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EVALUATION OF ORGANIC AND INORGANIC SELENIUM RATIO AS FEED ADDITIVE ONBLOOD PROFILE AND EGG LAYER NUMBER

BY

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Abstract

This study aims to evaluate and analyze the supplementary feeding of selenium (Se) on the blood profile and thenumber of eggs produced by layers. This study took the main object in the form of 60-week-old laying hens with*Isa Brown strain*. The research was conducted with the method of Completely Randomized Design (CRD) four treatments and six replicates, then tested further Duncan. The results of this study explained that supplementary feeding in the form of selenium (Se) with several doses had a significant effect on blood profile (Hemoglobin, Erythrocytes, Hematocrit, and Leucocytes) and the number of eggs produced by laying hens. The best dose of selenium was shown in treatment three (Commercial feed + organic selenium dose 150 grams/ton feed inorganicselenium + vitamin E dose 1000 grams/ton feed). The best treatment results are due to the additional feed contained in organic selenium as an antioxidant, increase immunity, fertility, improve reproduction, and even prevent various diseases such as arthritis, cancer, cardiovascular disease, *muscular dystrophy*, *lymphoblastic anemia*, and immunodeficiency which is good for the health of the body layer.

Keywords: *Blood profile, Egg count, Layer, Selenium, Vitamin E*

Introduction

Livestock business development has an important role in improving the welfare and standard of living of the community, especially farmers, providing employment for the community, supporting the rural economic system, and supporting the fulfillment of the need for animal protein for the people of Indonesia. One of the mainstays in the livestock sub-sector in Indonesia and has very good prospects for development is poultry farming. The development of poultry in Indonesia is currently running very rapidly compared to other livestock and one of them is laying hens. The poultry industry has several livestock commodity businesses, layer, and broiler farms. Chicken breeding, especially layer breeding, is generally commercial and is widely known and understood by the community regarding the benefits that can be obtained from the livestock business. The main purpose of raising laying hens is to increase egg production quickly, economically, and produce highly nutritious eggs to meet public demand.

Every business has its own risks, and layer farming is no exception. Chickens are susceptible to disease. Some of the problems in the field that can become obstacles and have a negative impact include low egg productivity, poor production performance including decreased feed consumption, decreased body weight, ration efficiency, and high mortality rates, high levels of stress that cause chickens to not routinely lay eggs, disease outbreaks, many eggs with damaged shells, and chickens not reaching the expected peak production at a certain age. This can cause losses to farmers. The success of a livestock business is influenced by several factors including feed, seed, environment, and management. Problems related to efforts to increase productivity and egg quality can be done by improving management and nutrient quality in the ration. Providing micronutrients as additional vitamins and minerals in feed also has an effect even though the amount needed is only small.

Growth and production of livestock will be disrupted if they are deficient in vitamins and minerals because these substances are needed to help the formation or breakdown of other nutrients in the body. Selenium is one of the microminerals needed by livestock. Poultry to meet the needs of selenium in the body, the selenium premix given is 0.2-0.3 kg/kg of commercial feed. Selenium is a component of the enzyme glutathione peroxidase, which destroys free radicals in the cytoplasm. There are two forms of selenium, organic and inorganic. Currently, many innovations are made in livestock products as an alternative to have high nutritional value and benefits for health, such as the provision of selenium in organic form in additional animal feed. Consumers expect that consumption of livestock products enriched with organic

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selenium (Se) will provide benefits as antioxidants, increase immunity, fertility, improve reproduction, and even prevent various diseases such as arthritis, cancer, cardiovascular disease, *muscular dystrophy*, *lymphoblastic anemia* and immunodeficiency.

