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Effect of mineral premix addition to feed on performance of SAN laying hens

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Abstract. Specific Antibody Negative (SAN) laying hens are chickens that have been raised from eggs with a history of negative Avian Influenza (AI) antibody results and negative antigen tests. This research aims to determine the effect of adding organic mineral premix to feed on the SAN performance of laying hens. This study used 72 laying hens aged 43 weeks which were divided into three treatment groups. Each treatment was repeated three times, each consisting of eight chickens, and kept for 35 days. The treatments given consisted of commercial feed without the addition of mineral premix as a control, commercial feed with the addition of 0.25% mineral premix, and commercial feed with the addition of 0.50% mineral premix. The parameters observed were egg production, feed consumption, feed conversion ratio and AI subtype H5 antibody titer results. The data analysis used was a one-way completely randomized design. The results of the study showed that giving mineral premix feed up to 0.50% did not affect the performance of SAN laying hens, so that the addition of mineral premix in feed up to 0.50% has not been able to increase the egg production of SAN hens, but is still able to produce eggs that are suitable as a medium viral AI H5N1.

1. Introduction.

Laying hens are chickens to produce eggs commercial. There are 2 groups of laying hens, the medium type and the light type. The medium types laying eggs with a brown shell colour while the light types laying eggs with a white shell colour [1]. The first chicken to enter and start breeding in Indonesia was the layer chicken which was thin and generally used as broiler chickens after its productive period was over. Specific Antibody Negative (SAN) laying hens are the light types laying eggs that have been raised from eggs with a history of negative AI antibody results and negative antigen tests. This SAN laying hens produce white eggs and are often used as a medium for virus propagation which is used as raw material for vaccines or used for field testing related to viruses in poultry.

The chickens were not vaccinated in their maintenance. SAN laying hens should not be vaccinated as the produced eggs are to be used for vaccine production and testing purposes. SAN eggs producing chickens are subjected to screening tests and routine tests for certain diseases. The productivity of laying hens can be disrupted by various factors, one of which is disease. Diseases in laying hens can reduce the quality and quantity of eggs, even causing death. One way to increase the immunity of SAN laying hens is by providing feed that contains sufficient and balanced minerals. Minerals are naturally occurring, non-organic elements that have functions in a range of metabolic processes, including those related to the immune system. Several minerals crucial for the immune health of laying hens encompass zinc (Zn), copper (Cu), iron (Fe), selenium (Se), and cobalt (Co).

These minerals can function as antioxidants, coenzymes, cofactors, and components of immune cells. One of the materials that can be used is organic minerals (premix). However, giving minerals to laying hens' feed must be done carefully, because a deficiency or excess of minerals can have a negative effect on the health and productivity of laying hens [2–5]. Therefore, it is necessary to know the optimal dose and the right proportion of these minerals in the feed of laying hens. SAN chickens are laying hens that are raised without using vaccination but are required to produce high and be free from disease. For that, the feed intake given needs to be added with mineral ingredients that can increase productivity.

2. Materials and methods.

The animal experiments in this study were carried out with the approval of the Ethical Clearance Committee of the Wates Veterinary Center (BBVet Wates), Ethical Clearance No: 001/KE/BBVet/VII/2022.

2.1. Materials.

The research tools used included chicken rearing cages with a litter system in the form of husks, analytical scales, tools used for feed proximate testing, tools used for mineral testing, tools of deferential leucocyte, scales, tools for necropsy. Seventy-two white leghorn chickens consisting of 1 male and 7 females aged 43 weeks, mineral premix, production chicken feed, and cages in the Experimental Animal Cage Installation (IKHP) at BBVet Wates Yogyakarta. Mineral premix, chicken feed production, ingredients used for feed proximate test, materials used for mineral tests, materials used for HI tests.

2.2. Methods.

The composition of nutrients in the feed listed in Table 1 and Table 2 is the result of feed analysis from the Clinical Pathology Laboratory of the Wates Veterinary Center and the Center for Quality Testing and Feed Certification, Bekasi (2022). The method used in this study was an experiment using a one-way Completely Randomized Design (CRD) consisting of three treatments and three replications, each replication consisting of eight chickens. The treatments given were: Commercial feed without feed additives (control), commercial feed with 0.25% additional premix, commercial feed with 0.5% additional premix

Table 1. Mineral Composition in Premix.

