Comparative study of semen quality traits between Etawah grade and Senduro bucks

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Abstract. This study compared the semen quality traits between Etawah grade (EGB) and Senduro bucks (SB) raised in Singosari National Artificial Insemination Center, Indonesia. A total of 96 ejaculated semen were collected from three EGB and three SB with an average age of three years. The ejaculates were evaluated for semen volume (SV), spermatozoa concentration (SC), total spermatozoa (TS), spermatozoa motility (SM), post-thawing spermatozoa motility (PTSM), the recovery rate of spermatozoa motility (RRSM), and frozen semen production (FSP). Data of SV, SM, PTSM, and RRSM were compared using the Mann-Whitney U test. While the data of SC, TS, and FSP were analyzed using an independent t-test. The results showed that SV, SM, PTSM, and RRSM were not significantly differed (P>0.05) between breeds. Whereas, SC, TS, and FSP of EGB were significantly higher (P<0.05) than SB. Therefore, it can be concluded that Etawah grade bucks can produce higher total spermatozoa and as a result higher frozen semen production for artificial insemination as compared to Senduro bucks.

1. Introduction

Goats are considered as livestock that has many advantages, including meat and milk producers, easy to maintain, and prolific breeders. Goats are also popular livestock in Indonesia, which is characterized by an increasing population year by year. The goat population in Indonesia was 17.9 million in 2016, this number was then increased to 19.1 million in 2020 [1]. However, the increase in goat population has not been able to make a significant contribution to meat and milk production in Indonesia. Goat meat production only contributes to about 1.49% of national meat production, while data on goat milk production is currently still not available [1].

One effort that can be made to expand the goat population is by using artificial insemination (AI). In general, this biotechnology consists of two stages, namely the semen collection and processing from superior male animals and semen deposition into the female animals [2-5]. The success rate of AI is highly dependent on the semen quality and the semen quality itself can be influenced by several things, including the breed of animals [6,7].

Etawah grade goat is declared as one of the Indonesian native goats based on the Decree of Minister of Agriculture of the Republic of Indonesia Number 695/Kpts/PD.410/2/2013. Etawah grade goat is originally the result of crossbreeding between Indian Etawah and Kacang goats. Senduro goat was also declared as another Indonesian native goat based on the Decree of Minister of Agriculture of the Republic of Indonesia 1055/Kpts/SR.120/10/2014. Senduro goat is originally the result of crossbreeding between Indian Etawah, Kacang, and Jawarandu goats, which has been going on since 100 years ago. Until now, the comparison of semen quality between Etawah grade bucks (EGB) and Senduro bucks
(SB) has never been reported. Therefore, this study aimed to compare the semen quality traits between EGB and SB.

2. Materials and methods

2.1. Experimental location
This experiment was conducted at Singosari National AI Center, Malang, Indonesia. The location is approximately between latitude 7.84° S and longitude 112.65° E with an elevation of 816 m above sea level. The average ambient temperature and relative humidity on the location were 23.94°C and 79.98%, respectively [8].

2.2. Experimental design
A total of six healthy bucks, with an average age of three years, were recruited in this study. The bucks were divided into two groups, one group consisted of three EGB and another group consisted of three SB. The bucks were reared in a similar way according to the standard protocol at Singosari National AI Center. The semen collection was done twice a week with an artificial vagina method [9,10]. A total of 96 ejaculates semen, 48 ejaculates of each of EGB and SB, were used for comparative evaluation of semen quality between these two breeds. The ejaculates were evaluated for semen volume (SV), spermatozoa concentration (SC), total spermatozoa (TS), spermatozoa motility (SM), post-thawing spermatozoa motility (PTSM), the recovery rate of spermatozoa motility (RRSM), and frozen semen production (FSP) [11].

2.3. Statistical analysis
The semen quality traits were assessed for normality using the Kolmogorov-Smirnov test. The data of SC, TS, and FSP were normally distributed, therefore, it was analyzed using an independent t-test. On the other hand, the data of SV, SM, PTSM, and RRSM were not normally distributed so that they were analyzed using Mann Whitney U test. P<0.05 was considered to be statistically significant. All statistical analysis was carried out by using SPSS software ver. 22 (IBM SPSS, NY, USA).

