The Effect of Expired Powder Milk ...

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Submission date: 19-Jun-2022 02:01PM (UTC+0800)
Submission ID: 1859284236
File name: 1655359119AAVS_10_6_1397-1405.pdf (277.81K)
Word count: 6578
Character count: 33124

Research Article

The Effect of Expired Powder Milk Supplementation on Different Protein Levels on the Performance of Laying Japanese Quails (*Coturnix coturnix japonica*)

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Abstract | This study aimed to determine the effect of expired milk powder supplementation at different protein levels on the performance of laying quail. This study used 240 heads of laying Japanese quail (*Coturnix coturnix japonica*) aged 42 days with 10% egg production in the layer phase aged 6-9 weeks. This study used an experimental method with a completely randomized design (CRD) in a 3x2 factorial with four replications. Each replication consisted of 10 laying quails. The first factor is expired milk powder supplementation with three levels, namely 0%, 0.25%, and 0.50%. The second factor is the level of protein requirement with two levels, namely 20% and 18%. The variables observed were ration consumption (g/head/day), daily egg production (%), egg weight (g/grain), egg mass (g/head/day), feed conversion, and income over feed cost (IOFC). The analysis of variance showed that supplementation of expired milk powder in the ration had no significant effect (P>0.05) on ration consumption, daily egg production, egg weight, egg mass, and ration conversion at 20% and 18% protein levels. Based on the study results, it can be concluded that the addition of expired milk powders up to a dose of 0.50% did not affect the performance of quail aged 6-9 weeks. Numerically, higher income over feed cost (Rp. 274,272) was attained from the quail layer fed with 20% protein.

Keywords | Expired milk powder, Protein level, Performance, Laying Japanese quail

Received | November 03, 2021; **Accepted** | May 04, 2022; **Published** | June 16, 2022
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Citation | Djulardi A, Amizar R, Sanjaya T (2022). The effect of expired powder milk supplementation on different protein levels on the performance of laying Japanese quails (*Coturnix coturnix japonica*). Adv. Anim. Vet. Sci. 10(6):1397-1405.
DOI | https://dx.doi.org/10.17582/journal.aavs/2022/10.6.1397.1405
ISSN (Online) | 2307-8316

INTRODUCTION

Japanese Quail (*Coturnix coturnix japonica*) is one of the potential livestock commodities as a source of high-quality animal protein. With their savory taste, quail eggs are very popular with the public. In addition, the price is also affordable and has good quality. Japanese quail has a high potential for breeding because of its high productivity. High egg production must be balanced with the availability of feed, good feed quality, low price, and its availability does not compete with humans. Previous researchers (Amoah and Martin, 2010; Gaol et al., 2015; Handayani et al., 2019) research in animal feeding has been geared toward finding potential substitutes for high-cost feed ingredients and proper feed formulation techniques a means of reducing cost and keeping production to the optimum level. Otherwise, one alternative feed that can be used is expired milk powder.

Expired milk powder is one of the industrial wastes and is not consumed by humans. The expired milk powder used in this study is a complementary food to breast milk, which is served in powdered formula milk given to infants aged 6-24 months and has passed the validity period to be consumed properly. There are 300 branches of powdered milk storage in Indonesia. In West Sumatra, the number of storage areas for milk powder is six branches located in Padang, Bukittinggi, Tanah Datar, Solok, South Solok, and Pariaman. Judging from the number of branches in West Sumatra, expired milk powder is 1,500 boxes (PT Nestle Indonesia branch Padang, unpublished results). Although unpublished work shows that the amount of expired milk powder in all branches in West Sumatra is 3,840,000 grams or 3,840 kg, and in Padang, it is 76,800 grams or 76.8 kg. So far, expired milk powder will be directly burned and not used anymore, so it can be an opportunity to use expired milk powder as additional feed-in quail rations.

Expired milk powder contains 16.59% crude protein (Laboratory of Livestock Biotechnology, 2020), 4.55% crude fat, 0.53% crude fiber (Feed Industry Technology Laboratory, 2019). Calcium 0.426%, phosphorus 0.852% and energy as much as 4,022 kcal/g (Non-Ruminant Nutrition Laboratory, 2019). Methionine 1.02%, lysine 1.27%, and tryptophan 0.12% (Testing, Calibration and Certification Services Laboratory Unit, 2019). Alim (2012) added that expired milk powder contains 25.8 protein, 0.9% fat, 4.6% lactose, and other nutrients such as sodium, potassium, vitamins, minerals, and amino acids.

