The relationship between subclinical mastitis and reproductive performance of etawa crossbreed (PE) goat in Kokap, Kulonprogo, Yogyakarta

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Abstract. Etawa crossbreed (PE) goat farm has been well developed in Kokap, Kulonprogo, and Yogyakarta. The important aspects that support it are doe’s health and reproductive performance. This study aimed to determine the relationship between subclinical mastitis incidence and reproductive performance of the does. This study used 84 does from four different farms, which tested using California Mastitis Test (CMT) to determine the mastitis status. The reproductive performance data gained through a questionnaire and the relation to the mastitis status was analyzed using Chi-square. The result showed that the prevalence of subclinical mastitis was 16.67% (14 does). In the non-mastitis does, 75.71% had long calving interval (CI), 88.57% had long days open (DO), 44.29% had Litter size (LS) 1, and 12.86% had service per conception (S/C) more than 2. Meanwhile, in the mastitis group, the does with long CI was 71.43%, long DO was 85.71%, LS 1 was 28.57%, and S/C > 2 was 14.29%. The chi-square analyses showed no relationship between subclinical mastitis cases with long CI (X²=0.22), long DO (X²=0.09), LS 1 (X²=1.19), and high S/C (X²=0.02). It can be concluded that there was no relation of mastitis cases to reproductive performance of PE does in Kokap, Kulonprogo, and Yogyakarta.

1. Introduction
Etawa crossbreed (PE) goat is one of the popular livestock in Indonesia as it has dual-purpose livestock, as a meat source and as milk source. This goat has been well developed in Kokap, Kulonprogo, and Yogyakarta. Data from the Center of Indonesia Statistic Bureau show that in 2018, the total number of goats in Kokap was more than 17 thousand in which many of them were PE goats [1]. In order to increase the population, the reproductive performance and health of the does play a pivotal factor.

Reproductive performance in a population is one of the characteristics of a successful farm. It provides an estimation of production efficiency in a population through measurement of several parameters, including calving interval (CI), days open (DO), service per conception (S/C), litter size (LS), the number of pregnant does in a population, birth weight, etc [2, 3]. All of those factors are easily altered by any change in the environment and body condition of the animal, therefore maintaining animal health is important to increase the reproductive performance.

One of the common diseases that can be found in dairy ruminant is mastitis. Mastitis is an infection in the udder of the animal that affects the milk yield, composition, and in overall health condition of the animal. Mastitis was detected and classified using California Mastitis Test (CMT) which is a simple and rapid test that can be done in less than a minute. The CMT has been used in several studies to determine the mastitis status in several ruminants [4].
animal. A previous study found that the PE population in Kokap was reported to have 15% subclinical mastitis cases approximately [4]. Subclinical mastitis is a condition where an animal does not show any sign of abnormalities, but its milk contains a high number of somatic cell, which indicates infection on the udder [5].

Mastitis has a negative impact on the economic income of the farmer through the reduction of milk yield and milk quality, through medication cost, and also through physiology disruption, including in reproductive biology. It has been widely known that mastitis has a negative effect on the reproductive performance of cow [6-8]. However, the understanding of the reproductive performance of subclinical mastitis goats is very limited. Therefore, this study aimed to understand the relationship of subclinical mastitis to the reproductive performance of PE goats in Kokap, Kulonprogo, and Yogyakarta.

2. Materials and method
The study used 84 PE does from four different farms in Kokap, Kulonprogo, and Yogyakarta. All of the does were in lactation period and physically in healthy condition. A total of 168 milk samples from all does were tested using California Mastitis Test (CMT) to determine the mastitis state. A positive result showed with the increase of solution viscosity. It was described into three different levels of viscosity, (+), (++), and (+++) in which the intensity of infection was highest in (+++).

To collect the data on reproductive performance from the farmer, a questionnaire was distributed. The question in the questionnaire included the services per conception (S/C), calving interval (CI), litter size (LS), days open (DO), the origin of the doe, the age of the first conception, and farmer’s personal information. The data of reproductive performance and mastitis state then were analyzed using Chi-square to see the relationship of both aspects.

3. Result and discussion
The result of the mastitis test showed that 14 (16.67%) individuals were subclinical mastitis (Table 1). The number of positive cases in each farm was different which related to the different management practices. Management practices are pivotal factors in maintaining a healthy udder. It has been described that subclinical mastitis is related to the time of weaning and the distance of waste disposal to the pen [4, 9]. The weaning age less than two months and disposal distance less than 15 m has been reported to be the factors that related to high cases of mastitis in goat [4]. Similarly, [9] also reported that the weaning age of the kid less than one month has been associated with the subclinical mastitis in goats with addition of age of does > 3years and good body condition score. Each farm in this study had different management practices which resulted in different positive cases.

