Conference Paper

Performance of Japanese Quails (*Coturnix coturnix japonica* Temminck & Schlegel, 1849) Fed Hatchery Waste Meal

Rysca Indreswari, Adi Ratriyanto, and Tristianto Nugroho

Department of Animal Husbandry, Faculty of Agriculture, Universitas Sebelas Maret, Jalan Ir. Sutami 36A, Surakarta, Jawa Tengah, 57126, Indonesia

Abstract

This study aimed to evaluate the effect of hatchery waste meal in ration on performance of quails. The experiment used 500 quails (*Coturnix coturnix japonica* Temminck & Schlegel, 1849) aged 30 d with an average initial body weight of 94.75 g ± 4.17 g. The quails were randomly allocated to five dietary treatments in a completely randomized design with five replicates containing twenty quails. The dietary treatments were: P0 = basal ration; P1 = 96 % basal ration + 4 % whole hatchery waste meal; P2 = 92 % basal ration + 8 % whole hatchery waste meal, P3 = 96 % basal ration + 4 % shells hatchery waste meal, P4 = 92 % basal ration + 8 % shells hatchery waste meal. The dietary treatments were given for 28 d. Performance data were analyzed by using analysis of variance, and when the treatment indicated significant effects, it was continued with orthogonal contrast test. Feeding hatchery waste meal improved the performance of quails ($P < 0.05$). Shells hatchery waste meal improved egg production, feed conversion, and protein efficiency ratio than whole hatchery waste meal ($P < 0.05$). Feeding 8 % whole hatchery waste meal improved egg production than 4 % whole hatchery waste meal ($P < 0.05$), while feeding 8 % shells hatchery waste meal tended to improve egg production than 4 % shells hatchery waste meal ($P = 0.09$). It can be concluded that hatchery waste meal improved the performance of quails, particularly 8 % shells hatchery waste meal, which showed the best response.

Keywords: Hatchery waste meal, Performance, Japanese quails, Shells, Whole

Corresponding Author:
Rysca Indreswari
rysca1103@yahoo.com

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1. Introduction

Japanese quail (*Coturnix coturnix japonica* Temminck & Schlegel, 1849) has proven to be a potential source of animal food protein [1]. They are prolific, required less feed, and the life expectancy is relatively longer (2 yr to 2.5 yr) than domestic fowl [2]. They mature in about six weeks and are usually in full egg production by 50 d with production up to 200 eggs to 300 eggs in their first year of lay [2]. Many studies showed that quail could easily adapt to commercial management conditions [3]. Quail meat and eggs are renowned for their high quality of protein, high biological value and low caloric content [4].

In Japanese quail farming, comparatively higher nutritional requirement, poor feed efficiency, short supply of ingredients, and an increase in prices of most of the feed ingredients result in high cost of production [5]. The high cost and unavailability of the conventional feed ingredients have led to the search for alternative (unconventional) sources of protein and energy. The efficient utilization of animal by-products can alleviate the prevailing cost and scarcity of feed materials, which have high competition between animals and humans [6]. Hatchery waste is primarily composed of dead chicks, infertile whole eggs, and shells from hatched eggs [7]. This material is usually incinerated, rendered, or taken to landfills [8]. The high moisture content of fresh waste makes disposal and incineration costly and it may be unsafe environmentally [8, 9].

Hatchery waste has a good nutrient content, for example 36.2 % crude protein, 23.9 % ether extracts, 0.9 % crude fiber, 25.1 % ash, 2795.2 kcal $\cdot$ kg^{-1} metabolizable energy (ME), 25.62 % calcium and 1.47 % phosphorus [5, 10]. Therefore, hatchery waste can be used as a source of protein, energy and calcium and phosphorus [11]. Protein from hatchery waste has a high biological value and digestibility, and the amino acids balance of hatchery waste is better than fishmeal and other animal protein sources [11–13]. Hatchery waste meal (HWM) is cheaper and profitable than soybean meal and fish [14].

Several studies have been conducted to examine the hatchery waste utilization in poultry. Replacement of fishmeal up to 100 % with hatchery waste meal did not affect feed intake, egg weight and feed conversion of quails [5]. Several other authors also conducted similar observations using poultry hatchery waste in laying hens [15]. The replacement of fishmeal with whole or shells hatchery waste meal in isoprotein diets did not affect feed intake but increased egg production and egg weight [16]. The objective of this experiment was to determine the effects of hatchery waste meal on production performance of quails.

2. Materials and Methods

2.1. Preparation of hatchery waste meal

Hatchery waste was obtained from Oxsy Jaya Farm, located in Gedongan, Colomadu, Karanganyar, Indonesia. Hatchery waste meal consisted of the shell, infertile eggs, and unhatched eggs. Hatchery waste was divided into two types of waste: whole hatchery waste meal (WHWM) and shells hatchery waste meal (SHWM). The WHWM was obtained from hatchery waste of the hatching process as a whole, whereas SHWM obtained from whole hatchery waste reduced by eggshell from hatched eggs. The hatchery waste was boiled at 100 °C for 15 min with a ratio of water and hatchery waste of 2 : 1. Then it was kept in ambient temperature for 12 h to 14 h. The boiled waste was moved into the filters for 10 min to 15 min and milled using a diskmill thereafter. The HWM was then oven-dried at 60 °C for 24 h [17].

