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Effect of Locally Sourced Feed Additives on Livestock Productivity

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Abstract— *This study aimed to determine the effect of feed additives on livestock productivity. The research involved 4 students from the Animal Husbandry study program who took the thesis, carried out from April to November 2024 in the UMBY Reproduction laboratory and the experimental research location in Pondokrejo village, Tempel, Sleman. In stage I, the study used 75 male and 75 female quails as livestock, along with feed additives such as rice vinegar, fermented banana heart, fermented bamboo shoots, fermented catfish, brown sugar which is hereinafter referred to as MOL, and egg yolk. The tools required include quail cages and equipment, tools for making fermented feed, scales, and documentation tools. The method used was experimental method, with a completely randomized design in a one-way pattern. There were 5 treatments, namely P1 = basal feed + 100% MOL + 0% egg yolk; P2 = basal feed + 75% MOL + 25% egg yolk; P3 = basal feed + 50% MOL + 50% egg yolk; P4 = basal feed + 25% MOL + 75% egg yolk and P5 = basal feed + 0% MOL + 100% egg yolk, each treatment was repeated 3 times, with 5 animals per replicate. Variables observed included feed consumption, body weight gain (BWG), egg production and reproductive performance. Data were analyzed using analysis of variance, and if there were differences in the means, it was followed by DMRT test. The results showed that all treatments in female quails had no significant effect on feed consumption, body weight gain, egg production, but had a significant effect ($P < 0.05$) on feed conversion. In male quails, there was a significant effect ($P<0.05$) on feed consumption, and feed conversion, but had no significant effect on body weight gain. The total ovum and egg production did not differ significantly across all treatments. It can be concluded that the addition of feed additives in male and female quails can maintain production and reproductive performance.*

Keywords— *Feed additives; quail; productivity; egg yolk. MOL.*

I. INTRODUCTION

Japanese quail (*Coturnix japonica* L.) is one of the potential livestock as a source of animal protein, having the advantage of the fastest production cycle compared to ducks and chickens. Quails have a high level of productivity, reaching 250 - 300 eggs/head/year with an egg laying period starting at the age of 40 - 45 days. In quail farming, large land areas are not required, so it can be undertaken on a small or large commercial scale. The problem that often occurs is that quail growth is not optimal , resulting in low body weight and suboptimal egg production. In addition, the demands of consumers who want quail eggs with low cholesterol and high nutrition require a real breakthrough. One of the efforts made is to provide feed additives in the form of local feed ingredients that are cheap and easily available around farmers. The additional feed in the form of formulas / mixture functions to increase appetite, maintain body resistance to disease attacks, accelerate early egg laying and enhance egg production.

An alternative to increase quail productivity is by providing feed additives in the livestock feed ration, one of which is by providing egg yolk and MOL. Feed additives are supplementary feed ingredients given to livestock with the aim of improving the quality of livestock production. To increase nutrient content and match the quality of commercial rations as well as to improve the quality of rations, usually an additive substance is added to the formulated feed. Feed additives are substances that is added to the ration/feed in relatively small amounts to increase the value of nutrient content to meet the needs of livestock. The use of feed additives in the feed serves to complement or increase the availability of nutrients that are lacking in the ration, increase productivity and animal health and increase production efficiency.

II. METHODOLOGY

The research was conducted from April to September 2024 at the experimental cages and the UMBY Biotechnology and Livestock Reproduction Laboratory. In phase I, 75 male and 75 female quails were used, with feed additives consisting of MOL consisting of rice vinegar, fermented banana heart, fermented bamboo shoots, fermented catfish, and egg yolk. The tools required include quail cages and equipment, tools for making fermented feed, scales, and documentation tools. The method used was an experimental method, with a completely randomized design in a single pattern. There were 5 treatments, namely P1 = basal feed + 100% MOL + 0% egg yolk; P2 = basal feed + 75% MOL + 25% egg yolk; P3 = basal feed + 50% MOL + 50% egg yolk; P4 = basal feed + 25% MOL + 75% egg yolk and P5 = basal feed + 0% MOL + 100% egg yolk, each treatment was repeated 3 times, with 5 quails per replicate. The observed variables included feed consumption, body weight gain (BWG), feed conversion, egg production and number of ovum. Data were analyzed using analysis of variance, if there were differences in the mean followed by DMRT test.

