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Research Article

The Productivity Comparison Between Bligon and Kejobong Goats in Indonesia, Based from On-Farm and On-Station Research

I Gede Suparta Budisatria[1*], Panjono[1], Nono Ngadiyono[1], H.M.J. Udo[2], Bayu Andri Atmoko[1]

[1]Faculty of Animal Science, Universitas Gadjah Mada, Jl. Fauna 3, Kampus UGM Bulaksumur, Yogyakarta, 55281, Indonesia; [2]Animal Production Systems Group, WIAS-Wageningen University, Marijkeweg 40, 6700 AH Wageningen, The Netherlands.

Abstract | This paper presented the productivity comparison between Bligon and Kejobong goats, two local goats developed by Indonesian smallholder farmers with traditional management. On-farm research was conducted for 12 months at the two farmer groups in Yogyakarta and Central Java with a total 75 farmers as respondents. Seventy-five does with 95 kids of Bligon goat, and 66 does with 87 pre-weaning kids of Kejobong goat were regularly monitored for body size, reproductive performance and pre-weaning growth. On-station (laboratory) research was done using 9 male Bligon and 9 male Kejobong goats of 6-8 months, kept for 5 months and investigated their dry matter (DM), crude protein (CP), total digestible nutrients (TDN) intakes, and average daily gain. The feed used consisted of groundnut leaves and rice bran. Feed was given 3.5% of body weight (70% groundnut and 30% rice bran) on a dry matter basis. The result from on-farm research showed Kejobong goats, either male or female had higher body length and rump height ($P<0.01$) than Bligon kids at different age categories. Service per conception, gestation period and postpartum mating of Kejobong goats was higher ($P<0.01$) than Bligon goats, while litter size did not significantly differ. Birth weight and pre-weaning mortality of Bligon and Kejobong goats was the same while weaning weight and average daily gain (ADG) were significantly higher ($P<0.05$) in Kejobong kids rather than Bligon kids. The result from on-laboratory research showed that feed intake (FI), dry matter intake (DMI), crude protein intake (CPI), and intake of total digestible nutrients (TDN) did not significantly differ between male Bligon and Kejobong goats, while ADG, feed conversion and feed cost per-gain was also the same. In conclusion, Kejobong goats had a potentially better performance in terms of growth, feed intake and feed efficiency compared to Bligon goats. However, poor management in terms of feed quality offered by the farmers makes that potential unpleasant and caused low reproductive performance of Kejobong does.

Keywords | Bligon and Kejobong goats, Body size, Farmers characteristics, Pre-weaning growth, Reproductive performance.

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***Correspondence** | I Gede Suparta Budisatria, Faculty of Animal Science, Universitas Gadjah Mada, Jl. Fauna 3, Kampus UGM Bulaksumur, Yogyakarta, 55281, Indonesia; **Email:** budisatria@ugm.ac.id
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INTRODUCTION

One of the basic properties needed for the development of livestock farming in Indonesia is the variety of animal genetic resources (AnGR). This variety was formed through domestication, natural and artificial selection within species. This formation of new breed types continues up to today. In resource-poor production environments, local species and breeds have many comparative advantages to exotic breeds, for example, adaptation to harsh environments and better reproductive performances as a result of natural selection (Astuti et al., 2007), yet these

AnGR are most at risk of genetic erosion (Anderson and Centonze, 2007). One of the species most adapted to local conditions and increasing in numbers worldwide is goats. Also, in Indonesia, goats are an important asset owned by small farmers, but ironically their existence is very often being forgotten, and they do not get attention in livestock development policies. Goats are well accepted by many people, but goat farming is still done traditionally (Budisatria et al., 2007; Elieser et al., 2012; Pakpahan et al., 2016). The way goats are being kept has not changed over the last decades (Budisatria et al., 2013).

