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Production Performance, Reproduction and Immunity of Sentul Hens at Different IgY Concentrations

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ABSTRACT

The aim of this study was to evaluate the effect of different IgY concentrations on the production, reproduction and immunity of Sentul chicken. This research used 20 month-old Sentul chickens which consisting of 10 chickens with high IgY concentration and 10 chickens with low IgY concentration Parameters observed included prelayer performance (feed consumption, weight gain, feed conversion, morbidity and mortality), layer performance (feed consumption, egg production, egg weight, feed conversion, hatchability, morbidity and mortality), and immunity at chicks (IgY concentration of eggs and chicks serum). The experiment was conducted as a completely randomized design. The treatments were high and low IgY concentration. All treatments were repeated 10 times. The data obtained were analyzed using the SAS program t-test. Morbidity and mortality were analyzed descriptively. The results of this research indicated that the prelayer period, chickens with high IgY concentration had a higher performance than chicken with low IgY concentration. This is caused by about 30% chickens with low IgY were in sick condition for approximately seven days. Further, the layer period showed that the chickens with high IgY concentration had lower production performance than the chicken with low IgY concentration. The study concluded that chickens at low IgY concentrations are susceptible to exposure to antigens that lead to decreased productivity. In normal conditions hens, Sentul with high IgY concentration resulted in low production. The observation of chicken immunity showed that concentration of IgY from chicks and eggs did not differ between hens with high IgY concentrations and hens with low IgY concentrations.

Keywords: IgY, Production, Reproduction, Sentul chicken

Introduction

Native chicken is a poultry that has the potential to be developed as a producer of animal protein in the form of meat and eggs. The consumption of native chicken products is still lower than that of broilers. This is because the native chicken population is lower than that of broiler chicken (Sudrajat and Isyanto, 2018). Several factors that cause low native chicken populations include scarcity of seeds, slow growth and high mortality due to disease (Gunawan, 2002). One solution to this problem is to produce native chicken seedlings that have high immunity. One native chicken that has the potential to be developed is Sentul chicken. Sentul chicken originating from Ciamis, West Java and is a dual-purpose type chicken having high egg production (12-30 grains per / period) as well as higher body weight compared to Kampong chicken (Sulandari *et al*., 2007).

Muhsinin *et al*. (2016) showed that Sentul chickens exposed to Salmonella pullorum using the Clearance test method were able to kill the disease agent by 27-55%. This indicates that the immunity to Sentul chickens varies. Immunity in chickens can be observed by looking at Immunoglobulin yolk concentrations (IgY) in the serum (Da Silva and Tambourgi, 2010). IgY is a substance that is identified as a protein molecule that can neutralize a number of microorganisms that cause infection or commonly referred to as antibodies.

Chicken is resistant to disease because chickens are able to produce antibodies or obtain high antibodies from the Hens. The immune system plays a role in fighting disease agents (bacteria, viruses, parasites, fungi, and others). Agents of these diseases cause a decrease in productivity and even death. Livestock which produces antibodies because of exposure to disease agents (antigens) called the formation of active immunity. This occurs after the chicken is vaccinated or exposed to illness from its environment. Amines that receive antibodies from the hen through eggs are called passive immunity. Lee *et al*. (2002) reported that antibodies (IgY) derived from Hens to child came from chicken egg yolks. IgY is also present in blood serum.

Chickens that have high IgY concentrations are expected to have a high immunity to fight the seeds of disease so that the metabolic process functions properly which has an effect on the production performance produced. Regar *et al*. (2013) reported that livestock that has high immunity (high IgY) produce good performance (production and reproduction). High IgY concentrations in chickens are expected to be passed on to chicks through egg yolk and chicks blood serum produced. The study of the relationship between serum IgY concentration and immunity and also the performance of chickens has not been widely done, especially in Sentul chickens. The research is expected to produce Sentul chicken seeds with high immunity accompanied by good performance.

Material and Methods

Chicken type

The chickens studied were hens Sentul, at the age of 5 months there were 20 chickens. The average body weight of Sentul chickens is 975.7 ± 161.99 g chicken^{-1}day^{-1}. 20 chickens were also kept with an average body weight of 1851.15 ± 172.73 g chicken^{-1}day^{-1} was used as a cock to fertilize a hen.