According to (Akil *et al*. 2023) organic selenium has a higher effectiveness and absorption ability in livestock than inorganic selenium. Selenium yeast in the body of livestock can be stored in body tissues to increase selenium content in milk, eggs, and meat. Another function of selenium is as an antioxidant and plays a role in the reproductive system for livestock. As an antioxidant selenium works by increasing the activity of theenzyme glutathione peroxidase where the enzyme can destroy free radicals in the cytoplasm. According to (Said and Sulmiyati. 2020) explained that the addition of selenium also increases production and reproductive performance with the regeneration of the reproductive organs (uterus). Selenium works by protecting thecellular membrane of the magnum so that the secretion of glandular duct cells functions more effectively which results in protein being secreted into the lumen of the magnum more so as to produce more egg white. This can also affect the quality of egg albumin and affect egg weight. Based on the background description above, this study aims to evaluate and analyze the comparison of the results of selenium and inorganic feeding in feed additives.

MATERIALS AND METHODS

Research Materials

A. Laying Chickens

The laying hens used were 60 weeks old with the *Isa Brown strain*. Initial rearing started from pullets and was obtained from Kandang Malang Pullet (KMP).

B. Material

The materials used in phase 1 of the study were organic selenium branded SELEN-OYE and inorganic selenium branded Introvit E Selen-WS produced by PT Tekad Mandiri Citra. KM 2 concentrate feed produced by PT Malindo Feedmill. Tbk.

C. Tools

The tools used in phase 1 of the study were battery cages measuring 20 x 35 cm complete with feed and drink containers, 1 ml syringes, EDTA tubes, stationery, surgical scissors, glove, digital scales.

Research Methods

The research method used a completely randomized design (CRD) with four treatments and sixreplications, as follows:

P0: Commercial feed
P1: Commercial feed + organic selenium at 150 grams/ton of feed
P2: Commercial feed + inorganic selenium + vitamin E dosage of 1000 grams/ton feed
P3: Commercial feed + organic selenium at a dose of 150 grams/ton feed inorganic selenium + vitamins E dose of 1000 grams/ton of feed.

Data Analyst

The research obtained was analyzed using *analysis of variance* (ANOVA) with a 5% test level. Data processing used Microsoft Excel version 2019. Calculations were carried out using the following equation:

Analysis of variance with a completely randomized design (CRD). If the treatment shows a significant effect (P<0.05) or very significant (P<0.01), It is continued with the *Duncan* Multiple Range test (Sudarwati *et al*. 2019). The formula for CRD below:

$Yij = \mu + \tau i + \varepsilon ij$

Description:

Y_{ij} = observation value in treatment $_{1-4}$ and replication $_{1-5}$
μ = common mean
τ_I = effect of treatment $_{1-4}$
ε_{ij} = effect of experimental error in treatments $_{1-4}$ and replications $_{1-5}$

RESULTS AND DISCUSSIONS

Hemoglobin

Based on the research that has been done, the results show that the provision of selenium as an additional feed gives a real effect (P<0.05) on hemoglobin levels in layers. The average results of hemoglobin levels can be seen in Table 1.

Table 1. Average of Hemoglobin in Layer

Hemoglobin				
Component	**P0**	**P1**	**P2**	**P3**
Average ± SD	13.20 ± 0.265^{c}	14.03 ± 1.964^{bc}	14.72 ± 0.530^{b}	15.57 ± 1.262^{a}

Notes: $^{a, b, c}$ = Different superscripts in the same row indicate that the supplementation of selenium in feed has a significant effect (P<0.05) on hemoglobin levels in layers. Hemoglobin was normal in layers with an average of 12.7-18.4 g/dl.

The results of hemoglobin analysis can be displayed in Table 1 which explains that the layers that are given additional feed in the form of selenium have a significant effect (P<0.05). Table 1 shows the best treatment data shown P3 with commercial feed plus organic selenium dose of 150 grams/ton feed and inorganic selenium + vitamin E dose of 1000 grams/ton feed, showing the best results of 15.57 ± 1.262. This is because the content in organic selenium and vitamin E acts as an antioxidant, increases immunity, fertility, improves reproduction, and even prevents various diseases such as arthritis, cancer, cardiovascular disease, *muscular dystrophy*, *lymphoblastic anemia* and immunodeficiency. The highest level of supplementary feed will produce high selenium content in liver, kidney, plasma, and meat in poultry (Dwiyanjono *et al*., 2023). Furthermore, the supplementary feed will be absorbed in the small intestine and transported by blood through amino acids. In the blood pigment, there is hemoglobin which will experience increased metabolism and release along with the body's metabolism. Hemoglobin biosynthesis begins in the erythrocyte and is continuous