Expired milk powder can be added to the feed to increase the nutritional content, often lacking or inappropriate in the ration. The ration's nutritional balance determines the ration's quality (Tarasewicz et al., 2006). The better the quality of the ration, the lower the conversion ratio achieved. The availability of essential amino acids such as lysine and methionine in feed must be considered because they often cause poultry deficiencies. This can lead to inhibition of the growth rate, affecting egg production in the egg-laying phase. Zainuddin et al. (2001) argue that local feed ingredients that are efficient in essential amino acids have not maximized the performance of poultry production. This can be overcome by supplementing synthetic amino acids from expired milk powder to increase feed efficiency in the metabolism of food substances (Pertiwi et al., 2017).

Egg production can be increased through a nutritional approach. Amino acids (lysine and methionine) are included in the feed supplements. Methionine can be supplemented to improve the nutritional status of livestock. Methionine contributes to increased protein synthesis, which is represented in increased egg production. Lysine has many uses in the body and is classified as a critical essential amino acid because its levels in the feed are deficient, so quail rations need to be added with synthetic amino acids that suit the needs of quail (Reis et al., 2011). Wahju (1992) said that protein and amino acids are essential factors affecting egg production. Therefore, providing amino acids and protein is needed for quail to produce eggs.

Protein is an essential nutrient present in the diet because it is a building block for meat and eggs. Quail eggs have a higher protein content than other poultry eggs, so the protein content of the ration for laying Japanese quail tends to be higher than the protein content of other laying Japanese quail rations. If the quail lacks protein, it will cause health problems, and its products will also decrease. The right protein content influences optimal productivity in the ration (Mousavi et al., 2013). There have been many studies on the use of protein in laying Japanese quail rations of 20% or even more. In Djulardi (1995) research, one uses 20% protein and 2,800 kcal energy in laying Japanese quail rations. For this reason, in this study, a decrease in protein levels was carried out by utilizing the complete amino acid content of expired milk powder, such as methionine 1.02%, lysine 1.27%, and tryptophan 0.12%. It is expected to improve the quality of laying Japanese quail rations without disturbing the performance of the quail itself and can reduce the cost of rations.

Therefore, this study aims to determine the limits and effect of expired milk powder supplementation at different protein levels in laying Japanese quail rations on the performance and IOFC value of laying Japanese quail.

MATERIALS AND METHODS

The experimental procedures were approved by the Universitas Andalas Animal Care and Use Committee (Padang, Indonesia; NO. 604/UN.16.2/KEP-FK/2021). This research was conducted in the poultry research enclosure of the Technical Implementation Unit (UPT) of the Faculty of Animal Science, Universitas Andalas.

MATERIAL

A total of 240 laying Japanese quails (*Coturnix coturnix japonica*) were used in this study, aged 42 days with a production period of 10% in the layer phase aged 6-9 weeks. Twenty-four units of battery cage made of wire, 50x30x25 cm, were used for ten quails in each cage. The rations used in this study were prepared using the constituent materials, namely corn brand, rice bran, concentrate 126 produced by Charoen Pokphand (CP) Group, bone meal, and expired milk powder. The content of food substances that make up the ration and the composition of feed ingredients can be seen in Tables 1, 2, and 3.

The proximate analysis of the ration was analyzed following the methods described by the AOAC (2016). The crude protein was determined using the Kjeldahl method, crude fiber, ash, and oven drying method to determine the moisture content.

Table 1: Content of nutrients (%) and metabolic energy (kcal/kg) of feed ingredients.

Ingredients	Nutrient contents							
	CP	Fat	CF	ME	Ca	P	Met	Lys
Rice bran[a]	10.14	6.72	11.51	1640*	0.37	0.84	0.27[c]	0.17[c]
Corn[a]	9.28	2.44	2.03	3300*	0.21	0.17	0.20[c]	0.18[c]
Concentrate[a]	37.23[e]	3.40	8[g]	2753	5.50[g]	1[g]	3.25[d]	1.70[d]
Bone meals[b]	0	0	0	0	24	12	0	0
Expired milk powder[a]	16.59[e]	4.55	0.53	4022	0.42	0.85	1.02[d]	1.27[d]

Sources: a= Laboratorium of Feed Technology, Faculty of Animal Science Peternakan, Universitas Andalas (2019); b= Nuraini *et al*. (2018); c= NRC (1984); d= Services for Testing, Callibration and Certification, IPB (2019); e= Laboratorium of Biotechnology, Universitas Andalas (2020); g= PT. Charoen Pokphan TBK; *= Scott et al. (1982).

Table 2: Feed composition.

Ingredients	Treatment rations (%)					
	S1R1	S2R1	S3R1	S1R2	S2R2	S3R2
Rice bran	7.0	7.0	7.0	9.0	9.0	9.0
Corn	49.5	49.5	49.5	53.0	53.0	53.0
Concentrate 126	39.5	39.5	39.5	34.0	34.0	34.0
Bone meals	4.0	4.0	4.0	4.0	4.0	4.0
Expired milk powder*	0	0.25	0.50	0	0.25	0.50
Total	100	100	100	100	100	100

Notes: * = as supplement); S1= Expired milk powder 0%; S2= Expired milk powder 0,25%; S3= Expired milk powder 0,50%; R1 = protein content 20%; R2 = protein content 18%.