III. RESULTS AND DISCUSSION

Feed Consumption

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Feed is a source of nutrition for quails, which must be fulfilled in order to produce optimum products. Feed is a factor that can have a major influence on livestock production and reproduction [1]. Feed which is given additively or additionally can affect feed consumption. Quails generally choose feed with a high energy content and continue with feed containing protein [2]. The amount of quail feed consumption can be calculated by subtracting between the quail feed provided and the residual feed [3]. The feed consumption results from the study can be seen in Table 1.

TABLE 1. Average feed consumption of female quails (gr DM/head/day)

Replication	Treatment				
	P1	P2	P3	P4	P5
1	12.66	11.91	13.66	12.60	13.61
2	12.27	13.84	13.27	13.36	11.72
3	13.43	12.68	12.10	12.22	12.48
Means (ns)	12.79	12.81	13.01	12.73	12.60

Note : ns : Not significant (P>0.05).

Based on Table 1, the provision of feed additives to female quails showed no significant difference (P>0.05). This may occur because the nutritional content of the feed is relatively the same. In addition, the insignificant differences in each treatment may occur due to the lack of palatability of the feed. According to [4], different feed textures and smell can affect feed consumption. This is because the smell and texture of the feed will interfere with palatability and affect feed consumption. In terms of numbers, it can be seen that in the P5 treatment, which was given 100% egg yolk, female quails showed the lowest feed consumption rate with almost the same body weight gain (Table 3). This indicates that the addition of egg yolk in the quail ration has an effect on feed consumption, although statistically it has not shown a significant difference. Whereas in male quails, it has a significant effect on feed consumption because the nutritional content contained in the feed additive is able to suppress feed consumption. The feed additives given to quails have a high protein and energy content. According to [5], the purpose of giving feed additives is to enhance the nutritional value or nutrient in livestock productivity so that it can increase livestock productivity. The complete data can be seen in Table 2.

The average results showed that the lowest feed consumption was obtained from the P5 treatment (11.74 gr DM/head/day) because the addition of feed additives in the P5 treatment had the highest protein percentage, which amounted to 23.72%. The largest protein is obtained from egg yolk. Protein in catfish and omega 6 in eggs can enhance feed digestibility. Egg yolk not only contains protein but also has a high fat content, ranging from 11.5% to 12.3%. Egg yolk consists of 65.5% triglycerides, 28.3% phospholipids, and 5.2% cholesterol [6]. Fat serves as the main energy source, providing 9 kcal/g, and is more effective than carbohydrates and protein in terms of energy provision because it has a very high calorie source [7]. Egg yolk has a fairly high protein content, which can influence feed consumption. Egg yolk not only contains protein but also has a high fat content, ranging from 11.5% to 12.3%. Egg yolk consists of 65.5% triglycerides, 28.3% phospholipids, and 5.2% cholesterol [6]. Fat serves as the main source of energy, providing 9 kcal/g, and is more effective than carbohydrates and protein in terms of energy provision because it has a very high calorie source [7]. According to [8] if the protein-energy content of the feed is low, feed consumption will increase to meet the protein-energy needs for growth. Conversely, if the protein-energy content of the feed is high, feed consumption will decrease.

TABLE 2. Average feed consumption of male quails (gr DM/head/day)

Replication	Treatment				
	P1	P2	P3	P4	P5
1	12.43	12.32	13.63	17.09	11.69
2	12.13	12.17	12.13	15.37	12.37
3	12.60	11.55	11.18	16.02	12.16
Means	12.39^{ab}	12.01^{ab}	12.31^{b}	16.16^{a}	11.74^{ab}

Note : different superscripts on the same line indicate a significant difference (P<0.05)

