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Non Genetic Factors Affecting Pre-Weaning Weight and Growth Rate of Ettawah Grade Goats

A. Sodiq
Faculty of Animal Science, University of Jenderal Soedirman
Jln. Dr. Soeparno No. 60, Kampus Karangwangkal, PO. Box 110 Purwokerto, Central Java, Indonesia
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ABSTRAK

Penelitian ini bertujuan mengkaji pengaruh berbagai faktor non-genetik terhadap bobot badan pada umur yang berbeda (lahir, 30, 60, 90 dan 120 hari) dan rataan pertambahan bobot badan (dari lahir sampai 30, 60, 90 dan 120 hari) pada kambing peranakan ettawah. Data anak kambing peranakan ettawah sebanyak 314 diambil dari Pusat Perbibitan Pedesaan Nasional di Kaligesing Purworejo Jawa-Tengah untuk dianalisa. Rataan bobot lahir (BW=3,44 kg), 30 hari (W30= 7,19 kg), 60 hari (W60= 11,05 kg), 90 hari (W90= 14,75 kg), 120 hari (W120= 18,86 kg), dan rataan pertambahan bobot badan dari lahir sampai umur 30 hari (ADG30= 125,6 g), 60 hari (ADG60= 126,97 g), 90 hari (ADG90= 125,87 g), 120 hari (ADG120= 128,78 g) dipengaruhi oleh jenis kelamin, jumlah anak sekelahiran, dan umur induk. Rataan BW, W30, W60, W90, W120, ADG30, ADG60, ADG90, dan ADG120 pada jantan lebih tinggi daripada betina. Rataan bobot lahir pada kelahiran kembar (dua dan tiga) lebih ringan dibanding pada kelahiran tunggal. Rataan bobot dan pertambahan bobot badan meningkat dengan bertambahnya umur induk. Implikasi hasil penelitian ini dapat digunakan untuk evaluasi genetik dan kemampuan induk dalam rangka memperbaiki kambing Peranakan Ettawah.

Kata kunci: kambing Peranakan Ettawah, faktor non-genetik, prasapih, bobot badan, pertambahan bobot badan

ABSTRACT

The present study was carried out to evaluate the effect of various non-genetic factors on live weights at different ages (at birth, 30, 60, 90, and 120 d of age), and on average daily gains (from birth to 30, 60, 90, and 120 d) of Ettawah Grade kids. Data from 314 records kids at the national village breeding centre of Kaligesing Purworejo Central Java province were analyzed. Results showed that average live weights at birth (BW= 3.44 kg), 30 d of age (W30= 7.19 kg), 60 d of age (W60= 11.05 kg), 90 d of age (W90= 14.75 kg), 120 d of age (W120= 18.86 kg), and average daily gain from birth until 30 d of age (ADG30= 125.6 g), 60 d of age (ADG60= 126.97 g), 90 d of age (ADG90= 125.87 g), 120 d of age (ADG120= 128.78 g) were influenced by sex, litter size, and age of dams. Means of BW, W30, W60, W90, W120, ADG30, ADG60, ADG90, and ADG120 of males were higher than females. Multiple (twin and triplets) born kids were lighter than single. Mean of body weight and average daily gain increased with the dam's age. The implication of these findings should be accounted in genetic evaluations and also should consider maternal ability for the improvement of Ettawah Grade.

Key words: Ettawah Grade goat, non genetic factor, pre-weaning, body weight, daily gain

INTRODUCTION

In Indonesia, goats are reared as a vital component of farming activities, especially by smallholders in the village community (Sodiq & Tawfik, 2003). They provide meat and manure to maintain soil fertility. Raising goats is a valuable part of sustainable farming. This has been achieved by integrating goat into farming system (Devendra, 2007). The contribution of goats within the total farming income for smallholder goat farming is considerable (Sodiq, 2005a; Sabrani & Knipscheer, 1992).