Table 3: Nutrient content of rations

Nutrient contents	Rations (%)					
	S1R1	S2R1	S3R1	S1R2	S2R2	S3R2
CP	20.00	20.50	20.09	18.48	18.53	18.57
Fat	3.02	3.03	3.04	3.05	18.53	3.07
CF	4.97	4.97	4.97	4.83	4.83	4.83
Ca	2.30	2.30	3.26	2.01	2.97	2.97
P	0.53	0.54	1.02	0.50	0.98	0.98
Met	1.40	1.40	1.40	1.23	1.23	1.24
Lys	0.77	0.77	0.77	0.69	0.69	0.69
ME (kkal/kg)	2835.73	2845.79	2855.85	2832.62	2842.67	2852.73

Description: Calculated from Table 1 and 2.

Methods

The research used a completely randomized design (CRD) in 3x2 factorial treatment with four replications. The treatments were supplementation of expired milk powder and a decrease in the level of protein requirements in the ration. The treatments were as follows: S1R1= 0% expired milk powder supplementation and 20% protein level, S2R1= 0.25% expired milk powder supplementation and 20% protein level, S3R1= 0.50% expired milk powder supplementation and protein level 20%, S1R2= 0% expired milk powder supplementation and 18% protein level, S2R2= 0.25% expired milk powder supplementation and 18% protein level and S3R2= 0.50% expired milk powder supplementation and 18% protein level. The observed variables were: feed consumption, daily egg production, egg weight, feed conversion, egg mass, and income over feed cost (IOFC).

Feed consumption

Feed consumption is calculated by subtracting the amount of feed given with the feed refused, calculated every week in g/head/day units. Feed consumption is known based on the following formula:

$$\text{Feed Consumption (g/head/day)} = \text{Feed Given (g)} - \text{Feed Refused (g)}$$

Egg production/ Quail day production (%)

Quail egg production was counted every day during the study. The formula used is:

$$\text{Quail Day Production (\%)} = \frac{\text{Amount of eggs}}{\text{Number of Quails}} \times 100$$

Then the eggs were collected and recorded.

Egg weight

Quail egg weight (g/egg) is calculated based on the total egg weight divided by the number of eggs laid. Egg weight is obtained from eggs that are weighed using a digital scale every day.

$$\text{Egg Weight (g/egg)} = \frac{\text{Total egg weight}}{\text{amount of eggs}}$$

Egg mass

Quail egg mass (g/head/day), calculated based on daily egg production (Quail Day) for one month multiplied by the average egg weight (g/grain) produced in that month.

Egg Mass (g/head/day) = % daily egg production x average egg weight (g/egg)

Feed conversion

Feed conversion was calculated by dividing feed consumption (g/head/day) by egg mass production (g/head/day).

$$\text{Feed Conversion (g/head/day)} = \frac{\text{Total feed consumed}}{\text{egg mass}}$$

Income over feed cost (IOFC)

One way to assess whether a food ingredient is quite economical and profitable or vice versa is to calculate it based on income from selling eggs minus production costs. The IOFC formula (Rp/Kg) is as follows:

π = Total Revenue (TR) – Total Cost (TC)

Procedure

Analysis of the nutritional content of the ingredients

Before conducting the research, it is necessary to analyze the nutritional content of the ingredients used. The feed ingredients used include concentrate 126 produced by Charoen Pokphand (CP) Group, rice bran, corn bran, bone meal, and expired milk powder. The analysis was carried out at the Feed Industry Technology Laboratory, Non-Ruminant Laboratory, Livestock Biotechnology Laboratory, Faculty of Animal Science, Andalas University, Padang. The essential amino acid content analysis was conducted at the Laboratory of Testing for Calibration and Certification Services, Faculty of Animal Science, Bogor Agricultural University.

Preparation of cages and sanitation

The cages and tools to be used were prepared first and sanitized to remove bacteria and dirt on the equipment used by washing the pests by liming and spraying with Rodhalon.

Making treatment ration

The ingredients for the rations used were: corn bran, rice bran, concentrate 126, bone meal, and expired milk powder. All the ingredients were weighed based on the composition of the treatment ration and mixed homogeneously. Mixing is done from the ration ingredients in small amounts to a large numbers. The preparation of rations was carried out once a week during the study.

Quail placement and treatment in cages

Placement and treatment in the cage were carried out using a lottery system. The letters S1R1-S3R1 with four repetitions each and S1R2-S3R2 with four on paper were rolled up and taken randomly.