Mineral Composition	Concentration	Unit Content
Calcium (Ca)	8.95	%
Phosphor (P)	1.09	%
Mangan (Mn)	85.88	mg/kg
Zink (Zn)	0.01	%
Iron (Fe)	718.73	mg/kg
Selenium (Se)	0.61	ppm

Table 2. Feed Nutrient Composition.

Nutrient Composition	Concentration (%)
Crude Protein	21.91
Coarse Fibber	6.00
Crude Fat	5.61
Calcium	4.35
Phosphor	1.20

2.2.1. Animal preparation and placement. A total of 72 laying hens of the SAN were reared for 30 days. Chickens were divided into three groups (24 individuals each) based on the treatment given. Furthermore, in each treatment group, the chickens were further divided into three sub-groups, each tail, according to the number of treatments. So, each treatment consisted of three groups as replicates and each replicate consisted of eight chickens. Each cage is equipped with a place to feed, lay eggs and drinking water. The rations were given ad libitum according to the treatment. Each cage is equipped with a place to feed, lay eggs and drinking water. The rations were given ad libitum according to the treatment.

Observation of performance includes ration consumption, feed conversion ratio, and recording of egg production. Recording of egg production is done every day. Feed consumption is recorded every day by calculating the remaining feed minus the amount of feed given. Feed conversion is calculated by dividing the total feed (kg) given by the addition of total body weight (kg).

2.2.2. Avian influenza antibody titer test. Blood collection by cleaning the inner wing with alcohol, and then the syringe is injected into the brachial vein ± 2 ml of blood was taken, then let the blood coagulate at room temperature for approximately 30 minutes, rotate using a centrifuge at 3500 rpm for 15 minutes, and separate the serum from the clot. This observation was made at the beginning of the study, 2 weeks after treatment (middle) and at the end of the study.

2.3. Parameters.
The variables measured in this study were performance: ration consumption, feed conversion ratio, and recording of egg production. The results of the H5 antibody titer test are 2.1.3 and 2.3.2.

2.4. Statistical Analysis.
The research data were analyzed using a one-way design and if there were differences between treatments, a further test was carried out in the form of Duncan's Multiple Range Test (DMRT).

3. Results and discussion.

3.1. Avian Influenza (AI) antibody titers in SAN laying hens.
Based on the observations, data on Avian Influenza Type H5 Antibody Titers were obtained as presented in Table 3:

Table 3. Effect of adding organic minerals AI H5 Antibody Titer.

	Premix Addition Mineral (%)		
Titer AB (log 2) ^{ns}	PM-0.00	PM-0.25	PM-0.50
Subtype 2.1.3	0	0	0
Subtype 2.3.2	0	0	0

^{ns} = non-significant

As indicated in Table 3, the examination of the AB AI H5 titer results revealed no discernible distinction between the treatments. On the 7th day examination, the chickens had an antibody titer 0, so that the chickens fulfilled the requirements as SAN egg producers of AI virus H5 isolation test media. In this study, giving organic minerals as antioxidants was able to prevent SAN laying hens from having negative antibodies for AI subtype H5 This shows that the mineral premix is able to retain the antibody. It is suspected that the zinc and selenium content in organic minerals used as antioxidants only work as immunogenic. According to Roitt [6] immunogenic is the property of compounds that can stimulate the formation of specific antibodies that are protective and increase cellular immunity.

3.2. Performance SAN laying hens.
Based on the research results, the performance of SAN laying hens was obtained by giving mineral premix to the ration as presented in Table 4.

Table 4. Performance SAN laying hens.

Performance[ns]	Premix Mineral (%)		
	PM-0.00	PM-0.25	PM-0.50
Feed Intake (g/head/day)	98.17±0.76	96.93±1.17	95.83±0.91
FCR	5.02±1.26	4.58±1.23	5.00±0.59
Eggs production(%)	50.85±12.72	56.53±9.45	49.77±6.88

[ns] = non significant

There were no real differences in the ration consumption variables at all levels of giving mineral premix with a range of 95.83-98.17 grams/head/day. The addition of mineral premix also had no real effect on feed conversion rates with a range of 4.58-5.02 and egg production of 49.77-56.53%.