Determination of the treatment of IgY concentration

Testing of IgY concentration in serum was carried out on 20 hens Sentul and 20 cocks Sentul. Testing of total IgY in serum using the indirect ELISA method according to Subekti and Yuniarto (2012) using an ELISA reader (Microplate Reader, Benchmark). The total IgY of the whole sample is averaged. The mean serum IgY in the hen is 9.55±1.25 mgmL-1. Chickens that have IgY concentrations above the average are classified as chickens with high IgY concentrations. Chickens that have an IgY concentration equal to or below the average are classified as chickens with low IgY concentrations. Hens with high IgY concentrations mated with cocks that have high IgY concentrations too, and vice versa.

Maintenance and hatching

The chicken was kept in the prelayer period to find out the production performance. The cage used is an individual cage made of bamboo. The size of the cage is about 35 x 35 x 50 cm^3, which is provided by the place of feed and drinking water. Cages are in a cage measuring 10 x 6 m2. The type of feed given is commercial feed for laying hens production period (PT Gold Coin, Indonesia). The food contains 16-18% protein and metabolic energy 2,700-2,800 kcal kg^{-1}. The feed was given 2 times a day at 6:00 a.m. WIB and at 16.00 WIB. The chicken was weighed using scales (Kitchen Scale Electronics, China) every week to determine body weight gain produced during maintenance. Parameters observed included feed consumption, body weight gain, feed conversion, morbidity, and mortality.

Entering the period layer, chickens were moved from cage to plot with a size of 1 x 2 m^2. Cocks are placed in the cage plot with a ratio of 1:1 and maintained for 2 months in the same cage with hens. The feed gave and the time is the same as the prelayer period. Eggs produced by each hen are weighed and recorded. Eggs are stored for hatching and partly for measuring IgY concentrations. In this period, observations were made on feed consumption, egg production during the study, egg weight, feed conversion, morbidity and mortality.

Collected eggs are cleaned using a dry cloth. Eggs are weighed using a weighing accuracy of 0.02 g (AJ 3000, Osaka, Japan) to obtain egg weight. The eggs are put into an incubator (IPB field science laboratory) for 1-18 days. The incubator used is an automatic incubator with a temperature of 37-38ºC and a humidity of 55-60%. The 18th day of hatching is carried out observation to find out the fertilized eggs. Fertile eggs are transferred to the hatchery with temperature 37-38ºC and humidity 60-70%. Hatched eggs are calculated by hatchability by comparing the number of chicks hatching and the number of fertilized eggs multiplied by 100% (El-Hanoun and Mossad, 2008).

Maintenance of hatching chicks is done in the brooder cage (temperature 37ºC). The feed given was commercial period starter feed with a protein content of 21.5-23.8% and metabolic energy of 3025-3125 Kcal kg1. Chicks are kept for 2 weeks. Blood collection was carried out at the age of 1 and 2 weeks to measure the concentration of IgY in serum with the indirect ELISA method according to Subekti and Yuniarto (2012). Tests of IgY concentrations of eggs produced in the two treatment Hens used the same method in testing chicken serum IgY concentrations.

Data analysis

The design was used a completely randomized design (CRD) with two treatments. The treatment is the different serum (high and low) IgY concentrations. Each treatment was repeated 10 times. Each replication consists of 1 hen Sentul. The variables observed were prelayer and layer performance, IgY egg concentration and IgY serum (chicks) concentration. The data obtained were analyzed by t-test with a confidence level of 95% SAS 9.0 software program. Data on morbidity and mortality were analyzed descriptively.

Result and Discussion

Prelayer performance

The prelayer period performance observed was the feed consumption, body weight gain, feed conversion morbidity, and mortality. The prelayer period is the period in which the chicken is heading to the production phase (period laying). Observation of prelayer performance is carried out for 1 month at the age of 5 months. The results of the observations are presented in Table 1.

The results of statistical analysis showed that body weight gain and chicken feed conversion with high IgY concentrations in the prelayer period were significantly different from those of low IgY concentrations but did not differ in their feed consumption. Sentul chickens that have high IgY concentrations produce higher body weight and lower feed conversion compared to Sentul chicken with low IgY. This is because during maintenance, there is a disease that attacks chickens with low IgY concentration approximately 3 chickens (30%) which caused a decrease in productivity. The disease attacks for 7 days. The chickens showed symptoms of coughing, sneezing accompanied by breath like snoring. Soeripto (2009) reported that chickens with these symptoms are indicated by Chronic Respiratory Disease, this disease is caused by the bacterium Mycoplasma gallisepticum. These results showed that the morbidity in chickens with low IgY concentrations was 30% and 0% mortality.

