Sigit Mugiyono et al./Animal Production. 17(3):169-176, Sept 2015
Accredited by DGHE No. 81/DIKTI/Kep./2011. ISSN 1411-2027

Reproductive Performance of Various Breeds of Sentul Chicken

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Abstract. This study was conducted to determine the reproductive performance of various breeds of Sentul chicken. The present research was assigned in an experiment model with a completely randomized design (CRD), with 5 breeds of Sentul chicken as treatments, namely Abu Sentul chicken = SA; Batu Sentul Chicken=SB; Emas Sentul Chicken=SE; Debu Sentul Chicken=SD; and Geni Sentul Chicken=SG. Each treatment was repeated 5 times with 4 female and 1 male birds each, thus the total number of chicken were 100 females and 25 males with an average initial female weight was 1,336.05±84.99 g and male weight was 2,050.53±121.78 g. The experiment was conducted for 14 weeks started from 20 week old until 34 week old. Variables measured were spermatozoa production, fertility, and hatchability. Data were subjected to analysis of variance and HSD test. Results showed that various breeds of Sentul chicken had no significant effect (P>0.05) on spermatozoa production, and had significant effect (P<0.05) on fertility and hatchability. It can be concluded that spermatozoa production of various breeds of Sentul chicken are relatively similar, while fertility and hatchability of Emas chicken was lower than that of Abu Sentul chicken and Batu Sentul Chicken.

Key words: Reproductive performance, spermatozoa production, fertility, hatchability, Sentul chicken

Abstrak. Penelitian ini dilakukan untuk mengkaji kinerja reproduksi berbagai jenis ayam Sentul. Penelitian ini menggunakan metode eksperimen dengan rancangan acak lengkap (RAL), Perlakuan adalah 5 jenis ayam Sentul yang terdiri atas ayam Sentul Abu = SA; ayam Sentul Batu = SB; ayam Sentul Emas = SE; ayam Sentul Debu = SD; dan ayam Sentul Geni = SG. Setiap perlakuan diulang 5 kali masing-masing terdiri dengan 4 betina dan 1 ekor jantan, sehingga jumlah total ayam sentul ada 100 ekor betina dan 25 ekor jantan dengan berat awal rata-rata ayam betina adalah 1.336,05±84,99 g dan berat ayam jantansebesar 2.050,53±121,78 g. Penelitian dilakukan selama 14 minggu mulai dari umur 20 minggu sampai 34 minggu. Variabel yang diukur adalah produksi spermatozoa, fertilitas, dan daya tetas. Data yang diperoleh kemudiandianalisis variasi dan dilanjutkan uji BNJ. Hasil penelitian menunjukkan bahwa berbagai jenis ayam Sentul tidak berpengaruh (P>0,05) terhadap produksi spermatozoa, dan berpengaruh nyata (P<0,05) pada fertilitas dan daya tetas. Penelitian ini dapat disimpulkan bahwa produksi spermatozoa berbagai jenis ayam Sentul relatif sama, sedangkan fertilitas dan daya tetas ayam Sentul Emas lebih rendah dibandingkan ayam Sentul Abu dan ayam Sentul Batu.

Kata kunci: kinerja reproduksi, produksi spermatozoa, fertilitas, daya tetas

Introduction

Sentul chicken is one of the local chickens developed in Ciamis, the exterior performance looks similar to bangkok chicken or fighting cocks, feathers are grey with a little red-golden color. Currently, the chicken are kept to produce eggs and meat. Sentul chicken is also known as Kalawu chicken. Sentul chicken has more superior trait compared to Kampung chicken, i.e. the relatively fast growth and high egg production (Kurnia, 2011). Based on the color of their feathers, Sentul chicken can be classified into five types of Sentul chicken such as Geni Sentul, Batu Sentul, Kelabu Sentul, Debu Sentul and Emas Sentul (Purnama, 2005).

