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Effect of Crossing Boer with Damascus Goats on Productive and Reproductive Performance

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Abstract: The aim of this work was studying the effect of crossing Boer with Damascus on productive and reproductive performance of goats. The results cleared the crossed kids (males and females) were superior weight at birth and weaning ($P<0.01$) and average daily gain ($P<0.05$) comparing to pure kids. Also, crossed kids (single and twin) had higher birth weight ($P<0.01$); weaning weight ($P<0.05$) and average daily gain ($P<0.05$). In general, male and single kids were heaver birth weight ($P<0.05$ and $P<0.01$, respectively); weaning weight and higher average daily gain than female and twin kids. Sex ratio (male: female) and single: twins were 61.54:38.46 and 23.08:76.92 in pure kids and 57.14: 42.86 and 42.86:57:14 in crossed kids. Fertility percent was the same for Boer and Damascus does (100%), while, kidding percent was high in Boer does (162.5%) when compare to Damascus does (140%). Crossed kids had lower mortality percent (4.76%) than pure kids (15.38%). Twins; males and females pure kids recorded the highest mortality percent (20.00%; 18.755% and 10.00 %, respectively).

Key words: Goats · Boer · Damascus · Crossbreeding · Productive and Reproductive Performance

INTRODUCTION

Goats are the most widely spread domestic species in the world and play an important economical role in developing countries [1]. Goats have been important for food and economic securities for countless years and their contributions to economic returns in developed countries has been rising as well [2].

In Egypt, goats are an important source of meat. They are distributed across the country, especially dense in the Nile valley and delta region [3].

Productivity of local goats from meat and milk very low, thus crossing purebred of goats such as Boer (daily gain range from 150-200g) with Damascus (milk production range from 2-5 Kg / day) will be produce hybrid of goats characterize with highly yield of milk and meat comparing with local.

Crossbreeding program uses a male of superior growth to produce lambs or kids for market, while maintaining moderate sized females that excel in fitness reproduction performance. When it comes to cross breeding meat goat breeds common crosses are Boer × Spanish goat, Boer × Angora goat, Boer × Nubian goat. Boer goat selective breeding over the last century has led to fast growth rates and excellent meat qualities, make them a popular choice for farmers. In addition, Boer goats have high disease resistance and adapt well to nearly every environment.

The Boer is the top meat producer for goat meat, low fat meat 2.58% fat- less than chicken. The Damascus goat has been improved for milk production and was used for creating many new or improved goat breeds, because of being noble and having striking characteristics.

MATERIALS AND METHODS

This trial was carried out at the Station of the Research and Agricultural Production (El-Nubaria, NRC, Egypt). The aim of this work was evaluate the productive performance of kids (purebred and crossbred) and reproductive performance of does. Sixteen Boer goats does, 15 Damascus does (2nd parity) and 2 Boer bucks were used in this study. There were two groups, first contains Boer does mated with Boer buck (BXB) and the

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Table 1: Chemical composition (on DM basis) of rations used

Item	Ration used for feeding breeding folk (R_1)	Ration used for feeding kids and does (R_2)
Organic Matter	93.00	93.00
Crude Protein	13.99	16.34
Crude Fiber	8.40	8.00
Ether Extract	7.40	7.20
Nitrogen Free Extract	63.21	60.46
Ash	7.00	7.00

second contains Damascus does mated with Boer bucks (B X D), all does were natural mating with Boer bucks in Autumn. Nutrient requirements of males and females calculated according to NRC [4] and increased 2 weeks before mating (flushing). Rations used for feeding during the breeding season (R_1) and after parturition (R_2) were shown in Table (1). Berseem (Winter); Berseem hay (Summer); water and minerals lacks were free choice. After 1.5-2 month of mating, X rays (Sonar) have been used for does to make sure of a pregnancy.

The following parameters were taken after parturition:

- For kids: type of birth, sex, birth weight, weaning weight, sex ratio and mortality %.
- For does: fertility % (number of does kidding to does used) and kidding % (number of kids born to kidded does).

