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Production and Quality of Eggs and Concentrations of Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH) in Local Chicken

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Abstract

This study aimed to assess the level of production and quality of eggs and the concentrations of Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) in Local Chicken. This research is a quantitative research. Research variables were the number of eggs, Hen House (HH), Hen Day (HD), egg-laying rhythm, interior and exterior quality of eggs, Luteinizing hormone (LH) and follicle-stimulating hormone (FSH). The type of chicken used was local chicken that is in a productive period as many as 72 chickens. Analysis of the data used was descriptive analysis. The results of the study found that 72 chickens were in normal conditions with the total eggs produced were 1180 and the average egg weight was 41.62 grams. Hen House was 11.80 eggs, Hen Day was 16.39 eggs, and the egg-laying rhythm was 2.61 days. The egg quality included the egg white index was 0.14 cm, the yolk index was 0.47 cm, the air sac diameter was 36.96 mm, the thickness of eggshell was 0.35 mm and the yolk color was yellow. FSH and LH concentrations increased during the post-incubation period to 181.61 pg/ml (FSH) and 2,325.86 pg/ml (LH). As for during the incubation period, the concentration of FSH and LH decreased to 58.48 pg/ml (FSH) and 1,771.93 pg/ml (LH).

Keywords: Local Chicken; Egg Productivity; Egg Quality; FSH and LH.

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1. Introduction

Local chicken is a native chicken in Indonesia that has been raised for a long time and is one of potential domestic chickens in Indonesia. Local chickens are found in all provinces and in various climates or regions. Local chicken is usually raised by people in rural areas close to rice fields or forests. Local chicken has adapted to simple breeding or raising environment conditions [1]. In line with the increasing population, changes in quality of life, nutritional awareness and improvement in education levels, demand for livestock products in the form of eggs and meat continues to increase [2,4].

Local chicken as a livestock has a potential to be developed in an attempt to meet the needs of eggs and meat because its treatment is relatively easy with quite high survival ability and good adaptation to the environment and feed. It is also relatively popular among the consumers. Its meat and eggs have tastes that are preferred by the community [5].

Local chicken is a domestic chicken (not race) group that has been domesticated and raised traditionally by the community [6]. Genetically, Local chicken is the descendant of green jungle fowl (*Callus varius varius* L.) which is then raised and utilized for the necessities of life and now known as Local chicken [7,9]. The aim of this study was to assess the level of production, quality and concentration of Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) of/in Local Chicken eggs.

2. Materials and method

2.1 Research Type

This research is a quantitative study concerning the number of production, exterior and interior quality, and levels of Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) of/in Local Chicken eggs.

2.2 Research Location and Time

This research has been conducted in June 2017 at Local Chicken Farm (*Peternakan Ayam Lokal*) which located in Duyu Village, Tatanga District, Palu City. Examination of FSH and LH levels was carried out in Endocrinology Laboratory of Veterinary Reproduction Department in January 2018 at Universitas Airlangga, Surabaya.

2.3 Research Variable

***2.3.1 Egg Productivity* is** the number of eggs produced by chickens that are in production period. Egg productivity also measures HH (Hen House), which is the ratio of the number of eggs to the total population of chickens at the beginning of raising or breeding and HD (Hen Day), which is the ratio of the number of eggs produced to the total population of chickens in cages.

***2.3.2 Egg-laying rhythm* is** the time from ovulation to the occurrence of spawning, the length of production time, clutch, incubation and return to egg-laying after incubation.

***2.3.3 Egg quality* is** divided into 2, namely interior and exterior. The interior egg quality observed was egg yolk index, albumen index, air sac diameter and egg yolk color. Exterior egg quality includes egg weight,

eggshell thickness, eggshell cleanliness and eggshell color.

***2.3.4 FSH profile* is** the concentration of FSH in the blood at each egg-laying phase/period through a hormone assay (FSH-Chicken: Fine Test China).

***2.3.5 LH profile* is** the concentration of LH in the blood at each egg-laying phase/period through a hormone assay (LH-Chicken: Fine Test China).

2.4 Data Collection Techniques

2.4.1 Egg Production

1) The number of eggs was calculated based on the number of eggs produced during the spawning phase.