The main breeds of goats in Indonesia are Kacang (small grade) and Ettawah Grade goats (Edey, 1983), and they are concentrated in the island of Java (DGLS, 2009). Ettawah Grade goats is a dual purposes breed and they are descended originally from crossings between

Corresponding author:
E-mail: sodiq_akhmad@hotmail.com

the Kacang with Etawah (Jamnapari) goats. This breed has a larger body frame, long hanging ears, a convex face and larger horns. Currently, the Ettawah Grade goat is a famous dual purpose breed for its relative higher body size and excellent body profile (Sodiq & Abidin, 2010). The total population of Ettawah Grade goat at the national village breeding centre of Kaligesing Purworejo about 45.000 head. Market demand of this breed tends to increase rapidly for domestic and export trade regime (Makka, 2004).

Few researches have evaluated productivity for early growth and little is known about factors influencing traits of Ettawah Grade goat especially under national village breeding centre. Body weights and growth during the early period are often considered as an early indicator of the late growth and economic benefit (Portolano *et al*., 2002; Hanford et al., 2006; Banerjee & Jana, 2010), and their rapid growth can minimize the cost of rearing and thus provide more profit to the farmer (Zhang *et al*., 2009). Information on live weight and growth in early period and factors influencing are important. Their importance stems from the fact that the future of goat production operation depend upon successful program for raising kids for replacement of parent stock (El-Abid, 2008). These traits are controlled by polygenes (Banerjee & Jana, 2010) and also affected by maternal and environmental factors (Kadim *et al*., 2003; Liu *et al*., 2005; Mandal *et al*., 2006). The objective of this study was to evaluate various non-genetic factors on live weights at different ages (at birth, 30, 60, 90, and 120 days of age), and average daily gains of Ettawah Grade kids under national village breeding centre of Kaligesing Purworejo Central Java province.

MATERIALS AND METHODS

General Site

This study was conducted at the national village breeding centre of Ettawah Grade Goat, located at Tlogoguwo village, Kaligesing Purworejo, Central Java province. The altitude of region around 650-850 m above sea level, and the relative humidity, ambient temperature, monthly rainfall ranges from 85.42%-90.72%; 21-29 °C; 248-379 mm, respectively. Forage availability follows the distribution of rainfall with abundant in rainy season.

Animals and Production System

The goat production system in Kaligesing Purworejo is typical of the region and similar management and nutritional practices by farmers. The animals were reared generally under an intensive system in permanent stilted housing. Goats were feed indigenous and established fodders in a cut-and-carry system. Mostly, goats were fed by *Calliandra callothyrsus meissn* (calliandra). Another leguminous such as *Gliricidia maculata* (gliricidia), *Leucaena glauca* (lamtoro), and also some shrubs and leaves (banana, cassava, jackfruit, and other trees) also practiced. The *C. callothyrsus* leaves have potential as a protein and mineral source. Protein, P and Ca contents were 24%, 3%, and 8%, respectively (Lowry *et al*., 1991). There was no toxin in *C. callothyrsus,* and it is a nutritious feed, and highly palatable and acceptable to goats (Subagyo, 2004). Goat farmer usually offered feed twice a day. During lactation period, goats need better quality feed and the nutritional status influencing their kids performance. The recorded dry mater intake and crude protein intake of does in lactation period were 1,300 g/d and 270 g/d, respectively. The nutrient requirements of lactation does (body weight 35-40 kg) for maintenance and milk production according to NRC (1981) were 1,200 g/d dry mater and 112 g/d crude protein. Natural mating system was applied by provided superior bucks in term of a high quality of Ettawah Grade Goat (Grade A) and organized by farmers' groups in order to improve their flock productivity.