After parturition kids were left with their mothers until weaning (105 days).

Rations used were chemically analyzed [5]. Two ways-factorials analysis and T-Test were applied for data. [6] and Duncan's Multiple Range Test [7] was used to separate means.

RESULTS

Productive and Reproductive Performance for Kids and Does: Average birth weight ($P<0.05$), weaning weight and daily gain for kids were higher for males than females (Table 2a), while the single and twins percent were similar for two sex (32.14%, 31.58 % for single males and female kids, respectively and 67.86% and 68.42% for twins males and females kids, respectively). Males and females Crossed kids were higher weight at birth and weaning ($P<0.01$) and daily gain ($P<0.05$) than pure Boer kids .There were a gap between single percent for crossed kids (42.86%) compare to pure Boer kids(23.08%) and also between twins percent for pure Boer (76.92%) and crossed kids (57.14%). Single kids had higher birth weight ($P<0.01$), weaning weight and daily gain than twin kids (Table 3a). Percent of single and twins kids were almost the same for males and females kids (60.00% single males, 59.38% twins males kids, 40.00% single females and 40.62 %twins females kids). Single and twins crossed kids had higher birth weight ($P<0.01$), weaning weight ($P<0.05$) and daily gain ($P<0.05$) than pure Boer kids. Males and females percent were 61.54% and 38.46% for Boer kids and 57.14% and 42.86 % for crossed kids does (Table 5). Kids weight at birth and weaning and daily gain were not significant ($P>0.05$) influenced by the interaction between breeds and sex (Table 2b). While the interaction between breeds and type of birth was significant on birth weight ($P<0.01$) and average daily gain ($p<0.05$) of kid (Table 3b). All crossed kids (males; females; single and twins) had higher birth weight ($P<0.01$), weaning weight and daily gain than Boer kids (Table 4). Percent of twins and males (76.92% and 61.54%) were higher for Boer kids than crossed kids (57.14 %and 57.14 %), in contrary, the crossed kids had higher single and female's percent (42.86 % and 42.86 %) than Boer kids. (23.08% and 38.46%). Mortality percent, from birth to weaning, in Boer kids was 15.38% (females10.0 %, males 18.75%, single zero and twins 20.00%) and was 4.76% in crossed kids (females zero%, males 8.33%, single zero% and twins 8.33 %). Fertility percent was the same for Boer and Damascus does (100%), while kidding percent were 162.5% and 140 % for Boer and Damascus. does (Table 5).

DISCUSSION

The present study cleared that the average birth weight , based on type of sex, was greater in males than females ($p<0.05$) and that agreement with Adhianto *et al.* [8] who found the males birth weight was 3.10 Kg and 2.94 kg for females. Also, Harowi [9] noticed that crossing Boer with Chinese goats produced a higher birth weight of males (4.25 Kg) than females (3.74 Kg). Another results published by Thepparat *et al.* [10] who found a significant different between birth weight of males and females. The same results obtained by Soundararajam and Sivakumar [11]; Azis [12]; Abd-Allah *et al.* [13]; Tatar *et al.* [14]; Mustefa *et al.* [15]; Azis *et al.* [16]; Azis *et al*. [17] and Bastola *et al.* [18] who reported that the birth weight of males is always heavier than females

Table 2: Effect of sex on production performance of kids

Table 2a: Main effects of breeds and sex

	Sex				Breeds			
Item	Males	Females	SEM	Significant	Pure Boer kids	Crossed kids	SEM	Significant
Number of Kids	28	19	-	-	26	21	-	-
Average birth weight, kg	3.55^{a}	3.35^{b}	0.076	*	2.95^{B}	3.95^{A}	0.076	**
Average weaning weight, kg	14.93	13.76	0.572	NS	12.86^{B}	15.83^{A}	0.572	**
Average daily gain, g	108.38	99.14	4.41	NS	94.38^{b}	113.14^{a}	4.41	*
Number of single	9	6	-	-	6	9	-	-
Single %	32.14	31.58	-	-	23.08	42.86	-	-
Number of twins	19	13	-	-	20	12	-	-
Twins %	67.86	68.42	-	-	76.92	57.14	-	-

a and b: Means in the same row within each treatment having different superscripts differ significantly (P<0.05). SEM: Slandered error of the means

* Significant at level (0.05). ** Highly significant at level (0.01). NS: not significant at level (0.05).

