Improving the Productive Performance of Local Baladi Goats throughout Crossbreeding with South African Boer

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ARTICLE INFO

Article history:
Received 10 November 2015
Accepted 22 December 2015
Available online 30 December 2015

Keywords:

ABSTRACT

The aim of this study is to test the effects of crossbreeding Egyptian indigenous local Baladi [LB] does with South African meat-specialized Boer [BO] bucks on the productive performance of the F1 crossbred kids. This study was carried out at the Goat Research Unit in the Department of Animal Production at El-Noubaria Experimental farm, National Research Center, Al-Emam Malek, Noubaria, Behira Governorate, and laboratories of Animal Production Department, National Research Center, Dokki, Giza. Records from 30 breeding does [10 Boer and 20 local Baladi] and one buck from each breed were used in this study. Pure Boer and Baladi bucks were used to breed the two breed groups; Baladi and Boer goats were on the average of 3-5 years old, while live body weight was on the average of [24.10 to 24.87 kg] for both the two Baladi groups [A and B] and 31.50 for pure Boers. Average daily growth [g/day] of kids after birth was higher [P < 0.05] for F1 crossbred [67.47] as compared to F1 Baladi kids [56.43]. At weaning, crossbred kids achieved weights of 10.77kg, while ones from the Baladi kids had an average weight of 8.54kg. Feed conversion ratio, average daily gain and daily DMI/h were higher in F1 crossbred kids in compare with pure Baladi kids. It was obviously noted that crossbreeding between Boer and Baladi goats resulted in higher weight gain in F1 Boer × Baladi crossbred kids compared to Baladi kids, so they can be considered the conditions in Egypt are favorable for raising crossbred kids due to increased potential for enhance meat production. The present study shows that using Boer bucks significantly improves productive performance of crossbred kids, and might prove valuable for the overall returns of the farms that will adopt this crossbreeding scheme.

INTRODUCTION

Recently, goats became an important aspect of animal production in Egypt. Improving goat productivity in Egypt could be achieved through better management and genetic programs. Breeding and selection programs of goats are widely carried out in many countries and have lead to the development of several specialized breeds [1 and 2]. Genetic improvement of goats in Egypt is imperative. To optimize gain from environmental influences, the genetic parameters and attributes of the animals for economic traits should be appraised regularly to enable breeders determine the breeding tools of their choice.

The Egyptian goat breeds, especially the Egyptian Baladi breed [Capra hircus] with a wider distribution across the Nile valley and delta, possess a high genetic variability. The local Baladi goats are hardy and small-to medium-sized and the hair is short to long. Using different crosses in order to improve growth traits in progeny is only one way crossbreeding can be beneficial. The efficiency of this process depends on the choice of the exotic breed selected, differences between the two parental breeds, the individuality of animals and the feeding management. The improved Boer breed was established in semi-arid South Africa after selection for enhanced weight gain from within local unimproved goat populations during the first half of the 1900s [3 and 4]. In recent years, the South African Boer goat breed has received considerable attention in the world and has become the main component in many goat improvement programs. Aim of the current research was to evaluate the effects that crossbreeding Egyptian indigenous Baladi does with South African meat specialized Boer bucks have on the growth rates of the F1 crossbred kids.

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MATERIALS AND METHODS

Animals and management description:
The present study was carried out at the Goat Research Unit of the Department of Animal Production at El-Noubaria Experimental farm, National Research Center, Al-Emam Malek, Noubaria, Behira Governorate, and laboratories of Animal Production Department, National Research Center, Dokki, Giza.

Breeding program:
Twenty local Baladi and ten pure Boer does with an average age [3-5 years] and weight ranged between 24.10 to 31.50 kg live bodies weights were used in the present study. At the start of the breeding season [fall of 2011], experimental does were fasted weighed, while Baladi goats were randomly assigned into two equal breeding groups [A and B]: one was natural mated by a Baladi buck [A], while the other was natural mated by Boer buck [B] and ten Boer does were natural mated by pure Boer buck. During gestation, pregnant does were confined to small traps and fed above their maintenance requirements. Pregnant does were kidded in confinement, while the offspring's were weighed 12 to 24 h after birth, at biweekly intervals and at weaning [approximately 120 day]. New born kids were not vaccinated and male kids were not castrated before weaning. Animals were managed under semi-intensive conditions, while veterinary care was available during the study.

Experimental animals and hormonal treatment:
Does in different experimental groups were synchronized during the breeding season, [September-December, 2011] with double intramuscular injections of prostaglandin PGF2α [Estromate; Essex Animal Health, Friesoythe, Germany]. Teaser buck were used to detect does in estrus twice daily [at 8 a.m. and 4 p.m.] for 30 minutes. A doe that stand and permitted the teaser buck to mount her was considered in heat. Females in heat were natural served by Boer and Baladi bucks, respectively according to the respective breeding group.

