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Nutritional Evaluation of the Use of Liquid Organic Protein as a Feed Additive on the Production Performance of Laying Hens

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Abstract:

This study aims to evaluate the use of Liquid Organic Protein as a feed additive on the performance of laying hens. The material used in this research was 200 Lohman laying hens aged 50 weeks. This study used an in vivo experimental method which was divided into 5 treatments. Observational variables consist of feed consumption, HDP, HHP, egg mass, FCR, and IOFC. Research data were analyzed statistically using analysis of variance with Completely Randomized Design (CRD). If the results are significantly different ($P<0.05$) or very significant ($P<0.01$), Duncan's multiple distance test will be tested. The results of the analysis of diversity (ANOVA) showed that the use of Liquid Organic Protein as a feed additive had no significant effect ($T>0.05$) on the HDP value. However, it did not show a significant effect ($T<0.05$) on feed consumption, HDP, HHP, egg mass, FCR, and IOFC in laying hens. The conclusion of this study is that the use of 1% Liquid Organic Protein as a feed additive can increase HDP but has not been able to increase feed consumption, HHP, egg mass, FCR, and IOFC in laying hens production.

Keywords **—Organic Protein, PST, Layer, and Production**

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I. INTRODUCTION

The success of a livestock business, especially the laying hens sector, is influenced by three fundamental factors, namely feed, seeds and management. Feed is one of the most influential factors in the livestock business. Therefore, the feed used must meet the needs of livestock, including the need for nutrients and not contain harmful substances that adversely affect livestock and also consumers who will consume livestock products. This aims to obtain maximum egg production, low levels of contamination by pathogenic microbes and chemical compounds and contain high protein. The preparation of feed that meets the standard requirements of livestock for nutrients depends on the feed ingredients used both in terms of supply, chemical composition and physical condition of the feed ingredients [1]. In preparing the feed, it is hoped that there will be a balance between nutrients, especially the content of metabolic energy (ME) with crude protein (PK) and other nutrients inexpensive. Based on some of these statements, the problem of availability of animal feed greatly influences the development of livestock businesses. To support this, animal feed is needed which is able to increase the production produced by livestock.

Increasing the quality and quantity of feed needs to think about alternative solutions, one of which is the use of feed additives for biotechnology

development products, including Organic Protein or Single Cell Protein (SCP). Organic Protein or PST is a product of single organism cell biomass. which contains protein, amino acids, high vitamin B complex, besides that it is an additional feed ingredient that can be used as a substitute for imported soybean meal and fish meal. SCP as a substitute for feed ingredients of protein origin has begun to be pioneered in Indonesia, with the hope of reducing dependence on the supply of protein-origin feed ingredients for these imported commodities [2]. The result or research reported that the use of yeast culture/ PST on the feed made ad only increase in production, egg quality, hatchability and viability of chicks [3].

One of the PST producers is PT Daesang Ingredients Indonesia, which circulates under the trademark Oranic Protein. The PST product is a by-product of the manufacture of Monosodium Glutamate (MSG). However, the use of Organic Protein from PT Daesang Ingredients Indonesia is still not optimal. Therefore it is necessary to conduct research on the use of organic protein in laying hens. It is hoped that this study will evaluate the use of liquid organic protein on the productivity of laying hens which include feed consumption, Hen Day Production (HDP), Hen House Production (HHP), egg mass, Feed Conversion Ratio (FCR), and Income Over Feed Cost (IOFC).

II. MATERIALS AND METHODS

A. Material

The material used in this research was 200 Lohman laying hens aged 50 weeks which were kept under an intensive system in battery cages. The control feed used is selfmix feed with a frequency of giving 2 times a day, namely in the morning at 07.30 WIB and in the afternoon at 13.00 WIB. Meanwhile, drinking water is available ad libitum. The feed additive used is Single Cell Protein (PST) from PT Daesang Ingredients Indonesia with the trademark Organic Protein. The PST product is obtained from a by-product of the manufacture of Monosodium Glutamate (MSG) which has a high crude protein content.