Provision of ration, drinking water, and sanitation of cages

The quail rations are given three times a day, which are given at 08:00 a.m, then at 2:00 p.m. WIB, and given at 5:00 p.m. WIB, and the drinking water given is given *ad libitum*. The ration given to the quail was following the needs of the quail for each treatment given. For sanitation, cleaning of the experimental area, feeding, and drinking for quail, quail manure was also carried out every day.

Data analysis

The data obtained were analyzed using means of Variance. If there were differences in treatment, Duncan's Multiple Range Test/DMRT was performed (Steel and Torrie, 1995).

RESULTS AND DISCUSSION

Consumption of ration

The average effect of treatment on the consumption of quail rations during the study with expired milk powder supplementation with different protein levels in the rations can be seen in Table 4. The average consumption of laying quail rations ranged from 19.77 g/head/day to 20.46 g/head/ day. The analysis of variance showed that the supplementation up to the level of administration of 0.50% had no significant interaction (P>0.05) on the consumption of the laying quail ration. The consumption of laying quail rations was the same in the treatment with expired milk powder supplementation (S2 and S3) with the treatment without expired milk powder supplementation (S1) with a decrease in protein level from 20% to 18% in the ration. Using 0.50% expired milk powder in the ration is still palatable by the quail, so it is not different from the control ration.

Table 4: Effects of treatments on feed consumption (g/head/day).

Supplementation (%)	Protein (%)		Average
	R1 (20%)	R2 (18%)	
S1 (0%)	20.24	20.37	20.31
S2 (0,25%)	20.46	20.31	20.38
S3 (0,50%)	19.77	20.33	20.05
Average	20.16	20.33	20.25

Note: ns non significant.

Expired milk powder gives the ration a good smell and taste, making it palatable by quail. According to Haddadin et al. (1996), the amount of feed consumed by livestock is influenced by palatability. Mahata et al. (2008) added that ration consumption could be influenced by color, taste, and aroma or smell of feed. In the study, the average consumption of laying quail rations aged 6-9 weeks ranged from 19.77-20.46 g/head/day. The results of ration consumption based on research are sufficient. Following the opinion of Listiyowati and Roospitasari (2005), the consumption of quail rations for more than six weeks is 17-19 g/head/day, but lower than Djulardi (1995), i.e., consumption of quail rations for more than six weeks is 21 g/head/day. In the opinion of Suprijatna et al. (2005) stated that the amount of feed consumption is very dependent on the size of the animal's body, genetic characteristics (breed), environmental temperature, production level, housing, the place for feeding, drinking water conditions, quality and quantity of feed and disease.

Daily egg production

The average effect of treatment on daily quail egg production during the study with expired milk powder supplementation with different protein levels in the ration can be seen in Table 5. The average quail egg production ranged from 41.34 to 51.38%. The results of supplementation of expired milk powder up to the level of 0.50% and a decrease in the level of protein to 18% in the ration did not provide a significant interaction (P>0.05) on the daily egg production of laying quail, unlike the fact that egg production is not caused by quail consuming protein and essential amino acids, especially lysine and methionine for the growth process, and have not been fully utilized for egg formation. Because quails are still in transition from the growth phase to the egg production phase, this causes low egg production. Suppose protein consumption for basic life is fulfilled. Protein will be used for egg production, following Rasyaf (2002), which states that ration consumption can influence egg production, especially protein consumption. Protein is the main element in the formation of eggs and added by Karaalp (2009) that all essential amino acid food substances (methionine, lysine, tryptophan) are needed for production.

The average production of quail eggs aged 6-9 weeks ranged from 41.34%-51.38%. A similar value was reported by Odunsi et al. (2007); the hen day production of laying quail is 49.8-59.0%. However, the egg production is lower than other studies, stating that quail's average production aged 6-13 weeks ranges from 60.35%-83.65% (Sarajar et al., 2016; Zacaria and Ampode, 2021). The difference is that this study was conducted only until nine weeks, while Sarajar was until 13 weeks. Supplementing natural feed additives in the diet can potentially improve the egg production performance of laying Japanese quails (Zacaria and Ampode, 2021). Similar results were obtained from the research of Ri et al. (2005) found that quail aged 6-10 weeks produced an average production of 51.30% containing 22% protein in the ration. Quail egg production in the early laying period ranges from 40-60% and continues to increase every week until it reaches peak production at about 20 weeks of age, reaching 90% (Mursito et al., 2016).

Table 5: Effects of treatments on daily egg production (%).

Supplementation (%)	Protein (%)		Average
	R1 (20%)	R2 (18%)	
S1 (0%)	47.39	42.59	44.99
S2 (0,25%)	47.52	41.34	44.43
S3 (0,50%)	43.72	51.38	47.55
Average	46.21	45.11	45.66

Note: ^{ns}non significant.