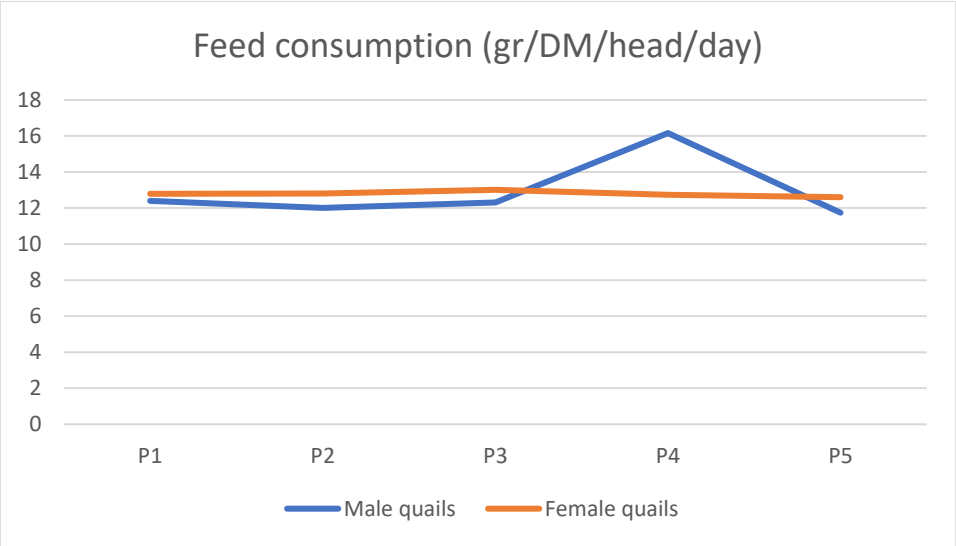

Figure 1. Male and female quails feed consumption graph (gr DM/head/day)

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Based on Figure 1, feed consumption of male quails showed a significant increase in the provision of feed additives egg yolk 75% plus MOL 25%. According to [8], if the protein-energy content of the feed is low, feed consumption will increase to meet protein-energy needs for growth. Conversely, if the protein-energy content of the feed is high, feed consumption will decrease. The highest feed consumption in this study was obtained from the P4 treatment (16.16 gr DM/head/day) because in the P4 treatment a lot of feed was wasted due to quail having a natural trait of scraping and pecking feed, so that wasted feed will affect the amount of feed consumed. While in female quails feed consumption for all treatments showed almost the same results. Feeding egg yolk additives can increase the concentration of Crude Protein (CP) and Total Digestible Nutrients (TDN). The increase in CP and TDN content is beneficial for livestock to enhance the energy needed in production and to support the reproductive activities for breeding female. Thus the higher protein consumed, will satiate the livestock longer, which can affect feed consumption.

The results of research [9], show that providing suplementary feed can increase the concentration of crude protein (CP) and total digestible nutrients (TDN) compared to providing basal feed. The increase in CP and TDN content is beneficial for livestock to enhance the energy needed in production and to support the reproductive activities of breeding female. So that the high protein consumed, will satiate the livestock longer and can affect feed consumption.

Average daily weight gain (ADG)

The daily weight gain of female and male quails during the study can be seen in Table 3 and Table 4. The results showed that supplementary feeding in the form of egg yolk and MOL in all treatments resulted in a non-significant in weight gain for both female and male quails.

TABLE 3. Average weight gain of female quails (gr/head/day)

Replication	Treatment				
	P1	P2	P3	P4	P5
1	4.22	4.01	4.46	4.07	4.59
2	3.93	4.52	4.40	4.21	3.89
3	4.34	4.13	3.97	3.87	4.18
Means (ns)	4.16	4.22	4.28	4.05	4.22

Note: ns = Not significant (P>0.05).

TABLE 4. Average weight gain of male quails (gr/head/day)

Replication	Treatment				
	P1	P2	P3	P4	P5
1	3.91	4.10	4.28	4.40	3.67
2	3.89	4.19	3.95	3.95	4.08
3	3.99	3.92	3.76	4.20	3.91
Rerata (ns)	3.93	4.07	4.00	4.19	3.89

Note: ns = Not significant (P>0.05).