Sentul chicken has several superiorities, such as relatively fast growth and higher egg production than that of the other local chicken. With the existence of these superiorities, Sentul Chicken can be used as a industrial commodity to be further developed into a superior local chicken. Chicken Sentul development is very important to explore its potential, considering the diminishing population and it serves as Indonesian local chicken germplasm.

Data from Department of Livestock Services of West Java showed that the Sentul chicken population in Ciamis regency in 2011 was only around 1 percent of the total local chicken in Ciamis whose population of about 2.8 million head. Based on some of these considerations, it is necessary to excavate the potential data of Sentul Chicken both maintained by farmers in semi-intensive and through research conducted intensively in the laboratory.

Materials and Method

This research was conducted with an experimental method at Sub Experimental Station and Poultry Production laboratory of the Animal Science Faculty, University of Jenderal Soedirman Purwokerto.

Materials

The materials used in this experiment were a hundred hens and 25 roosters of Sentul chicken, with average body weight 1,336.05±84.99 g for hen and 2,050.53±121.78 g for rooster, twenty five plot cages and the equipment, chicken feed based on theirproduction period, vitamins, vaccines and medicines. Observation was carried out for 14 weeks.

Data analysis

Data were analyzed in completely randomized design (CRD), with five treatments of various Sentul chickens i.e. SA = Abu chicken, SB = Batu Sentul chicken, SD = Debu Sentul chicken, SE = Emas Sentul chicken and SG = GeniSentul chicken. Each experimental unit filled 4 hens and 1 rooster, repeated five (5) times, thus involving 100 hens and 25 roosters kept for 14 weeks starting at 20 weeks of age until 34 weeks of age.

Variables measured was the production of spermatozoa, fertility and hatchability. Data were subject to analysis of variance followed by honestly significant difference test according to Steel and Torrie (1993). Mathematical models used were as follows.

$$Yij = \mu + \alpha i + \Sigma ij$$

Description :

Yij = reproductive performance of various Sentul chicken to i and j

μ = Mean of all treatment

αi = effect of various Sentul chicken to i the treatment

Σij = error due to the influence of various Sentul chicken to i and replication to j

Results and Discussion

Production of Spermatozoa

Spermatozoa production of Sentul Chicken observed in this study was the semen volume, sperm concentration, motility and abnormalities spermatozoa, from 3 times semen collection periods. The complete data concerning the production of a variety of chicken Sentul spermazoa was presented in Table 1.

Results of analysis of variance showed that the various of Sentul chicken had no significant effect (P>0.05) on semen volume, sperm concentration, motility and abnormalities of spermazoa.

Semen volume

Results of analysis of variance showed that a variety of chicken Sentul had no effect (P> 0.05) on volume of semen. It shows that semen volume of various types of Sentul chicken tend to not show any differences. It is influenced in part by genetic factors of Sentul chicken. Genetic possessed of variety of Sentul chicken no different, due to the appearance of the coat color phenotype produced. According to Febrianti et al. (2014) that the chicken Sentul has a fairly high genetic diversity shown from allele amplifiedvariation is quite high and also the absence of allele specifications that characterize a particular breed.

The difference of local chicken breeds would be reflected in the appearance of their phenotype, whereas based on the genetic, it still needs genetic selection.

Table 1. Spermatozoa production of various sentul chicken

Sentul Chicken	Quantity of Spermatozoa		Quality of Spermatozoa	
	Semen Volume (ml)	Spermatozoa[1)] Concentration	Motility (%)	Abnormality (%)
SA	0.46±0.08	2.78±0.74	73.50±4.04	6.67±1.67
SB	0.34±0.20	2.53±0.54	75.80±5.45	6.11±0.89
SD	0.42±0.16	2.52±0.50	74.00±4.90	6.11±1.14
SE	0.41±0.16	1.83±0,.48	76.00±2.00	8.30±2.37
SG	0.53±0.15	3.00±0.48	80.60±2.51	5.77±1.39
Average	0.43±0.20	2.55±1.01	76.09 ± 4.53	6.51±1.63

SA = Sentul Abu, SB = Sentul Batu, SD =Sentul Debu, SE = Sentul Emas, SG = Sentul Geni, 1) = 10^9 cells/ml.