Data Collection and Analysis

Data on live weights at different ages including live weights at birth (BW), at 30 d of age (W30), at 60 d of age (W60), at 90 d of age (W90), at 120 d of age (W120), and average daily gain from birth until 30 d of age (ADG30), until 60 d of age (ADG60), until 90 d of age (ADG90), until 120 d of age (ADG120) were obtained from 314 Ettawah Grade kids. Kids were weaned at 120 d of age. Collecting data was conducted in the period of January 2006 and August 2007. The various non genetic factors assessed were: sex, litter size, and dam's age (1, 2, 3, 4, and 5-6 yr). The Least-squares means (LSM) and standard errors (SE) was calculation according to the General Linear Model (GLM) to identify significant differences. Multiple Range test devised by Duncan test was than applied.

Multiplicative sex adjustment factors for birth weight (BW), weaning weight (W120), and average daily gains (ADG120) were developed as the ratio of the LSM for males to the LSM for the sex to be adjusted. Multiplicative adjustment factors for litter size in birth weight (BW), weaning weight (W120), and average daily gains (ADG120) were developed as the ratio of the LSM for twins born kids to the LSM of the litter size to be adjusted. Dam age multiplicative adjustment factors for birth weight (BW), weaning weight (W120), and average daily gains (ADG120) were based on the ratio of the LSM of 3 yr old dam to the LSM for the dam age to be adjusted.

RESULTS AND DISCUSSION

The overall mean live weights of Ettawah Grade kids at birth (BW) was 3.44±0.03 kg, live weights at 30 d of age (W30) was 7.19±0.07 kg, live weights at 60 d of age (W60) was 11.05±0.11 kg, live weights at 90 d of age (W90) was 14.75±0.12 kg, and live weights at 120 d of age (W120) was 18.86±0.14 kg (Table 1). Sodiq (2005b) found that birth and weaning weight of Ettawah Grade had an average of 3.29±0.03 and 17.8±0.28 kg, respectively. Heramono & Sodiq (2006) recorded the live weight of male and female Ettawah Grade kids at 6 mo of age were 20.66±1.19 and 18.70±1.21 kg, respectively. Atabany *et al*. (2001) reported that birth weight of Ettawah Grade was

ranged between 2.63-4.29 kg. Devendra & Burns (1983) reported that birth weight of Jamnapari in Malaysia were 3.75 kg and in India for male and female were 4.65 and 4.05 kg, respectively. Birth weight of Indonesian Jamnapari crossbreed for single male and female were 3.0 and 2.6 kg, respectively.

The average daily gain were higher than previous value reported by Sodiq (2005b) that growth rate till weaning of Ettawah Grade with an average 123.1±0.1 g/d. Jimenez-Badillo *et al*. (2009) reported that faster growth rate of kids as a result of the suckling period and related to the excellencies of milk production potential of the mothers. Meyer *et al.* (1994) indicated that the live weight of an animal and its early growth rate, in particular untill weaning, are determined not only by its own genetic potential but also by the maternal environment. These represent mainly the dam's milk production and mothering ability, though effects of the uterine environment and extra-chromosomal inheritance may contribute.

Effect of Sex

Live weight (BW, W30, W60, W90, and W120) of Ettawah Grade male kids were always heavier than females (Table 1). These results agree with previous studies in other breeds by several authors Mioč *et al*. (2011) on Croatian goat, Sodiq *et al*. (2010) on Kacang goat, Zhang *et al*. (2009) on Boer goat, Vargas *et al*. (2007) on Native Creole goat, Browning *et al*. (2004) on Boer and Kiko goat, Zhou *et al*. (2003) on Inner Mongolia Cashmere goat, Portolano *et al*. (2002) on Sicilian Girgentana goat, Al-Shorepy *et al*. (2002) on Emirati goat.

Average daily gain (ADG30, ADG60, ADG90, and ADG120) of Ettawah Grade kids for male was higher than females (Table 2). Jimenez-Badillo *et al*. (2009), Browning *et al*. (2009), Bharathidhasan *et al*. (2009), Ballal *et al*. (2008), Otuma & Osakwe (2008a), Elabid (2008), Browning *et al*. (2004), Ugur *et al*. (2004), Hyder *et al*. (2002), Singh *et al*. (2002), Mahgoub & Lu, (1998), and Mahgoub & Lodge, (1996). Zhang *et al*. (2009) revealed that sex differences on Boar goat increased with growth rate. Sex difference on average daily gain could be explained by the influence of sexual hormones on animal development affecting body dimensions and fat deposits, as well as, muscle and bone. Sex differences were between 97 and 228 g on averages daily gain from birth to weaning.