Table 2b: Interactions between breeds and sex

	Breeds					
	Pure Boer kids		Crossed kids			
	Sex					
Item	Males	Females	Males	Females	SEM	Significant
Number of Kids	16	10	12	9	-	-
Average birth weight, kg	3.07^{b}	2.82^{b}	4.02^{a}	3.88^{a}	0.076	NS
Average weaning weight, kg	14.02^{ab}	11.69^{b}	15.84^{a}	15.82^{a}	0.572	NS
Average daily gain, g	104.29^{ab}	84.48^{b}	112.57^{a}	113.71^{a}	4.41	NS
Number of single	5	1	4	5	-	-
Single %	31.25	10	33.33	55.56	-	-
Number of twins	11	9	8	4	-	-
Twins %	68.75	90.00	66.67	44.44	-	-

a and b: Means in the same row having different superscripts differ significantly at level (P<0.05). SEM: Slandered error of the means

* Significant at level (P<0.05). NS: not significant at level (P<0.05).

Table 3: Effect of Type of birth on production performance of kids

Table 3a: Main effects of breeds and type of birth

	Type of birth				Breeds			
Item	Single	Twins	SEM	Significant	Pure Boer kids	Crossed kids	SEM	Significant
Number of Kids	15	32	-	-	26	21	-	-
Average birth weight, kg	3.66^{A}	3.41^{B}	0.071	**	3.12^{B}	3.95^{A}	0.071	**
Average weaning weight, kg	15.01	13.98	0.586	NS	13.20^{b}	15.79^{a}	0.586	*
Average daily gain, g	108.11	100.67	4.20	NS	96.00^{b}	112.76^{a}	4.20	*
Number of males	9	19	-	-	16	12	-	-
Males %	60.00	59.38	-	-	61.54	57.14	-	-
Number of females	6	13	-	-	10	9	-	-
Females %	40.00	40.62	-	-	38.46	42.86	-	-

a and b: Means in the same row within each treatment having different superscripts differ significantly (P<0.05). SEM: Slandered error of the means

* Significant at level (P<0.05). ** Highly significant at level (P<0.01). NS: not significant at level (P<0.05).

Table 3b: Interactions between breeds and type of birth

	Breeds					
	Pure Boer kids		Crossed kids			
	Type of birth					
Item	Single	Twins	Single	Twins	SEM	Significant
Number of Kids	6	20	9	12	-	-
Average birth weight, kg	3.38^{B}	2.85^{C}	3.93^{A}	3.97^{A}	0.071	**
Average weaning weight, kg	14.65^{ab}	11.75^{b}	15.38^{a}	16.20^{a}	0.586	NS
Average daily gain, g	107.33^{a}	84.76^{b}	109.05^{a}	116.48^{a}	4.20	*
Number of males	5	11	4	8	-	-
Males %	83.33	55.00	44.44	66.67	-	-
Number of females	1	9	5	4	-	-
Females %	16.67	45.00	55.56	33.33	-	-

a, b and c: Means in the same row having different superscripts differ significantly at level (P<0.05). SEM: Slandered error of the means

* Significant at level (P<0.05). ** Highly significant at level (P<0.01). NS: not significant at level (P<0.05).

Table 4: Production performance of total kids

Item	Pure Boer kids	Crossed kids	SEM	Significant
Number of Kids	26	21	-	-
Average birth weight, kg	2.97^{B}	3.95^{A}		**
Average weaning weight, kg	13.06	15.83		NS
Total body weight gain, kg	10.09	11.88	-	-
Average daily gain, g	96.1	113.1		NS
Number of single	6	9	-	-
Single %	23.08	42.86	-	-
Number of twins	20	12	-	-
Twins %	76.92	57.14	-	-
Number of males	16	12	-	-
Males %	61.54	57.14	-	-
Number of females	10	9	-	-
Females %	38.46	42.86	-	-

**: Highly significant at (P<0.01)

A and B Means in the same row having different superscripts differ significantly at level (P<0.01) using T-Test.