Differences in phenotype shown by the color of Sentul chicken feathers in fact did not have direct relationship with productivity of Sentul chicken, so it does not affect the volume of semen. Sentul chicken has long been developed at the same area in Ciamis regency of West Java, so they have well adapted to the environment. The ability that causes Sentul chicken have the same ability despite differences in coat color, so weight growth of Sentul chicken is relatively no different. Genetically Sentul chicken growth rate is relatively the same, so the semen volume is also not different. Greater weight will produce more semen volume as well. It concurred with Soeparno et al (2005) that the weight plays an important role as a determinant of semen production. Animals that have a larger body size will have a greater testicular tissue, which in turn is capable of producing semen in larger volumes as well.

Sperm concentration

Results of analysis of variance showed that variety of Sentul chicken had no significant effect (P>0.05) on the concentration of spermatozoa. The concentration of spermatozoa various types of chicken Sentul tend to not show any difference between Sentul chicken. The results showed that variety of chicken Sentul did not affect the concentration of semen. According to Partodihardjo (1982) the concentration of sperm depends on the age, feed, breeds, body weight and frequency of semen collection. It is alleged that various Sentul chicken have the same genetic makeup. Genetic owned by various Sentul chicken was not different, the appearance of the resulting coat color was due to the resulting phenotype. As supported by the opinion of Gilbert (1980), the sperm concentration is one of the characteristics derived. In addition, other contributing factors to the concentration of spermatozoa is the color and consistency of semen. Semen color obtained from the study, the average pure white color with a thick consistency and only a small portion with a clear watery consistency. This is made clear by Soepiyana et al. (2006) that the color and consistency of semen determine the concentration of sperm; when the semen is thick and white, the sperm concentration is high, and in contrast when semen is translucent watery the concentration is low. Poultry semen volume is relatively a little, while the concentration is quite high, depending on each breed and individual (Toelihere, 1993).

Sperm motility

Results of variance analysis on various types of Sentul chicken on sperm motility showed that the treatment of various Sentul chicken had no significant effect (P>0.05). Contributing factor to uniform motility of various sentul chicken value is influenced by genetic factors. Sartika (2005) in Baktiningsih (2013) states that the size of a trait inherited by the parent can be determined based on the value of the heritability. According to Soller et al. (1965), the value of sperm concentration, semen volume and sperm motility of roosters have a genetic trait inherited from the parents. Heritability value (h2) of rooster sperm motility was 0.87 while according to Hu et al. (2013), heritability rooster sperm motility was 0.85. It indicates that 85% of the phenotypic diversity of sperm motility due to the additive of genetic variance. Kabir et al. (2007) stated that the heritable motility was 0.82.Hu et al. (2013) stated that the genetic correlation between semen volume and sperm concentration was 0.68 indicating the increase in volume did not always lead to lower sperm concentration. Results of research have shown that the average volume of semen of various of sentul chicken is 0.04±0.02 ml, whereas the average concentration of spermatozoa of various of sentul chicken is 2,55x109 cells/ml semen. Semen color has a higher genetic correlation if it is compared with the motility and sperm abnormalities. These findings suggest that the color of semen may affect sperm motility; if semen was milky white and opaque, the motility was high, and decreased sperm abnormality. Thus, semen color reflected the concentration of spermatozoa and was associated with a number of progressively moving spermatozoa, depending on the proportion of abnormal spermatozoa.The results showed that the average of motility ranging from 73.50% to 80.60% with the average of 76.09%. These results are in accordance with Hafez (1985) and Bramwell (2002) that individual poultry semen motility is normally 60-80%. Good motility allows sperm cells to reach the egg in the oviduct tract in a relatively short time, thus allowing fertilization occur perfectly.In addition, according to Chalah et al. (1999), motility of rooster fresh semen ranging from from 73.9 to 83.2%, while according to Mosenene (2009), fresh semen motility ranging from 67.9 to 70.1%. Semen quality determine the success of sperm in reaching the ovum. Sperm motility is affected by the amount of oxygen and Ca ++ ion in semen (Parker and McDaniel, 2006).