2) HH (Hen House) calculated egg production by dividing the number of eggs spawned by chickens that were caged throughout the production period (the number of dead chickens was not counted) with the initial number of chickens that had been caged then multiplied by 100%.

3) HD (Hen Day) calculated daily egg production, in which the calculation was by dividing the number of eggs with the number of chickens at that time then multiplied by 100%.

2.4.2 The egg-laying rhythm was laying one or more eggs on the same day, then followed by a day of rest

2.4.3 The following techniques were done to determine the exterior and interior quality of eggs.

1. To obtain egg weight data, the eggs were weighed using a weighing device with a scale of 0.1 and the weighing was done for each egg.
2. Data on egg shape were set based on 3 types of shape, namely round, pointed and oval. If the width and length were same then it was round, if the width was smaller than the length it was oval, if the width and length ratio was 2/3, it was oval.
3. Cleanliness of egg yolk (eggshell) was determined based on the presence or absence of stains or dirt on the eggshell.
4. The thickness of eggshell was determined by taking one part of the eggshell then its thickness was measured using a digital caliper.
5. The yolk index was determined based on the measurement of height and diameter of the yolk using a digital caliper. The height was measured from the base of the yolk in the container until the highest peak of it. Meanwhile, the diameter was measured from the edge of the yolk through the midpoint.
6. Determination of yolk index used the yolk index formula = egg yolk height / egg yolk diameter. As for the formula for calculating egg white (albumin) index = egg white height / egg white diameter
7. Measurement of air sack was determined by taking the blunt part where the air sack is found. Measurement was done from the bottom of the air sack up to the highest peak. As for the diameter was measured from the edge of the air sack through the midpoint.

2.4.4 Profiles of FSH and LH were assessed using hormone assays (LH-Chicken and FSH-Chicken: Fine Test China).

2.5 Research Materials

The type of chicken used in this study was local chicken that was in a production period as many as 72 chickens.

The materials used in the study were 72 female chickens; hormones (FSH - Chicken: Fine test chicken and LH - chicken: Fine test chicken); chicken feeds for starter, grower and layer period with a composition of corn (150 kg), concentrate (100 kg), bran (50 kg), vitamins and minerals, water, vaccine ND Lasota, vaccine ND Clon-45, eye drop (Medivac ILT), ND-AI (H5N1) medicine, anthelmintic Nemasol, sand, fine lime, food candle, yolk color fan; camera; equipment for writing; clock; label paper, ruler, broom stick, shovels, plates, tube racks and black tarps.

2.6 Data Analysis

The data analysis used was descriptive analysis using Ms. Excel program.

3. Results

Table 1 shows the number of chickens that were in normal conditions was 72 with the total eggs produced were 1180 eggs and the average egg weight was 41.62 grams. Hen House was 11.80 eggs which show the ratio of the number of eggs to the total population of chickens at the beginning of breeding. Meanwhile, the Hen Day was 16.39 eggs which show the number of eggs produced was 16.39 eggs per day. A clutch of 2.61 days means that out of 72 chickens, all of them needed an average time interval between egg-laying per day as many as 2.61 days. The egg quality is presented by egg white index of 0.14 cm, yolk index of 0.47 cm, air sac diameter of 36.96 mm, eggshell thickness of 0.35 mm and yolk color of yellow.

Table 2 shows the FSH and LH concentrations increased during the return to egg-laying period (post-incubation) to 181.61 pg/ml (FSH) and 2,325.86 pg/ml (LH). During the incubation period, concentration of FSH and LH decreased to 58.48 pg/ml (FSH) and 1,771.93 pg/ml (LH).