SEM: Slandered error of the means

NS: not significant at level (P<0.05).

Table 5: Reproduction performance of does and kids

Item	BxB	BxD
Fertility %	100	100
Kidding %	162.5	140
*Mortality %	15.38	4.76
For:		
Female %	10.00	----
Male %	18.75	8.33
Single %	----	-
Twins %	20.00	8.33

*From birth to weaning

and that because the work of androgen hormone found in males fetus which produced growth in all body tissues [19, 10] while androgen in females fetus inhibitor the growth [20, 21]. Also, estrogen has worked in the fetus (50 days old), pipe bone is a place where muscles are attached. Inhibition of the growth of the fetus bone tissue causes the birth weight of males is higher than female's kids. Based on type of birth, average birth weight was heavier for single (P<0.01) than twin (Table 3a) and that in line with results of Soundararajam and Sivakumar [11] and Adhianto *et al.* [8] who reported that the kids birth weight was 3.20 Kg and 3.04 Kg for the single vs. twin. Tatar *et al.* [14] indicated that Damascus single kids was heavier (P<0.05) birth weight than twin kids. Also, Deribe *et al.* [22] and Nasich [23] found that the birth type of crossbred, location where the animals kept, age of the parent, seasonal factors and availability of forage have effect on birth weight. Birth weight increased with a decrease in litter size [24]. During embryo growth, the single fetus could absorb more amount of nutrient from its mother compare to twin fetus [25].

Crossbred kids at birth were significantly (P<0.01) heavier than pure Boer (Table 4) and that may be due to the result of hybrid vigor. Similar results were obtained (Boer x Nguni goats) by Lehloenya *et al.* [24], Devendra and Buris [26] and Bajhau and Kennedy [27] who said the birth weight of crossbred kids were higher than pure breeds Also, Abubakr *et al*. [28] noticed higher birth weight (P<0.05) for crossed kids from Boer bucks x Desert does when compare to Desert bucks x Desert does. Tatar *et al.* [14] found that birth weight of Damascus pure kids was 3.69 Kg. and that value lower than our data concerning with crossbred kids, 3.95 kg. All these results demonstrated birth weight of crossbred kids was higher than pure kids and that very close to our data (Table 4). Crossed kids (Boer bucks x Murciono-Granadina does, MG) significantly difference (P<0.01) compared to MG purebred kids in birth weight [29]. The present study cleared that no significant effect of birth type and sex on weaning weight of kids and that disagreement with data obtained by Deribe *et al.* [22] who reported the birth type and sex had a significant effect on weight of kids at weaning.

Single and males kids had higher weaning weight than twin and females (Tables 2a & 3a) and that in line with Adhianto *et al.* [8]; Deribe *et al.* [22]; Abd-Allah *et al*. [13], Bastola *et al.* [18] and Perez-Baena *et al*. [29].

Our data demonstrated that weight of crossbred kids were higher at weaning than purebred. Similar results obtained by Graza and Graza [30] and Greyling [31] noted that Boer crossbred kids were 15 % heavier at weaning than purebred. Also, Blackburn [32] reported greater body weight at 4, 8, 12 weeks of age for Boer crosses than for Spanish goats.