Differences in sexual chromosomes, probably in the position of genes related to growth, physiological characteristics, difference in endocrinal system (type and measure of hormone secretion especially sexual hormones) lead to difference in animal growth. In relation to endocrinal system, estrogen hormone has a limited effect on the growth of long bones in females. That could be one of the reason in which females have smaller body and lighter weight against males (Baneh & Hafezian, 2009). 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) (Sodiq *et al*., 2010). This may be attributed to the anabolic effect of male sex hormones (Hafez, 1962). Afzal *et al*. (2004) reported that the gestation period of does carrying male kids is usually slightly longer (1–2 d) than those carrying female kids.

The same age (1, 2, 3, 4, and 5-6 yr) birth and weaning weight and pre-weaning daily gain of male kids were heavier than females. The same age and sex, the birth and weaning weight and pre-weaning daily gain of multiple (twins and triplets) born kids were lighter than single born kids (Table 3). Single Ettawah Grade kids were 15% and 12% heavier than twins, and twins were 23% and 18% heavier than triplets in birth and weaning weight, respectively (Table 4).

Table 1. Least square mean (±S.E.) for birth weight (BW), live weight at 30, 60, 90, and 120 days of age (W30, W60, W90, W120) by sex, birth type, and dam age of Ettawah Grade goats

Effects	N	BW(kg)	N	W30(kg)	N	W60(kg)	N	W90(kg)	N	W120(kg)
Mean	314	3.44±0.03	312	7.19± 0.07	312	11.05±0.11	294	14.75±0.12	268	18.86±0.14
Sex		**		**		**		**		**
Male	154	3.55±0.05^{a}	153	7.33± 0.10^{a}	153	11.21±0.16^{a}	145	14.97±0.18^{a}	132	19.09±0.19^{a}
Female	160	3.33±0.04^{b}	159	7.06± 0.11^{b}	159	10.85±0.15^{b}	149	14.52±0.15^{b}	136	18.66±0.17^{b}
Birth type		**		**		**		**		**
Single	77	3.86±0.06^{a}	76	7.99±0.16^{a}	76	12.18±0.23^{a}	70	16.04±0.25^{a}	63	20.63±0.25^{a}
Twins	222	3.35±0.03^{b}	221	7.01±0.07^{b}	221	10.79±0.18^{b}	209	14.45±0.12^{b}	193	18.48±0.14^{b}
Triplets	15	2.73±0.13^{c}	15	5.87±0.14^{c}	15	8.98±0.16^{c}	15	12.71±0.39^{c}	12	15.63±0.41^{c}
Age of dam		*		**		**		**		**
1 yr	38	2.89±0.08^{c}	38	6.34±0.19^{c}	38	9.98±0.31^{c}	38	13.71±0.37^{c}	36	17.25±0.41^{c}
2 yr	67	3.32±0.06^{b}	67	7.02±0.12^{b}	67	10.76±0.19^{b}	67	14.62±0.23^{b}	65	18.71±0.25^{b}
3 yr	61	3.40±0.07^{ab}	60	7.13±0.14^{b}	60	11.06±0.22^{ab}	59	14.74±0.23^{b}	59	18.75±0.26^{ab}
4 yr	85	3.63±0.05^{ab}	84	7.47±0.16^{ab}	84	11.23±0.23^{ab}	84	15.05±0.24^{b}	71	18.49±0.27^{ab}
5&6 yr	61	3.89±0.06^{ab}	61	7.61±0.122^{ab}	61	11.98±0.25^{a}	44	15.45±0.29^{b}	35	20.48±0.61^{a}

Note: Means, within the same classification followed by different letters are significantly different (P<0.05), otherwise they are not. * P<0.05, ** P<0.01.