Egg weight

The average effect of treatment on quail egg weight during the study with expired milk powder supplementation with different protein levels in the ration can be seen in Table 6. The highest average weight of quail eggs aged 6-9 weeks was obtained in the S2R1 treatment (expired milk powder supplementation 0.25% with 20% protein) is 10.17. At the same time, the lowest was obtained in the S2R2 treatment (expired milk powder supplementation of 0.25% with a protein level of 18%) was 9.07%. The results showed that supplementation of expired milk powder in the ration up to the administration level of 0.50% and a decrease in the protein level of up to 18% in the ration had no significant effect (P>0.05) on the weight of laying quail eggs. The unreal effect of recognition of egg weight is because the quail is still not optimally utilizing the nutritional content contained in the ration. The quail utilizes the nutrients in the feed for growth, which causes the weight and number of eggs produced not optimal. According to Yuwanta (2004), what determines egg weight is the energy content of the feed, the protein content of the feed, methionine acid, unsaturated fatty acids, especially linoleic acid, minerals, especially phosphorus, and anti-nutrients. Lesson and Summer (2001) added that the amino acid methionine greatly influences egg weight gain. In addition, another factor that affects egg weight is the age of the quail. The older the quail, the heavier the eggs will be, following Zita et al. (2013) opinion, which states that egg weight increases with increasing quail age.

The study results (Table 6) show that the average weight of quail eggs aged 6-9 weeks is 9.07-10.17 g/grain. The results of this study are close to the results of Djulardi's (1995) that the weight of quail eggs above six weeks of production is an average of 10 g/grain. The results of this study are higher than those of Ri et al. (2005) on quail aged 8-9 weeks with feed containing 22% protein, namely 9.2

grams/grain. The low egg weight in this study was thought to be the quail that had not yet reached the peak of egg production. Nowaczewski et al. (2010) stated that quail eggs at the beginning of laying eggs were small, and the size of the eggs would increase with age until they reached a stable size during the reproductive season.

Table 6: Effects of treatments on egg weight (g/egg).

Supplementation (%)	Protein (%)		Average
	R1 (20%)	R2 (18%)	
S1 (0%)	10.16	9.88	10.02
S2 (0,25%)	10.17	9.07	9.62
S3 (0,50%)	9.75	10.06	9.90
Average	10.03	9.67	9.85

Note: [ns]non significant.

Egg mass

The average effect of treatment on egg mass during the study with supplementation of expired milk powder with different protein levels in the ration can be seen in Table 7. The average mass of quail eggs was aged 6-9 weeks, and the highest results were obtained in the S3R2 treatment (supplementation of expired milk powder 0.50 % with a protein level of 18%), which is 5.49 g/head/day. In contrast, the lowest average egg mass was obtained in the S2R2 treatment (expiration of expired milk powder 0.25% with a protein level of 18%), which was 4.22 g/head/day. The analysis of variance showed that the effect of expired milk powder supplementation up to a level of 0.50% had no significant effect (P>0.05) both at 20% and 18% protein levels on egg mass.

Table 7: Effects of treatments on egg massa (g/head/day).

Supplementation (%)	(%) Protein		Average
	R1 (20%)	R2 (18%)	
S1 (0%)	4.99	4.41	4.70
S2 (0,25%)	5.01	4.22	4.62
S3 (0,50%)	4.51	5.49	5.00
Average	4.84	4.70	4.77

Note: [ns]non significant.

Suprijatna et al. (2005) stated that the value of egg mass depends on the percentage of daily egg production and egg weight. These two factors are directly proportional to the mass of the egg. The higher the egg production and the average egg weight, the higher the egg mass. During the study, the average mass of eggs ranged from 4.22-5.49 g/head/day. This result is lower when compared to the results of research by Maknun et al. (2015), which produced an average mass of quail eggs which was 5.43-6 g/head/day. The low egg production and egg weight also cause the egg mass to be below. Quail production is still in the early stages of production. Following the opinion of Nowaczewski et al. (2010) that quail eggs at the beginning of laying eggs are small, the size of the eggs increases with age until they reach a stable size during the reproductive season. Both of these factors cause small egg mass numbers.

Feed conversion

The average effect of treatment on quail feed conversion during the study by supplementing expired milk powder with different protein levels in the ration can be seen in Table 8. The average feed conversion in this study ranged from 3.54-4.60 g/head/day. The high rate of feed conversion in this study was due to the ability of quail change the consumed ration used for the growth process so that the nutrients contained in the ration were not optimal for the egg formation process. Lasley and Campbell (1985) argue that feed conversion is influenced by the ability of livestock to digest feed ingredients, the adequacy of feed substances for life, growth, and the type of feed consumed. Amrullah (2004) stated that the conversion value of a good ration ranged from 1.75 to 2.00 g/head/day. The ration conversion can be used to measure the efficiency of the ration; the lower the ration conversion rate means, the higher the efficiency of the use of the ration, and conversely, the higher the ration conversion rate means, the lower the ration efficiency level (Ensminger, 1992).