Table 1: Productivity and Quality of Local Chicken Eggs

No.	Research Variables	Value	Unit
1.	The number of local chicken in layer period	72	Chickens
2.	Egg Production:		
	2.1 Total Number of Egg	1180	Eggs
	2.2 Weight of Egg	41.62 ± 6.03	Gram/egg
	2.3 HH (Hen House)	11.80	Chickens
	2.4 HD (Hen Day)	16.39	Eggs
3.	Clutch (Time interval between eggs)	2.61	Days
4.	Egg Quality:		
	4.1. Albumen Index	0.14 ± 0.07	Cm
	4.2. Yolk Index	0.47 ± 0.09	Cm
	4.3. Diameter of Air Sac	36.96±2.34	mm
	4.4. Yolk Color	7	Yellow
	4.5. Eggshell Thickness	0.35±0.08	mm
	4.6. Incubation Period	21	Days
	4.7. Days Open	68	Days

Table 2: Data on the Average Concentration of FSH and LH in Local Chicken during Normal Spawning Period[1,2)]

No.	Measurement Time	Concentration (pg/ml)	
		FSH	LH
1.	Pre-Incubation or Initial Egg Production Period	162.15	2,521.08
2.	Incubation Period	58.48	1,771.93
3.	Post-Incubation or Return to Egg-Laying Period	181.61	2,325.86

1) Assay Identification: Chicken FSH & LH, Fine Test China, Calibration units 15,6 – 1000 pg/ml Sensitivity <7,8 pg/ml. Endocrinology Lab, Department of Veterinary Reproduction, Unair, 2018.
2) The number of local chicken in layer period is 72 chickens.

4. Discussion

The results showed that the average egg produced by local chicken was 16.4 eggs/chicken in one spawning period with an average egg weight of 41.62 grams and HD of 16.39 eggs. This means that local chicken has the potential to be developed as local laying hens which producing local chicken eggs that have their own market segments. The reproductive pattern of hens is influenced by internal factors of chickens, including hereditary factors, namely the age of sexual maturity, spawning cycle and behavior, as well as physical condition during molting, body weight, the ability to survive for live or against serious disease and efficiency in processing food substances into production results (eggs). As for the influencing external factors are the amount of feed and the type of food consumed, as well as the environment including the season, housing system, light and temperature of the cage [10–14].

The reproduction pattern of local hen represents a form or pattern in one reproductive cycle consisting of a series of times, namely the period of egg production (days, eggs) including several clutches (C1-Cn) and some intervals between clutches (Tt-Tn), period of incubation (Mg) around 21 days and the period of chick care (Ma) around 74 - 133 days [15]. It is in line with the opinion of Mulyono (1996) which said that the reproductive time of local female chickens consists of the period of adaptation and mating with males of 14 days, the laying period of 14-21 days, the period of incubating eggs of 21 days, and the period of parenting or chick care of 60-90 days. Thus, in one year, the local female chickens have 2-3 reproductive periods [16].

Egg production of Local chicken is lower than laying hens. The productivity of Local chicken is low, with an average of 60 eggs per year and an average egg weight of 30 g/egg. The body weight of the old rooster is no more than 1.9 kg, while the females are even lower with an average weight of 1.4 to 1.7 kg [8]. The hen begins to lay eggs when they are 190 days or 6 months old. This female parent is able to incubate 8-15 eggs. After the eggs hatch, the hen takes care of her child or chick until weaned. The average weight of 90 days old chicks is around 425 g [17].

One of the factors causing low production of Local chicken eggs is the nature to incubate the eggs. Egg

production can be stopped when the chickens show symptoms of incubation which then followed by a long rest period (not laying eggs) ranging from 209 - 271 days/chicken/year [15]. When it reaches sexual maturity, immature egg cells begin to grow very quickly. In general, chicken ovaries have a sequence of maturation (hierarchy) in its follicular development. This hierarchy is related to the process of filling egg yolk and usually occurs in 4 to 6 follicles. This number varies between individuals, the longer the egg laying cycle, the more the number of follicular sequences. The most mature follicle is called F1, then followed by F2, F3, F4, F5 and F6. The development of follicles is influenced by the collaboration of FSH and LH [18,19].

5. Conclusion

Egg-laying rhythm of local chickens is naturally described as the level of egg production of 1180 eggs with a spawning interval of 2.61 days for 31 days, the length of incubation period was 21 days and the time needed to return to production after incubation period was 68 days. The concentrations of FSH and LH during the initial egg production or pre-incubation period were 162.15 and 2,521.08; during the incubation period were 58.48 and 1,771.93; and during the return to egg-laying period were 181.61 and 2,325.86.

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