Daily gain of single kids was 10% higher than twins, and twins were 7% higher than triplets. Birth weight, weaning weight, and average daily gains male kids were heavier than female kids. Linear effects of dam age on birth weight, weaning weight, and average daily gains were found with the maximum values produced by 5&6 yr old. Sodiq (2005b) found that birth weight of Ettawah Grade goats increased with the advance in parity up to the 4th parities, and male kids tend to be higher than those of female kids. Findings of current study (Table 1,

Table 2. Least square mean (+S.E.) for average daily gain from birth until 30, 60, 90, and 120 days of age (ADG30, ADG60, ADG90, ADG120) by sex, birth type, and dam age of Ettawah Grade goats

Effects	N	ADG30(g)	N	ADG60(g)	N	ADG90(g)	N	ADG120(g)
Mean	312	125.60±2.00	312	126.97± 1.61	294	125.87±1.19	268	128.78±1.00
Sex		**		**		**		**
Male	153	126.65±2.75[a]	153	127.92±2.32[a]	145	127.03±1.81[a]	132	129.85±1.44[a]
Female	159	124.59±2.91[b]	159	126.06±2.24[b]	149	124.75±1.55[b]	136	127.71±1.41[b]
Birth type		**		**		**		**
Single	76	137.94±4.89[a]	76	138.81±3.43[a]	70	135.64±2.41[a]	63	137.62±1.96[a]
Twins	226	122.79±2.17[b]	221	124.45±1.83[b]	209	123.67±1.35[b]	193	124.72±1.07[b]
Triplets	15	104.44±4.79[c]	15	104.22±2.99[c]	15	110.89±4.27[c]	12	116.89±3.06[c]
Age of dam		*		**		**		**
1 yr	38	115.89±4.96[c]	38	118.29±4.43[c]	38	120.26±3.64[c]	36	121.51±3.08[c]
2 yr	67	124.55±3.07[b]	67	125.53±2.72[b]	67	125.95±2.30[b]	65	128.98±1.95[b]
3 yr	60	125.88±3.99[b]	60	128.13±3.34[b]	59	126.89±2.39[b]	59	129.19±1.89[b]
4 yr	84	126.79±4.81[b]	84	128.97±3.34[b]	84	126.46±2.35[b]	71	129.82±1.98[b]
5&6 yr	61	134.98±4.77[a]	61	133.99±3.99[a]	44	129.93±3.14[a]	35	133.76±2.74[a]

Note: Means, within the same classification followed by different letters are significantly different (P<0.05), otherwise they are not. * P<0.05, ** P<0.01.

Table 3. Mean and standard error of birth and weaning weight, and average daily gain by the sex at the same age of dam and birth type of Ettawah Grade goats

