks at the Commercial Zone Animal Laboratory, Department of Animal Science, Faculty of Agriculture, Bengkulu University. The experimental design used in this study was a completely randomized design with 5 treatments with 5 replications and each replication consisted of 5 quails. The treatment given was P0 as a control; P1 ration contained 0.5% commercial feed supplement; P2 ration contained 0.5% Moringa leaf powder; P3 ration contained 1.5% Moringa leaf powder; P4 ration contained 2.5% Moringa leaf powder. The results showed that the Moringa leaf powder in rations up to a level of 2.5% had no significant effect (P>0.05) on feed intake, egg weight, egg production, egg mass production, and feed conversion ratio. Based on the results of the study, it was concluded that the administration of 0.5% Moringa leaf powder could replace commercial feed supplements. The higher levels of Moringa leaf powder administration did not improve egg production performance. The addition of commercial feed supplement in quail rations was not necessary.
Keywords: Moringa leaves, egg production, quail

Introduction

There are several types of quail, one of which is the Coturnix coturnix japonica. This type of quail is most popularly raised by the community as a producer of eggs and meat (Subekti and Hastuti, 2013). The use of a high quality of feedstuffs is needed to increase livestock production. The price of commercial diets are highly dependent on the price of imported feedstuffs so that they are prone to price increases. Therefore, alternative steps are needed to reduce the cost of diet without reducing the quality of diet and the production performance.

To increase poultry productivity and to prevent stress, farmers usually use feed additives in their diets. The purpose of its use is to increase productivity, health, and nutritional status of poultry. Commercial feed additives have been used for a long time. Human awareness of the importance of healthy living and the desire to return to nature by reducing the consumption of synthetic drugs and preferring to consume natural medicines (Hargono, 1996). Likewise for the world of animal husbandry, the use of synthetic feed additives in the diet is increasingly being reduced. Therefore, an effort is needed to replace synthetic feed additives with natural feed additives but have the same function as synthetic feed additives. One of the potential feed additives is *Moringa* Leaves powder (*Moringa oleifera* L).

Moringa leaves (*Moringa oleifera* L) have been known to contain flavonoids, saponins, tannins, and other phenolic compounds that have antimicrobial activity

(Sato et al., 2004) so that they can be used as natural feed additives. Feed additive is a material that is mixed into the diet that can affect the health and nutritional status of poultry (Adams, 2000).

Moringa leaves have a fairly high protein content, which is around 22.75% (Melo et al., 2013). High protein content can improve egg production performance, as stated by Suprijatna et al. (2005) that the percentage of production during the production period is significantly influenced by the level of protein during the production period. The results of the research by Juarsa et al. (2018) shows that the administration of 5% Moringa leaf solution can increase feed intake, egg production, and also improve feed conversion ratio with no mortality. Based on the description above, the authors conducted a study using Moringa leaf flour in the diet to increase the performance of quail egg production.

This study aims to evaluate the effect of using Moringa leaf powder in the diet to improve the performance of quail egg production. The research hypothesis is as follows.

1. Giving 0.5% Moringa leaf powder is thought to replace commercial feed additives

2. Higher levels of Moringa leaf flour are thought to increase the performance of quail egg production.

Materials and Methods

This research was conducted from December 2020 to February 2021 at Commercial Zone Animal Laboratory, Department of Animal Husbandry, Faculty of Agriculture, Bengkulu University.

Moringa Leaf Powder

Moringa leaves that have been picked are placed on a tarp. Moringa leaf drying was done by aerating the leaves on a tarp until the water content of Moringa leaves decreases and the Moringa leaves look dry. Drying was not carried out in direct sunlight, because it was feared that it could damage the nutrition. After that, the Moringa leaves were ground using a grinding machine to obtain Moringa leaf powder. Then Moringa leaf powder was tested for proximate analysis.

Quail, Feed and Treatment

This study used quail aged 55 days of age with a total of 125 birds and were put into experimental plots, then they were given experimental diets for 8 weeks. The diet and drinking water were provided ad libitum.

This study used completely randomized design) with 5 treatments and each treatment consisted of 5 replications, and each replication consisted of 5 quails. The quails were distributed into experimental treatments as follows. P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with

0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

The ration used in this study contained 20% crude protein and 2800 kcal/kg metabolic energy. Table 1 presented the composition of the experimental diet. The variables measured were feed intake, egg weight, egg production, egg mass production, and feed conversion ratio.

Data analysis

The quail egg production data were analyzed by ANOVA (Analysis of variance) and if the analysis had a significant effect (P<0.05), further tests were carried out with DMRT.