Birth type and sex of kids had a positive effects on pre-weaning growth rate, single and males kids had higher daily gain than twin and females (Tables 2a & 3a) and that very close with Deribe *et al*. [22] (2015) who found the single and male kids had higher growth rate (93.77 and 83.21 g/ d) than twin and females (66.76 and 77.32 g/d) at pre weaning period and that may be the twin kids need to compete for milk from their mother while single kids are sole users of milk [33, 34]. Bastola *et al.* [18] found that the pre-weaning daily gain were higher for males and single (137.86 and 135.00 g) than females and twin (107.15 and 100.11g). Also, average daily gain of single and males kids (157 and 156g) were higher than twin and females (151 and 148 g) kids [8]. Perez-Baena *et al.* [29] reported the males and single kids had greater average daily gain (140 and 142g), from birth to 9 Kg. live body weight, than females and twin (124 and 132 g), also crossbred kids from Boer bucks x Murciono-Granadina (MG) goats have higher growth rate (150g) than MG purebred kids (114g). Abd-Allah *et al.* [13] noted that the average daily gain at weaning (90 days) for pure Boer kids, males and females, was higher (80 and 79g/ d) compared to crossed Boer kids (66.22 and 66.20 g/d) and that disagreement to our results. Sex differences increase with growth rate indicating that male kids are more responsive to improvement in the environment [35].

Pre-weaning growth rates are often considered as a nearly indicator of the late growth and economic benefit [36-38].

The sex ratio (males to females) of crossbred males kids was higher (57.14%:42.86%, see Table 4) and that similar to value (57.67%: 42.86%) found by Soundararajam and Sivakumar [11] and Soundararajam and Sivakumar [39] who reported 57.71%: 42.29% in crossbred kids (Boer x Kanni). In contrary, Bastola *et al.* [18] indicated that the sex ratio in crossed Boer was higher for females (54.27%) than males (45.73%). While, Sivakumar and Soundararajam [40] said that the sex ratio was 50.34%: 49.66% in crossed Boer kids (Boer x non-descript goats), this result is similar to data (50.61%; 49.39 %) obtained by Deokar *et al.* [41] in Osmanabada kids. Genetic factors from the parents affecting in sex ratio, parents born of elders who born more females and vice vs. [21, 42]. Soundararajam and Sivakumar [11] found that the percentage of twin and single in crossed Boer were higher in males (58.54% and 56.94%) than females (41.46% and 43.56%) and that in line with our results (60.00% single males and 59.38% twin males). Fertility rate in Boer and Damascus does in the present study was 100% and that higher than data obtained by Bastola *el al.* [18] who noticed the fertility in Boer does was 60%, also, Erasmus and Fourie [43] who published the fertility in pure Boer does range from 71 % to 84 % with average 79 %.

The kidding rate in Boer does was 162.5% (Table 5) and that very near from the value (161.1%) reported by Bastola *et al.* [18] and lesser than the finding of Duricic *et al.* [44] i.e. 180 %; Malan [45] i.e. 189 % and Erasmus and Fourie [43] i.e. 182 %. Al-Merestani *et al.* [46] indicated the kidding rate in pure Damascus does ranged from 178 % to 180 % and that higher than our value (140 %).

Mortality rate, from birth to weaning, was higher in pure Boer kids (15.38%) compared to in crossbred kids, 4.76 % (Table 5) and that disagreement with Nugroho *et al*. [47] who said the mortality rate (2012-2015) ranged from 3.33 to 32.65% in pure Boer kids and lower than F_1 cross, Boer x Jawarad does (8.16-43.oo%).

The factors contributing to early kids mortality are birth type, age, sex, season, birth weight, management nutritional status of the does and forms of material and neonatal behavior [48]. Erasmus and Fourie [43] noticed the mortality rate in pure Boer were 10.8% in single and 8.3% in twin and that higher than our value for single (zero%) and lesser than for twin (20.00%). Males kids showed lower mortality (19.04 %) vs. females, 37.50 % that found by Abd-Allah [49] and that disagreement with the present study, while, twin kids recorded greater mortality (31.25 %) than single kids (zero) and this result in line of our data (zero% in single and 20.00 % in twin).

CONCLUSION

Based on the data of this work could be said the crossed kids had superior birth weight; weaning weight; average daily gain and lesser mortality rate compared to those of the pure Boer kids. This result indicates the Damascus doe may be better and more beneficial than Boer doe to crossing with Boer bucks and breeding in dry climatic conditions like Egypt.

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