In Indonesia, so-called Kacang goats have been kept for more than 200-year ages (1800), although there was little interest in goats (Budisatria, 2009; Adiwinarti et al., 2015). Early last century Jamnapari goats, in Indonesia referred to as Etawah, were imported from India to upgrade the Kacang goats. In different areas in Indonesia, farmers have developed different types of goats. Two local breeds of goats are Bligon and Kejobong goats. Bligon goat is a name being used by people in Gunungkidul area, an upland limestone area in Yogyakarta province. Actually, these goats resulted from mating local Kacang does with Etawah Cross males. The blood profile of Bligon goats shows that they are 50% more Kacang goats. Their body shape is similar as of Kacang goats, and their body size is smaller than Etawah Cross. Bligon goats are widely distributed at the northern coast of Java island and Yogyakarta province (Budisatria, 2009; Murdjito et al., 2011).

The Kejobong are widely found in Kejobong district of Purbalingga regency, the area where they originated found. Exploration of the genetic history of these goats is still in research, but from their physical appearance, it is suggested that the Kejobong is related to Kacang goats. It could be that Kejobong goats resulted from cross mating between Kacang goats with goats from India such as Etawah or Benggala. They underwent farmers' selection from generation to generation until up to the existence of their homogenous black colour (Astuti et al., 2007). Nowadays, this breed is found not only in Kejobong district but also in other districts in Central Java province, such as Banjarnegara district. Kejobong goats have dominantly black body colour so that this breed is also called as Black Kejobong. A small proportion of the Kejobong were white, light brown, dark brown, reddish-brown, or grey (Sodiq and Haryanto, 2007). Black hair colour is highly dominant compared to the other colours. The facial profile is mostly roman nose which is concave similar to Etawah Cross, with convex dorsal line (Budisatria, 2009).

Farmers value these goat breeds very much however, their protection or conservation, as well as their utilization, exist on paper only. Both farmers and scientists have expressed concern that their existence is threatened (Astuti et al., 2007). The erosion of domestic animal diversity is of serious concern if current production levels are to be sustained, and the changing demands of future markets are to be addressed. Protecting, conserving, as well as developing and thinking of utilization of local animal germplasm needs to be supported by guidelines that can protect the genetic potency of local breeds and for supporting the livelihoods of their owners. However, indigenous germplasm carries genes that enable them to tolerate harsh environments, cope with thorny vegetation in drought-prone areas, walk long distances and repel attacks by disease and pests. Due to these advantages, indigenous breeds need to be preserved so that they can be farmed in their pure form or used as the dam-line in cross-breeding programmes aimed to improve productivity and to ensure that traits such as disease and parasite tolerance can be passed to their offspring (Lehloenya et al., 2005).

The problem in breeding goat strategy in Indonesia is the limited information on basic data for the production and reproduction of goats as a basis for increasing productivity (Adhianto et al., 2019). This paper presents the productivity comparison between Bligon and Kejobong goats, two local goats developed by Indonesian smallholder farmers with traditional management. It is expected that this paper can give the illustration of the potency of goat germplasm in Indonesia, as initial data to protect, conserve, and to make use of goat germplasm for scientific as well as economic advantages.

MATERIALS AND METHODS

Ethical clearance

All experimental procedures were approved and carried out in accordance with the Rules of Animal Welfare and all research on animals was conducted according to the Institutional Committee on Animal Use (Faculty of Veterinary Medicine Universitas Gadjah Mada) with no. 0034/EC-FKH/Eks./2020.

On-farm research

This research was conducted for 12 months at the two farmers groups; Purwo Manunggal farmer group, Panggang sub-district, Gunungkidul District, Yogyakarta and Ngudidadi farmer group, Kejobong sub-district, Purbalingga District, Central Java. Farmers group is the non-formal organization of farmers; farmers themselves developed it. The members of the farmers' group lived in each other's neighbourhood, farmers group had a committee and held monthly meetings.

Panggang sub-district lies in the middle zone, on average 339 m above sea level. It is a hilly area with limestone and

stony soils, which are rather infertile. It can be categorized as dry land. More than half of the region has 'lythosol' soil types. The region has been subject to extensive drought and famine within the last hundred years. The region is also characterized by poor, facilities, infrastructures and low-income levels. This condition has led to a high level of poverty in this region. However, it has a huge potential in agriculture, especially the production of cassava, arable crops, livestock and forestry. The development of the agricultural sector is an important policy objective. The main agricultural income source is livestock (BPS Yogyakarta, 2019).