B. Method

This study used a feed experiment method with in vivo techniques. This study consisted of 5 treatments and 4 replications where each replicate contained 10 laying hens, each treatment was given organic protein of 0%, 1%, 2%, 3% and 4%. The nutrient content of the feed in each treatment is shown in Table 1. The treatment used in this study is as follows:

T0 = 100% Control Feed (without treatment)
T1 = 99% Control Feed + 1% Organic Protein
T2 = 98% Control Feed + 2% Organic Protein
T3 = 97% Control Feed + 3% Organic Protein
T4 = 96% Control Feed + 4% Organic Protein

Tabel 1.
Nutrient content of treated feed

	Dry Weight (%)	Ask (%)	Crude Protein (%)	CF_a (%)	CF_i (%)	Calcium(%)	Pospor (%)	Gross Gnergy(Kal/g)
T0	89,36	10,27	17,78	3,81	3,49	4,32	0,68	3665
T1	89,88	9,71	18,27	4,18	3,02	3,81	0,64	3640
T2	89,01	10,02	18,73	4,46	4,02	3,80	0,59	3682
T3	88,04	11,43	19,94	3,45	0,76	4,20	0,60	3620
T4	87,90	10,84	20,73	3,70	1,98	4,24	0,67	3531

Note: Laboratory proximate test data of the Animal Husbandry and Fisheries Office of Blitar Regency

C. Observational Variables

The variables observed to determine the effect of using liquid organic protein as a feed additive on the performance of laying hens are as follows:

1. Feed consumption

feed consumption is obtained by calculating the feed given minus the remaining feed on the day in question [4].The formula used to calculate feed consumption in this study is as follows:

Feed Consumption (g/head/day)
=Feed Given − Feed Remaining

2. HenDay Production

HDP is calculated from the number of eggs produced during the study divided by the number of chickens alive that day multiplied by 100% [5]. The HDP value in this study is known using the following formula:

$$\text{HDP (\%)} = \frac{\text{Today's number of eggs}}{\text{Today's number of chickens}} \times 100\%$$

3. Hen House Production

HHP dihitung dari telur yang dihasilkan dibagi jumlah ayam pada pertama kali masuk kandang dikalikan dengan 100% [6]. The HHP calculation used in this study is as follows:

$$\text{HHP (\%)} = \frac{\text{Number of eggs during the study}}{\text{Initial number of chickens entered}} \times 100\%$$

4. Egg mass

Egg mass is calculated by multiplying the percentage of daily egg production (HDP) by the average egg weight [7]. The egg mass formula used in this study is as follows:

Eggmass (g/head/day)= Hen Day Production × average egg weight

5. Feed Convertion Ratio (FCR)

FCR calculation is done by comparing the feed consumed (kg) with the number of eggs (kg) [8]. The formula used to calculate feed conversion is as follows:

$$\text{FCR} = \frac{\text{result feed consumption (kg)}}{\text{result egg production (kg)}} \times 100\%$$

6. Income Over Feed Cost (IOFC)

IOFC is calculated from the difference between the income obtained from the sale of eggs and the cost of feed within a certain period [9].

IOFC= Income - feed cost

Information::

income=egg production × egg price
biaya pakan=konsumsipakan× harga
feed cost = feed consumption × treatment feed prices

D. Data analysis

The research data were tabulated and statistically analyzed using analysis of variance (ANOVA) with Completely Randomized Design (CRD). If the results are significantly different (T<0.05) or very significant (T<0.01), then proceed with Duncan's multiple range test or Duncan Multiple Range Test (DMRT) according to the instructions [10] as follows:Yij = μ + τi + €ij

III. RESULTS AND DISCUSSION

Research data on the effect of using Liquid Organic Protein as a feed additive on feed consumption, Hen Day Production (HDP), Hen House Production (HHP), egg mass, Feed Conversion Ratio (FCR), and Income Over Feed Cost (IOFC) in full can be seen in Table 2.

Table 2.
Results of Research Data Effect of Treatment on the Performance of Production of Laying Hens

which variable Observed	Treatment				
	T0	T1	T2	T3	T4
feed consumption (g/head/day)	114,0±1,48	114,2±1,64	114,0±0,60	113,8±1,75	112,5±0.93
HDP (%)	77,1±2,75[a]	83,7±4,08[b]	80,1±2,77[ab]	79,9±3,00[ab]	76,2±2,13[a]
HHP (%)	77,1±2,75	83,7±4,08	78,5±4,78	78,4±4,78	73,2±4,73
Eggmass (g/head)	48,2±1,64	51,1±2,57	49,1±2,19	48,4±2,25	46,5±1,55
FCR	2,38±0,79	2,24±0,10	2,38±0,14	2,42±0,14	2,53±0,15
IOFC (Rp/head/day)	136,6±32,2	204,0±45,1	153,5±53,8	150,3±50,4	110,0±50,3

Note: Different [a-b]Super script showed a significant difference in each treatment (T<0.05).