Hens with high IgY concentrations, although kept in the same cage as chickens, had low IgY concentrations, did not show symptoms of CRD as described above. This indicates that chickens with high IgY concentrations have a higher immunity and are able to overcome the exposure to the disease.

The impact of the transmission of chickens with low IgY concentration is a decrease in body weight and an increase in feed conversion value. The results of this study are in line with the research of Soares *et al*. (2016), which stated that disease-infected chickens use a large portion of the nutrients in their feed to form immunity in an effort to fight the transmitting antigens.

Layer performance

The layer period is the period the chicken enters the egg production period. The layer period performance observed included feed consumption, egg production, egg weight, feed conversion, hatchability, morbidity, and mortality. The observation of the layer period is carried out for 2 months at the age of 6-8 months. Maintenance during this layer period does not occur in any disease. The chickens are maintained in healthy conditions and the mortality is 0%. Observation of the performance layer is presented in Table 2.

The results of this study showed that chickens that have low IgY concentrations consume feed that is not significantly different from chickens that have high IgY concentrations. Chickens performance with a low IgY concentration is better than chicken with high IgY concentration which is characterized by the high egg production and lower feed conversion value.

Hens with high IgY produced egg production of 14.75 g chicken^{-1}, significantly lower than that produced by chickens with low IgY concentrations (20.20 pigs-1). Lamont *et al*. (2003) reported that there is a negative correlation between the nature of resilience and productivity. Jamilah *et al*. (2013) stated that nutrient in feed is used for productive and formation of antibodies. High immune systems tend to have low egg production because the intake of nutrients consumed is more used for the formation of immunity. Low immunity causes nutrients in feed to be used to synthesize eggs (Rauw *et al.*1998). This causes feed conversion in the layer period for chickens with real high IgY concentrations to be more inefficient. The results of this study are in line with the results of a study by Kogut (2009) which reported that high production chickens have low immune properties.

The egg weight produced from these two hens with different IgY is not statistically significant. This is because the weight of eggs is greater influenced by genetic factors than environmental factors (Bell and Weaver, 2002). Egg weight in this study is almost the same as Sulandari *et al*. (2007) which is around 38.3 grams item-1. Egg production obtained in this study falls into the category of low production because new chickens enter the initial period of laying eggs.

Table 1. Performance of prelayer Sentul chicken during the research

Parameters	Hens IgY	
	High	Low
Feed consumption (g chicken^{-1}day^{-1})	121.92±4.68	121.88±3.27
Daily weight gain (g chicken^{-1}day^{-1})	20.65±4.17^{a}	14.10±3.25^{b}
Feed conversion	6.44±1.09^{a}	8.93±1.59^{b}
Morbidity (%)	0	30
Mortality (%)	0	0

Different letter superscripts in the same row show significant differences (P<0.05).

Table 2. Performance of layer Sentul chicken during the research

Parameters	Hens IgY	
	High	Low
Feed consumption (g chicken^{-1}day^{-1})	121.17±1.86	121.68±0.47
Eggs production (g chicken^{-1})	14.75±4.49^{b}	20.20±5.95^{a}
Weight eggs (g chicken^{-1})	38.99±0.69	38.44±1.63
Feed conversion)	12.74±4.83^{a}	9.20±1.72^{b}
Hatchability (%)	69.65±7.02	72.39±5.63
Morbidity (%)	0	0
Mortality (%)	0	0

Different letter superscripts in the same row show significant differences (P <0.05).

This is in accordance with the statement (Scenes *et al.* 2004) which stated that at the beginning of chicken production produces low egg production, then rises slowly until a certain time.

The hatched eggs produced in this study after going through the hatching process produce a value of hatchability that is not different. The hatchability in this study is low because there is a disturbance in the hatching machine used during hatching. King'ori (2011) reported that one of the factors that affect hatchability is the hatching condition.