Abnormal spermatozoa

Results of analysis of variance showed that various Sentul chicken had no significant effect (P>0.05) on abnormal sperm. Various Sentul chicken did not affect abnormal sperm. The parameter that characterizes the genetic potential of livestock is heritability (Mu'in, 2008). According to Kabir et al. (2007), the abnormal spermatozoa heritability value of 0.42 means 42% of the abnormal sperm value is influenced by genetic. Abnormality of sentul chicken spermatozoa were observed to have the same genetic ability based on the pattern of alleles, absence of allele-specific which can characterize the specification of local chicken in various phenotypes, so the different breeds of locall chicken including sentul chicken were reflected from the display phenotype alone (Sartika et al., 2004). The statement indicates that sentul chicken with different phenotypes produce the similar value of abnormal spermatozoa. Mean of abnormalities obtained is 6.51±1.63% as reported by Mardalestari (2005) in Arabic chicken 14%. The same thing was also stated by Siudzinska and Lukaszewicz (2008), normal morphology of spermatozoa ranging from 70-80%, while according to Tselutin et al. (1999) and Long and Kulkarni (2004) ranging from 91-94% normal forms of spermatozoa, or about 6-9% abnormal spermatozoa form. Spermatozoa abnormality showed impaired spermatogenesis and this can be attributed to age, nutrition and pollution. In addition, improper handling during the process of ejaculation can affect the increased sperm abnormalities in semen (Flood et al., 2001). Hafez (1985) states that sperm abnormalities are grouped into 3 i.e. primary abnormality, secondary abnormality and tertiary abnormality. Primary abnormality occurs in the testes during the process of spermatogenesis precisely in semiferi tubules. Spermatogenesis is the process of forming sperm cells that occurs in epithelial (tubules) seminiferi under control of gonadotropin hormone (FSH and LH) from the anterio pituitary. Seminiferi tubule consists of Sertoli cells and cells germinalis. Spermatogenesis occurs in three phases, namely spermatogonial phase, the phase of meiosis and spermatogenesis phase which takes 13-14 days. Primary abnormality characterized by a head that is too small (microcephalic) or too large (macrocephalic), wide head, tail or body double. Secondary abnormality occurs in the epididymis during ejaculation. Abnormal sperm was characterized by granules of protoplasm on the base of the tail precisely in the caput epididymis of sperm. Abnormal tertiary was characterized by tail broken, circular tail and enlarged head did not cause by stud factor. Shape abnormalities found in this study are broken tail, double tails, oversize heads, double head, no tail, body and tail folding circular. According to Nurfirman (2001), the prevalent general shape abnormalities are the loss of the tail, coiled tail and broken tail. abnormality may occur during spermatogenesis and transport in male reproductive organs, could also at the time of collecting and treatment. Spermatozoa without tail is not only caused by a manufacturing fault preparations but also by a pathological disorder, deficiency of food and extreme temperature changes (Salisbury and Vandemark, 1985).

Fertility and hatchability

Analysis of variance result of various sentul chicken showed that variety of sentul chicken had significantly different effect (P<0.05) on both fertility and hatchability. Honestly significant difference test revealed a highly significantly difference between the hatchability of emas sentul chicken and abu sentul chicken and batu sentul chicken, but no significant effect (P>0.05) was observed among Sentul chicken on fertility and hatchability.