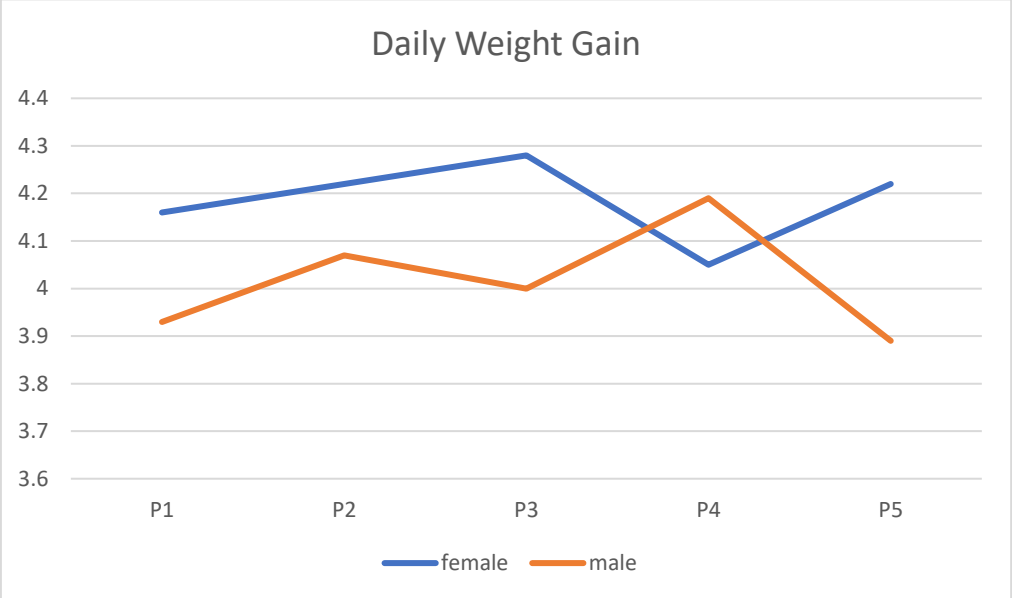

Figure 2. Daily weight gain graph of quails (gr/day)

Figure 2 shows the fluctuation in weight gain of quails treated with egg yolk and MOL as feed additives. Although the graph fluctuates, statistically the provision of egg yolk and MOL feed additives in various levels shows no significant difference. The daily weight gain of female and male quails that differed not significantly was due to the level of feed consumption that was not significantly different, besides that the nutritional content of the feed consumed was also the same and had an impact on body weight gain that was not significantly different.

Body weight change is a very important factor in the aspect of breeding and livestock management [10]. Furthermore, it is said that the provision of different feed energy-protein balance has no effect on quail body weight gain at each age level. The insignificant weight gain can be attributed to the condition of the livestock still undergoing bone growth. In this study, the quail body weight gain was not significant because the quails being studied were 2 weeks old, so they were still classified as young livestock that are still experiencing bone growth.

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However, the provision of feed additives had a better effect compared to the research results by Aggrey et al. in [11] where the 5-week-old male quail body weight reached 96.13 grams. In this study (Table 5 and Figure 3.), the 5-week-old male quails produced weight of each treatment of P1 133.59; P2 135.67; P3 135.39; P4 140.08 and P5 129.19 grams. The provision of feed additives that positively impacts growth is due to the feed containing high levels of protein which is an important factor in growth. According to [12], nutrients in feed, one of which is protein, are beneficial for growth.

The quality and quantity of feed consumed affects body weight gain [13]. During the study, quail body weight did not show any significant differences, although on the other hand the total feed consumption tended to be different. This is in line with the statement delivered by [14] that the total of different feed consumption between treatments does not necessarily result in body weight difference, as this is caused by the varying digestibility levels in each quail.

Feed conversion

Feed conversion can be calculated by dividing the amount of feed consumed by the final body weight gain during the study. The average feed conversion of female and male quail is shown in Table 5, Table 6 and Figure 3.

The analysis results showed that the treatment did not significantly affect the feed conversion of female quails but had a significant effect on male quails. The highest average feed conversion of male quails was obtained in P4 at 3.86 and the lowest in P2 at 2.95. The results of this treatment indicate that P2 has the most efficient conversion rate (2.95), due to low feed consumption with a high increase in quail body weight.

TABLE 5. Average feed conversion of female quails

Replication	Treatment				
	P1	P2	P3	P4	P5
1	3.00	2.97	3.06	3.10	2.96
2	3.12	3.06	3.02	3.17	3.01
3	3.09	3.07	3.05	3.16	2.99
Means (ns)	3.07	3.03	3.04	3.14	2.98

Note: ns = Not significant (P>0.05).

