Reproductive Performance of Kacang Goats in Closed Population Areas of Sidoarjo Regency, East Java, Indonesia

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Abstract. The objective of this study was to determine the reproductive performance of Kacang goats in a closed population area of Oro-Oro Farm located in Sawohan Village, Buduran Subdistrict, Sidoarjo Regency. We used 146 Kacang goat with a range of parity from 1 to > 7. Data analysis was carried out using the ANOVA test, Least Significant Difference (LSD) test, coefficient of variation test and descriptive test to measure litter size, pre-weaning mortality, kidding interval (KI), days open (DO) and Kacang goat reproduction index. The results showed that the highest litter size was 1.69 ± 0.63 at parity 6, the lowest pre-weaning mortality at parity > 7 was 11.76%, the shortest kidding interval and days open was at parity 4 for 7.35 ± 1.22 and 2.35 ± 1.22 months, respectively. The best Kacang goat reproduction index was 2.22 at parity 6 with coefficient of variation of 38.06%, 41.08% and 13.36% for litter size (LS), days open (DO), kidding interval (KI). Conclusively, there was a diverse reproductive performance of Kacang goats in the closed population area of Oro-Oro Farm located in Sawohan Village, Buduran Subdistrict, Sidoarjo Regency based on parity 1 to > 7, in which the higher the parity, the higher the reproductive performance. However, parity 5 onwards saw a declining reproductive performance due to weakened livestock conditions.

Keywords: Kacang goat, diversity of reproductive performance, parity, litter size, days open

Abstrak. Penelitian ini bertujuan untuk mengetahui performa reproduksi kambing kacang pada areal tertutup Peternakan Oro-Oro yang terletak di Desa Sawohan, Kecamatan Buduran, Kabupaten Sidoarjo. Kambing kacang yang digunakan 146 kacang dengan rentang paritas 1 sampai > 7. Analisis data dilakukan dengan menggunakan uji ANOVA, uji Beda Nyata Terkecil (BNT), koefisien variasi dan uji deskriptif yang terdiri dari *litter size*, mortalitas pra-sapih, *kidding interval* (KI), *days open* (DO) dan indeks reproduksi kambing kacang. Hasil penelitian menunjukkan *litter size* tertinggi pada paritas 6 sebesar 1,69 ± 0,63, mortalitas pra-sapih terendah pada paritas > 7 sebesar 11,76%, *kidding interval* terpendek dan *days open* pada paritas 4 sebesar 7,35 ± 1,22 dan 2,35 ± 1,22 bulan, serta indeks reproduksi kambing kacang terbaik pada paritas 6 sebesar 2,22 dengan koefisien variasi masing-masing sebesar 38,06%, 41,08% dan 13,36% untuk LS, DO dan KI. Disimpulkan bahwa terdapat keragaman performa reproduksi kambing kacang pada areal populasi tertutup peternakan Oro-Oro yang terletak di Desa Sawohan, Kecamatan Buduran, Kabupaten Sidoarjo berdasarkan paritas 1 sampai > 7, artinya semakin meningkatnya paritas meningkatkan kinerja reproduksi tetapi pada paritas 5 dan seterusnya kinerja reproduksi akan menurun karena kondisi ternak yang melemah.

Kata kunci: Kambing kacang, keragaman penampilan reproduksi, paritas, litter size, hari buka

Introduction

Goats in Indonesia are dominated by Kacang goats. Kacang goats have existed in Indonesia since the 1900s, exhibiting an ability to reproduce and survive in simple management system. Kacang goats is suitable to raise for its meat and skin, in addition to being prolific, agile, resistant, and adaptable to various environments (Khalil et al., 2019; Hidayat et al., 2019). According to Batubara et al. (2012), in their developments, most Kacang goats have been crossed with imported goats and their offspring is spread across Indonesia.

Undirected crossbreeding of Kacang goats results in too-high genetic diversity which potentially endangers the purity of Kacang goat genetic (Suyadi et al., 2019). When combined with environmental diversity (Ve), genetic diversity (Vg) leads to phenotypic diversity (Vp). Qualitative and quantitative traits are different among species and form a diversity of

phenotypes (Noor, 2008). High phenotypic diversity in a homogeneous environment means genetics have a greater influence than the environmental, and thus enabling animal breeding program to maintain the genetic purity of livestock.

Farmers in Sawohan Village, Buduran Sub-District, Sidoarjo Regency raise their goats in a closed population condition because, according to Suyadi et al. (2019), the farms are located in urban areas. The farmers do not need to buy a lot of feed because the goats freely graze in around pond areas (Nasich et al., 2018). This study aims to determine the reproductive performance of Kacang goats in a closed population area of Buduran village, Sidoarjo, East Java.