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following several stages in erythrocyte development. As long as the nucleus is present in the erythrocyte, hemoglobin formation will continue. Hemoglobin, hematocrit, and erythrocytes will increase when the animal is in a stressful or comfortable condition, as they release catecholamines (epinephrine/norepinephrine). Hemoglobin levels are also influenced by sex, feed, age, and environmental conditions (Sturkie, 1976). The altitude at which livestock are raised also affects the level of hemoglobin produced in the blood (Atmadilaga, 1979). The process of hemoglobin synthesis begins in pro-erythroblast then proceeds to the reticulocyte stage in the bone marrow, then continues to mature erythrocytes.

Erythrocytes

Based on the research that has been done, the results show that the provision of selenium as an additional feed has a significant effect (P<0.05) on erythrocyte levels in layers. The average results oferythrocyte levels can be seen in Table 2.

Table 2. Average of Erythrocytes in Layer

Erythrocytes				
Component	**P0**	**P1**	**P2**	**P3**
Average ± SD	9.72 ± 0.576^{c}	9.75 ± 0.663^{b}	10.02 ± 0.518^{a}	10.30 ± 0.833^{a}

Notes: $^{a, b, c}$ = Different superscripts in the same row indicate that the supplementation of selenium in feed has a significant effect (P<0.05) on erythrocyte levels in layers.

The results of erythrocyte analysis in Table 2 explained that the layers that were given additional feed in the form of selenium had a significant effect (P<0.05). The best treatment data presented in Table 2 is shown by P3 with commercial feed plus organic selenium at a dose of 150 grams/ton of feed and inorganic selenium + vitamin E dose of 1000 grams/ton of feed, showed the best result of 10.30 ± 0.833. This is because erythrocytes are filled with one-third of hemoglobin (Campbell, 1995). Hemoglobin in erythrocytes allows the ability to bind oxygen, this is because hemoglobin is a protein rich in iron. Erythrocyte levels can also be affected by the way layers are raised, for example a case study conducted by (Pakiding *et al*. 2016) revealed that the hematological status of layers raised using a *free-range* systemwill produce higher hematocrit values when compared to erythrocytes that do not display different values. When erythrocytes leave the bone marrow and enter the bloodstream, they will continue to form a small amount of hemoglobin for several days or thereafter (Schalm, 2010).

Hematocrit

Based on the research that has been done, the results show that the provision of selenium as an additional feed gives a significant effect (P<0.05) on hematocrit levels in layers. The average results of hematocrit levels can be seen in Table 3.

Table 3. Average of Hematocrit in Layer

Hematocrit				
Component	**P0**	**P1**	**P2**	**P3**
Average ± SD	9.72 ± 0.576^{c}	9.75 ± 0.663^{b}	10.02 ± 0.518^{a}	10.30 ± 0.833^{a}

Notes: $^{a, b, c}$ = Different superscripts in the same row indicate that supplementation of selenium in feed has a significant effect (P<0.05) on hematocrit levels in layers.