TABLE 6. Average feed conversion of male quails

Replication	Treatment				
	P1	P2	P3	P4	P5
1	3.17	3.00	3.19	3.88	2.92
2	3.12	2.90	3.07	3.89	3.03
3	3.15	2.95	2.97	3.81	3.11
Means	3.15^{b}	2.95^{c}	3.08^{bc}	3.86^{a}	3.02^{bc}

Note: Different superscripts on the same line indicate significant differences (P<0.05)

The feed conversion value with the addition of egg yolk and MOL in this study is relatively good compared to the results of research by [13], the feed conversion in quail was 3.9. While [15] stated that the average feed conversion for quails reached 4.30 which ranged from 4.03-4.73. Feed conversion indicates the level of feed utilization, efficient feed utilization can be seen from a decreasing conversion rate, and conversely, a high conversion rate indicates low biological value. [16].

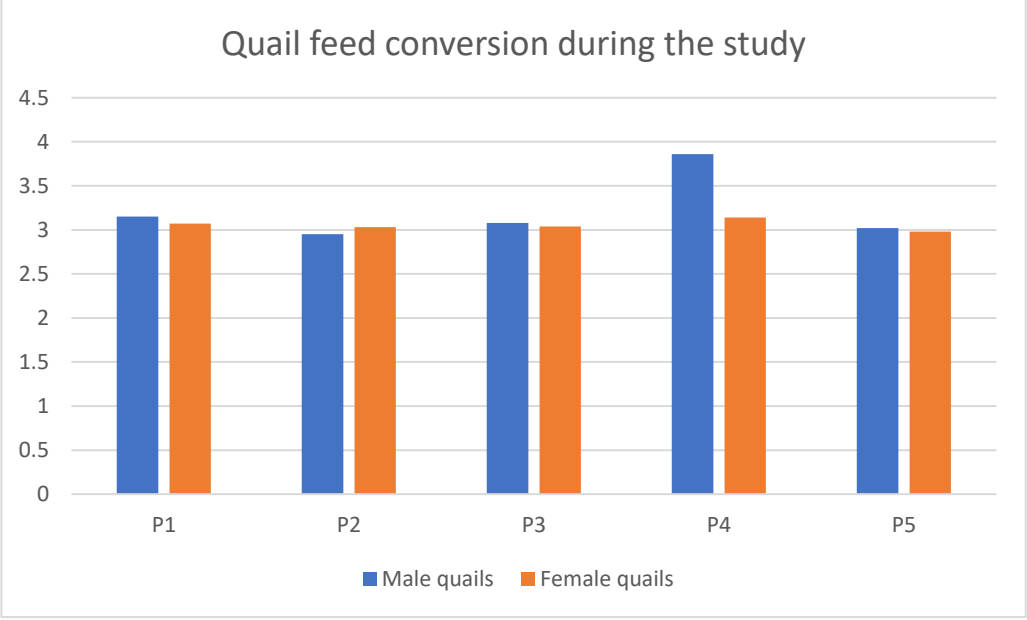

Figure 3. Diagram of quail feed conversion during the study

Figure 3 shows that the feed conversion of all treatments for female livestock showed almost the same results, while in male quails, P4 showed the highest results. The high feed conversation value could be caused by the fact that quails are frequently held during supplementary feeding, which can lead to stress in the quails. Prolonged stress can affect the quails and disrupt their feed metabolism, resulting in inefficient feed utilization. The high feed conversion value indicates that the quails in P4 were less efficient in converting feed into meat.

Number of ovum

Ovum or follicle have a shape similar to grapes [17]. Counting the number of ovum by counting the total ovum

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containing yolk and without yolk. The results of the total quail ovum count can be seen in Table 7 and Figure 4.

TABLE 7. The effect of feed additive on the total number of ovum in quail (pcs)

Replication	Treatments				
	P1	P2	P3	P4	P5
I	42	68	57	57	56
II	50	34	56	53	52
III	42	60	51	55	59
Means (ns)	44.67	54.30	54.7	55.00	55.67

Note: ns = Not significant (P>0.05).

The results of ovum count showed that the provision of feed additives with different levels of egg yolk had no significant effect on the total ovaries of female quails. The insignificant results are thought to be the feed given to each treatment has almost the same crude protein content (iso protein). Providing feed with the same protein content causes the amount of crude protein synthesized for the egg formation process to be the same, resulting in a similar production quantity [18].