Fertility

Fertility of Batu sentul chicken eggs was higher than that of Emas Sentul Chicken, while the fertility of Abu Sentul chicken, Debu Sentul chicken and Geni Sentul Chicken were relatively the same. It is due to the genetic differences that are owned by each parent. The nature of the individual, both qualitative and quantitative trait characteristics was determined by her genes and alleles arranging in pairs of DNA found in the cell nucleus (Sidadolog, 2011; Deivendran R and Yeong Ho Hong. 2015). Sentul chicken have relatively high genetic diversity shown of variations amplified allele was quite high and also the absence of specific alleles that can characterize a particular breed.

Table 2. Fertility, Hatchability, and hatching weight

Sentul Chicken	Fertility (%)	Hatchability (%)
SA	83.11±15.30^{ab}	81.30± 6.65^{b}
SB	97.48±2.47^{b}	81.55±8.75^{b}
SD	68.94±29.14^{ab}	67.61±14.60^{ab}
SE	54.49±16.39^{a}	51.71±6.45^{a}
SG	78.25 ±21.28^{ab}	72.87±13.97^{ab}
Average	77.12±22.71	71.40±14.67

Means value within a column with different superscripts differ significantly (P≤0.05).

Local chicken breed differences were reflected from the phenotypes display only (Sartika et al., 2004). Sartika (2005) in Baktiningsih (2013) stated that, the size of a trait inherited by the parent can be determined based on the value of heritability. Heritability (h2) of the eggs fertility, according to Sidadolog et al. (1996) in Sidadolog (2007) that is equal to 0.42. Based on this, the type of Sentul chicken can affect the egg fertility. Fertility of Batu Sentul Chicken was higher than that of Emas Sentul Chicken because of the different of genetic capabilities, in addition the egg production is also higher than that of the Emas Sentul. According to Rahayu et al. (2005), that the egg production may affect the egg fertility.

Hatchability

The hatchability of Batu Sentul Chicken and Abu Sentul was significantly different from Emas Sentul Chicken, while Debu Sentul chicken and Geni Sentul Chicken were relatively the same. This is thought due to genetic differences of each type of Sentul chicken obtained from its parent. This opinion is supported by the Sidadolog (2011) which states that every individual has the arrangement of genes (2n) in accordance with genes obtained from the parents. Applegate et al. (1998) and King'ori (2011) add that hatchability is a quantitative trait that can be measured in chicken. Quantitative trait is influenced by a large number of gene pairs, each of which can act additive, dominant or epistasis (Noor, 2008), together with environmental influences/nongenetik (Martojo, 1992; Dzoma, 2010). According to Sidadolog (2007), on the nature of quantitative, estimation of trait hereditability was used as the estimated heritability value. Estimates of heritability (h2) of hatchability according to Sidadolog et al. (1996) in Sidadolog (2007) that is equal to 0.38. It is based on the diversity of the additive effect of genes in total diversity contained in the phenotypic trait. This determination is used because each trait will be passed permanently from generation to generation (Sidadolog, 2007). Based on this, the various Sentul chicken can produce differnt egg hatchability.Batu sentul chicken hatchability had a higher than that of Emas Sentul chicken because of the different of genetic abilities, and the hatchability was also higher than that of Emas Sentul chicken. Results show that the hatchability of Batu Sentul Chicken and Emas Sentul Chicken eggs 97.48% and 54.49%, respectively. This is in accordance with North and Bell (1990) that hatchability may affect the hatchability of eggs.

Conclusions

Based on the results of this stud, it can be concluded that the production of spermatozoa (semen volume, concentration, motility and sperm abnormalities) of various Sentul Chicken are relatively similar. However, fertility and hatchability of Emas Sentul chicken were lower than that of Abu Sentul chicken and Batu Sentul chicken.

Acknowledgement

Author would like to express countless gratitude for the opportunity and the assistance provided in the activities of research, to the Directorate of Research and Community Services, Ministry of the Research, Technology, and Higher Education of the Republic of Indonesia.

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