Feeding programs and management of experimental does:
Does were given supplement that varied from stage to stage with one typical feed consisting of Yellow corn, Soybean meal, Cottonseed meal, Wheat bran, Linseed meal, Rice bran, and molasses [Table 1]. Depending on age and reproductive stage, crude protein of [CFM16 %] presented for doe groups in late gestation until weaning and decreased by 2 and 4 percentage units during flushing for breeding [CFM 14 %] and early gestation [CFM 12%], respectively.

Does were provided roughages [Alfalfa hay, Berseem 2nd cut and Groundnut vines hay] that varied according to the season and the animal’s physiological stage. NRC recommendations [5] for goats were applied during different stages of the productive and reproductive study. Feeding programs of does at different productive and physiological stages and composition of different CFM diets are presented in [Tables1 and 2]. Price of feed cost per kg gain were calculated; based on feed ingredients price [L.E. / ton] in [2011-2012] as follows; Berseem hay: 1500, CFM [12% CP, 14% CP, 16% CP and 18% CP] were 2100, 2200, 2300 and 2400, respectively [including cost of manufacture and transport]. Price of groundnut vines hay [air dried] was 600.00 L.E. /ton.

Feeding breeding bucks [the sires]:
Breeding bucks were daily offered Berseem hay ad lib out of the breeding season. Two weeks before and during the breeding season [September-December], bucks were raised on 0.50 to 0.90 kg concentrate feed mixture [12% CP] and available roughage ad lib.

Pre-weaning feeding:
At approximately two weeks of age, the first generation [F1] [pure kids and Boer x Baladi crossbreds] was creep fed a kid starter [18 % CP]. Kids were start feeding [CFM] at 1% of live body weight up to weaning [4 months], besides suckling their dams. Vitamins and minerals were supplemented and freely drinking water was offered with their dams. Berseem [2nd cut] was available free choice. Kids were not vaccinated before weaning. Male kids were not castrated before weaning.

Birth weight, sex, and type of birth were also recorded at kidding. All does were vaccinated for enterotoxaemia, internal and external parasites. Water was freely available.

Weaning up to 6 months:
Male and female kids were start feeding a CFM [14% CP] at 4% of body weight from weaning up to six months. The basal ration composed of concentrates feed mixture: roughage [Berseem hay] [70:30%].

Feeding and management of weaning kids up to live market weight of males:
After weaning [4 months], kids of different experimental groups [13 males] were separated from their dams, while male kids [4 Boer, 4 crossbreds and 5 Baladi] were fattened on a fattening ration consisted of CFM 16 % CP + BH. Diets were daily offered in 2 meals, at [9 a.m. and 4 p.m.]. Daily feed intakes for both groups were biweekly adjusted according to the real changes in their live body weight. Daily feed allowances were calculated
according to NRC recommendation, [5]. Male kids were weighed biweekly at 24 h after birth and thereafter weekly for 12 weeks. Weight gains [g/day] of both does and kids were derived as [final BW [g] - initial BW [g]]/number of days involved. Full weaning of kids was applied after 120 days of age. The experimental ingredients were chemically analyzed for determination of dry matter [DM], organic matter [OM], crude protein [CP], crude fiber [CF], ether extract [EE], crude fiber [CF], nitrogen free extract [NFE] and ash contents according to A.O.A.C. [6] [Table 2].

### Measurements:

Kids were weighed within 24 h after birth and thereafter weekly for 12 weeks. Weight gains [g/day] of both does and kids were derived as [final BW [g] - initial BW [g]]/number of days involved. Full weaning of kids was applied after 120 days of age. The experimental ingredients were chemically analyzed for determination of dry matter [DM], organic matter [OM], crude protein [CP], crude fiber [CF], ether extract [EE], crude fiber [CF], nitrogen free extract [NFE] and ash contents according to A.O.A.C. [6] [Table 2].

### Statistical analyses:

Data were statically analyzed with SPSS 15.0 [7] software using parametric tests. One-way ANOVA was used to compare means of different factors in goats of the different groups. Differences among means were ranked using Duncan’s New Multiple Range Test [8]. All analysis were carried out in triplicates and the differences were considered significant at [p<0.05].