Age of dam and birth type	Birth weight (BW, kg)		Weaning weight (W120, kg)		Average daily gain (ADG120, g)	
	Male	Female	Male	Female	Male	Female
1 yr:						
Single	3.19±0.09[a]	2.79±0.45[b]	19.37±1.39[a]	19.03±2.20[b]	129.80±9.93[a]	127.99±3.84[b]
Twins	2.96±0.18[c]	2.63±0.09[d]	17.81±0.73[c]	17.29±1.51[d]	114.29±4.95[c]	113.93±2.44[d]
2 yr:						
Single	3.89±0.18[a]	3.56±0.13[b]	20.26±0.63[a]	20.16±0.68[b]	139.48±4.72[a]	137.93±5.41[b]
Twins	3.41±0.08[c]	3.35±0.07[d]	18.70±0.30[c]	18.52±1.28[d]	126.89±2.29[c]	125.35±2.44[d]
Triplets	2.40±0.18[e]	n.a	15.93±0.32[e]	n.a	115.28±1.27[e]	n.a
3 yr:						
Single	4.19±0.14[a]	3.85±0.13[b]	20.95±0.21[a]	20.62±0.41[b]	140.41±1.03[a]	139.01±6.39[b]
Twins	3.53±0.07[c]	3.33±0.11[d]	18.92±0.60[c]	18.33±0.38[d]	129.17±3.31[c]	125.38±2.97[d]
Triplets	n.a	2.17±0.70[e]	n.a	14.93±1.05[e]	n.a	111.98±8.48[e]
4 yr:						
Single	4.24±0.15[a]	4.10±0.06[b]	20.95±1.92[a]	20.83±0.52[b]	140.55±7.48[a]	140.01±4.12[b]
Twins	3.59±0.07[c]	3.52±0.06[d]	19.09±0.44[c]	18.36±0.38[d]	132.43±3.31[c]	125.64±3.31[d]
Triplets	3.35±0.24[e]	3.00±0.21[f]	16.58±0.65[e]	15.10±1.05[f]	121.18±5.34[e]	119.11±7.92[f]
5&6 yr:						
Single	4.25±0.12[a]	4.11±0.15[b]	21.83±1.04[a]	21.78±0.76[b]	140.83±5.78[a]	140.08±7.30[b]
Twins	3.61±0.10[c]	3.59±0.08[d]	19.31±1.30[c]	19.01±0.38[d]	127.95±5.62[c]	126.11±2.84[d]

Note: Means, within the same classification followed by different letters are significantly different (P<0.05), otherwise they are not. n.a = not available.

2, 3, and 4) indicating there was a general tendency for improvement of body weight (BW) and average daily gain (ADG) of Ettawah Grade goats with the increase of dam age, smaller number of litter and male sex of kids. Therefore, sex of kids, litter size and dam age takes into account the ability of dam to produce high quality kids in terms of higher body weight at birth and weaning and faster growth rate.

Effect of Litter Size

Live weight (BW, W30, W60, W90, and W120) and daily gain (ADG30, ADG60, ADG90, and ADG120) Ettawah Grade kids born as singles were higher than twins and triplets (Table 1 and 2). Atabany *et al*. (2001) found that birth weight of Ettawah Grade goat for single, twins, triplets and quadruplets were 4.29, 4.08, 3.17, and 2.63 kg respectively. Findings obtained from this research are in agreement with other results by Husain *et al*. (1996), Mahgoub & Lu (1998), Mourad & Anous, (1998), Alexandre *et al*. (1999), Al-Shorepy *et al*. (2002), Portolano *et al*. (2002), Browning *et al*. (2004), Liu *et al*. (2005), Baiden (2007), Boujenane & El Hazzab (2008), Miah & Alim (2009), and Ince (2010). Single kids do not have to compete for space or nutrients in their mother's uterus (Jimenez-Badillo *et al*., 2009; Elabid, 2008). Twins receive less milk than singles (Baneh & Hafezian, 2009). Therefore, singles kids are heavier than twins when weaning and their average daily gain is higher. In this study, regarding to live weight at 30 d of age (W30), the differences were of 0.53 kg between single and twins and 1.13 kg between single and triplet, whereas between twin and triplet it was 0.6 kg. This finding higher than Serra Transmontano kids reported by Jimenez-Badillo *et al*. (2009) that the differences were of 0.41 kg between single and twins and 0.60 kg between single and triplet, whereas between twin and triplet it was 0.19 kg. The differences weaning weight (W120) were of 1.15 kg between single and twins and 5 kg between single and triplet, whereas between twin and triplet it was of 2.85 g. The differences in average daily gain from birth to weaning was of 13.77 g between single and twins and 30.98 g between single and triplet, whereas between twin and triplet was 17.20 g. The gain of single born kid over the twin and triplet ones in daily weight gain was similar with Angora kids (Liu *et al*., 2005; Husain *et al*., 1996), on Barbari goat (Bharathidhasan *et al*., 2009), Kacang kids (Sodiq *et al*., 2010), and crossbreeding among Thai Native, Anglo-Nubian, Boer and Saanen (Supakorn & Pralomkarn, 2009).