The results of hematocrit analysis can be displayed in Table 3 which explains that the layers given additional feed in the form of selenium have a significant effect (P <0.05). Table 3 shows the best treatment data shown by P3 with commercial feed plus organic selenium at a dose of 150 grams/ton feed and inorganic selenium + vitamin E at a dose of 1000 grams/ton feed, obtaining the best results of 60.07 ± 1.828. This is because an increase in hematocrit value will also be followed by an increase in hemoglobin levels (Soetrisno, 1987). Normally, hematocrit in broilers averages 49.6 ± 1.828. So, the results of the above study can be said to be normal. The hematocrit value is highly dependent on the number of erythrocytes, because erythrocytes are the largest cell mass in the blood (Virden et al., 2007). The hematocrit value with the number of erythrocytes has a relationship. The greater the number of erythrocytes, the greater the hematocrit value in the blood. Vice versa, a decrease in hematocrit value can be caused by erythrocyte damage, decreased erythrocyte production, or can also be influenced by the number and size of erythrocytes (Dawson and Whittow, 2000). An increase or decrease in hematocrit value in the blood will have an impact on blood viscosity. The greater the hematocrit percentage, the higher the blood viscosity. This situation is due to spleen contraction or dehydration. Spleen contraction is stimulated by the release of the hormone epinephrine, which occurs when animals experience fear, pain or exercise. The hematocrit value will have a negative impact if it is affected by the viscosity of the blood. A high or low hematocrit causes an increase and conversely will slow blood flow in the capillaries and speed up the work of the heart (Cunningham, 2002).

Leucocytes

Based on the research that has been done, the results show that the provision of selenium as an additional feed gives a real effect (P<0.05) on leucocyte levels in layers. The average results of leucocyte levels can be seen in Table 4.

Table 4. Average of Leucocytes in Layer

Leucocytes				
Component	**P0**	**P1**	**P2**	**P3**
Average ± SD	9.72 ± 0.576^{c}	9.75 ± 0.663^{b}	10.02 ± 0.518^{a}	10.30 ± 0.833^{a}

Notes: $^{a, b, c}$ = Different superscripts in the same row indicate that supplementation of selenium in feed has a significant effect (P<0.05) on Leucocytes levels in layers.

Leucocytes are a health indicator that ducks are healthy and

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not exposed to disease. An increase and decrease in the number of white blood cells in the blood can mean the presence of pathogens, inflammation, autoimmune diseases, so it is necessary to know the normal picture of white blood cells in ducks. The results of leucocyte analysis can be displayed in Table 4 which explains that the layers given additional feed in the form of selenium have a significant effect (P <0.05). Table 4 shows the best treatment data shown by P2 with commercial feed plus inorganic selenium and vitamin E doses of 1000 grams/ton of feed, obtaining the best results of 20.35 ± 3.302. The number of leucocytes is also influenced by the way the layers are raised. Case studies conducted by (Pakiding *et al*. 2016) revealed that the leucocyte status of layers reared using a *free-range* system will produce higher values. Then continued by (Harahap *et al*. 2023) who examined the provision of additional feed in the form of calcium complex in duck commodities. The results of the study explained that the addition of calcium and herbal dregs had no significant effect (P>0.05) on leucocyte values and leucocyte differentials consisting of (lymphocytes, heterophils, monocytes,eosinophils, basophils, and H/L ratio). So that the study concluded that the addition of calcium complex and herbal dregs in feed with different concentrations for 60 days gave results that had no effect on the leucocyte differential of Mojosari laying ducks, although these conditions were still physiologically normal. Research conducted by (Wang *et al*. 2016) explained that there was a decrease in the number of leucocytes given the treatment of 0.675 mg/kg selenium yeast and vitaminE 200 mg/kg in basal feed due to excess selenium. Selenium given in excess can induce oxidative stress through increased production of reactive oxygen species (ROS) which can damage genomic DNA and oxidative lipids and proteins.

Quantity of Egg Cells

Based on the research that has been done, the results show that the provision of selenium as an additional feed has a significant effect (P <0.05) on the number of eggs in layers. The average numberof egg cells can be seen in Table 5.

Table 5. Average of Quantity of Egg Cells in Layer

Quantity of Egg Cells				
Component	**P0**	**P1**	**P2**	**P3**
Average ± SD	23.67 ± 1.106^{c}	31.33 ± 2.560^{b}	38.00 ± 2.828^{a}	38.83 ± 2.911^{a}

Notes: $^{a, b, c}$ = Different superscripts in the same row indicate that supplementation of selenium in feed has a significant effect (P<0.05) on the number of eggs in layers.

