Assessment of the Kid Production Traits of Kacang Goat under Smallholders Production System

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Abstract. The main objectives of this study were to assess the influence of environmental (non-genetic) factors on kid production traits of Kacang goat under smallholders production system. The study was conducted at the Kacang goat smallholders, located at the centre of Kacang goat in Gundi subdistric, Purwodadi regency, Central Java. The kid production traits evaluated are birth weight, weaning weight, and growth rate till weaning. The environmental factors assessed were: sex (male, female), type of birth (singles, twins, triplets) and dam's parity (1-7). Data were analysed statistically according to the analysis of variance procedure using the General Linear Model (GLM). Least squares analysis revealed that dam's parity, birth type, and sex of kid were significant sources of variation for birth and weaning weight and pre weaning growth in Kacang kids. The average birth weight, weaning weight and pre weaning growth of males (2.07±0.02 kg; 10.457±0.1 kg; 69.35±0.73 g/d) were found to be higher than females (1.95±0.02 kg; 9.15±0.09 kg; 60.73±0.71 g/d). Kid production traits increased with parity, with the largest values at the fourth parity and then slightly decreased thereafter. The average male and female birth weight (2.18±0.03 kg; 2.02±0.03 kg), weaning weight (10.72±0.11 and 9.39±0.13 kg) and pre weaning growth (71.63±0.79 and 62.21±0.96 g/d) of single kids were heavier than twins, and triplets indicating the influence of the mothering ability of doe. It was recommended, the farmers should consider maternal ability for improvement of weaning weight and growth rate of Kacang kids.

Key Words: Kacang goat, kid production, birth weight, weaning weight, growth rate

Introduction

Goats constitute important animals in small farm systems in the developing countries (Devendra, 1988). In Indonesia, goats are kept as an important component of farming activities, particularly by smallholders. Nearly ninety nine percent of small ruminants such as goat and sheep are found the hand of smallholders. The contribution of goats within the total farming income for small goat keepers is substantial (Sabrani and Knipscheer, 1992). In the uplands area of Java, the total economic benefits from goat flocks were 25% higher than from sheep flocks (Budisatria et al., 2010). The majority of goats in Indonesia are concentrated in the Island of Java (DGLS, 2009), and the major breeds being the Kacang and Peranakan Etawah goat (Edey, 1983; Djajanegara and Setiadi, 1991). Kacang goats are relatively small with a compact body frame, have erect ears and short horns in both sexes. The Kacang goat is the most common native breed of the Indonesian adapted to the local environment. Mostly, under smallholders production system Kacang goats are kept primarily for meat production.

Major determinants of profitability in meat goat enterprise are growth traits. However, three pre-weaning growth traits (birth weight, weaning weight and growth rate) were used for goat breeding program (Supakorn and Pralomkarn, 2009). Several studies, have shown that birth weight is affected by sex type of birth, parity order, nutrition and year or season of kidding (Alkass et al., 1999; Shetaewi et al., 2001; Elabid, 2008). One of the economically important traits, as stated by Afzal et al. (2004) is mass of kids at birth, which is influenced by breed, but also under significant influence of year, season, kid sex, type of birth as well as age of mothers. Birth weight is the first observed trait in the life of an animal on which growth, production and reproduction traits are dependant (Koratkar et al., 1998).

Goat production traits are affected by various non genetic factors like sex, season,

year and type of birth (Kumar et al., 2007; Liu et al, 2005; Al-Shorepy et al., 2002; Nagpal et al., 1995). The growth traits are important factors influencing profitability in any meat producing enterprise. Rapid growth during the early period can minimize the cost of rearing and thus provide more profit to the farmer. The birth weight and early growth rate of animals are determined not only by genetic potential but also by maternal and environmental factors (Mandal et al., 2006; Zhang et al., 2009). The growth determines the meat producing ability up to a marketable age. Rapid growth during the pre-weaning period minimizes the cost of rearing, thus providing more profit to the farmer (Malik et al., 1986). The force and presentation of shock at weaning depend on several factors, especially on the age and body weight of kids at the time of weaning, as well as on their nutrition prior to weaning (Memiši et al., 2009). An understanding of influencing factors and genetic principles affecting the production traits is needed to implement optimal breeding and selection programs (Chang et al., 2009). In any production system, goat productivity will be uniquely influenced by complex interactions of environmental, biological and socio economic variables. Therefore, the main objectives of this study were to assess the influence of environmental (non-genetic) factors on kid production traits of Kacang goat under smallholders production system.