2.2. Management of experimental birds

Five hundred 30 d.o female Japanese quails obtained from Karanganyar with an average initial body weight of of 94.75 g ± 4.17 g were used for this study. The quails were randomly allocated to five dietary treatments in a completely randomized design with five replicates containing twenty quails. The dietary treatments were: P0 = basal ration; P1 = 96 % basal ration + 4 % WHWM, P2 = 92 % basal ration + 8 % WHWM, P3 = 96 % basal ration + 4 % SHWM, P4 = 92 % basal ration + 8 % SHWM.

The research was conducted in two stages, adaptation and treatment. The adaptation is performed at the age of 30 d until the egg production 10 % in order to adapt to the environment, cages, and ration. It is expected that feed intake and egg production can be uniform. The quails were given ration twice a day, at 07:00 and 13:30. The commercial ration was given from the age 30 d to 39 d. At the age 40 d to 41 d the quails were adapted to the basal ration (Table 1) with a ratio of 50 % commercial ration and 50 % basal ration. The basal ration was given from the age of 42 d until 10 % egg production. The treatment rations (Table 2) were given thereafter, for 28 d.

Table 1: The composition and nutrient content of basal ration.

Ingredient	Proportion (%)
Corn	45.45
Rice bran	18.56
Soybean meal	20.05
Fishmeal	6.75
Coconut oil	1.25
dl-methionine	0.05
Dikalsium fosfat	1.50
Limestone	5.80
Premiks	0.25
NaCl	0.25

Table 2: Composition and nutrient content of experimental rations.

Components	Treatments				
	P0	P1	P2	P3	P4
Basal diet (%)	100	96	92	96	92
Whole hatchery waste meal (%)	0	4	8	0	0
Shells hatchery waste meal (%)	0	0	0	4	8
Nutrient content					
Metabolizable energy (kcal · kg^{-1})	2 800.00	2 789.03	2 777.98	2 841.62	2 882.88
Crude protein (%)	18.00	18.50	19.00	18.86	19.71
Crude fat (%)	1.75	2.57	3.38	2.86	3.96
Cude fiber (%)	4.97	4.94	4.92	4.92	4.87
Crude ash (%)	5.08	7.13	9.16	6.27	7.46
Calcium (%)	3.40	4.24	5.07	3.64	3.88
Available phosphorus (%)	0.50	0.58	0.65	0.52	0.53
Lysine (%)	1.02	0.97	0.93	0.97	0.93
Methionine (%)	0.40	0.39	0.37	0.39	0.37

2.3. Data analysis

Performance data were analyzed by using analysis of variance, and when the treatment indicated significant effects, it was continued with orthogonal contrast test [18].

3. Result and Discussion

Feeding HWM improved the performance of quails ($P < 0.05$). Feed consumption increased with the increased in production and egg weight. It happened since the increase in production and egg weight requires nutrients such as energy and more protein [19]. Quails fed SHWM consume more ration than WHWM due to higher egg production, while quails fed WHWM 8 % consume ration more than WHWM 4 %, due to the relatively higher egg production (Table 3).

The SHWM improved egg production, feed conversion and protein efficiency ratio than WHWM (Table 4). Khan and Bhatti stated that processed SHWM is rich in protein and essential amino acids compared to processed WHWM [13]. Feeding 8 % WHWM improved egg production compared with 4 % WHWM ($P < 0.05$), while feeding 8 % SHWM tended to improve egg production than 4 % SHWM ($P = 0.09$). The higher nutrients intake led to the increase in follicle number and development as well as egg weight [17, 20].

Table 3: Performance of quails fed hatchery waste meal in the ration.

Treatments	Feed intake (g /bird/day)	Egg production (%)	Egg weight (g)	Feed conversion ratio	Protein efficiency ratio
P0	24.71	68.70	9.46	3.80	1.46
P1	25.82	73.55	10.07	3.50	1.55
P2	26.10	77.91	10.19	3.33	1.60
P3	26.03	79.87	10.11	3.22	1.65
P4	26.24	83.24	10.33	3.06	1.66

P0 = basal ration; P1 = 96 % basal ration + 4 % WHWM; P2 = 92 % basal ration + 8 % WHWM; P3 = 96 % basal ration + 4 % SHWM; P4 = 92 % basal ration + 8 % SHWM.

Table 4: Results of orthogonal contrast test.

	Feed Intake (g/bird/day)	Egg Production (%)	Egg Weight (g)	Feed Conversion Ratio	Protein Efficiency Ratio
P0 *vs* P1, P2, P3, P4	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
P1, P2 *vs* P3, P4	< 0.01	< 0.01	0.38	< 0.01	0.02
P1 *vs* P2	0.04	0.04	0.42	0.05	0.24
P3 *vs* P4	0.10	0.09	0.16	0.11	0.75

P0 = basal ration; P1 = 96 % basal ration + 4 % whole HWM; P2 = 92 % basal ration + 8 % whole HWM; P3 = 96 % basal ration + 4 % shells HWM, P4 = 92 % basal ration + 8 % shells HWM.

4. Conclusion

It can be concluded that HWM improved performance of quails, particularly 8 % shells HWM that showed the best response.

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