Reproduction Index of Kacang Goat Dam Reared under Closed Population in Buduran Sub-District, Sidoarjo Regency, East Java, Indonesia

Suyadi Suyadi, W Andre Septian, A Furqon, TE Susilorini and Moch. Nasich

Faculty of Animal Science, University of Brawijaya
Jl. Veteran, Malang 65145, Indonesia
E-mail: suyadi@ub.ac.id

Abstract: This study was aimed to evaluate the reproduction index of Kacang goat does reared under closed population with extensive farming system in the Fishpond area of Buduran Sub-District, Sidoarjo Regency, East Java Province, Indonesia. A total of 146 Kacang does data were purposively selected and collected from around 1,700 Kacang goat population through survey and interview with 12 farmers. All of the obtained data collected, were analyzed descriptively. The results showed that most of the Kacang goat dams (67.80%) delivered single kid, and then followed with twin (30.13%) and triplet (2.05%) per partus, with the average litter size of 1.34 ± 0.51. The pre-weaning mortality observed was about 20.40%. The kidding interval and days open were 7.41 ± 0.99 and 2.41 ± 0.99 months, respectively. Moreover, the results also showed that the Kacang does had the reproduction index of 1.69. The research concluded that Kacang goats are well adapted and suitable to be reared with extensive farming system in Sidoarjo Regency regarding to reproduction index and performances.

Keywords: Kacang goats, reproductive performances, reproduction index.

1. Introduction
Kacang goat is believed as the main genetic source of all goat breeds that exist at present day in Indonesia. This breed has a relatively small body frame, well adapted to the tropical environment, and has been well distributed across Indonesia regions. The crossbreeding of Kacang goat with other exotic breeds to obtain superior breeds which have good environmental adaptation has been well practiced overall the country. Some of the common crossbreds are (i) Ettawah crossbred goat (crossbreeding between Kacang goat with Ettawah goat with the phenotypic characteristics are close to Ettawah goat); (ii) Jawarandu goat (similar to Ettawah crossbred but its phenotypic characteristics are close to Kacang goat); (iii) Kosta goat (crossbreeding between Kacang goat with Khasmir/Angora/Ettawah); and (iv) Senduro goat (a recessive breed selected from Etawah crossbred goat with fully white hairs) (Zein et al., 2012). However, the current genetic diversity of Kacang goats are too high due to the unmanaged crossbreeding practice by the farmers. Thus, the condition would endanger genetic purity of Kacang goat.
The effort to maintain genetic purity of livestock breed can be done through rearing under closed population. The goat farmers in Sidoarjo Regency in East Java Province is known to rear their livestock under a closed population system. Those rearing practice is commonly done due to the condition that the farms are located in an urban area, so that other goat breeds are not found in around this area. In addition, Nasich et al. (2018) stated that goat farmers in Sidoarjo had the characteristics to raise their livestock in extensive farming system, and let their livestock to free graze around the fishpond area. The data from the Directorate of Livestock and Animal Health in East Java showed that the goat population in Sidoarjo had increased from 2014, which reached around 31,617 goats in 2015 and around 2,000 of them were reared in Buduran Sub-District as Kacang goats.

Conservation and development of Kacang goat is important in order to serve as local genetic resources for good goat farming development in the future. The closed population goat farming practice by farmers in Sidoarjo showed the potential to maintain genetic purity of Kacang goat in Indonesia. However, measurement of the reproductive performance of Kacang goat reared extensively under closed population should be done to understand and ensure the goat farming sustainability as well as to maintain the Kacang goat conservation. Thus, this study aims was to evaluate the reproduction index of Kacang goat dam reared under closed population and extensive farming system in Buduran Sub-District, Sidoarjo Regency, East Java Province, Indonesia.

2. Materials and Methods
The study was conducted in “Oro-Oro” Kacang goat community farm in Sawohan Village, Buduran Sub-District, Sidoarjo Regency. The area is mostly occupied with fishponds, and located 4 meters above sea level, with the average temperature of 30°C, humidity of 79%, and rainfall of 2,000 mm/year. There were 37 goat farmers in the community farm with the total population were around 1,800 Kacang goats. A purposive sampling was done to select the sample of the study, including 12 goat farmers with a total of 146 Kacang does were selected. The Kacang goat population structure as well as the shelter condition is presented in Table 1 and Figure 1.

