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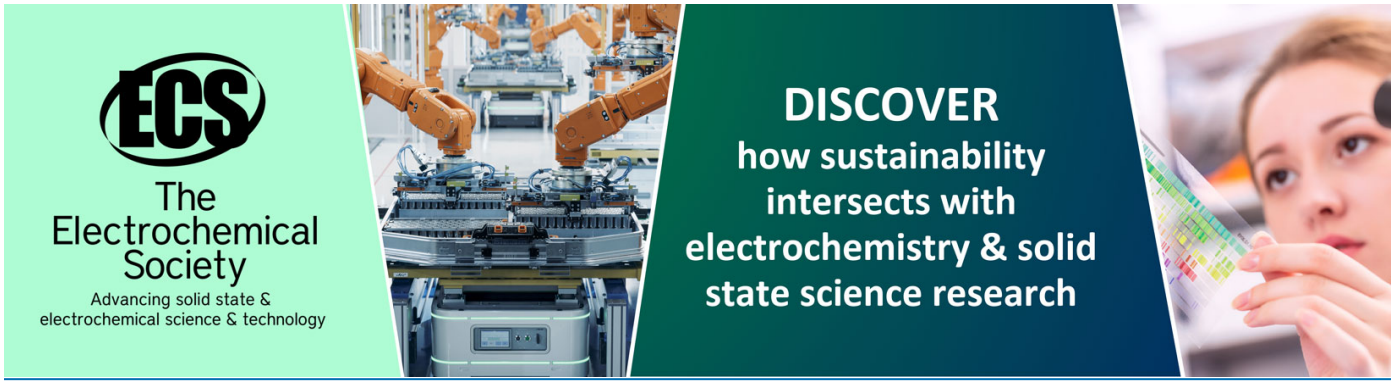

Birth and weaning weight of kids from different Boer goat crosses

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Abstract. Crossbreeding in Indonesian goat has been a common practice to improve genetic quality by mating the local does with exotic goat to produce offspring. The offspring, kids, are expected to have higher production performance compared to its parents, but robust towards tropical environment especially the available feed resources. Therefore, the aim of this paper is to characterize the production performance of offspring resulted from Boer crossed with different doe breeds. Birth and weaning weight (adjusted for 77 days of age) data were collected from kid records and their pedigree that born (n = 4,042) between January 2012 – June 2015 in CV. Kambing Burja, East Java, Indonesia. In this study, purebred Boer bucks (n = 23) were mated to three distinct doe breeds: pure Boer (n = 161), local Jawarandu (n = 700) and Boer × Jawarandu cross (Boerja, n = 501) to produce offspring. To analyze effect of weight data, linear model was built using breed (doe), year, and kid sex as fixed effects. According to the linear model, year gave effect to birth and weaning weight. Results showed all those fixed factors were significantly ($P<0.01$) affecting to birth and weaning weight. Boer offspring shows heaviest birth (3.16±0.60 kg, 2.99±0.63 kg and 2.84±0.58 kg; respectively) and weaning weight (15.02±3.94 kg, 13.67±3.87 kg and 13.48±3.70 kg; respectively); compared to both Boerja and Jawarandu. Moreover, sex also gave significant effect where male was heavier than female. It is concluded goat production performance in this study was affected by the factors of breed, year and sex. To achieve better performance in goat crossbred, breed, composition became a factor that need to be considered.

1. Introduction

Indonesia has a large population of goats, it is about 19 million in 2016 [1]. Local goat in Indonesia consists of various breeds, including Kacang goat, Costa, Jawawandu, Etawa Grade, Gembrong and many others [2]. Indonesian local goat has some advantages such as high adaptability, good reproductive ability, good mothering ability and prolific. However, Indonesian local goats have low meat production capabilities [3].

To solve this problem, Indonesian government and breeders conducted crossbreeding to increase the genetic potential of local goat as meat producers [4]. The most popular goat that have high meat production capability is Boer goat. Boer goat is a meat-type goat originating from South Africa [5] has heavy body weight, rapid growth [6] and highly adaptable to the environment [7]. In addition, Boer has high fertility, high prolificacy and good mothering abilities [8]. The results of this crossbreeding are expected to produce goats that have good production and reproduction ability but also have high adaptability to the environment and feed sources.

Birth weight and weaning weight are among of the parameters to determine the production potential of goat. One of the factors affecting birth weight and weaning weight is the effect of dam [9,10]. The results of crossbreeding between Boer goat with Kacang goat produced kids with birth weight and weaning weight of 32% and 35% higher respectively compared to pure Kacang goat [11]. Meanwhile crossbred between Boer goat with Etawa Grade produce kids with birth weight and weaning weight 15,6% and 10,07% higher than Etawa Grade goat [12].