IgY (Immunoglobulin yolk)

IgY is found in egg yolk and serum. Immunity in chickens can be observed by looking at the concentration of IgY in the serum (Da Silva and Tambourgi, 2010). The IgY concentrations measured in this study included hen IgY as a treatment, egg IgY and IgY 1 and 2 weeks old chicks. The IgY concentration of eggs and chicks serum produced in both treatments were not statistically different. The IgY concentrations of eggs and IgY of chicks produced in this study were relatively the same. This is because when raising chickens they are kept in the same environment, besides that there are no chickens exposed to the disease during the layer period, as well as when raising chickens. Verma *et al*. (2017) stated that the maintenance environment greatly influences immunity to the chicken. The presence of infection from the environment causes changes in antibody titers (Schat *et al*. 2012). Giving the same type of feed also causes the resulting IgY concentration not to be statistically different. Jamilah *et al*. (2013) reported that antibody formation is strongly influenced by the feed given. The balance of nutrients in the feed is needed for optimal antibody formation. Observations of eggs and chicks IgY are presented in Table 3.

Chickens originating from Hens with high IgY concentrations tend to produce high IgY concentrations as well. The same was reported by Sun *et al*. (2013), which states that chickens with high serum IgY concentrations produce egg yolks with high IgY concentrations. The IgY concentration of eggs in both treatments was in the normal range. The Range of IgY in egg yolk, according to the Gaetaniet *et al*. (2017) is 10-25 mgmL-1. Jeong and Hoon (2006) stated that IgY is actively transferred from the hen serum to egg yolk as an egg defense against infection from disease agents from the environment. IgY in egg yolk is transferred to chicks as the body's earliest defense after hatching.

IgY in a chicks serum is IgY which is transferred from the yolk during the embryonic process. The IgY concentration of eggs transferred to their chick can be reflected in the IgY concentration of 1 week old chicks. The results showed that chickens with high IgY concentrations produced chicks with slightly higher IgY concentrations compared to chickens originating from Henss with low IgY concentrations. High IgY in eggs results in a higher concentration of IgY in the embryonic process. Sun *et al*. (2013) reported that high IgY in the hen was positively correlated with IgY eggs and chicks produced. IgY concentrations in 1 week old chicks are in the normal range. Hamal *et al*. (2006) reported that chicks are very susceptible to pathogens originating from the environment in the first week after hatching because the immune system has not fully developed so that maternal antibodies (IgY) are the main means of protection against specific antigens. Total IgY concentration in chicken blood serum can be an indication of fitness, health and nutrition of chickens (Sun *et al*. 2013).

Observations on IgY of 2 weeks old chicks showed a decrease in concentration in both treatments, but not statistically different. IgY concentrations of chicks at 2 weeks of age decreased because the IgY was used to neutralize antigens originating from the environment. This is because vaccination of chicks in this study was not carried out. Chicks that produced from hens with low IgY concentrations decreased the IgY concentration higher (19.36%) compared to chicks originating from Hens with high IgY concentrations (16.78%), overall, this study proves that hens with high IgY concentrations are able to overcome disease exposure (CRD). Hens with high IgY concentrations produce chicks who have IgY concentrations not statistically different, but slightly higher in Hens with high IgY concentrations. These results indicate that the hen with high IgY is needed to produce chicken seeds to be distributed to the community, because the community in general is still not able to implement Biosecurity properly, regularly and correctly, even though it has lower production under normal conditions. This is due, chickens with low IgY concentrations are more prone to exposure to disease agents. The agent of the disease causes a decrease in productivity and even death in livestock, resulting in higher production costs needed for handling diseases and increasing Biosecurity.

Table 3. IgY concentration of eggs and IgY of Sentul chicks during the research ($mgmL^{-1}$)

Parameters	Hens IgY	
	High	low
Eggs IgY ($mgmL^{-1}$)	19.95±6.12	17.25±4.54
Chicks IgY, 1 week (serum) ($mgmL^{-1}$)	10.84±2.64	9.50±2.97
Chicks IgY, 2 weeks (serum) ($mgmL^{-1}$)	9.02±3.10	7.66±1.29
Declined IgY concentration (Chicks IgY, 1 week to 2 weeks) (%)	16.78±6.24	19.36±6.48

Conclusion

High IgY in Sentul chickens is able to overcome exposure to disease agents. Hens with High IgY has a higher weight gain, but under normal condition results in lower production performance. IgY eggs and serum of chicks from the hens that have high and low IgY are the same.

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