The results of the analysis of the number of egg cells can be displayed in Table 5 which explains that the layers that are given additional feed in the form of selenium have a significant effect (P<0.05). Table 5 shows the best treatment data shown by P3 by giving commercial feed plus organic selenium at a dose of 150 grams/ton of feed and inorganic selenium + vitamin E at a dose of 1000 grams/ton of feed, obtaining the best results of 38.83 ± 2.911. This is influenced by feed quality. Good feed quality, in this case, the content of protein, amino acids, and linoleic acid will affect egg weight, because feed with good quality will produce large eggs (Mampioper *et al*., 2008). Furthermore, research conducted by (Lidyawati *et al*., 2018) explained that the addition of vitamin E-selenium in feed had no significant effect (P>0.05) on egg weight. Although statistically, the addition of vitamin E and selenium levels does not have a significant effect on egg weight, when viewed from the value of egg weight in the treatment feed added with vitamin E and selenium has a greater egg weight when compared to control feed. Another case study from (Dwiyanjono *et al*., 2023) explained that the addition of selenium can affect the weight of yolk and albumen. The addition of yolk weight occurs due to the absorption of protein in the small intestine and then transported by blood in the form of amino acids and binds with selenium to the ovary which plays a role in helping follicular development, while the addition of albumen weight occurs with the bond between selenium and essential amino acids, namely methionine which will produce selenomethionine. The addition of inorganic selenium (*sodium selenite*) in layer feed has no significant effect on albumen weight (P>0.05), meaning that the addition of *sodium selenite* at a dose of 0.2 mg/kg, 0.4 mg/kg, and 0.6 mg/kg feed has not been able to increase the weight of egg albumen in commercial layer hens. This is likely because *sodium selenite is* more difficult to be absorbed by the body compared to organic selenium (Heryadi et al., 2020). In research related to the provision of selenium as supplementary feed conducted by (Haryuni *et al*., 2019) showed that the provision of vitamin E-selenium levels in feed had no significant effect (P>0.05) on hatching egg weight. The existence of an unreal effect is due to the energy and fat content of all treatment feeds are the same. Selenium (Se) can be found in organic and inorganic forms. In laying poultry, selenium functions to improve shell quality, increase haugh unit (yolk and white quality), increase yolk and white weight, maintain egg quality when stored. *Haugh unit* (HU) is a measure of inner egg quality obtained from the relationship between egg white height and egg weight (Saraswati *et al*. 2018).

CONCLUSIONS

Evaluation and analysis of the administration of organic and inorganic selenium can have a significant effect on blood profiles and the number of eggs produced by layers. This is because Selenium content can destroy free radicals in the cytoplasm. Providing organic selenium (Se) will provide benefits as an antioxidant, increase immunity, fertility, improve reproduction, and even prevent various diseases such as arthritis, cancer, cardiovascular disease, *muscular dystrophy*, *lymphoblastic anemia*, and immunodeficiency. Meanwhile, organic selenium has a higher effectiveness and absorption ability in livestock than inorganic selenium.

REFERENCES

1. Akil, S., Piliang, W.G., Wijaya, CH., Utomo, DB and Wiryawan, G. 2023. Enrichment of Organic Selenium, Inorganic, and Vitamin E in Quail Feed on Performance and Potential of Quail Eggs as a

Source of Antioxidants. *Journal of Livestock Research and Innovation*, 7 (1), pp 9-18.