### RESULTS AND DISCUSSION

**Productive performance of kids at different productive stages:**

**Effect of breed on live body weight [kg] of kids at different productive stages:**

**Birth weight:**

Data presented in [Table 3] indicated significant differences [P<0.05] among different breed groups in the average live body weight at different ages and stages of the live kids due to breed differences. In addition, the average birth weight of kids in the present study might be attributed to the feeding program for pregnant does groups; since it was revealed that, the higher level of concentrate diet [CP], the higher expected kids’ birth weight.

The results implied that, kids of Boer × Baladi crosses were significantly [P< 0.05] heavier than the kids of pure Baladi at birth to one year old age. Crossbreeding with Boer goats increased birth weight, growth rate, and mature weight in Cashmere goats as shown by Newman and Paterson [9]. The birth weight of kids is highly variable, and is mostly under the influence of breed. In most cases it represents 1/15 of the body weight of an adult goat as reported by Morand-Fehr [10]. However, Jiabi et al. [11] studied the improvement effect of

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**Table 1: Formulation of the experimental ration.**

<table>
<thead>
<tr>
<th>Items</th>
<th>CFM 18% 450</th>
<th>CFM 16% 450</th>
<th>CFM 14% 450</th>
<th>CFM 12% 450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>18</td>
<td>14</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Un decorticated cotton seed meal</td>
<td>200</td>
<td>50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>140</td>
<td>100</td>
<td>170</td>
<td>210</td>
</tr>
<tr>
<td>Linsseed meal</td>
<td>100</td>
<td>70</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rice bran</td>
<td>140</td>
<td>110</td>
<td>110</td>
<td>170</td>
</tr>
<tr>
<td>Molasses</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Limestone</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>vitamins &amp; Minerals mixture[1]</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

1- Each 3 kg vitamins and minerals mixture contains: Vit. A 1200000 IU, Vit. D3 2200000 IU, Vit. E 10,000 mg, Vit. K3 2000 mg, Vit. B1 1000 mg, Vit. B2 5000 mg, Vit. B6 1500 mg, Vit. B12 10 mg, Pantothenic acid 10,0 mg, Niacin 30,000 mg, Folic acid 1000 mg, Biotin 50 mg, Choline 300,000 mg, Manganese 60,000 mg, Zinc 50,000 mg, Copper 10,000 mg, Iron 30,000 mg, Iodine 100 mg, Selenium 100 mg, Cobalt 100 mg and CaCO3 to 3,000 gm.

**Table 2: Chemical composition of ingredients used by experimental animals on DM basis.**

<table>
<thead>
<tr>
<th>Feed</th>
<th>% DM</th>
<th>Composition [%DM]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OM</td>
<td>CP</td>
</tr>
<tr>
<td>CFM 12%</td>
<td>89.63</td>
<td>92.41</td>
</tr>
<tr>
<td>CFM 14%</td>
<td>82.70</td>
<td>92.80</td>
</tr>
<tr>
<td>CFM 16%</td>
<td>80.56</td>
<td>92.77</td>
</tr>
<tr>
<td>CFM 18%</td>
<td>89.16</td>
<td>92.86</td>
</tr>
<tr>
<td>Berseem 2nd cut</td>
<td>15.22</td>
<td>85.87</td>
</tr>
<tr>
<td>GHV</td>
<td>88.45</td>
<td>87.14</td>
</tr>
<tr>
<td>BH</td>
<td>88.22</td>
<td>87.12</td>
</tr>
</tbody>
</table>

DM= Dry matter, OM= Organic matter , CP= Crude protein , CF= Crude fiber , EE= Ether extracts, CFM 12% = Mixture contained 12% Crude protein, CFM 14% = Mixture contained 14% Crude protein, CFM 16% = Mixture contained 16% Crude protein, CFM 18% = Mixture contained 18% Crude protein, BH= Berseem Hay, GHV= Groundnut vines hay.
crossbreeding Boer goats and Sichuan native goats, revealed that the F1 crossbred goats grew faster than local breeds with the advantages of better meat production, great potential for improvement in production, good mating ability and significantly hybrid vigor. The lower body weight of pure Baladi kids was expected because does with small weight at mating will have small kids at birth. As in all placental mammals, the maternal uterine space has a finite capacity to gestate offspring. Dams’ weight is also related to birth weight of kids.

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### Table 3: Effect of breed on live body weight (kg) of kids born to experimental groups at different productive stages.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Experimental groups</th>
<th>Birth [Kg]</th>
<th>6 months</th>
<th>12 months</th>
<th>Weaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth [Kg]</td>
<td>14</td>
<td>1.94c</td>
<td>9</td>
<td>10.77c</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>8.54c</td>
<td>7</td>
<td>13.35c</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>26.71c</td>
<td>7</td>
<td>28.00±1.125</td>
<td></td>
</tr>
</tbody>
</table>

Note: a, b, c: Means in the same row with different superscripts are significantly [P < 0.05] different.