Laying hens that are kept in cages with an environmental temperature above their comfort point will give reactions such as increasing heat loss by panting, increasing drink consumption, reducing feed consumption and production will decrease because feed consumption decreases. This causes only a small amount of feed substances to enter the body. Apart from that, limited feed substances will be used to maintain body heat balance so that production is limited [7].

Based on the research results, it shows that there is no significant difference in ration consumption between treatments. Holoubek et al. [8] reported that the addition of Fe and Cu to the rations of laying hens also had a significant effect on increasing the efficiency of ration use.

3.2.1. Ration conversion. The results of the study showed that there was no real difference between treatments regarding the ration conversion value. The ration conversion value in this study ranged between 4.58-5. This value shows that it is higher than the standard ration conversion for laying hens, namely 2-3 [9].

This high conversion of rations is caused by high environmental temperature stress. Lucas and Marcos [10] stated that high temperatures would increase ration conversion by 25.6%. At high temperatures, chickens will experience heat stress, where feed consumption will decrease and egg production will also decrease. Mack et al. [11] stated that there will be a decrease in egg production, egg weight and shell thickness in chickens that experience heat stress. Farnell et al. [12] also explained that heat stress conditions will reduce egg production by 13.2-57%. This decrease in egg production results in an increase in ration conversion.

3.2.2. Production of embryonated chicken eggs. Based on the observation results, egg production data was obtained as shown in the graph in Figure 4. Based on Figure 1:

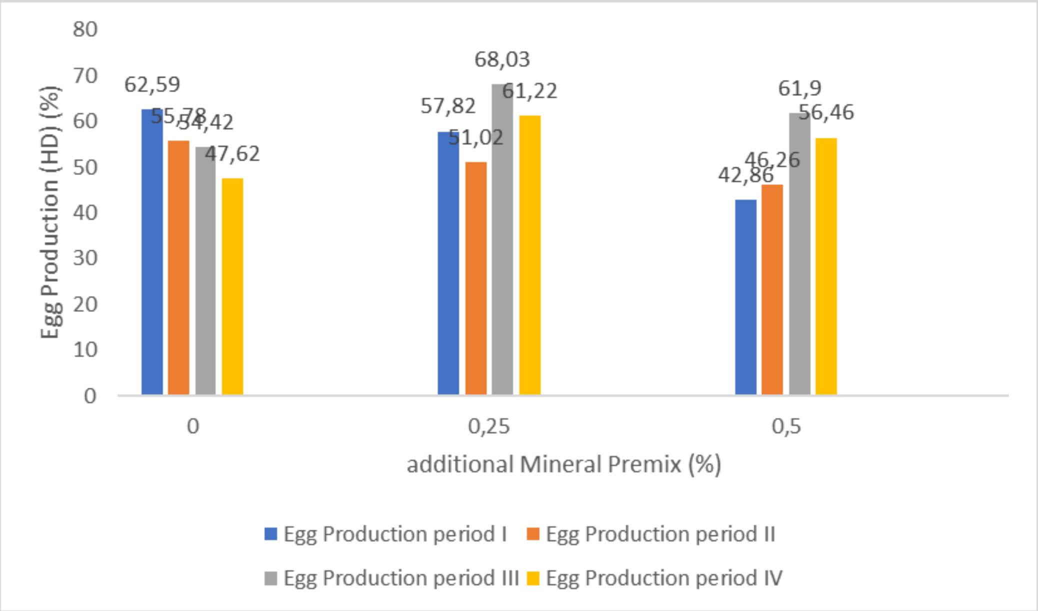

Figure 1. Egg Production 4 weeks.

It is known that the three treatments after maintenance for 35 days showed egg production results below the standard from DEKALB Delta White Commercial Layer. Based on these standards, egg production (Hen Day Average) at 43 weeks of age is 86.8%. Referring to other research conducted by Untari et al. [13] it is known that the egg production of White Leghorn chickens at around 56 weeks of age is only around 48%.

4. Conclusion.

That the addition of mineral premix in feed up to 0.50% has not been able to increase the egg production of SAN hens, but is still able to produce eggs that are suitable as a medium viral AI H5N1.

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