Kejobong is one of the sub-districts of 18 sub-districts in Purbalingga district, Central Java Province. This sub-district is categorized as a middle zone with some hilly areas, and the majority of the land consists of drylands (88.2%). The population in 2010 was 50,691 people and 14,334 households. The majority of the land is used to grow annual crops, mainly cassava. Cassava leaves is the major source of goat feed (BPS Jawa Tengah, 2019).

In total, all farmers group members (30 farmers at Puromanunggal and 45 farmers in Ngudidadi) were selected, and their goats were monitored for 12 months. Purwo Manunggal farmers groups kept Bligon goats, while Ngudidadi farmers groups kept Kejobong goats. In total, 75 does; 95 kids in Purwomanunggal and 56 does; 87 pre-weaning kids at Ngudidadi were regularly monitored. The data include farmers characteristics, body size of goat, reproductive and production performance. All members of a group were asked specific questions related to their animal condition, and farmers characteristics include age, goat ownership and status of ownership, the experience of keeping a goat, goat composition, land ownership, objective of keeping a goat, farming and production system, heat detection ability, and feed offered for their goat. All goat was measured the body size include chest girth, body length, rump height, and ear length. The monitoring of reproductive performance included services per conception (S/C), gestation period, litter size, birth weight, postpartum mating, mortality, weaning weight, average daily gain, kidding intervals, kid crop, doe reproduction index and doe productivity.

Goats productivity in terms of kid crop, doe reproduction index, and doe productivity over one year were calculated using an equation described by Amir and Knipscheer (1989). Pre weaning kids were observed directly, it consisted of birth and weaning weight, pre-weaning mortality, and average daily gain. The productivity was estimated as:

$$Kid\ crop = \left[\frac{number\ of\ kids\ born - number\ of\ kids\ mortality}{number\ of\ doe}\right] \times \frac{12}{calving\ interval} \times 100\%$$

Doe productivity (DP) is the multiplication of doe reproduction index (DRI) and an average of weaning weights, which is:

$$DRI = \frac{litter\ size\ (1 - mortality)}{Kidding\ interval\ (year)}$$

The growth of kids was measured directly by weighing the kids at birth and weaning ages and regularly monitoring on their mortality. The average daily gain was then calculated by:

$$Average\ daily\ gain = \frac{weaning\ weight\ (kg) - birth\ weight\ (kg)}{weaning\ ages\ (days)}$$

Experimental station research

This research was conducted to investigate the performances of male Bligon, and Kejobong goats kept in an intensive system. In total, 9 male Bligon and 9 male Kejobong goats of 6-8 months were used, kept for 5 months. The feed used consisted of groundnut leaves and rice bran. Feed was given 3.5% of body weight on a dry matter basis; the proportion was 70% groundnut leaves and 30% rice bran. Feed was offered twice a day, in the morning and afternoon. Feed was weighed before it was offered to the goats, while feed refused was weighed one day after feeding, in the morning. Feed analyses were done to calculate dry matter intake (DMI), crude protein and total digestible nutrients (TDN) intakes. Goats were weighed every two weeks in the morning, before feeding to investigate goat growth and adjust feed offered. The average daily gain was to calculate with initial body weight was subtracted from final body weight, and the result was divided by the period of measurement. Feed conversion was calculated by dividing feed intake by gain, while feed cost per kg gain was calculated, to investigate the cost required to produce 1 kg of gain.

Statistical analysis

The characteristics of the farmers were presented in percentages and analyzed descriptively. Productivity was analyzed using Independent T-test to compare information between Bligon and Kejobong goats, while body sizes, birth weight, weaning weight and daily gain of goats were analyzed using 2x2 factorial analysis with sex and breed as a factor.