Table 8: Effects of treatments on feed convertion (g/head/day) [ns]

Supplementation (%)	Protein (%)		Average
	R1 (20%)	R2 (18%)	
S1 (0%)	4.05	4.45	4.25
S2 (0,25%)	3.93	4.60	4.26
S3 (0,50%)	4.36	3.54	3.95
Average	4.12	4.19	4.15

Note: [ns]non significant.

The results of the analysis of diversity showed that supplementation of expired milk powder in the ration up to a 0.50% level of administration and a decrease in protein content of up to 18% in the ration had no significant effect (P>0.05) on the conversion of laying quail rations. The expired milk powder supplementation up to 0.50% was also as efficient in producing eggs as the control ration. Babangida and Ubosi (2006) argue that the ration conversion compares the ration spent producing many eggs. Laksmiwati (2006) added that the lower the feed conversion, the higher the efficiency of rations.

Maknun et al. (2015) stated that feed conversion is influenced by feed consumption and egg mass so that if there is an increase between the two, the feed conversion value will remain balanced. In addition to the consumption of rations, the quality of the rations also affects the conversion of rations. This follows Anggorodi (1985) opinion, which

Table 9: Average *Income over feed cost* (Rupiah).

Description	Ration treatments					
	S1R1	S2R1	S3R1	S1R2	S2R2	S3R2
Income						
1. culling quails	380.000	370.000	390.000	390.000	400.000	380.000
2. Egg	205.200	198.800	191.600	186.000	185.200	208.000
Total gross income (Rp)	585.200	568.800	581.600	576.000	585.200	588.000
Variable costs						
Feed Cost (Rp)	310.928	310.928	310.928	324.340	324.340	324.340
Total Variable Costs (Rp)	310.928	310.928	310.928	324.340	324.340	324.340
IOFC	274.272	257.872	270.672	251.660	260.860	263.660

states that the quality of the ration determines the size of the conversion produced, a good quality ration with a balanced nutritional content, and has high palatability to the conversion of the resulting ration, the better.

Income over feed cost (IOFC)

IOFC is income derived from the difference between egg sales and feed costs (Muharlien and Nurgiartiningsih, 2015). Income Over Feed Costs during the study can be seen in Table 9. The highest average IOFC value was obtained in the S1R1 treatment (0% expired milk powder supplementation with a decrease in protein level 20%), Rp. 274,272, and the lowest average IOFC was found in the S1R2 treatment (expired milk powder supplementation of 0% with a decrease in the protein level of 18%), which is Rp. 251,660. The IOFC value shows the total income from the sale of eggs minus the cost of feed. A high IOFC value indicates that the higher the income earned. The amount of egg production influences income over feed cost (IOFC), the selling price of eggs in the market, and feed cost during the study. The survey results show that the selling price of quail in the city of Padang, Payakumbuh ranges from Rp. 15,000/quail when the quail has entered the production phase. Kurniawan et al. (2015) state that IOFC is influenced by consumption, egg production, egg prices, feed prices, and the selling price of quail per head.

The difference in IOFC values S1R1-S3R2 was due to different feed consumption and egg production. In the treatment, S1R1 is the highest IOFC value. The income in the S1R1 treatment is better than in the other treatments. The low IOFC value in the S1R2 treatment caused low egg production, which was not proportional to the ration costs incurred, causing losses. Widjastuti and Kartasudjana (2006) argue that the higher the IOFC, the more profitable and efficient the business is.

CONCLUSIONS AND RECOMMENDATIONS

Based on the study results, it can be concluded that the addition of expired milk powder up to a dose of 0.50% did not affect the performance of quail aged 6-9 weeks. Numerically, higher income over feed cost (Rp. 274,272) was attained from the quail layer fed with 20% protein.

ACKNOWLEDGMENTS

The author would like to thank Andalas University, which has funded this Research Scheme "Riset Dosen Pemula (RDP)" with Contract Nomor: T/34/UN.16.17/PT.01.03/Pangan-RDP/2020.

NOVELTY STATEMENT

In this paper, we determine the limits and effect of expired milk powder supplementation at different protein levels in laying Japanese quail rations.

AUTHOR'S CONTRIBUTION

Ade Djulardi created the idea, designed the experiments, and wrote the primary manuscript. Robi Amizar edited and finalized the manuscript. Tigor Sanjaya experimented, collecting and analyzing data.