Materials and Methods

This research was conducted at Oro-Oro farm located in Sawohan Village, Buduran Subdistrict, Sidoarjo Regency. The farm is located around a fishpond area which is 4 meters above sea level with temperatures around 30°C, 2000 mm/year rainfall and ± 79% humidity. We used 146 Kacang goats obtained from 12 farmers in Sawohan Village, Buduran District, Sidoarjo Regency, and raised them extensively.

Figure 1.   Sawohan Village, Buduran Sub-district, Sidoarjo Regency

We surveyed the farmers in direct interviews using questionnaires as the primary data and farmers' records as the secondary data. The phenotypic data were litter size, pre-weaning mortality, kidding interval, days open, and the doe's reproductive index.

Table 1. Number of Kacang goat does for this research based on parity

No	Parity	Total (Heads)
1	1	30
2	2	30
3	3	24
4	4	20
5	5	18
6	6	13
7	>7	11
	Total	146

Data Analysis

Data of kidding interval, litter size and days open were analyzed using the ANOVA test to determine the effect of parity on reproductive performance. Difference among means (p <0.05) was determine by the Least Significant Difference (LSD) test, and the diversity was described using coefficient of variance method. The reproductive index and pre-weaning mortality were calculated using the formula below and analyzed descriptively.

Doe's Reproductive Index formula:

$$\text{Reproductive Index} = \frac{Littersize\ (1 - \text{Preweaning Mortality})}{Kidding\ interval}$$

Pre-weaning Mortality formula:

$$\text{Pre} - \text{weaning Mortality (\%)} = \frac{Total\ \text{pre} - \text{weaning offspring death}}{Total\ delivered\ offspring} \times 100$$

Results and Discussion

Parity is a part of the reproductive cycles which represents the birth index of animal maternity. The results of the litter size, pre-weaning mortality, Days Open (DO), kidding interval and the Doe's reproductive index of Kacang goats in Sawohan village based on different parities are shown in Table 2.

Table 2. Means and coefficient of variance (C.V) value of litter size, pre-weaning mortality, days open, kidding interval and the doe's reproductive index of Kacang goats in Sawohan village based on different parities

Variables	Parity							C.V (%)
	1	2	3	4	5	6	>7	
Litter size	1.06[a]±0.25	1.26[ab]±0.44	1.37[bc]±0.49	1.45[bc]±0.60	1.38[bc]±0.50	1.69[c]±0.63	1.54[bc]±0.68	38.06
Pre-weaning mortality (%)	31.25	26.31	12.12	20.68	16.00	18.18	11.76	-
Days open (month)		2.40±0.72	2.37±0.92	2.35±1.22	2.44±1.33	2.38±0.86	2.63±1.02	41.08
Kidding interval (month)		7.40±0.72	7.37±0.92	7.35±1.22	7.44±1.33	7.38±0.86	7.63±1.02	13.36
Reproductive index		1.50	1.96	1.88	1.87	2.22	2.12	

Different superscripts showed highly significant differences (P<0,01)

Litter Size

The results showed that parity 1 was not significantly different from parity 2 but very significantly different from parity 3, 4, 5, 6, >7. Parity 2 was not significantly different from parity 1, 3, 4, 5, >7 but significantly different from parity 6. Parity 3 was significantly different from parity 1 but not significantly different from parity 2, 4, 5, 6, >7. Parity 4 was significantly different from parity 1 but not significantly different from parity 2, 3, 5, 6, >7. Parity 5 was significantly different from parity 1 but not significantly different from parity 2, 3, 4, 6, >7. Parity 6 was significantly different from parity 1 and 2 but not significantly different from parity 3, 4, 5, >7. Parity >7 was significantly different from parity 1 but not significantly different from parity 2, 3, 4, 5, 6 with a coefficient of variance of 38.06%. These findings are in accordance with Deribe et al. (2014) and Vostry and Milerski (2013) that the higher the parities, the higher the litter size. The fact that parity advances with the increasing litter size shows that does become physiologically mature with age (Taye et al., 2011). Parity is one of the sources of litter size variation (Deribe et al., 2014). The lowest average litter size is at parity 1 (1.06[a]±0.25) and the highest is at parity 6 (1.69[c]±0.63). Table 2 shows an increase of average litter size from parity 1 to parity 4. The increases of parity will increase the litter size (Sudewo and Santosa, 2011). The contributing factors to litter size include the age of doe, parity, body weight, genetic and environmental (Miah et al., 2016). Similarly, Sodiq and Sadewo (2008) reported that the litter size of a goat is strongly influenced by parity and the size of the doe's body.

The average litter size at parity 5 started to decrease before it went up in parity 6 and down again in next parity. The decreasing average of litter size may be due to different factors including environment, feed and physiology of livestock. Similar to this, Adhianto et al. (2013) stated that age of the doe, body weight, type of birth, buck influence, season and nutritional level collectively affected litter size. Also, Wati et al. (2014) mentioned genetics, quality and quantity of available feed and the breed of the livestock as the factors contributing to the number of offspring at birth.