RESULTS

The characteristics of the Bligon and Kejobong farmers

Table 1 present the characteristics of Bligon and Kejobong farmers, including the ownership and objectives of keeping goats. The numbers of goats kept by farmers were the same,

Table 1: Characteristics of Bligon and Kejobong goat farmers

Parameter	Bligon	Kejobong	Sig.
Numbers of farmers	30	45	
Farmers age (year)	44.9	51.4	0.01
Goats ownership (head)	4.0	4.1	0.84
Experience on keeping animal (year)	13.0	8.7	0.00
Goats composition (head):			
Pre-weaning (0-3 month)	0.5	1.2	0.00
Post weaning (3-6 month)	0.5	0.3	0.18
Young (6-12 month)	0.9	0.6	0.12
Adult (more than 12 months)	2.1	1.9	0.34
Status of ownership (%)			
Private	95.5	76.2	
Sharing	4.5	23.8	
Land ownership (hectare):	1.1	0.2	
Objectives (%):			
Saving	34.5	85.7	
Manure	27.6	0.0	
Commercial	37.9	14.3	
Farming system (%):			
Feedlot	27.2	0.0	
Breeding	72.8	90.5	
Mixed	0	9.5	
Production system (%):			
Full confinement	100.0	100.0	
Grazing	0	0	
Mixed	0	0	
Heat detection ability (%):			
Very good	29.2	9.5	
Good	54.2	9.5	
Ample	16.6	42.9	
Poor	0.0	38.1	
Feed offered	Roughages (cassava leaves, ground nut straw, leucaena, gliricidia, jackfruit leaves), native and improved grass	Cassava leaves Native grass	

4 head/farmers, mostly adult goats. Most Bligon goat farmers owned their goats, while 24% of Kejobong goat farmers kept goats through sharing arrangement with other farmers. The experience in keeping animals was higher in Bligon than Kejobong goats farmers. Moreover, Bligon farmers owned 5 times the land area than Kejobong farmers.

The majority of Kejobong goat's farmers kept goats for saving reason, whereas in Bligon goat's farmers, the reason for keeping goats was varied widely, either for saving, manure and main income, however, Bligon goat's farmers tended to keep their animal for business compared to Kejobong goats' farmers. None of the farmers kept their goats under grazing systems, and goats were kept with full confinement systems.

Body sizes of Bligon and Kejobong goats

Table 2 presents body sizes of Bligon and Kejobong goats at different sex and age categories. Kejobong kids had higher body length and rump height ($P<0.01$) than Bligon kids at the same ages. There was no interaction effect of sex and breed found on the body sizes of goats.

Table 2: Body sizes of Kejobong and Bligon goats (of different sex and age).

Age (month)	Body size (Cm)	Bligon		Kejobong	
		Male	Female	Male	Female
3	Chest girth^{ns}	43.0±1.77	42.7±4.03	43.2±3.18	43.2±4.40
	Body length	34.1±2.75^{b}	33.5±2.92^{b}	37.2±1.11^{a}	38.8±3.34^{a}
	Rump height	37.4±2.27^{b}	36.9±2.63^{b}	41.8±1.32^{a}	42.2±3.21^{a}
	Ear length^{ns}	15.5±1.01	15.1±1.72	16.8±0.92	17.8±0.73
6	Chest girth	50.4±1.82^{b}	52.4±2.02^{b}	57.9±1.35^{a}	58.4±1.14^{a}
	Body length	43.0±1.71^{b}	45.5±2.35^{b}	49.6±1.45^{a}	51.4±0.83^{a}
	Rump height	45.4±2.32^{b}	48.2±2.77^{c}	55.4±1.56^{a}	58.0±0.71^{a}
	Ear length^{ns}	18.3±1.50	18.3±1.39	18.2±0.52	18.6±0.37
12	Chest girth	63.3±5.79^{b}	64.0±3.36^{b}	68.3±2.04^{a}	68.6±1.04^{a}
	Body length	53.5±4.36^{b}	53.2±3.41^{b}	56.0±1.08^{a}	54.8±1.41^{b}
	Rump height	56.8±6.13^{b}	51.5±3.37^{c}	62.0±2.05^{a}	62.7±1.55^{a}
	Ear length	20.1±2.12^{b}	21.0±1.93^{b}	19.5±2.50^{a}	18.5±0.50^{a}
24	Chest girth	71.8±3.66^{a}	69.9±5.73^{b}	74.0±3.06^{a}	71.4±1.31^{a}
	Body length	65.0±4.23^{b}	56.7±3.78^{a}	59.7±2.60^{a}	60.1±0.79^{a}
	Rump height	69.0±6.09^{b}	60.6±3.56^{a}	62.7±0.89^{a}	63.8±1.31^{a}
	Ear length	23.7±2.41^{a}	20.6±1.99^{b}	22.0±1.53^{a}	19.4±0.93^{b}