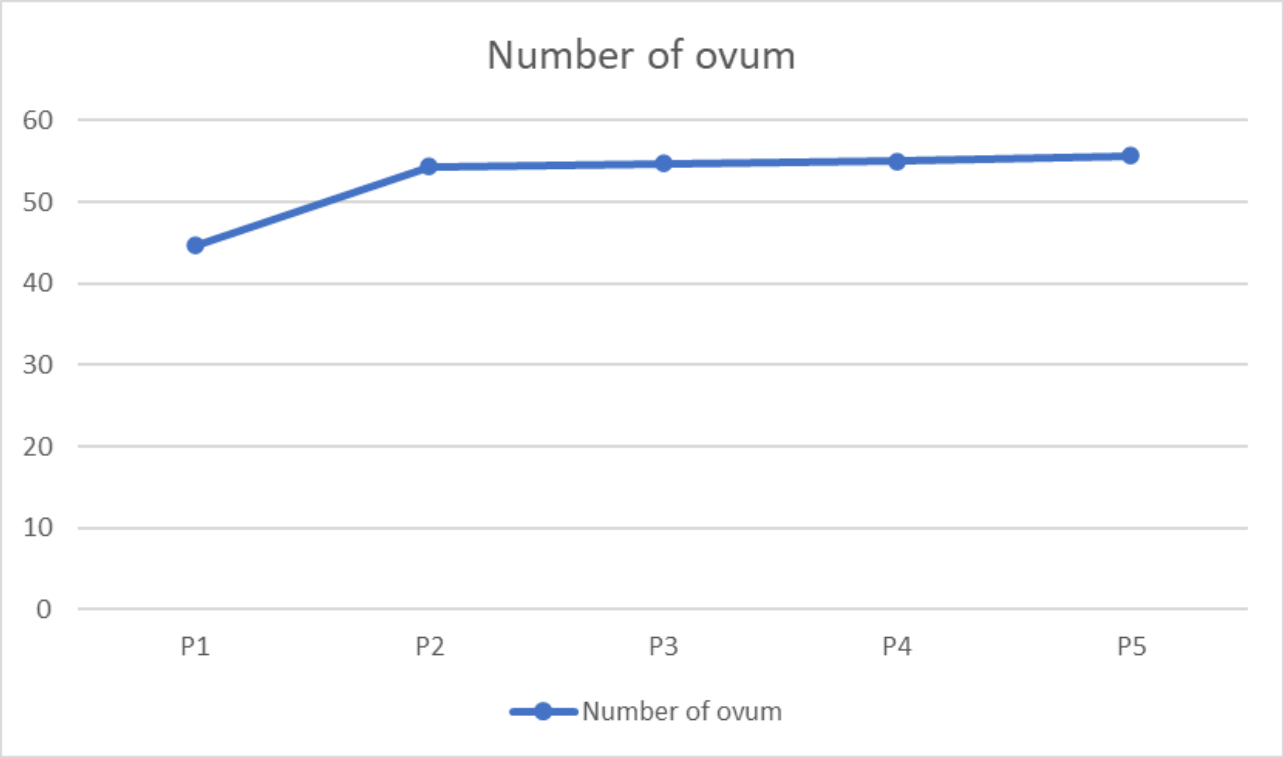

Figure 4. Graph of total ovum of female quails

The total number of quail ovum presented in the graph shows that supplementary feeding of egg yolk and MOL to quail tends to increase the total number of ovum/egg in treatments P2 to P5. It can be observed that catfish as one of the MOL ingredients has high protein content, low fat, carotene, vitamin A, phosphorus, calcium, iron, vitamin B1, vitamin B6, vitamin B12, and is rich in amino acids [19]. Generally, fish has components rich in lysine, but low in tryptophan [20]. Eggs contain vitamins such as vitamin A, vitamin B, niacin, thymine, riboflavin, vitamin E, and vitamin D [21].