3. Results and discussion
The average SV of bucks in this study was 1.85 ml/ejaculate. In comparison with other Indonesian native goats, the SV of bucks in this study was relatively lower than Kacang bucks (2.52 ml/ejaculate) [12], but relatively higher as compared to Samosir bucks (0.13 ml/ejaculate) [13]. Moreover, SV of bucks in this study also relatively higher than Toggenburg (1.00 ml/ejaculate), Saanen (0.97 ml/ejaculate) [13], and Boer bucks (1.10 ml/ejaculate) [14] raised in tropical condition.

Table 1 shows that SV was not significantly differed (P>0.05) between EGB and SB. In line with this finding, it was also reported that the breed of bucks (Anglo Nubian, Etawah grade, and their crossbred) had no significant effect on SV [15]. Similarly, no effect of breed on SV was also reported between Toggenburg and Saanen bucks [13].

The average SC and TS of bucks involved in this study were 2.82 billion/ml and 5.26 billion/ejaculate, respectively. The average SC value in this study was relatively lower as compared to Kacang (3.96 billion/ml) [12] and Samosir bucks (4.15 billion/ml) [13]. However, this SC value was higher as compared to Saanen (1.67 billion/ml) [13], Boer (2.22 billion/ml) [14], and Anglo Nubian bucks (0.87 billion/ml) [15].

The significant effect (P<0.05) of the breed was detected on SC and TS, with EGB had a higher value of these parameters as compared to SB (Table 1). This finding is probably because EGB had a higher scrotal circumference (29.00±1.00 cm) as compared to SB (27.33±3.21 cm). The higher scrotal circumference indicating the higher spermatogenesis, for that reason scrotal circumference had a positive correlation with SC [16, 17]. The higher TS in EGB than SB was expected because TS was calculated from SC data. In line with this finding, the higher scrotal circumference in Jamunapari bucks also resulted in the higher SC as compared to Black Bengal bucks [18].
Table 1. Comparison of semen quality between Etawah grade (EGB) and Senduro bucks (SB).

| Parameters          | EGB       | SB        |
|---------------------|-----------|-----------|
| SV (ml/ejaculate)   | 1.96±0.63a | 1.75±0.47a |
| SC (billion/ml)     | 3.05±0.83b | 2.59±0.67a |
| TS (billion/ejaculate) | 6.02±2.74b | 4.49±1.61a |
| SM (%)              | 68.96±3.25a | 69.17±4.29a |
| PTSM (%)            | 40.55±5.49a | 39.94±4.04a |
| RRSM (%)            | 58.85±9.06a | 57.94±6.34a |
| FSP (doses/ejaculate) | 104.69±67.31b | 78.61±44.52a |

abValues with uncommon superscripts within the same row differ significantly at P<0.05.

The average value of SM, PTSM, and RRSM of bucks in this study were 69.06%, 40.24%, and 58.39%, respectively. The SM and PTSM of bucks in this study were relatively lower than Gembrong bucks (another Indonesian-native goat), which had SM and PTSM of 85.00% and 45.50%, respectively [20]. However, SM of bucks in this study was relatively higher than Saanen bucks raised in tropical conditions with SM ranged from 30 to 54% [21].

The results showed that SM, PTSM, and RRSM were similar (P>0.05) between EGB and SB (Table 1). Similarly, a previous study also showed that SM was similar among Anglo Nubian, Etawah grade, and their crossbred bucks [15]. In rams, it was also reported that the breeds had no significant on SM, PTSM, and RRSM [11].

The average FSP of bucks involved in this study was 91.65 doses/ejaculate. This value was relatively lower when compared to fat-tailed and Garut rams with 146 and 112 straw/ejaculate [11]. As shown in Table 1, the FSP of EGB was significantly higher (P<0.05) than SB. In agreement with this finding, a significant difference on FSP was also detected between fat-tailed and Garut rams [11]. According to the Indonesian National Standard [22], the frozen semen of bucks should have a minimum of 50 million spermatozoa/straw. Since the calculation of FSP was based on SC data, the higher SC will also be followed by the higher FSP.

4. Conclusion
According to the results of this study, it can be concluded that Etawah grade bucks can produce higher total spermatozoa and as a result higher frozen semen production for artificial insemination as compared to Senduro bucks.

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