Materials and Methods

The study was conducted at the Kacang goat smallholders, located at the centre of Kacang goat in Gundi subdistric, Purwodadi regency, Central Java. The Kacang is indigenous goat found in some area of Indonesia, is characterized relatively small with a compact body frame, have erect ears and short horns in both sexes. It is hardly, nimble, well adapted and widely distributed in the area. Its principal value is in meat production. It has a relatively thin coat with coarse hair, and males have a pronounced, long, coarse mane (Devendra and Burns, 1983). Goat production system and also environmental conditions have relatively similar among farmers and locations. The purpose of raising Kacang goat is mostly for meat production. Animals were provided with permanen housing in small flock by natural mating method. Forage availability follows the distribution of rainfall with abundant and good quality forages in the rainy season. In the wet season, forages is generally scarce and of low quality. A supplementary concentrate was not fed to the animals. Combination between cut and carry feeding system and limited tethering were practiced.

The kid production traits evaluated are birth weight, weaning weight, and growth rate till weaning. The environmental factors assessed were: sex (male, female), type of birth (singles, twins, triplets) and dam's parity or parity order (1-7). Data were analysed statistically according to the analysis of variance procedure using the General Linear Model (GLM) of Statistical Product and Service Solution Software SPSS Inc (1998). Duncans multiple range and turkey's significant difference test were used to identify significant differences.

Results and Discussion

Birth Weight of Kacang Kid

The kids production traits of Kacang goat monitored under Smallholders Production System are presented in Table 1, 2 and 3. The overall least-square means of birth weight of Kacang kids were 2.07±0.02 kg (male) and 1.95± 0.02 kg (female) in the present investigation.

Table 1. Mean and standard error of birth weight (kg) of Kacang kids

Factors	Male kids	Female kids
Type of birth	**	**
Single	2.18 ± 0.03^{a}	2.02 ± 0.03^{d}
Twin	2.05 ± 0.01^{b}	1.93 ± 0.02^{e}
Triplet	1.97 ± 0.02^{c}	1.89 ± 0.02^{f}
Parity	**	**
Parity 1	1.98 ± 0.04^{ab}	1.80 ± 0.06^{ef}
Parity 2	2.07 ± 0.03^{bc}	1.85 ± 0.03^{f}
Parity 3	2.16 ± 0.02^{c}	1.95 ± 0.03^{f}
Parity 4	2.25 ± 0.02^{d}	1.94 ± 0.02^{f}
Parity 5	2.16 ± 0.02^{c}	1.87 ± 0.02^{f}
Parity 6	1.90 ± 0.03^{a}	1.74 ± 0.02^{e}
Parity 7	1.81 ± 0.04^{a}	1.63 ± 0.03^{e}

Values bearing different superscript at the same row differ significantly (* P<0.05, ** P<0.01)

These values were higher than the reported earlier by Devendra and Burns (1983) values birth weight of Kacang goat in Haringhatta and India for male and female were 1.3 and 1.1 kg, respectively. The birth weight had been reported to be 1.87±0.64, 2.36±0.36 and 2.43±0.20 kg in Kacang, Peranakan Etawah and Crossing between Kacang and Peranakan Etawah goats, respectively (Harris et al., 2009).

Least squares analysis (Table 1) revealed that dam's parity, birth type, and sex of kid were significant (P<0.01) sources of variation for birth weight in Kacang kids. Similar results, were observed by Afzal et al. (2004) in Beetal kids and and Zhang et al. (2009) in Boar goat.

Type of birth had a significant influence on birth weight (Table 1). Single born male and female kids (2.18±0.03 kg; 2.02±0.03 kg) were heavier than the multiple born kids of male and female twin (2.05±0.01 kg; 1.93±0.02 kg) and male and female triplet (1.97±0.02 kg; 1.89±0.02 kg), as they had better opportunities in the uterus of their dams as compared to multiple kids. Table 1 reveals that the mean birth weight decreased with increasing litter size. The difference in birth weight between single births and multiple births was highly significant (P<0.01). The lighter weight of multiple birth kids at birth might be due to decreased availability of nutrients due to competition and reduced space in the prenatal development. Elabid (2008) revealed that single born kids weighed significantly heavier than twins and similarly twins were heavier than triplets in Sudanese Nubian Goat Kids. This may be due to that litter mates had to share the prenatal maternal nourishment unlike kids born as singles. Similar variations were observed by Malik and Kanaujia (1991) in Beetal goats, Ghosh et al. (2001), Koratkar et al. (1998) in Osmanabadi breed, and Tsegaye (2009) in Ethiopian goat. Baiden (2007) reported that birth weight of West African Dwarf goat were similar between single births (1.43±0.04 kg) and twins (1.34±0.03 kg), but singles were significantly heavier than triplets (1.24±0.05 kg).

