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THE EFFECT OF DIFFERENT BREEDS AND AGES ON SEMEN PRODUCTION AT SINGOSARI NATIONAL INSEMINATION CENTER

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ABSTRACT

The study was aimed to evaluate semen production on different levels of breeds and ages. A total of 28 bulls were used in this study constisted of 13 Bali bulls, 6 Simmental bulls, and 9 Ongole Grade bulls. The bull's age was ranged from 2 to 5 years old. The semen was collected at Singosari National Artificial Insemination Center three times a week during 2018. Bull's semen was evaluated macroscopically and microscopically. Parameters analyzed in this study were semen volume, sperm motility and concentration. The result showed that the different semen quality was found among the bulls at different ages. Semen volume increased with time until 5 years genarally. Bali cattle had the lowest sperm concentration. Ongole Grade cattle had higher sperm motility and lower semen volume. Simmental had the lowest sperm motility. Simmental cattle had semen volume more than 6 mL. In conclusion, Ongole Grade cattle have higher semen production than Bali and Simmental. The failed semen collection was found among the bulls but the qualified semen production based on SNI would be used in the process of frozen semen at Singosari National Artificial Insemination Center.

Key words: *Semen volume, sperm motility, sperm concentration*

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INTRODUCTION

Indonesia has large animal genetic resources including local cattles. Indonesian indigenous cattle is contributed by two bovine species; Bos indicus (Zebu) and Bos javanicus (Banteng) (Mohamad *et al*. 2011). Some local cattles reared by farmers in East Java are commonly Ongole Grade cattle and Bali cattle. The local cattles have important role to supply the national needs of meat and support local farmer's income. Ongole Grade cattle is a crosbred cattle between Java cattle and Sumba Ongole cattle (well adapted Indian Brahman cattle in Sumba island) (Suyadi, et al. 2014).

This cattle was well known as beef cattle that have good reproductive performance, meat quality, and resistance to some diseases (Astuti, 2004; Rohyan *et al*. 2016; Sumadi, *et al.* 2017). Bali cattle (*Bos sondaicus*) is an indigenous breed that have good adaptation in tropical climate, poor feed quality, resistant to tropical parasites, and good reproductive efficiency (Pribadi *et al*. 2014; Pribadi *et al*. 2015)]. Beside the local cattle breeds, imported cattle breeds are raised in Indonesia including Simmental cattle. As subtropical cattle breed, Simmental is preferred to crosbreed with local cattle because they have bigger muscle and faster growth (Sutarno and Setyawan, 2016)

The increase of cattle population is one of successful keys to fulfill the national needs of meat. This program could be accelerated using artificial insemination (AI). The success of AI is affected by some factors such as semen quality. Semen quality was determined by semen evaluation macroscopic- and microscopically including sperm motility, sperm concentration, and semen volume (Suyadi, 2012). Semen quality is affected by breed, age, feed, macro and micro climate. As a National Institution, Singosari National Artificial Insemination Center (SNAIC) plays impotant role to provide qualified semen production. The characteristics of good semen for AI are 60-70% sperm motility, >2+ sperm mass movement, ≤20% abnormality, 7-10 mL ejaculate volume, and 1,000-1,500x10^6 sperm concentration (Ax *et al*. 2008a; Ax *et al*. 2008b; Argiris *et al*. 2017].

According to the mentioned description, information about semen production and quality was needed to provide good semen for supporting AI program. The objective in this study was aimed to evaluate semen production in Singosari National Artificial Insemination Center (SNAIC) affected by breed and bull's age.

MATERIALS AND METHODS

Animal management

In this study, a total of 28 bulls were used including 13 Bali bulls, 6 Simmental bulls, and 9 Ongole Grade bulls. There were 2 levels of age; young age (2-3 yr) and middle age (4-5 yr). A total of 1387 ejaculates were collected in 2018 at Singosari National Artificial Insemination Center, Malang, Indonesia. Data of semen production including sperm motility, sperm concentration, and ejaculate volume were collected from the record book. Bulls were raised under similar environment and management system. Individual barns were used to house the bulls. All procedures in this research were approved by The Animal Care and Use Committee of Universitas Brawijaya No.1156-KEP-UB.

Semen collection

Semen was collected three times a week by an experienced barn technician at Singosari National Artificial Insemination Center using an artificial vagina. First, the technician sexually stimulated the bulls using a teaser bull and the false mounting were conducted three times before collecting semen. The semen volume was measured using the tube installed on artificial vagina gravimetrically. A total of 35 µL semen diluted in 3.5 mL of 0.9% NaCl solution were used to analyze the sperm concentration in photometer SDM 6 (Minitube, Germany). A total of 0.1 µL semen were diluted in 0.1 µL prewarmed

(37^{o}C) diluent containing Tris and used to determine the sperm motility. Sperm motility was determined by microscopy analysis using 200x magnifications.

Data analysis

The fixed factors in this research were breed and bull age. The dependent variables were sperm motility, sperm concentration, and semen ejaculate volume. Data were analyzed using General Linear Model procedure in SPSS ver. 26.0. The Duncan test were used as Post Hoc test in this model. The factorial model in this research followed the formula:

$$Y\ ijk = \mu + B\ i + A\ j + (BA)\ ij + \varepsilon\ ijk$$

Where:

Y ijk	: semen volume, sperm concentration, and sperm motility
μ	: overall mean
B i	: effect of breed
A j	: effect of bull age
(BA) ij	: interaction between bull age and season
ε ijk	: random error

RESULT AND DISCUSSION

Sperm motility

In this research, sperm motility was significantly affected by breed and bull's age ($P<0.01$). Interaction between breed and bull's age was not found ($P>0.05$). The effect of bull's age was also reported in previous studies on Ongole Grade, Holstein, and Sahiwal bulls (Sitanggang, 2018; Boujenane and Boussaq, 2013; Bhakat *et al*. 2011). According to Table 1, the sperm motility of young cattles was 1% higher than middle age. Simmental bulls had lower sperm motility than local breed cattles (Bali and Ongole Grade bulls). Eventhough there was statistical difference, both of them had qualified sperm motility for frozen semen process.