A. Effect of Treatment on Feed Consumption

Feed consumption is the amount of feed that can be consumed by chickens. Feed consumption is an important aspect for evaluating feed quality [11]. Feed consumption plays a crucial role in laying hen farming, where feed consumption that is too low may indicate that the feed given has low palatability so it is unable to meet the nutritional needs of laying hens. that feed consumption is a supporting factor to determine production performance, the higher the livestock consumes the feed provided, the more feed nutrients will be digested to support production [12]. However, too high feed consumption also has the potential to increase feed costs. From this description, it can be concluded that the ideal feed consumption value is in accordance with their needs.

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T>0.05) on the consumption of laying hens. There is no significant difference in the value of feed consumption in the use of liquid organic protein as a feed additive, which is thought to be caused by the energy content in the control feed and the relatively similar treatment. chickens will stop consuming feed when the energy needs for their bodies can be fulfilled [13]. that the high energy content of feed can reduce feed consumption [14].

Based on the research results in Table 3 it shows that the highest feed consumption during the study was achieved by T1 which was able to consume feed of 114.2 g/head/day. Then, followed by T0 and T2 with 114.0 g/head/day, T3 with 113.8 g/head/day, and T4 with 112.5 g/head/day. Although all treatments in this study still did not meet the standard of feed consumption requirements, the deficiencies were not significant. that the standard consumption of feed for laying hens of the Lohman

strain aged 50 weeks is 117 g/head/day [15]. There was no significant difference between treatments. It can also be concluded that liquid organic protein substitution of 1-4% for basal feed did not reduce the palatability of feed for laying hens.

B. Effect of Treatment on Hen Day Production Hen Day Production

(HDP) is the percentage between the total daily egg production and the number of chickens that were present at that time [16]. The HDP value is strongly influenced by the nutritional content of the feed consumed. previous research conducted

reported that feed consumption determines the level of HDP values [18]. In another studystated that the HDP value in laying hens is influenced by the nutritional content of feed consumed by laying hens, where the higher the crude protein and energy content in the feed is directly proportional to the egg production produced [19].

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T> 0.05) on the HDP value. Based on the research data in Table 2, it shows that the highest HDP value during the study was in T1 with 83.7%, followed by T2 with 80.1%, T3 with 79.9%, T0 with 77.1%, and T4 with 76.2based on the test results showed that P1 was significantly different for all treatments, while T2 and T3 were significantly different for T0 and T4. The average HDP achieved by all treatments in this study can be said to be relatively low when states that the HDP standard for Lohmann Brown chickens aged 50 weeks is 94%. The low HDP value in this study was not only caused by feed consumption which was still below standard, but also a combination of several other factors. Acc the HDP value is influenced by the quality of the feed, the type of chicken strain, the age of the chicken, the condition of the chicken, and the cage environment[20].

Increasing the percentage of Liquid Organic Protein as a feed additive has no effect on increasing HDP values linearly. In fact, the lowest HDP value is found at P4. This is presumably due to the content of nucleic acids in Organic Proteins which can cause a decrease in protein absorption. The results stated that although single-cell proteins have high nutritional value because they contain high protein, B vitamins, amino acids, and fat, they contain high nucleic acids which cause slow digestibility [21].

C. Effect of Treatment on Hen House Production

Hen House Production (HHP) is the amount of egg production in a certain period of time based on the number of chickens at the beginning of the chickens producing eggs [22]. Unlike the case with HDP, the high and low HHP values are also influenced by the mortality rate in laying hens. The HHP value is inversely proportional to the chicken mortality rate, where the higher the mortality rate in the treatment, the lower the HHP percentage.

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T> 0.05) on the HHP value. Based on the research data in Table 2, it shows that the highest HHP value during the study was in T1 with 83.7%, followed by T2 with 78.5%, T3 with 78.4%, T0 with 77.1%, and T4 with 73.2%. When referring to which states that the average HHP value of laying hens is at 80 – 90% [23]. So, in this study only T1 had an average HHP according to this statement. The highest HHP obtained by T1 in this study was influenced by the percentage of HDP which was significantly different for all treatments and zero mortality.

In this study, it was recorded that only T0 and T1 had no mortality. Meanwhile, the highest mortality rate occurred in T4 with 2 deaths, and 1 in T2 and T3. If converted in percentage form with each treatment consisting of 40 laying hens, the mortality at T4 is 5% and at T2 and T3 is 2.5%. This mortality percentage is quite high when compared which stated that the standard mortality at 50 weeks of age is 1.3% [24].