Conflict of interest

The authors have declared no conflict of interest.

REFERENCES

Alim MN (2012). The effect of offering rejected milk on the appearance of the rooster. Doctoral dissertation, Universitas Airlangga.

Amoah JK, Martin EA (2010). Quail (*Coturnix coturnix japonica*) layer diets based on rice bran and total or digestible amino acids. J. Appl. Biosci., 26: 1647–1652.

Amrullah IB (2004). Laying chicken nutrition. Penebar Swadaya, Jakarta.

AOAC (2016). Official methods of analysis of the association of the official analytical chemists. 20th ed. Washington, D.C., USA.

Anggorodi R (1985). Recent advances in poultry feed science.

Universitas Indonesia. Jakarta.

Babangida S, Ubosi CO (2006). Effects of varying dietary protein levels on the performance of laying Japanese quail (*Coturnix coturnix japonica*) in a semi-arid environment. Niger. J. Anim. Prod., 33(1): 45-52. https://doi.org/10.51791/njap.v33i1.1494

Djulardi A (1995). The response of laying quail (*Coturnix coturnix japonica*) to the provision of ration with various phosphorus content and protein energy balance. Dissertation Pasca Sarjana Universitas Padjajaran, Bandung.

Ensminger MA (1992). Poultry science (animal agriculture series). 3rd Edition. Interstate Publishers, Inc. Danville, Illinois.

Feed Industry Technology Laboratory (2019). Results of the feed Analysis. Faculty of Animal Science, Andalas University, Padang.

Gaol SEL, Silitonga L, Yuanita I (2015). Substitution of commercial feed with expired bread to performance of quails (*Coturnix coturnix japonica*) on starter to start pullet age. J. Ilmu Hewani Tropika, 4(2): 61-65.

Haddadin MSY, Abdulrahim SM, Hashlamoun EAR, Robinson RK (1996). The effect of Lactobacillus acidophilus on the production and chemical composition of hen's eggs. Poult. Sci., 75(4): 491-494. https://doi.org/10.3382/ps.0750491

Handayani IAL, Ardana IBK, Kendran AAS (2019). Giving of reject milk in feed to the number of erythrocytes, hemoglobin levels, and packed cell volume (PCV) values in male crossbreed piglets weaning. Indones. Med. Vet., 8(3): 273-282. https://doi.org/10.19087/imv.2019.8.3.273

Karaalp MUSA (2009). Effects of decreases in the three most limiting amino acids of low protein diets at two different feeding periods in Japanese quails. Br. Poult. Sci., 50(5): 606-612. https://doi.org/10.1080/00071660903260748

Kurniawan D, Widodo E, dan Natsir MH (2015). The effect of using tomato flour as a feed ingredient on the performance of quail production. Indones. J. Anim. Sci., 25(1): 1-7.

Laboratory of Animal Biotechnology (2020). Results of the feed Analysis. Faculty of Animal Science, Andalas University.

Laksmiwati NM (2006). Effect of starbio and effective microorganism-4 (Em-4) as probiotics on appearance of male ducks age 0-8 weeks. Majalah Ilmiah Peternakan, 9(3): 164331.

Lasley JF, Campbell JR (1985). The science of animals that serve humanity. McGraw-Hill. Book Company, New York.

Leeson S, Summers JD (2001). Nutrition of the chicken. University Books. Guelph, Ontario, Canadá, pp. 67.

Listiyowati E, dan Roospitasari K (2005). Management of commercial quail cultivation. Edisi Revisi. Penebar Swadaya. Jakarta.

Mahata ME, Dharma A, Ryanto HI, Rizal Y (2008). Effect of substituting shrimp waste hydrolysate of Penaeus merguensis for fish meal in broiler performance. Pak. J. Nutr., 7(6): 806-810. https://doi.org/10.3923/pjn.2008.806.810

Maknun L, Kismiati S, dan Mangisah I (2015). Production performance of quail (*Coturnix coturnix japonica*) with treatment of quail egg hatching waste flour. J. Ilmu-Ilmu Peternakan (Indones. J. Anim. Sci.), 25(3): 53-58. https://doi.org/10.21776/ub.jiip.2015.025.03.07

Mousavi SN, Khalaji S, Ghasemi-Jirdehi A, Foroudi F (2013). Investigation on the effects of various protein levels with constant ratio of digestible sulfur amino acids and threonine to lysine on performance, egg quality and protein retention in two strains of laying hens. Ital. J. Anim. Sci., 12(1): e2. https://doi.org/10.4081/ijas.2013.e2

Muharlien M, dan Nurgiartiningsih VA (2015). Utilization of papaya leaf waste in the form of flour and juice to improve production performance of arabic chicken. Res. J. Life Sci., 2(2): 93-100. https://doi.org/10.21776/ub.rjls.2015.002.02.3

Mursito D, Yunianto VD, dan Wahyono F (2016). Calcium and phosphorus levels of quail blood phase layer with the effect of liquid additives red dragon fruit (*Hylocereus polyrhizus*). (Doctoral dissertation, Fakultas Peternakan Dan Pertanian Undip).