Table 1. Effect of breeds and ages on sperm motility (%)

Variables	Bali (n=559)	Simmental (n=357)	Ongole Grade(n=471)	Total
Young age (n=777)	67.64 ± 5.17	63.67 ± 4.17	69.03 ± 5.04	67.45 ± 5.32^{B}
Middle age (n=610)	67.04 ± 4.77	67.06 ± 4.56	63.35 ± 3.79	66.39 ± 4.75^{A}
Total	67.31 ± 4.96^{b}	65.49 ± 4.69^{a}	66.98 ± 5.10^{b}	66.98 ± 5.10

Different superscript shows significant differences ($P<0.01$)

Ongole Grade bulls had higher sperm motility at young age than middle age, whereas the sperm motility of Simmental bulls at young age was lower than midlle age. Sperm motility of Ongole Grade bulls had similar pattern on Holstein bulls where bulls aged 2-4 yr had higher sperm motility than bulls aged 5 yr (Argiris *et al*. 2017).

In this research, sperm motility of Bali bulls was descriptively not different between young and middle age. This result was different with previous studies that stated sperm concentration of Bali and Crossbred Jersey bulls decreased with age (Gopinathan *et al*. 2018; Isnaini *et al*. 2019). Simmental bulls had higher sperm motility at middle age around 67.06%. This sperm motility was higher than previous study where sperm motility of Simmental bulls aged 4-8 yr was less than 65% (Putri *et al.* 2019).

Sperm concentration

Breed and bull's age statistically affected sperm concentration in this research

(P<0.01). There was no interaction between breed and age on sperm concentration (P>0.05). In Table 2, young bulls had sperm concentration higher than middle age. This results was different with previous study where the sperm concentration increased with age on Bali bulls (Sarsaifi *et al*. 2013). Sperm concentration of Simmental and Ongole Grade bulls in this research were higher than Bali bulls.

Table 2. Effect of breeds and ages on sperm concentration ($x10^6$/mL)

Variables	Bali (n=559)	Simmental (n=357)	Ongole Grade (n=471)	Total
Young age (n=777)	1,124.84 ± 214.69	1,235.23 ± 355.22	1,172.73 ± 381.73	$1,170.59 \pm 332.88^{B}$
Middle age (n=610)	1.031,86 ± 226.60	1,133.56 ± 427.21	1,137.82 ± 316.59	$1,082.68 \pm 321.93^{A}$
Total	$1,073.44 \pm 225.95^{a}$	$1,180.33 \pm 398.30^{b}$	$1,164.65 \pm 367.66^{b}$	1,131.93 ± 330.89

Different superscript shows significant differences (P<0.01)

In this research, sperm concentration of Bali bulls at young age was higher than middle age. It was similar with previous study where sperm concentration of young and middle age were >1,100x10^6/mL and <1,050x10^6/mL, respectively (Nugraha *et al*. 2019). The sperm concentration of Simmental bulls was under 1,200x10^6/mL. It was different with previous study where sperm concentration of Simmental bulls were more than 1,400 x10^6/mL (Putri *et al*. 2019). The sperm concentration of Ongole Grade bulls in this research was significantly lower than Holstein bull in presvious study which was more than 3,110 x10^6/mL (D'Andre *et al*. 2017). The sperm concentration was increased following sexual development, maturity, and testicular size. Growth hormone (GH) affected testicular mass and increased sperm concentration with age (Masood *et al*. 2016).

Semen ejaculate volume

The result showed that semen ejaculate volume was affected by breed and bull's age (P<0.01). Effect of interaction between breed and age was not found on semen volume (P>0.05). Bulls at young age had lower semen volume (Table 3). Simmental bulls had highest semen volume whereas semen volume of Ongole Grade bulls was the lowest.

Semen volume increased with age on all cattle breeds. The semen volumes of Bali, Simmental and Ongole Grade bulls were 5.33; 6.39; and 5.05 mL. On Bali bulls, previous study (Haryani *et al*. 2016) reported that the semen volume was <4.00 mL. It was lower than in this study.

The peak of semen ejaculate volume on Ongole Grade and Simmental bulls were 3-6 yr (Sitanggang 2018; Fuerst-Waltl e*t al*. 2006)]

Table 3. Effect of breeds and ages on semen volume (mL)

Variables	Bali (n=559)	Simmental (n=357)	Ongole Grade (n=471)	Total
Young age (n=777)	5.13 ± 1.24	5.86 ± 1.55	4.97 ± 1.80	5.21 ± 1.62^{A}
Middle age (n=610)	5.48 ± 1.74	6.85 ± 2.24	5.31 ± 1.70	5.89 ± 2.00^{B}
Total	5.33 ± 1.54^{b}	6.39 ± 2.01^{c}	5.05 ± 1.78^{a}	5.51 ± 1.83

Different superscript shows significant differences (P<0.01)

CONCLUSION

Sperm motility, sperm concentration, and semen ejaculate volume were affected by breed and age. There was no interaction between breed and bull's age. Sperm motility and sperm concentration decreased with age. Generally, Ongole Grade bulls had better semen quality in 2018.

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