2. Atmadilaga. 1979. The *Position of Traditional Livestock Businesses and Livestock Companies in the Livestock Development System*. Graduate Workshop of the Faculty of Economics. Gadjah Mada University, Yogyakarta.
3. Campbell, T. W. 1995. *Avian Hematology and Cytology*. Lowa: Iowa State University Press. Cunningham, J. G. 2002. *Textbook of Veterinary Physiology*. Saunders Company, USA.
4. Dawson, W.R., and G.C. Whittow. 2000. *Regulation of Body Temperature*. pp 343 - 379 in Sturkie's Avian Physiology. G. C. Whittow, ed. Academic Press, New York, NY.
5. Dwiyanjono, N. A., Rosidi, and N. Hidayat. 2023. The Effect of Inorganic Selenium Supplementation in Feed on Albumen Weight, Yolk Weight, Yolk, and Albumen Weight Ratio in Laying Chickens. *Journal of Animal Science and Technology*. 5 (1), pp 30-38.
6. Harahap, M. A., Natsir, M. H., Damayanti, C. A., Wibowo, S., Adli, D. N., and Sjofjan, O. 2023. Effect of Providing Calcium Complex and Herbal Dregs in Feed on Leucocyte Count and Leucocyte Differential in 32 Weeks Old Mojosari Laying Ducks (*Anas javanica*). *Journal of Tropical Animal Nutrition*, 6 (1), pp 26-35.
7. Haryuni, N., A. Lidyawati, and B. Khopsoh. 2019. The Effect of Vitamin E - Selenium Addition Level in Feed Against Fertility and Hatching Eggs of Sentul Chicken Crosses with LayingHens. *Scientific Journal of Integrated Animal Husbandry*. 7 (3), pp 287-292.
8. Heryadi, A. L., A. Shalihat, R. Pratiwi, and Mutakin. 2020. Selenium Species in Vegetables: Benefits and Toxicity for the Body. *Pharmaceutical Scientific Journal*. 16 (2), pp 155-166.
9. Lidyawati, A., B. Khopsoh, and N. Haryuni. 2018. The Effects of Vitamin E and Selenium Level Addition in Feed to Performance of Artificial Insemination Laying Hens. *Scientific Journal of Integrated Animal Husbandry*, 6 (2), pp 106-110.
10. Mampioper, A., S.D. Rumetor, and F. Pattiselano. 2008. Egg Quality of Laying Hens Feeding Rations Substituted with Corn and Cassava Flour. *Journal of Tropical Livestock*. 9 (2), pp 42-51.
11. Pakiding, W., Ambo, A., Rachman, H. M., Mustakim, M., and Watungadha, F. 2016. Hematological Status of Laying Races Chickens Raised in *Free-Range* System with Different Types of Forage. *National Seminar on Animal Husbandry 2*, 37-44. Makassar: Faculty of Animal Husbandry, Hasanuddin University.
12. Said, NS and Sulmiyati. 2020. Effect of Introvit-E-Selen Injection on Duration of *Force Molting* and *Hen Day of* Isa Brown Chicken. *Journal of Animal Science and Technology*, 1 (2). Saraswati, T. R., S. Tana, and S. Isdadiyanto. 2018. *Organic Feed and Metabolism in Quail*. UNDIP Press. Semarang.
13. Schalm, O. W. 2010. *Vetenary Hematology*. 6th Edition.Lea and Febriger, Phidelpia. Soetrisno. 1987. *Dictate of Livestock Physiology*. Faculty of Animal Husbandry Unsoed, Purwokerto.
14. Sturkie, P. D. 1976. *Blood: Physical Characteristics, Formed, Elements, Hemoglobin, and Coagulants in Avian Physiology*. 3rd rd Edition. Springer Verlag, New York.
15. Sudarwati, H., M. H. Natsir, and V. M. A. Nurgiartiningsih. 2019. *Statistics and Experiment Design: Application in Animal Husbandry*. Malang, Indonesia: Brawijaya University Press.
16. Virden, W.S., M.S. Lilburn, J.P. Thaxton, A. Corzo, D. Hoehler and M.T. Kidd. 2007. The Effect of Corticosterone-Induced Stress on Amino Acid Digestibility in Ross Broilers. *Poult. Sci*. 86: 338-342.
17. Wang Y, Jiang L, Li Y, Luo X, and He J. 2016. Excessive Selenium Supplementation Induced Oxidative Stress and Endoplasmic Reticulum Stress in Chicken Spleen. *Biological Trace Element Research*, 172, 481-487.

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