| Farm         | Subclinical mastitis (n=84) |   |
|--------------|----------------------------|---|
|              | Positive | Negative |
| Uperma       | 1       | 17       |
| Mantep Makaryo | 8       | 29       |
| Subur        | 0       | 10       |
| Wira Merapi  | 5       | 14       |
| **Total**    | 14      | 74       |

Reproductive performance can be defined through several parameters, including CI, DO, LS, and S/C. The overall reproductive performance of all can be seen in Table 2. Based on the result, the mean CI is 8.24±2.35 months. Calving interval is defined as the duration after giving birth to the next one. The smaller its number showed better performance as it indicates the possibility of kidding in a year could be higher and eventually the number of the kids also higher. The average CI of PE goat is 8 months approximately [10], so the CI under 8 months could define as short while CI more than 8 months could define as long CI. The result of this study showed that overall, the CI is longer than the reference.
Table 2. The overall reproductive performance of PE does in Kokap, Kulonprogo, and Yogyakarta.

| Parameters               | Value  | Mean±Std. Dev |
|--------------------------|--------|---------------|
| Calving interval         | Month  | 8.24±2.35     |
| Days open                | Month  | 5.24±1.85     |
| Litter size              | Kid    | 1.61±0.54     |
| Services per conception  | Time   | 1.13±0.34     |

Days open is the period between kidding and the next pregnancy. The normal days open of goat is less than 90 days or 3 months approximately [11], but DO of this study is more than 5 months which indicates that the DO is too long. One of the reasons is that the farmer has limited knowledge of the time range to mate the does as most of the goats were not used for dairy goats but meat sources so that the pregnancy and kidding rate is not the main focus.

In this study, the mean of LS is 1.61±0.54 which is slightly lower from PE goat in Turi, Sleman with 1.9±0.6 [12]. The higher LS, the better reproductive performance is. However, LS 1.61 indicates that the number of kids produced most of does was 2 or twin so that it could still be considered as normal LS. The overall result of S/C in this study is 1.13±0.34. S/C is defined through the number of service that could produce a successful pregnancy so that the lowest number of them is better [13]. Previous studies found that the S/C of PE goat is ranging between 1.35-1.92 [13-15]. Meanwhile, the mean S/C in this study is lower than 1.35, which indicates that the does in this study have good fertility.

The comparison of reproductive performance in non-mastitis and mastitis goats show that both in healthy and mastitis goats, there were does with long CI (75.71 % and 71.43%, respectively), long DO (88.57% and 85.71, respectively), single kidding/LS 1 (44.29% and 28.57, respectively), and S/C higher than 2 (12.86% and 14.29%, respectively). Based on Chi-square analysis, there was no relationship of subclinical mastitis cases to a low reproductive performance that represented by long CI, long DO, LS 1, and S/C higher than 2 ($X^2$ < 3.84) (Table 3).

Table 3. The relationship of the reproductive performance to mastitis case of PE goat in Kokap, Kulonprogo, and Yogyakarta.

| Parameters               | Non-mastitis | Mastitis | X$^2$ |
|--------------------------|--------------|----------|-------|
| Calving interval         | Long         | 53 (75.71%) | 10 (71.43%) | 0.11 |
|                         | Normal       | 17 (24.29%) | 4 (28.57%)  |
| Days open                | Long         | 62 (88.57%) | 12 (85.71%) | 0.09 |
|                         | Normal       | 8 ((11.43%) | 2 (14.29%)  |
| Litter size              | 1            | 31 (44.29%) | 4 (28.57%)  | 1.19 |
|                         | > 1          | 39 (55.71%) | 10 (71.43%) |       |
| Service per conception   | > 2          | 9 (12.86%)  | 2 (14.29%)  | 0.02 |
|                         | 1            | 61 (87.14%) | 12 (85.71%) |

Mastitis is known to disrupt hypothalamus-pituitary hormones secretion. Hormones from this site such as Gonadotropin-Releasing-Hormone (GnRH), Follicle Stimulating Hormone (FSH), and Luteinizing Hormone (LH) are the main regulator of reproduction function in mammals [16]. The disruption is suggested caused by some bacterial that are commonly found in mastitis cases such as Gram-negative Escherichia coli. Endotoxin produced by the Gram-negative bacterial is causing the release of cytokine that could block the production of GnRH and eventually the FSH and
LH. The disruption of FSH could negatively alter the oocyte maturation while LH is needed for ovulation, therefore, the abnormality on both hormones production could affect poor reproductive performance [17]. In addition, cortisol that could be produced in infection of Gram-positive bacterial also can disrupt FSH and LH regulation [17, 18]. Therefore, maintaining udder health is important to increase the reproductive performance. The result of this study showed that the mastitis goats do not relate to the poor reproductive performance parameters. Thus, the mechanism mentioned above may not be the reason for long CI, long DO, LS 1, and S/C >2 or it could be caused by the number of mastitis cases is too low.

4. Conclusion
In this study, the subclinical mastitis cases do not have a relationship to poor reproductive performance such as long CI, long DO, LS 1, and S/C > 2.

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