D. Effect of Treatment on Egg Mass

Egg mass or egg mass is the result of multiplying the hen day production with the average weight of the eggs produced. Therefore, the egg mass value depends on the second factor. If there is an increase in the value of these two factors, then the egg mass value will also be higher [25]. The calculation of the egg mass value serves as the basis for calculating FCR and IOFC.

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T> 0.05) on the value of egg mass. Based on research data the egg mass values as shown in Table 2 show that the highest egg mass values during the study were at T1 with 51.1 g/head, followed by T2 with 49.1 g/head, T3 with 48.4 g /head, T0 with 48.2 g/head, and T4 with

46.5 g/head. Although the results of the statistical analysis showed significant differences in the percentage of HDP, these results were not directly proportional to the results of the statistical analysis of the egg mass values obtained in this study. This is thought to be caused by the grammatical average of relatively the same egg weight.

The relatively same egg weight in this study was caused by the amount of feed consumption which was not significantly different and the nutrient content between treatments was also relatively the same. Egg weight is strongly influenced by the nutrients contained in the feed consumed by laying hens. stated that low feed quality can lead to small yolk sizes that affect egg weight. The content of protein and amino acids in the feed has a considerable influence on egg weight, where about 50 percent of the DM of the eggs consists of protein and amino acids in the feed [26]. Research results who reported that higher protein consumption would increase the weight of the eggs produced. In addition to protein, the calcium content in the feed also affects egg weight. Calcium plays an important role in the formation of eggshells stated that a lack of calcium will cause the eggshell to become thin [27]. added that protein, vitamin D, and calcium deficiencies can lead to decreased egg weight [28].

E. Effect of Treatment on Feed Conversion Ratio

Feed Conversion Ratio is a feed conversion value which means the ratio of the amount of feed consumed to the weight of the eggs produced [29]. In simple terms, FCR in laying hens is defined as the amount of feed needed to produce 1 kg of eggs. The smaller the FCR value, the more efficient the amount of feed consumed so that it affects the amount of egg production [30].

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T> 0.05) on the FCR value. The results of the study showed that there was no significant difference in the effect on FCR due to the value of feed consumption and egg mass which were also not significantly different. Based on the research data as shown in Table 2, it shows that the best FCR value during the study was at T1 with 2.24, followed by T0 and T2 with a value of 2.38, then T3 with 2.42, and T4 with 2.53. Meanwhile, the standard FCR value for Lohmann Brown laying hens aged 50 weeks is 2.37 [31].

Although the results of statistical calculations did not show a significant difference in the FCR values during the study, the FCR at T3 and T4 which had a relatively large adrift with the standard indicated that the feed given was inefficient. The feed given to laying hens can be said to be inefficient when the FCR number is high. that the high FCR number is due to the high level of feed consumption but the low number of eggs produced[32].

F. Effect of Treatment on Income Over Feed Cost

Income Over Feed Cost (IOFC) is the gross income obtained from the difference between income from egg sales and costs incurred for feed [33]. IOFC is one of the crucial variables in determining the results of feed evaluation. Providing quality feed and being able to increase the consumption of nutrients, HDP, HHP, egg mass, and FCR in laying hens, but if it has uneconomical feed costs and low IOFC is also not ideal when applied to laying hens.

The results of data analysis (ANOVA) using Liquid Organic Protein as a feed additive did not have a significant effect (T> 0.05) on IOFC. The results of the study showed that there was no significant difference in the effect of the treated feed on the IOFC value due to the weight of the eggs produced and feed consumption which did not show a significantly different effect either so that the IOFC results had no significant effect. egg weight and feed consumption are the determining factors for the IOFC value. In addition, feed prices and egg prices can also affect the IOFC value [34].

Based on the research data as shown in Table 2, it shows that the best FCR value during the study was in T1 with Rp. 204.0/head/day, then T2 with Rp. 153.5/head/day, T3 with Rp.

150.3/head/day, and T0 with Rp. 136.6/head/day, and T4 with Rp. 110.0/head/day. The high IOFC value at T1 was thought to be due to the fact that 1% liquid organic protein substitution was able to produce many eggs and a high weight balanced by the same feed consumption as other treatments. This is comparable to research by [35] which states that the high and low IOFC values are due to the larger or smaller difference between sales and feed costs during rearing.

IV. CONCLUSIONS

Based on the results of this study it can be concluded that the use of Liquid Organic Protein as a feed additive of 1% (T1) showed significantly different results (T<0.05) on HDP values compared to all treatments. However, the use of Liquid Organic Protein did not make a significant difference (T<0.05) to feed consumption, HHP, egg mass, FCR and IOFC.

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