There is no record found about the product of crossbreeding from Boer buck and Local Jawarandu doe. Jawarandu goat are crossbred from Etawa Grade with Kacang goat. For that the purpose of this study was try to found any differences in kids' birth weight and weaning crossed Boer bucks with three different goat breeds.

2. Methods

Data were collected from CV. Kambing Burja, East Java, Indonesia. Data obtained from January 2012 to June 2015. Boer bucks (n = 23) were mated into three distinct doe breeds, following these mating scenarios:

MS1: Boer Bucks x Boer does (n = 161)
MS2: Boer Bucks x Jawarandu (Boerja; n = 700); and
MS3: Boer Bucks x Boerja (n = 501)

Boer bucks and does are imported from Australia, but some Boer doe were born in Indonesia as the result of MS1. Jawarandu goat are crossbred of Etawa Grade with Kacang goat obtained from farmer around East Java. Boerja goat are product of Boer buck mate with Jawarandu doe in CV. Kambing Burja as the result of MS2. A total of 4,042 offsprings with three different breed compositions was produced. Birth and weaning weight were recorded.

Female goats are kept in colony, containing 20-25 goat each flock. Female goats are not separated by its breed, therefore no different in management. Boer bucks and all of does breed naturally by joining (male : female is 1 : 20-25) in the flock for 45 days.

Birth and weaning (adjusted for 77 days of age) weight data were analyzed by linear model. Year of born, offspring sex and doe breed as fixed effects according to the following basic model:

$$\mathbf{y_{ijkl} = \mu + Year_i + Sex_j + DB_k + \varepsilon_{ijkl}}$$

Where
Y_{ijkl} : response (birth and weaning weight)
μ : general mean
Year : year of birth effect (i = 1,2,3,4)
Sex : offspring sex effect (j = 1,2)
DB : doe breed effect (k = 1,2,3)
ε_{ijkl} : residuals

3. Results and discussions

Result showed that year of birth affect ($P < 0,01$) birth weight and weaning weight (Table 1). Birth and weaning weight of kids vary widely each year. The heaviest birth and weaning weight gained in 2014, then lightest birth weight gained in 2012 and weaning weight in 2013. This result is in agreement with several reports [5,10]. The high variation of birth and weaning weight in each years can be explained from changes in management, climate and sample size [10]. Variations every year might be explained partly by differences of rainfall which in influence grass production and feed availability [13].

Result showed that kid sex significantly influence ($P < 0.01$) birth and weaning weight (Table 1). The male kids are always heavier than female. This is because the rate of prenatal growth of male is

higher than female [14].The male kids always grew faster than female, this indicates that the male sex more quickly adaptable to the environment [10].

Dam breed has significant effect ($P < 0.01$) on birth and weaning weight (Table 1). Boer doe produces heaviest birth weight compared to Burja and Jawarandu doe. Jawarandu doe produces lighter kids compared to Boerja. The higher birth weight of the kids from Boer does is not surprising and is consistent with previous reports [15]. Birth weight is determined by extra-chromosomal inheritance and intrauterine environmental or dam effect [9]. Parent as an individual gives great influence to birth weight, in relation to the ability of each parent in providing good uterine environment during pregnancy through fulfillment of nutrient for embryo. Body measurement of the doe related to uterus capacity and nutrient supplying for embryo [16]. Boer doe is the biggest and Jawarandu is lightest. Based on that body measurement, Boer doe has bigger carrying capacity than Burja and Jawarandu.

Table 1. Number of records (n), mean and standard deviation of birth and weaning weight of kids in various dam breed, year and sex.

Factor	Level	n	Birth Weight (kg)	Weaning Weight (kg)
Dam Breed	Boer	561	3.16 ± 0.60^{a}	15.02 ± 3.94^{a}
	Boerja	1,231	2.99 ± 0.63^{b}	13.67 ± 3.87^{b}
	Jawarandu	2,250	2.84 ± 0.58^{c}	13.48 ± 3.70^{b}
		P value	< 0.01	< 0.01
Year	2012	704	2.64 ± 0.47^{d}	13.42 ± 3.20^{b}
	2013	1,172	2.69 ± 0.48^{c}	12.94 ± 3.74^{c}
	2014	1,392	3.23 ± 0.62^{a}	14.86 ± 4.04^{a}
	2015	774	3.00 ± 0.60^{b}	13.29 ± 3.60^{b}
		P value	< 0.01	< 0.01
Sex	Male	2,001	2.99 ± 0.63^{a}	14.19 ± 4.01^{a}
	Female	2,041	2.86 ± 0.58^{b}	13.31 ± 3.56^{b}
		P value	< 0.01	< 0.01

Note: Different superscripts in the same factors and traits were significantly different ($P < 0,01$).