| Farmer Number | Pre-weaning (heads) | Weaning (heads) | Mature (heads) | Total (heads) | Shelter Size (m²) | Shelter Density (heads/m²) |
|---------------|---------------------|----------------|---------------|--------------|------------------|---------------------------|
| 1             | 13                  | 6              | 15            | 34           | 12               | 2.83                      |
| 2             | 5                   | 34             | 8             | 47           | 40               | 1.18                      |
| 3             | 6                   | 9              | 15            | 30           | 18               | 1.67                      |
| 4             | 28                  | 15             | 26            | 69           | 27               | 2.56                      |
| 5             | 15                  | 7              | 12            | 34           | 28               | 1.21                      |
| 6             | 14                  | 11             | 13            | 38           | 36               | 1.06                      |
| 7             | 15                  | 19             | 18            | 52           | 32               | 1.63                      |
| 8             | 35                  | 31             | 30            | 96           | 90               | 1.60                      |
| 9             | 22                  | 26             | 23            | 71           | 20               | 3.55                      |
| 10            | 9                   | 8              | 10            | 27           | 20               | 1.35                      |
| 11            | 20                  | 16             | 22            | 58           | 40               | 1.45                      |
| 12            | 10                  | 16             | 10            | 36           | 21               | 1.71                      |
| Total         | 192                 | 198            | 202           | 592          | 384              |                           |

The Kacang goats were reared under closed population and extensive farming system. The feeding was done fully through free grazing from 09.00 AM to 17.00 PM without any concentrate feed addition. Over the night the goat stay back under shelters (Figure 1).
observed variables in this study were litter size, pre-weaning mortality, kidding interval, days open, and reproduction index of does. All of the data were collected through survey and interview with questionnaire as the primary data and farmers’ recording sheet as the secondary data.

Data Analysis
The litter size, kidding interval, and days open data were analyzed with ANOVA, and followed with LSD test to determine significant differences by assisting SPSS Package Program (Version 21.0). The pre-weaning mortality and reproduction index were analyzed descriptively and measured as follow:

- **Pre-weaning mortality (%)**: \( \frac{\text{The total pre-weaning kids death}}{\text{The total of delivered kids}} \times 100 \)
- **Reproduction index**: \( \frac{\text{Littersize (1-Pre-weaning mortality)}}{\text{Kidding interval (year)}} \)

3. Results and Discussions
   **Litter Size**
   The result of litter size measurement in this study is presented in Table 2. It can be seen that the kidding type in one parturition of Kacang goat in this study can be divided into three groups, which were singlet, twin, and triplet. The singlet kidding is shown to be mostly occurred (67%), and then followed with twin (30%) and triplet (3%) kids. Moreover, the average litter size of Kacang goat dams in this study is 1.34 ± 0.51. The result is slightly higher compared to research by Mahmilia (2007), which showed that the average litter size of Kacang goat is 1.31. However, research by Nasich *et al.* (2019) showed higher results, with the average litter size of Kacang goat reared in highlands area was around 1.6. The results also showed lower litter size compared to the finding by Kaunang, Suyadi, and Wahjuningsih (2014) which showed that the natural mating of Ettawah crossbred had higher litter size of 1.80. The condition is expected as the genetic factors of Kacang goat would cause smaller body conformation compared to the Ettawah breed, which would affect the litter size as well.
Table 2. Kidding type and average litter size of Kacang goat breed.

| Kidding type | Number of Does (heads) | Percent Does (%) | Number of delivered kids (heads) |
|--------------|------------------------|------------------|----------------------------------|
| Singlet      | 99                     | 67               | 99                               |
| Twin         | 44                     | 30               | 88                               |
| Triplet      | 3                      | 3                | 6                                |
| **Average litter Size** | | **1.31 ± 0.51** | | 

The litter size is affected by the total of successful ovulation and embryonal mortality. The low litter size of the livestock could also be affected by the given feed and genetic factors. The nutrition consumed will affect on body growth and reproductive hormone regulation in the body. Wati, Aka, and Saili (2014) stated that the litter size is affected by several factors, such as genetic factors, quantities and qualities of the given feed and the breed of the goats. Sodiq and Sadewo (2008); and Adhianto et al. (2012) added that the litter size of goat would be highly affected by number of parities, body conformation, ages of dams, genetic factors, seasons and nutrition intakes. In this study, the Kacang goat dams in the study area were freely grazing field grass around the fishpond without any feed addition. It could be predicted that the does received inadequate feed in both quality and quantity. An approach to improve the litter size of Kacang goat dams in this study might be done by giving more qualified feeds and better breeding management.

**Pre-weaning mortality**

The pre-weaning mortality indicates the mothering ability of the dams and the kids’ ability to adapt to the environment. The pre-weaning mortality would be affected by several factors, such as bad pre-weaning management, low colostrum intake, housing condition, as well as farm hygiene condition (Widaningsih and Nurdiani, 2000).