In overall, under parities 1-7 and all type of birth (single, double and triplets), the male kids were heavier (P<0.01) than female kids (Table 1). There was a sex influence on the birth weight, where males being heavier (2.07±0.02 kg) than females (1.95±0.02 kg), the difference was found to be highly significant (P<0.01). This may be attributed to the anabolic effect of male sex hormones as stated by Hafiz (1962). Afzal et al. (2004) reported that it may be due to the fact that the gestation period of does carrying male kids is usually slightly longer (1–2 days) than those carrying female kids. Results of this study agreed with the finding of Koratkar et al. (1998) and Elabid (2008) for Sudanese Nubian goats. Other researchers, Karna et al. (2001) also reported that sire and sex of kid exerted a significant effect on birth weight in Cheghu kids, and Bharathidhasan et al. (2009) reported that the average birth weight of male and female kids in Barbari goat was 1.92 ± 0.07 and 1.84 ± 0.07 kg, respectively.

The figures in Table 1 demonstrate that the birth weight of male and female Kacang kids in the 2-5 parities were heavier than those born in the first, seventh and sixth parities. The present study indicated that parity order had significant effect on birth weight with the peak value in the 4^{th} and 5^{th} parities, and then tend to decline (Table1). The present result complies with what had been obtained by Elabid (2008) for Sudanese Nubian goats and Verma et al. (1991) for Black Bengal goats. The parity of dam effect may be explained by the better development of dam's uterus with increasing parity and age (Zhang et al., 2009).

Weaning Weight and Pre-Weaning Growth Rate of Kacang Kid

Mean with standard error for the effect of dam's parity, birth type, and sex of kid on weaning weight and pre-weaning growth rate of Kacang kids are presented in Table 2 and 3. Average weaning weight and pre-weaning growth rate of Kacang was 9.8±0.09 kg and 65.04±0.72 kg/day, respectively. These findings of pre-weaning growth rate of Kacang kid higher than other studies. The respective values for pre-weaning growth rate of Kacang kid reported by Garantjang (2004) and Liwa (1996) were 45.2-57.0 and 30.17-66.42 g/d, respectively. Devendra and Burns (1983) reported Kacang kids weaned at 12 weeks of age at an average live weight of 7.5 kg only weighed 10.8 kg at 30 weeks.

Table 2. Weaning weight (kg) of Kacang kids

Factors	Male kids	Female kids
Type of birth	**	**
Single	10.72±0.11^{a}	9.39±0.13^{c}
Twin	10.58±0.07^{a}	9.09±0.07^{c}
Triplet	10.06±0.12^{b}	8.97±0.09^{d}
Parity	**	**
Parity 1	9.81±0.17^{bc}	8.98±0.19^{fg}
Parity 2	10.24±0.18^{c}	9.12±0.18^{g}
Parity 3	10.58±0.07^{de}	9.67±0.08^{hi}
Parity 4	10.92±0.08^{e}	9.89±0.08^{i}
Parity 5	10.38±0.09^{cd}	9.35±0.09^{gh}
Parity 6	9.79±0.07^{ab}	8.65±0.08^{fj}
Parity 7	8.89±0.12^{a}	8.12±0.15^{j}

Values bearing different superscript at the same row differ significantly (* P<0.05, ** P<0.01)

Table 3. Pre-weaning growth (g/d) of Kacang kids

Factors	Male kids	Female kids
Type of birth	**	**
Single	71.63±0.79^{a}	62.21± 0.96^{c}
Twin	69.14±0.52^{a}	61.32± 0.51^{c}
Triplet	67.29±0.89^{b}	58.67± 0.65^{d}
Parity	**	**
Parity 1	64.12±1.21^{bc}	60.14±1.22^{fg}
Parity 2	65.12±0.78^{c}	62.58±0.79^{g}
Parity 3	68.19±0.68^{de}	66.59±0.65^{hi}
Parity 4	69.52±0.60^{e}	67.21±0.61^{i}
Parity 5	66.75±0.62^{cd}	65.75±0.66^{h}
Parity 6	59.01±0.67^{a}	55.11±0.61^{j}
Parity 7	57.78±0.81^{a}	54.58±0.83^{j}

Values bearing different superscript at the same row differ significantly (* P<0.05, ** P<0.01)