^{a,b,c} Different superscripts denote significant differences between means within rows (P<0.01).

On six-month-olds, Kejobong goats had higher body size (P<0.01) than those of Bligon goats in all parameters, either for male or female goats, except for ear length, however, there was no interaction effect of sex and breed of goats on the body sizes.

On one-year-olds, Kejobong goats had significantly (P<0.01) higher body size than those of Bligon goats. In Kejobong goats, a male has a longer body than female, while in Bligon goats, a male has higher rump than the female.

On two-year-olds, female Bligon goat significantly has the lowest chest girth, body length and rump height. Male Bligon goat, however, has the longest body, ear and highest rump.

Reproductive performance of Bligon and Kejobong doe

Table 3 presents the production performances of Bligon and Kejobong goats. Services per conception, postpartum mating period, and kidding intervals were higher in Kejobong goats than Bligon goats (P<0.01), whereas litter size did not significantly differ. Include the weaning weights or whatever weights used in the doe productivity index in Table 3. The reproduction parameters resulted in a 22% higher kid crop percentage and 21% higher doe reproduction index in Bligon goats (P<0.01) compared to Kejobong goats. Doe productivity did not differ significantly between the two goat breeds, this was due to the higher weaning weights of Kejobong goats.

Pre-weaning growth

Table 4 presents birthweight, weaning weight, average daily gain and mortality of Bligon and Kejobong kids. There were no significant differences in birth weight and pre-weaning mortality between Bligon and Kejobong goats. However, weaning weight and ADG were significantly higher (P<0.05) in Kejobong kids than in Bligon kids. Sex did not have a significant effect on the birth weight, weaning weight and average daily gain both in

Table 3: Reproductive performance of Bligon and Kejobong does kept by farmers

Parameter	Bligon	Kejobong	Sig.
Numbers of does	59	56	
Service per conception (time)	1.2 ± 0.4	1.7 ± 0.7	0.01
Gestation period (month)	5.0 ± 0.1	5.1 ± 0.1	0.01
Litter size (head)	1.7 ± 0.5	1.6 ± 0.6	0.28
Post partum mating (month)	3.2 ± 0.4	3.8 ± 0.7	0.01
Kidding intervals (month)	8.4 ± 0.5	9.4 ± 0.9	0.01
Kid crop (%)	226.1 ± 70.6	185.0 ± 67.5	0.01
Doe reproduction index (head/year)	2.3 ± 0.7	1.9 ± 0.7	0.01
Doe productivity (kg/head/year)	20.1 ± 5.9	21.4 ± 7.6	0.30

Table 4: Average of birth weight, weaning weight and daily gain of Bligon and Kejobong kids

Parameter	Bligon		Kejobong	
	Male	Female	Male	Female
Birthweight (kg) [ns]	2.2 ± 0.23	2.1 ± 0.19	2.2±0.06	2.1±0,06
Weaning weight (kg)	8.3 ± 1.32[b]	7.8 ± 1.23[b]	11.4±0.31[a]	12.0±0.98[a]
Average daily gain (g/head/day)	75.7 ± 20.92[b]	64.5±18.13[b]	99.5±3.17[a]	107.0±9.78[a]
Pre-weaning mortality (%)[ns]	6.7		7.3	

[a,b]Different superscript at the same rows denote significant differences (P<0.05).