Results and Discussion

Feed Intake

The effect of Moringa leaf powder on feed intake was presented in Table 1. The results of the analysis of variance showed that the use of Moringa leaf powder had no significant effect (P>0.05) on feed intake in the second, third, fourth, fifth, seventh, eighth week and during the study, while in the first and sixth weeks of the study the use of Moringaleaf powder had a significant effect (P<0.05) on the feed intake. Further test results showed that the first week of feed intake at P0 was not significantly different from P1 and P4 but significantly lower than P2 and P3, while between P1, P2, P3 and P4 was not significant. The sixth week of feed intake at P0 was not significantly different from P1, P2, P3 and P4 while between P3 and P1, P2, and P4 was significantly different.

The results of the analysis of variance showed that the treatment had no significant effect (P>0.05) on the average weekly feed intake and during the study. The average of weekly feed intake obtained in each treatment ranged from 191.66 g/bird to 202.63 g/bird. The results of the study were higher than those of Juarsa et al. (2018), who found that performance of quail egg production given a solution of Moringa leaves had feed intake from the 1st to 4th week of 158.2 g/bird/week – 170,2 g/bird/week.

Table 1. Effect of Moringa leaf powder on feed intake of quails

Weeks-	Feed intake					
	P0	P1	P2	P3	P4	P
	…g/bird …					
1	187.92^{a}	173.32^{ab}	200.40^{b}	200.84^{b}	183.76^{ab}	0.04
2	186.16	187.52	194.20	185.04	207.04	0.26
3	214.11	215.92	213.64	216.04	228.68	0.68
4	195.61	193.52	194.96	198.48	180.49	0.33
5	204.52	202.96	206.76	183.68	194.41	0.78
6	205.86^{ab}	188.19^{a}	201.72^{a}	225.08^{b}	188.03^{a}	0.01
7	182.54	180.77	186.40	201.76	202.74	0.42

8	156.56	193.85	196.72	210.12	198.25	0.29
Total	1533.28	1536.05	1594.80	1621.04	1583.40	0.47
Average	191.66	192.01	199.35	202.63	197.93	0.47
SD	17.91	13.13	8.33	14.29	15.43	

P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with 0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

According to Anggorodi (1995) feed intake was influenced by several factors, including: age, ration palatability, diet energy, production level, diet quantity and quality. The protein content in Moringa leaves is 22.75% (Melo et al., 2013), the metabolic energy content in Moringa leaves according to Sari (2017) is 2415 kcal/kg. The results of the calculation of the nutritional composition of the treatment rations showed that the protein and energy content was almost the same (Table 2).

Table 2. Diet formulation used in the present study and their nutritional composition

Feedstuffs (%)	P0	P1	P2	P3	P4
Rice bran	10	10	10	10	10
Yellow corn	38,5	38,5	38,5	38,5	38,5
Layer concentrate	50,5	50	50	49	48
Mineral Mix	1	1	1	1	1
Top Mix	0	0,5	0	0	0
Moringa leaf powder	0	0	0,5	1,5	2,5
Total	100	100	100	100	100
Protein (%)	20,94	20,78	20,89	20,79	20,69
ME (kcal/kg)	2823,09	2809,59	2826,22	2832,48	2838,74
Fat (%)	5,22	5,19	5,20	5,18	5,15
Crude fiber (%)	7,01	6,96	7,00	6,93	6,93
Ca (%)	5,80	5,75	5,76	5,67	5,58
P (%)	0,93	0,93	0,93	0,93	0,92

The energy content in the diet is a barrier to feed intake, because if the needs of the poultry have been met, the poultry will instinctively stop eating (Lokapirnasari, 2017). So, one of the factors that caused the feed intake to remain unchanged was the similar energy content of the experimental diet among the treatments.

Egg Weight

The weight of quail eggs from the first week to the eighth week and during the study of each treatment is presented in Table 3.

Table 3. Effect of Moringa leaf powder on egg weight of quails

Week-	Egg Weight					
	P0	P1	P2	P3	P4	P
	…g/egg…					
1	10.22	10.06	10.20	10.27	10.24	0.97
2	10.38	10.14	10.43	10.20	10.26	0.70
3	10.29	10.40	10.23	10.31	10.33	0.98
4	10.46	10.73	10.58	10.55	10.47	0.85
5	10.51	10.48	10.56	10.42	10.36	0.98
6	10.78	10.29	10.67	10.41	11.10	0.63
7	10.51	10.58	10.65	10.48	10.40	0.88
8	10.45	10.16	10.37	10.54	10.44	0.82
Average	10.45	10.36	10.46	10.40	10.45	0.99
SD	0.17	0.23	0.18	0.13	0.28	

P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with 0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