The present works (Table 1, 2, and 3) indicate that the higher number of litter (twins and triplets) effects tended to reduce birth weight and resulted in lighted kids at weaning and slower growth rates in kinds of Ettawah Grade. The farmers should be aware of this weakness, tended to take extra care of this category of kids, allowing them to suckle for longer periods before milking the extra milk from their dam. It was also crucial to improve the feeding and management especially for higher number of litter (twins and triplets) in maintaining the body weight during mating and pregnancy in order to increase birth weight and daily gain and also attain good weaning weights.

Table 4. Multiplicative adjustment factors for the effect of sex, birth type, and dam age on birth weight (BW), weaning weight (W120), and average daily gain (ADG120) of Ettawah Grade goats

Effects	Birth weight (BW)	Weaning weight (W120)	Average daily gain (ADG120)
Sex			
Male	1.00	1.00	1.00
Female	1.07	1.02	1.08
Birth type			
Single	0.87	0.89	0.91
Twins	1.00	1.00	1.00
Triplets	1.23	1.18	1.07
Age of dam			
1 yr	1.18	1.09	1.06
2 yr	1.02	1.00	1.01
3 yr	1.00	1.00	1.00
4 yr	0.94	1.01	0.99
5&6 yr	0.87	0.92	0.97

Effect of Dam Age

The age of dam significantly affect the live weight (Table 1) and average daily gain (Table 2) of Ettawah Grade kids. Dam kidding at the first year had lighter kids than those kidding at the 2, 3, 4, 5, and 6 yr and the same result were observed in average daily gain. The live weight (BW, W30, W60, W90, and W120) of kids increased with the increasing age of the dam. These findings are in agree with the report of Jimenez-Badillo *et al*. (2009), Ahuya *et al*., (2009), Hermiz *et al*., (2009), Valencia *et al*. (2007), and Mavrogenis & Papachristoforou (2000). The weights at birth and weaning of offspring of young goat was lower than those of older goats (Tsegaye, 2009; Ćinkulov *et al*., 2009; Jimenez-Badillo *et al*., 2009; Liu *et al*., 2005; Portolano *et al*., 2002; Mourad & Anous, 1998; Alexandre *et al*., 1999; Sánchez *et al*., 1994).

Ettawah Grade kids born from 1 yr old goats (Table 2) had lower average daily gain (ADG30, ADG60, ADG90, and ADG120) than those which were born from 2, 3, 4, 5, and 6 yr old dam. This fact is probably due to the development of the physiological processes with increase in parity of the dam. These findings are in line with the results reported by Jimenez-Badillo *et al*. (2009) in Serrana Transmontano kids, Otuma & Osakwe (2008b) in Nigeria Sahelian gots, and Wenzhong *et al*. (2005) in Angora goats. Liu *et al*. (2005) reported that ADG from birth to weaning of kids from first kidding was lower than those of older does, indicating that the poor condition of dams was responsible for reduced average daily gain from birth to weaning. Zhang *et al*. (2009) confirmed that the parity of dam effect may be explained by the better development of dam's uterus with

increasing parity and age, and this effect influenced the pre-weaning growth. Due to the unfavorable effects of young dams on their kids, Liu *et al*. (2005) and Mirzaei *et al*. (2011) suggested that it was essential to improve the feeding and management of kids, especially in maintaining the body weight during mating and pregnancy. This present study (Table 1, 2, and 3) revealed that birth and weaning weight and also daily weights gains of Ettawah Grade kids born from 1 yr old dam had lower than those which were born from older dam (2 to 6 yr of age). Therefore, improvement of non-genetic factors in the flocks of Ettawah Grade especially at the first parity such as dam nutrition before mating and late pregnancy. The improvement may increase postpartum body weight in order to replenish body stores and produce enough milk for nursing their young.

CONCLUSION

The live weight as well as average daily gain were influenced by sex, litter size, and age of dams. These factors should be accounted in genetic evaluations for the improvement of Ettawah Grade.

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