Table 5: Nutrient intakes and growth of male Kejobong and Bligon goats

Parameter	Bligon	Kejobong	Sig.
Feed intakes (g/head/day) [ns]	2.1±0.13	2.2±0.05	0.39
% DMI [ns]	2.9±0.21	3.3±0.46	0.34
Nutrient intakes: (g/kg/day)			
Dry matter[ns]	60.2±4.26	70.6±7.24	0.64
Crude protein[ns]	5.7±0.41	6.7±0.69	0.64
Total digestible nutrients [ns]	29.3±2.07	34.4±3.53	0.64
Average daily gain (g/head/day) [ns]	21.1±9.53	41.4±8.10	0.20
Feed conversion ratio [ns]	21.7±1.41	14.8±3.27	0.28
Feed cost per gain (Rp/kg) [ns]	78,150±4.191	31,820±7,032	0.28

Bligon and Kejobong goats. Male Kejobong goats had 31% higher in ADG compared to male Bligon kids, while ADG of female Kejobong kids was 1.6 times higher than those of female Bligon kids.

Experimental station research

Table 5 gives feed intake (FI), dry matter intake (DMI), crude protein intake (CPI) and total digestible nutrients (TDN intake) and average daily gain (ADG), feed conversion and feed cost per gain of male Bligon and Kejobong goats. There was no significant difference between male Bligon and Kejobong goats in FI, DMI, CPI, and intake of TDN. Average daily gain, feed conversion and feed cost per-gain was also the same between the two types of local goats. On average, all goats required more than 2 kg of feed per day.

The average daily gain of male Kejobong tended to be higher than those of male Bligon goats. Also, the same result was found on the feed conversion and feed cost per gain. The feed conversion and feed cost per gain of male Bligon goats almost two times higher than male Kejobong goat. This condition was indicating that in Bligon goats, more feed and cost were needed to produce one kg of gain compared to Kejobong goats. However, due to the small numbers of animals used in this study, those differences were statistically not significant.

DISCUSSION

The characteristics of farmers, and the role of small ruminants in the livelihoods of the people in current study were comparable with the previous study by Budisatria et al. (2007) who stated that the flocks had small numbers with about 2 adult goats. Farmers had more than 5 years of experience in keeping goats. The main difference between the two areas was that Bligon farmers had much more land than Kejobong farmers.

Some Kejobong goat farmers applied to share arrangement to be able to keep animals. Smallholders are typically trapped in poverty because they do not have the money required to invest in income-enhancing innovations (Jabbar et al., 2002). In addition, formal credit for livestock and related efficiency improving inputs is often less accessible to smallholders than credit for crop production (van Veen, 2001). In the absence of formal credit scheme, sharing is the only source of the farmers to keep animals. The sharing arrangement helps farmers who would like to keep small ruminants but do not have enough capital (Budisatria et al., 2010), it was also easy and risk-avoiding for the farmers, since there was no debt payment burden (Haq et al., 2019).

It was surprisingly and contradicted with the study of Budisatria et al. (2007), that the main reason for keeping small ruminants for Bligon goat farmers was commercial purposes. However, their function as a capital asset, followed by the production of manure was the main motivation for Kejobong goats' farmers. Farmers, however, have their own opinion on commercial purposes. Bligon farmers realized that keeping goats is the only way to gain cash. Therefore

they perceived that keeping goats acts as a kind of commercial activity.

All farmers practised cut-carry feeding; goats were fully confined in the housing. The intensification of land use has resulted in major changes in management. All goats were kept in confinement. The increase in the human population requires the use of all available land for the production of food. The intensification of land use has resulted in major changes in small ruminant management (Budisatria et al., 2007). As a consequence, livestock farmers had to change from grazing towards cut-and-carry feeding (Palte, 2010). The larger body sizes of Kejobong goats compared to Bligon goats could have been caused by selection done by the farmers, from generation to generation until the existence of the homogenous black colour (Astuti et al., 2007; Budisatria, 2009). Bligon goats, however, were not selected for specific attributes. Farmers mated their Kacang goats with Etawah grade for improving body sizes only. Therefore they do not have any specific characteristic, the colour varies widely, and the face is mostly flat similar to Kacang goats, the local smallest goats found in Indonesia. Based on the exterior characteristics, Kejobong goats had mostly a Roman nose face which is concave, long body with strong legs and bowl-like big breast, which similar to exterior characteristics of Etawah Cross.