Vitamin A is a fat-soluble vitamin for growth and development, including proliferation and embryonic differentiation in the fetus [22]. Vitamin E plays a role in the process of sperm storage in the female reproductive tract to enhance fertility and acts as an antioxidant that protects semen from free radicals that can damage the integrity of DNA in the spermatozoa nucleus [23]. Eggs contain amino acid components such as alanine, arginine, aspartic acid, cysteine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, and valine [24]. The use of tryptophan in poultry feed improves amino acid balance and enhance poultry growth performance through increased appetite, feed efficiency and protein synthesis [25].

Methionine is an essential amino acid that plays a role in the body's metabolism to promote health, growth, and development of reproductive organs [26]. Combining the egg yolk component with MOL gives a good effect because it combines different amino acids and vitamins. According to [27], the fewer the number of follicles, the lower the production of eggs/offspring.

Hen Day Production (HDP)

The addition of egg yolk and MOL feed additives to female quails on egg production (hen day production) is presented in Figure 6.

The percentage level of HDP in Figure 5 shows the average HDP including P1; 33.33%, P1; 33.33%, P3; 25.00%, P4; 22.22%, P5; 50.00%. In this study, the quails started laying eggs at 40 days of age for treatment P5, 41 days for P1, 42 days for

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P2 and P3, and 43 days for P4. The HDP data was collected at the age of 43 days and taken only for one day, this is also a factor that can show the less significant influence of the treatment.

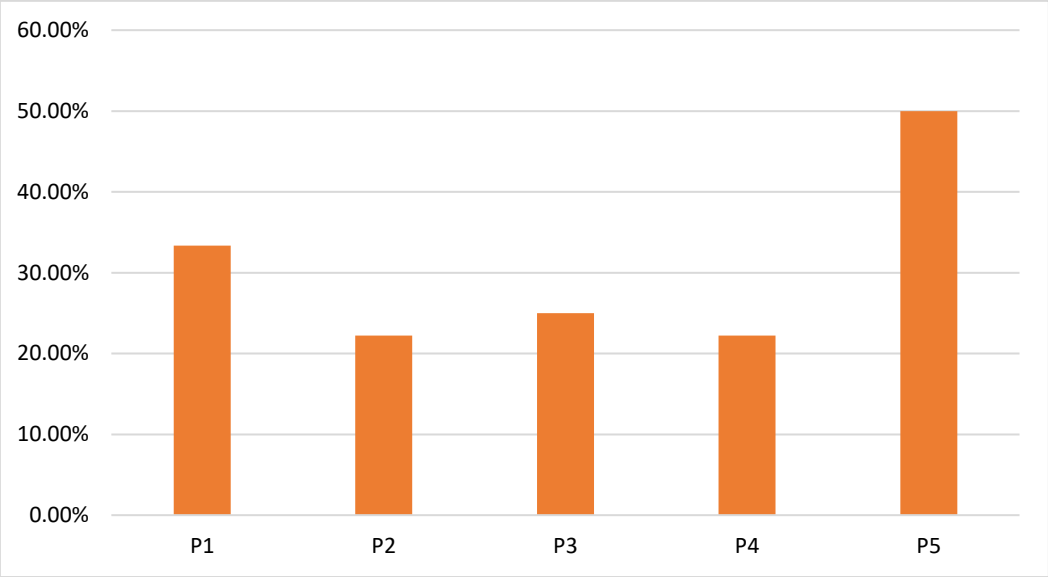

Figure 5. Diagram of hen day production value

Treatment P5 had the highest HDP value of 50.00%, which is due to P5 being the feed with the highest yolk addition (100%). Feed plays a central role in farming activities and has a significant contribution to egg formation. According to [28], egg yolk contains carbohydrates, proteins, fats, vitamins and minerals. And according to [29], egg yolk can be considered as a source of nutrition for the embryo, formed from the accumulation of fat and protein transferred from the liver to the ovaries in poultry. This can help the growth and development of follicles or potential quail eggs.

The average age of quails starting to lay eggs is 35-42 days[31], and quails usually reach sexual maturity at around 8 weeks of age. If we look at the research data, it can be said that P5 started production at the earliest, but the age at which they start laying eggs is still within the average age range for quails. The suboptimal egg production in quails is due to their young age, resulting in a less than optimal HDP value.

IV. Conclusions

From the results of the study it can be concluded that the addition of egg yolk and MOL feed additives at various levels provides good quail production performance, increases the number of eggs and reduces the feed consumption.

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