Postnatal growth was affected by big proportion of environment compared to genetic potency. Then dam effect just affected by supplying milk [17]. Boer goat have a high growth and origin from South Africa [15] which has same tropic climate with Indonesian environment, thus, Boer doe can produce kids with greater weaning weight than others. Boerja and Jawarandu doe produce kids with the same weaning weight. We assumed that this is because Boerja and Jawarandu have almost the same potential. Boerja doe is crossbred of Jawarandu and Boer, so it already has 3 compositions of breed. The addition of Boer breed was not able to increase the weaning weight.

4. Conclusions

The fixed effects such as year, kids sex and dam breed are very important to birth and weaning weight of goats. Crossing between Boer bucks with Boerja and Jawarandu doe resulted in kids with similar weight. Considering blood composition in resulted offspring for better production performance need to be carefully planned along with better recording system to evaluate.

References

[1] BPS-Statistics Indonesia 2017 *Statistical Yearbook of Indonesia* (Jakarta: BPS-Statistics Indonesia)

[2] Periasamy K, Vahidi S M, Silva P, Faruque M, Naqvi A, Basar M, Cao J, Zhao S, Thi L, Pichler R, Garcia M, Shamsuddin M, Boettcher P, Fernando J, Han J, Ajmone P, Diallo A and Viljoen G J 2017 Mapping molecular diversity of indigenous goat genetic resources of Asia

Small Rumin. Res. **148** 2–10
[3] Budisatria I G S, Udo H M J, Eilers C H A M and Van Der Zijpp A J 2007 Dynamics of small ruminant production A case study of Central Java, Indonesia *Outlook Agric.* **36** 145–52
[4] FAO 2003 *National Report on Animal Genetic Resources Indonesia (A Strategic Policy Document)* (Food and Agriculture Organization (FAO))
[5] Schoeman S, Els J and van Niekerk M 1997 Variance components of early growth traits in the Boer goat *Small Rumin. Res.* **26** 15–20
[6] Casey N H and van Niekerk W A 1988 The boer goat. I. Origin, adaptability, performance testing reproduction and milk production *Small Rumin. Res.* **1** 291–302
[7] Malan S W 2000 The improved Boer goat *Small Rumin. Res.* **36** 165–70
[8] Greyling J P 2000 Reproduction traits in the Boer goat doe *Small Rumin. Res.* **36** 171–7
[9] Zhang C, Yang L and Shen Z 2008 Variance components and genetic parameters for weight and size at birth in the Boer goat *Livest. Sci.* **115** 73–9
[10] Zhang C, Zhang Y, Xu D, Li X, Su J and Yang L 2009 Genetic and phenotypic parameter estimates for growth traits in Boer goat *Livest. Sci.* **124** 66–71
[11] Elieser S, Sumadi, Budisatria G S and Subandriyo 2012 Productivity comparison between Boer and Kacang goat dam *J. Indon. Trop. Anim. Agric.* **37** 15–21
[12] Kostaman T and Sutama I 2006 Korelasi bobot badan induk dengan lama bunting, litter size, dan bobot lahir anak kambing Peranakan Etawah *Seminar Nasional Teknologi Peternakan dan Veteriner* hal 522–7
[13] Al-Shorepy S A, Alhadrami G A and Abdulwahab K 2002 Genetic and phenotypic parameters for early growth traits in Emirati goat *Small Rumin. Res.***45** 217–23
[14] Sutama I K, Budiarsana I G M, Setianto H and Priyanto A 1995 Productive and reproductive performances of young Ettawah-cross does *Indon. J. Anim. Vet. Sci.* **1** 81–5
[15] van Niekerk W A and Casey N H 1988 The boer goat. II. Growth, nutrient requirements, carcass and meat quality *Small Rumin. Res.* **1** 355–68
[16] van Niekerk M, Botha M E, Casey N and Schoeman S J 1996 Heritability estimates for pre-weaning growth traits in the Adelaide Boer goat flock *South African J. Anim. Sci.* **26** 6–10
[17] Robinson O W 1981 The influence of maternal effects on the efficiency of selection; A review *Livest. Prod. Sci.* **8** 121–37