The experimental results showed that the treatment had no significant effect (P>0.05) on egg weight. One factor that affected egg weight is feed intake of quails. Overall feed intake of all treatment groups were similar. Thus no change in egg weight might be caused by no change in feed intake of quails. The average value of egg weight from the lowest was P1 (10.36), P3 (10.40), P0 (10.45), P4 (10.45), and P2 (10.46). This average result was in accordance with the research of Juarsa et al. (2018), who showed that the inclusion of solution of Moringa leaves resulted in egg weight of 9.6 – 10.8 g. Moringa leaves contains amino acids aspartic acid, glutamic acid, alanine, valine, leucine, isoleucine, histidine, lysine, arginine, phenylalanine, tryptophan, cysteine and methionine (Aminah et al., 2015). Leeson and Summers (2005) stated that protein and amino acids are the most important nutrition in controlling egg size. It is postulated that the level of administration of Moringa leaf powder was too low so that the function of the amino acids present in Moringa leaves did not affect the weight of the eggs. In addition, the factors that could affect the egg weight included the type of diet, the amount of feed intake, the house environment and the quality of the diet (Listyowati and Roospitasari, 2005). In this study, the protein content given in the diet was almost the same, ranging from 20.69% - 20.94%, resulting in relatively the same egg weight among the treatment groups.

Egg Production

The effect of Moringa leaf powder on egg production is presented in Table 4.

Table 4. Effect of Moringa leaf powder on egg production of qualis

Week	Egg production					
	P0	P1	P2	P3	P4	P
	…egg/bird…					
1	4.40	3.96	4.76	4.28	5.00	0.63
2	5.25^{ab}	4.48^{a}	5.88^{b}	6.24^{b}	6.12^{b}	0.04
3	5.81	5.52	5.92	6.04	6.04	0.75
4	5.25^{a}	5.72^{a}	5.84^{ab}	6.72^{b}	6.75^{b}	0.01
5	5.77	6.44	5.60	6.20	6.32	0.53
6	5.57	5.53	5.68	6.36	5.27	0.62
7	4.81^{a}	4.23^{a}	6.04^{b}	5.12^{ab}	5.15^{ab}	0.04
8	5.22	4.59	4.88	6.44	5.40	0.44
Total	42.08	40.47	44.60	47.40	46.05	0.28
Average	5.26	5.06	5.58	5.93	5.76	0.28
SD	0.48	0.86	0.49	0.81	0.63	

P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with 0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

The experimental results showed that the use of Moringa leaf powder had no significant effect (P>0.05) on egg production at the first, third, fifth, sixth, eighth week, and during the study.. In the second, fourth and seventh weeks of the study the use of Moringa leaf powder had a significant effect (P<0.05) on egg production. Further test results showed that egg production in the second week at P0 was not significantly different from that of P1, P2, P3 and P4, while between P1 and P2, P3, and P4 was significantly different. Egg production in the fourth week at P0 was not significantly different from that of P1 and P2, but significantly lower than that of P3 and P4, while between P2, P3 and P4 it was not significantly different. In the seventh week the egg production of P0 was not significantly different from that of P1, P3 and P4, but was significantly lower than that of P2, while between P2, P3 and P4 the difference was not significant. The results of the analysis of variance showed that the treatment had no significant effect (P>0.05) on the average weekly egg production and during the study. The average weekly production of quail eggs in each treatment ranged from 5.06 to 5.93 eggs/head/week.

Maknun et al. (2015) stated that egg production is influenced by the crude protein content in the diet. The crude protein content in the diets treated with Moringa leaf powder was 0.5%, 1.5% and 2.5% almost the same, ranging from 20.69% - 20.94%. These results indicate that the availability of amino acids for egg formation is the same resulting in similar egg production. Abbasi et al. (2014) stated that the protein content, especially amino acid, was able to affect the immune system related to the health of quail. The availability of amino acids in the

diet also affects egg production (Santos et al., 2016)

Egg Mass Production

The egg mass production from the first week to the eighth week and during the study from each treatment is presented in Table 5.