Reproductive performance is one of the main determinants of productivity of small ruminants (Tano et al., 2003; Menendez-Buxadera et al., 2004; Mellado et al., 2006). Female Bligon goats had a better reproductive performance than female Kejobong goats. Therefore they had higher kid crop percentages and higher doe reproduction index. Many different processes determine reproduction efficiency and these processes include age at first kidding, kidding interval, birth type and the litter sizes at birth and the weaning rate (Greyling, 2000), they have economic significance since they determine reproductive performance and the productivity of a goat enterprise (Urdaneta et al., 2000). Main reproductive concerns are an optimum litter size (with a high survival to weaning), and the ability to breed does at a given period that will fit specific market demand, therefore, controlling reproduction of goats is necessary to group kidding over a limited period and also to facilitate nutrition adjustments with the physiological stage and lactation needs of batches of animals (Fatet et al., 2011). The fact that most Kejobong farmers had poor ability to detect the heat of goats (Table 1) could also affect relatively poor reproductive performances of Kejobong goats. Difficulties on oestrus detection, insignificant oestrus signs, and unknow time of ovulation caused low reproduction performance of the animal (Widayati et al., 2010). The management system, which includes the nutritional requirement and rearing environment, can affect reproductive performance considerably (Song et al., 2006). Improved feeding significantly reduces the age at puberty of female kids. Hence specific managerial strategies could be developed following the type of production systems targeted by farmers (Chentouf et al., 2011).

Poor performances of female Kejobong goats was not so in their kids. Kejobong kids had a better pre-weaning performance than Bligon kids in terms of weaning weights and average daily gain. Less litter size and high pre-weaning mortality of Kejobong goats might affect the growth of pre-weaning kids. Marai et al. (2002) found that the productivity of goats born as singles was higher than those of twin and multiple births. The smaller litter sizes and high mortality rate, causing low numbers of stillbirth kids at pre-weaning, less competitiveness between kids for milking. Therefore kids had the opportunity to maximize their growth during pre-weaning ages, so average daily gain and weaning weight was also high.

Overall, Bligon goat farmers' seem to manage their small ruminants better than Kejobong goat farmers'. Kejobong goats farmers offered cassava leaves as main feed for their goats combined with native grass, while Bligon goats farmers offered various types of local forages which can be easily found in their surroundings since most of them are living close to the forest side. Budisatria et al. (2010) found that abundant tree leaves are available for farmers who live close to forest areas, and often they integrate their annual crops with legume trees, which function as a fence and provide feed for small ruminants. Moreover, farmers believe that this is a major strength in keeping goats. It is well recognized that the nutritional status of animals influences their reproductive performance (Mukasa-Mugerwa et al., 2002; Lassoued et al., 2004; Melaku et al., 2004), nutritional strategies can also modulate the oestrous cycle and affect reproductive performances (Fatet et al., 2011). The condition was supported by the experimental station results, which showed that Kejobong goats had potentially good performances in terms of growth, feed intake and feed efficiency (Table 5). With better feed, Kejobong goats had almost two times higher growth than Bligon goats. The fact that Kejobong goats had larger body sizes than Bligon (Table 2) could be the entry point to improve their growth performances if there are sufficient feed resources available. Mellado et al. (2006) found that large body sizes at birth and early life of kids are linked to better performance as adults.

CONCLUSION

Bligon and Kejobong goats had good production potential under their usual farming conditions. Kejobong goats had comparatively better performance in terms of growth,

feed intake, feed efficiency, and body sizes. Whereas, the reproductive performance of Kejobong goats including postpartum mating and kidding interval, kid crop and doe reproduction index were inferior than Bligon goats. It is suggested that poor management, including poor ability to detecting the heat, and poor quality of feed resulted in the fact that their potential could not be exploited.

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CONFLICT OF INTEREST

The authors have declared no conflict of interest.

AUTHOR CONTRIBUTION

All authors contributed equally.

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