Non-Ruminant Nutrition Laboratory (2019). Results of the feed Analysis. Faculty of Animal Science, Andalas University, Padang.

Nowaczewski S, Kontecka H, Rosiński A, Koberling S, Koronowski P (2010). Egg quality of Japanese quail depends on layer age and storage time. Folia Biol. (Kraków), 58(3-4): 201-207. https://doi.org/10.3409/fb58_3-4.201-207

NRC (National Research Council), 1984. Nutrient Requirements of Poultry, 8th edn. Nutrient Requirements of Domestic Animals Series. National Academy of Sciences, Washington, DC.

Nuraini., Y. S. Nur, and A. Djulardi. (2018). Fermented Cocoa Pod with *Pleurotus ostreatus* to Produce Low Cholesterol Eggs and Poultry Meat. Hikom DIKTI Research Report. LPPM Andalas University, Padang.

Odunsi AA, Rotimi AA, Amao EA (2007). Effect of different vegetable protein sources on growth and laying performance of Japanese quails (*Coturnix coturnix japonica*) in a derived savannah zone of Nigeria. World Appl. Sci. J., 3(5): 567-571.

Pertiwi MED, Mastika IM, Nuriyasa IM (2017). The effect of fish meal replacement with expired powder milk in rations on the performance and nutrient digestibility of male native chickens (2-10 Weeks). Majalah Ilmiah Peternakan, 20(3): 123-128.

Rasyaf M (2002). Poultry food ingredients in Indonesia, Eds-9. Yoyakarta: Penerbit Kanisius.

Reis RS, Barreto SLT, Gomes PC, Lima HJD, Medina PM, Ferreira F (2011). Relationship of methionine plus cystine with lysine in diets for laying Japanese quails. R. Bras. Zootec., 40(5): 1031-1037. https://doi.org/10.1590/S1516-35982011000500014

Ri E, Sato K, Oikawa T, Kunieda T, Uchida H (2005). Effects of dietary protein levels on production and characteristics of Japanese quail eggs. J. Poult. Sci., 42(2): 130-139. https://doi.org/10.2141/jpsa.42.130

Sarajar CL, Montong MER, Najoan M (2016). The performance of quail (*Coturnix–coturnix japonica*) given rice snail flour (*Pila ampullacea*) as a substitute for fish meal in the ration. Zootec, 37(1): 62-69. https://doi.org/10.35792/zot.37.1.2017.14223

Scott ML, Nesheim MC, Young RJ (1982). Nutritions of the chickens. Second Ed. M.L. Scott and Associates Ithaca, New York.

Steel RGD, dan Torrie JH (1995). Statistical principles and procedures. (Jakarta: PT. Gramedia Pustaka Utama).

Suprijatna EU, Atmomarsono dan R. Kartasudjana (2005). Basic science of poultry. Penebar Swadaya. Jakarta.

Tarasewicz Z, Szczerbinska D, Ligocki M, Wiercinska M, Majewska D, Romaniszyn K (2006). The effect of differentiated dietary protein level on the performance of breeder quails. Anim. Sci. Pap. Rep., 24(3): 207-216.

Testing, Calibration and Certification Services Laboratory Unit

(2019). Results of the feed analysis. Bogor Agricultural University, Bogor.
Wahju J (1992). Poultry nutrition science, Eds-3. Gadjah Mada University Pres. Yogyakarta.
Widjastuti T, dan Kartasudjana R (2006). The effect of restricted feeding and its implication on the performance of *Coturnix-coturnix japonica* at the first production phase. J. Indones. Trop. Anim. Agric., 31(3): 162-166.
Yuwanta T (2004). Poultry basics. Kanisius: Yogyakarta.
Zacaria AM, Ampode KM (2021). Turmeric (*Curcuma longa* Linn.) as Phytogenic dietary supplements for the production performance and egg quality traits of laying Japanese quail. J. Anim. Health Prod., 9(3): 285-295.
Zainuddin D, Resnawati H, Iskandar S, dan Gunawan B (2001). Provision of energy levels and synthetic essential amino acids in the use of local feed ingredients for native chicken rations. Special edition. Livestock Research and Development Center. Bogor. Book III, pp. 42-47.
Zita L, Ledvinka Z, Klesalová L (2013). The effect of the age of Japanese quails on certain egg quality traits and their relationships. Vet. Arhiv., 83(2): 223-232.

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