Table 5. Effect of Moringa leaf powder on egg mass production

Week-	Egg mass					
	P0	P1	P2	P3	P4	P
	…g/bird…					
1	44.68	40.16	48.52	44.08	51.08	0.65
2	54.41^{ab}	45.64^{a}	61.24^{b}	63.63^{b}	62.81^{b}	0.04
3	59.55	57.40	60.51	62.24	62.44	0.78
4	54.86^{a}	61.64^{ab}	61.88^{ab}	70.88^{b}	70.54^{b}	0.02
5	60.48	67.26	59.06	64.24	65.42	0.49
6	59.80	57.03	60.76	66.11	59.17	0.87
7	50.32^{a}	44.87^{a}	64.32^{b}	53.76^{ab}	53.67^{ab}	0.05
8	54.21	47.56	50.84	67.76	56.68	0.44
Total	438.31	421.56	467.13	492.69	48.81	0.26
Average	54.79	52.70	58.39	61.59	60.23	0.26
SD	5.38	9.47	5.61	8.66	6.38	

P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with 0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

The experimental results showed that the treatment had no significant effect (P>0.05) on egg mass production at the first, third, fifth, sixth, eighth week, and during the study. Meanwhile, in the second, fourth and seventh weeks of the study, the use of Moringa leaf flour in the diet had a significant effect (P<0.05) on the egg mass production. Further test results showed that the second week of egg mass production at P0 was not significantly different from P1, P2, P3 and P4, while P1 and P2, P3 and P4 were significantly different. Egg mass production in the fourth week at P0 was not significantly different from P1 and P2 but was significantly lower than P3 and P4 while between P1, P2, P3 and P4 was not significantly different. In the seventh week the egg production of P0 was not significantly different from that of P1, P3 and P4, but was significantly lower than that of P2, while between P2, P3, and P4 it was not significantly different. In the second and fourth weeks the highest average egg mass production was obtained P3, in the seventh week the highest average egg mass production was obtained P2. This was thought to be related to the production of P2 and P3 eggs (Table 9) which was also higher than other treatments. The results of the analysis of variance showed that the treatment had no significant effect (P>0.05)

on the average egg mass production per week and during the study.

The average weekly egg mass production in this study was 52.70 – 61.59 g/bird/week. This study was in contrast to the research of Juarsa et al. (2018) who gave quails with a solution of Moringa showed significant effect (P <0.05) on egg mass production. Egg mass production is influenced by egg production and egg weight. Egg weight is influenced by the type or type of quail. Based on the results of the study the use of Moringa leaf powder in the diet did not have a negative impact on egg mass production.

Feed Conversion Ratio

The feed conversion ratio of quails from the first week to the eighth week and during the study of each treatment is presented in Table 6.

Table 6. Effect of Moringa leaf powder on feed conversion ratio

Week-	Feed conversion ratio					
	P0	P1	P2	P3	P4	P
1	4.21	4.32	4.13	4.56	3.60	0.73
2	3.42	4.11	3.17	2.91	3.30	0.08
3	3.60	3.76	3.53	3.47	3.66	0.94
4	3.57^{c}	3.14^{c}	3.15^{bc}	2.80^{ab}	2.56^{a}	0.01
5	3.38	3.02	3.50	2.86	2.97	0.49
6	3.44	3.30	3.32	3.40	3.18	1.00
7	3.63	4.03	2.90	3.75	3.78	0.06
8	2.89	4.08	3.87	3.10	3.50	0.24
Total	3.54	3.74	3.43	3.31	3.31	0.45
SD	0.36	0.50	0.40	0.59	0.41	

P0 = A diet without Moringa leaf and commercial feed additives the control, P1 = A diet with 0.5% topmix P2 = A diet with 0.5% Moringa leaf powder, P3 = A diet with 1.5% Moringa leaf powder, P4 = A diet with 2.5% Moringa leaf powder.

The experimental results showed that the use of Moringa leaf powder in the diet had no significant effect (P>0.05) on feed conversion ratio. However these treatments resulted in a significant effect (P<0.05) in the fourth week. The results of the further test showed that the 4th week ration conversion at P0 was not significantly different from P1 and P2 but was significantly higher than P3 and P4, while between P2, P3 and P4 the difference was not significant. The results of the analysis of variance showed that the treatment had no significant effect (P>0.05) on the average weekly ration conversion.

The average weekly ration conversion in this study was 3.29 – 3.64. The results of this study are higher than those of Juarsa et al. (2018) who use a solution of Moringa leaves which resulted in an average feed conversion ratio ranging from 2.74 – 2.87. From the research results, this feed conversion ratio is still ideal as stated by Hazim et al. (2010) the ideal feed

conversion ratio is 3.67 – 4.71. The use of Moringa leaf powder did not have a significant effect because the level of Moringa leaf powder was too low so that the amount of flavonoids consumed was thought to be very low. This flavonoid is a compound that has antioxidant properties. Dewi et al. (2014) stated that Moringa leaf has anti-bacterial and anti-fungal properties, and therefore, harmful pathogenic bacteria in the digestive tract could be killed by these compounds contained in Moringa leaves.

Conclusion

Based on the results of the study, it could be concluded that giving 0.5% Moringa leaf powder could replace the commercial feed additive. In addition, higher levels of Moringa leaf powder did not improve egg production performance.

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