Kid management from birth to breeding is an essential component of the goat enterprise. With the possible exception of the nutritional management of the doe herd, the kid management program has the greatest effect on the long-term productivity of the goat herd. Production traits of goat are affected by various genetic and non genetic factors such as sex, season, year and type of birth (Alkass et al., 1999; Shetaewi et al., 2001; Elabid, 2008). Least squares analyses (Table 2 and 3) revealed that dam's parity, birth type, and sex of kid were significant (P<0.01) sources of variation for weaning weight and pre-weaning growth rate in Kacang kids. Similar results, were found by Bharathidhasan (2009) in Barbari goat. Other researchers in various breeds, Saithanoo et al. (1993) and Pralomkarn et al. (1996) reported that sex, types of birth and dam's party influenced growth traits of goats for meat in Thailand, Tsegaye (2009) in Ethiopia, and Browning et al. (2009) in Spanish meat goats.

Single born kids of male and female Kacang goat have the largest weaning weight and pre-weaning growth traits were 10.72±0.11 and 9.39±0.13 kg; and 71.63±0.79 and 62.21±0.96 g/d, respectively (Table 2 and 3). These results are in agreement with the findings reported in other breeds (Voia et al., 2010; Turkson et al., 2004; Portolano et al., 2002; Mandal et al., 2006). Zhang et al. (2009) reported that the values of body weight at 30 days and pre-weaning growth for twins can catch up with those for single. In this study (Table 2 and 3) weaning weight and pre-weaning growth of Kacang kids between single and triplets revealed no significant difference (P>0.05), which predicts that the twins have greater growth potential in late period than the single. This theory was in accordance with the previous report by Zhang et al. (2006). Growth advantage of single in early period might result from its lower competition for nutrition supply of dam in gestation period than the multiple birth ones. The growth dominance of twins in late period is partly due to the balanced nutrition and environment from dam in suckling period, and partly due to their forceful adaptive capacity to the environmental variation. So it is very useful and economic to increase the number of kids at birth in order to improve the productive capacity of does.

Bharathidhasan et al. (2009) found that weaning weight and pre weaning daily gain of single born kids and twin born kids in Barbari goat were 7.16±0.44 kg and 55.56±4.80 g and 6.71±0.40 kg and 55.45±4.41 g respectively. Pre-weaning growth traits and growth rate of single kids were significantly heavier than twins, triples and quadruplets. In fact, maternal abilities such as milk yield and milking ability could influence these traits. However, the animals would be susceptible to dystocia because they tend to have high birth weight or high prolificacy. Therefore, the producers should consider maternal ability for improvement of weaning weight and growth rate and kidding difficulty of high birth weight animals.

The results of this research showed that parity of dam significantly affect the weaning weight and pre-weaning growth. Least-squares means of weaning weight and pre-weaning growth of male and female Kacang kids show a peak value in the 4th and 5th parities, and then tend to decline (Table 2 and 3). Similar results also found by Zhang et al. (2009) studied in Boer goat. The weaning weight and average preweaning daily gain had increased in second parity than first parity (Bharathidhasan et al., 2009). These findings are in agreement with the results reported in other goat breeds (Mavrogenis and Papachristoforou, 2000; Valencia et al., 2007). The parity of dam effect may be explained by the better development of dam's uterus with increasing parity and age, and this effect affects the pre-weaning growth more significantly than late growth.

Kid management from birth to breeding is an essential component of the goat enterprise. Increase in size and weight are important measurements of success. This results of this study (Table 2 and 3) demonstrated that the average *weani*ng weight and pre-weaning growth for male Kacang kids (10.457±0.1 kg; 69.35±0.73 g/d) had higher value than in female (9.15±0.09 kg; 60.73±0.71 g/d). These finding are not in line with Bharathidhasan et al. (2009) study on Barbari goat reported that average weaning weight of female kids (7.01±0.42 kg) had higher value than male kids (6.85±0.40 kg). Other researchers, found that males were always heavier and grew faster than the females (Zhang et al., 2009). Sex differences increase with growth rate indicating that male kids are more responsive to improvements in the environment, which is also predicted by Hermiz et al. (1997) in Angora goats.

Conclusions

This study revealed that sex, types of birth, and dam's parity has influence on the kids production traits (birth weight, weaning weight and pre weaning growth) of Kacang goat. Moreover, the birth weight, weaning weight and pre weaning growth of males were found to be higher than females. Kid production traits increased with parity, with the largest values at the fourth parity and then slightly decreased thereafter. Birth weight, weaning weight and pre weaning growth of single kids were also found to be heavier than twins, and triplets indicating the influence of the mothering ability of doe. Hence, the farmers should consider maternal ability for improvement of weaning weight and growth rate of Kacang kids.

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