Table 3. Pre-weaning mortality, days open, kidding interval and reproduction index of Kacang goat dams

| Variable                           | N      | Value          |
|------------------------------------|--------|----------------|
| Pre-weaning mortality (%)          | 193*   | 20.7           |
| Days open (moths)                  | 166**  | 2.41 ± 0.99    |
| Kidding interval (months)          | 116**  | 7.41 ± 0.99    |
| Reproduction index                 | 116**  | 1.69           |

*) number of kids, **) number of dams

In this study, the pre-weaning mortality was 20.40% (Table 3.). A higher pre-weaning mortality of Kacang goats was shown in research by Elieser et al. (2012) which was at 23.6%. The pre-weaning mortality of Kacang goats in this study would affect the farming sustainability, thus urges proper improvements in the farming management. According to Hasibuan and Mahmilia (2010), pre-weaning mortality at 10% would be enough to harm farming efficiency.

The high pre-weaning mortality in this study is caused by bad pre-weaning management by the farmers. Several causes of pre-weaning death which were found in this study include sickness and accident. The extensive farming system would offer simpler rearing management and lower cost operation (Nasich et al., 2018) as if management is left to the environment; however, the environmental factors would play a significant role affecting the goats’ health and death. Thus, improvement on the pre-weaning management, such as
providing proper housing for the kids, and controlling feeding and environmental condition would be recommended to increase farming efficiency.

Days open
Days open is the time interval between the time of delivery of birth until the time for dams to conceive. The days open would indicate dams’ fertility, where lower days open would increase the fertility. In this study, the days open of Kacang goat dams were around 2.41 ± 0.99 (Table 3). The result is lower compared to the finding of Atabany et al. (2001) on Ettawah crossbred which showed the days open at 110 days, indicating that Kacang goat is very adaptive in the extensive rearing with simple management and low quality and quantity of feed.

The finding in this study showed that the days open of Kacang goat dams reared in extensive farming system under closed population was considered to be ideal. Research by Malik, Taspirin and Salman (2016) showed that more than 120 days open indicating the period time of anestrus postpartum. The short days open in this study might be caused by natural mating of the goats and giving more exercise activity during grazing in fishpond area every day. Budiarsana and Sutama (2011) stated natural mating would still have better days open compared to the artificial insemination. Other factors known to affect days open include estrous cycle and environmental factors. The days open also had positive correlation with kidding interval, which longer days open would resulted in longer kidding interval as well.

Kidding interval
Kidding interval is the time interval between the birth of a kid and the next birth from the same dams. In this study, the kidding interval of the Kacang goat dams was at 7.41 ± 0.99 months (Table 3). The kidding interval in this study is better compared to the finding of Elieser et al. (2012), which showed that the kidding interval of Kacang goat dams in their research was more than 8 months. The finding in this research showed that kidding interval of Kacang goat dams reared in the Sawohan Village, Sidoarjo Sub-District was still good even though the goats were reared in extensive farming system.

However, Mahmilia (2007) stated that the kidding interval following programmed artificial insemination with intensive management would take around 147 to 155 days. In extensive farming system, the mating of the goats would have occurred naturally, thus the kidding interval would be longer compared to the artificial insemination. Sumartono et al. (2015, 2016) showed that the kidding interval would be affected by the time of first estrous postpartum, while Elieser et al. (2012) added that heat stress would also affect kidding interval. In this study, the kidding interval of Kacang goats was observed. The breed is known to have small body conformation which would be more adaptable to the tropical environment such as in Indonesia. The condition thus allows Kacang goat to still have a good calving interval even though reared in extensive farming system which would be more prone to heat stress.

Reproduction index
Reproduction index indicates the reproductive efficiency of the dams. The factors determining the reproduction index of the dam are litter size, pre-weaning mortality and kidding intervals. The changes in those factors thus would affect the reproduction index of the dams. The reproduction index of Kacang goat dams in this study was 1.69 (Table 3), which is still preferable in the extensive farming system. However, the result is below the reproduction index standard of Kacang goats by Sodiq and Sumaryadi (2002), which is at 3.07. Efforts to improve the reproduction index in the Kacang goat farms in this study is then
suggested to achieve more efficient farming practice, especially to reduce the pre-weaning mortality until less than 5%. In this study, the Kacang goats were reared under closed population and extensive farming system. The closed population would ensure the genetic purity of Kacang goat, and natural mating in extensive farming system would resulted in a good days open. Improvement in feeding and breeding management is recommended to improve the litter size, pre-weaning mortality, and kidding interval of Kacang goats, which would have resulted in better reproduction index as well.

Conclusions
The research concludes that Kacang goats were well adapted and suitable to be reared under closed population with extensive farming system in Sidoarjo Regency in regards to its reproductive performances. However, efforts to improve the reproduction index are suggested to improve the farming efficiency, thus ensure the conservation of Kacang goats as local resources in Indonesia.

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