Pre-weaning Mortality

The pre-weaning mortality rate of Kacang goat in this study was lower than that reported by Elieser et al. (2012), namely 23.6%. The highest number of deaths is at parity 1, which can be due to low mothering ability in which the does are reluctant to nurse the kid. Lack of milk in pre-weaned goat can be fatal and cause death. Kurnianto et al. (2007) state that young doe is still in the growing process which affects their longing trait – younger does may have weak longing traits than the older does. Safari et al. (2012) and Boujenane et al. (2013) showed that parity has insignificant effect on pre-weaning mortality of kids. Mortality may be associated with many factors like parity, litter size, dam weight at kidding, birth weight of kids, kidding season, dam milk yield, disease, and dam nutrition (Moni and Samad, 2019).

The low value of pre-weaning mortality at parity seven and above could be due to either the influential good traits of Kacang goats or the small amount of data that affected the calculation of pre-weaning mortality. This result is in accordance with Vostry and Milerski (2013) that the highest survival of weaned livestock is observed from three to four years of doe's age. Mothering ability can be influenced by genetic factors, doe's experience, nutritions during the partus phase, breed, environmental temperature, and offspring's behavior (Jarmuji, 2010).

Kidding Interval

Kidding interval is a time period between mating period (previous and next) and length of pregnancy or period between two times of kidding (Murdjito et al., 2011). The statistical analysis using ANOVA showed no significant difference between parity and kidding interval with coefficient of variance of 13.36%. This result is in accordance with Suyadi et al. (2021), Sudewo et al. (2012) and Sharma et al. (2017) that parity gave no significant effect (P>0.05) on kidding interval. We found that the shortest kidding interval is at parity 4, whereas the highest is at parity seven and above. While shorter kidding interval produces a higher reproductive efficiency, the longer kidding interval affects further productivity (Widiastuti et al., 2021). Kidding interval for Kacang goat decreased to parity 4 and then went up to parity 5. It is in accordance with Zhang et al. (2009) that the increase in the reproductive performance of broodstock at parity 2, 3 and 4 is caused by the conditions pertaining to the doe's reproductive organs. The kidding interval at parity 6 decreases but without significant difference. Parity >7 has the longest kidding interval because the doe is already old so its reproductive system and physical condition start to decline. Similarly, Elieser et al. (2012) stated that at parity 5 onwards the reproductive performance of the livestock decreases because the livestock is considered old and experiences declining function of the reproductive organs and hormonal mechanisms in the body. Therefore, decreased kidding interval may be due to livestock genetics and livestock conditions.

Days Open

The statistical results of ANOVA on days open showed no significant difference between parities with coefficient of variance of 41.08%. The lowest average days open of Kacang goat doe in this research was at parity 4 and the highest is at parity >7. The high and low of the days open can be influenced by factors including mating, estrous cycle, and environment. Days open can be a determining factor to the level of reproductive efficiency: the longer the days open, the poorer the reproductive efficiency. Days open also affects the kidding interval, in which the longer days open may result in a longer kidding interval. Malik et al. (2016) stated that if the length of the empty period exceeds 120 days in female PE goats, it shows a reproductive abnormality. The length of goats' days open are normally 2-3 months (Murdjito et al., 2001). Days open at parity 2 to parity 4 has decreased due to matured reproductive condition as parity increases. This is in accordance with Zhang et al. (2009) that the increase in the reproductive performance of the doe at parity 2, 3 and 4 is due the condition of doe's reproductive organs that mature with age. Some contributing factors to ideal kidding interval of mature does are the interval between the emergence of first estrous and pregnancy, mating failure, embryo death, environment condition, breed and rearing system (Parasmawati et al., 2013; Suyadi et al., 2020)

Reproductive Index

The reproductive index of Kacang goat at parity 3 was higher than that in parity 2, 4, and 5, because parity 3 had a low percentage of pre-weaning mortality, thus affecting the doe's reproductive index. The high and low of the doe

reproduction index is influenced by maintenance management factors. Good maintenance management can reduce mortality, increase litter size and shorten kidding interval so as to increase broodstock productivity (Adhianto et al., 2013).

Conclusions

The research concluded that there was a diversity of reproductive performance of Kacang goats with coefficient of variation of 38.06%, 41.08% and 13.36% for LS, DO and KI, respectively in the closed population area of Buduran Sidoarjo village based on parity 1 to> 7, meaning that the increasing parity would increase reproductive performance. Parity 5 onwards, however, saw a decreasing reproductive performance due to weakened livestock conditions. The greater value of the coefficient of variation indicates a higher level of relative variations.

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