This may be due to favorable maternal environment as evidenced by the higher body weight at kidding reported by Prasad *et al.* [12] and Khan [13] in Barbari and Jamnapari breeds of goats. The differences in birth weight between kids born could be the results of maternal nutrition [high and low nutrients available for the foetus].

Rastogi *et al.* [14] reported low birth weight of kids from the Gravid does group supplemented with low level of concentrate during pregnancy compared to high and medium level of concentrate supplementation groups. Similarly, Akingbade *et al.* [15] investigated the relationship between body weight of South African indigenous does during pregnancy and the development of the foetus. They reported that the live weight of pregnant does during gestation affects the amount of available energy for foetal growth [16]. However, size and health status of a doe may be another important factor, which may affect birth weight of kids [17].

Furthermore, Min *et al.* [18]; Geyling *et al.* [19]; Malau-Aduli *et al.* [20] and Alexandre *et al.* [21] found that milk yield increased with the increased level of concentrate diet. However, Lehloenyia *et al.* [22] recorded a lower birth weight by approximately 0.90 kg in South Africa.

**Weaning weight:**

Weaning weight of kids is influenced by breed, birth weight, weaning age, pre-weaning nutrition, litter size and lactation performances of the dam. The higher significant [P < 0.05] values for weaning weight were observed in Boer kids [12.84 kg] than pure Baladi [8.54 kg] and Boer × Baladi crosses [10.77 kg]. Results of the present study [Table, 3] for birth and weaning weights from kids of pure Boer are somewhat lower than the reports of earlier literature, where Boer goats averaged up to 3.9 kg at birth and 29 kg at weaning [weaned at 4 months] [23 and 24]. At weaning on 56 days, F₁ Boer × Carpatina crossbred kids registered an average body weight as [13.92 kg], with 3.58 kg higher than purebred Carpatina kids, with average weaning body weights of [10.34 kg]; differences registered between the two genotypes were higher significant [P < 0.001], [25].

**Six months to one year old age:**

The lower body weight of pure Baladi kids at birth in the present study [1.94 kg] still showing significant [P < 0.05] lower body weight at weaning [8.54 kg], at six months [11.41 kg] and at one year old age [22.28 kg] [Table, 3]. At one year old, F₁ Boer × Baladi crossbred kids registered an average live body weight of [26.71 kg] and were higher than purebred Baladi kids, indicating positive effect of breeding on improving local goats body weights. Differences in live body weight between the two Baladi groups [A and B] were found to be significant [P < 0.05], [Table, 3]. Results obtained from studies carried out in both India and Egypt revealed that body weight of the crossbred kids was heavier than the purebreds, possibly due to heterosis.

**Effect of breed on average daily gain [g/day] of kids at different productive stages:**

**Birth to weaning age:**

Provision of improved feeding system during late pregnancy and lactation period might increase the growth performance of kids. The highest significantly [P < 0.05] ADG values were recorded from birth to weaning in this study are justifiable given the fact that, the kids born had a plenty of food since they were given concentrate feed mixture [18 CP %] during pre-weaning, besides suckling their dams.

In addition, the weight gain of Baladi kids is closely associated with lower level of milk intake during the weaning period and declines with declining milk production. Least-square means for average daily gain [ADG] of kids are presented in [Table, 4]. The mean average daily gain from birth to weaning of Boer × Baladi crossbred kids [67.47 g] was significantly [P < 0.05] higher than pure Baladi kids [56.45 g]. Higher estimates for ADG during first 28 days after kidding, were reported by [25], where F₁ Boer × Carpatina crossbred kids registered an average daily gain of 225.12 g/day which was significantly higher [P < 0.001] than pure Carpatina kids, [159.76 g/day].
Ngwa et al. [26] reported greater ADG and G/F for week 1 to week 14 [222 g/day and 136 g/kg, respectively] for Boer-cross wether goats when fed a concentrate diet containing 19.8% CP.

Table 4: Effect of breed on average daily gain [g/day] of kids at different productive stages.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Experimental groups</th>
<th>No. Baladi</th>
<th>No. Boer × Baladi</th>
<th>No. Boer</th>
<th>X±SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to weaning [g]</td>
<td>10</td>
<td>56.45a</td>
<td>9</td>
<td>67.47a</td>
<td>8</td>
</tr>
<tr>
<td>Weaning to 6 months [g]</td>
<td>8</td>
<td>43.63b</td>
<td>7</td>
<td>44.43b</td>
<td>7</td>
</tr>
<tr>
<td>6 months to one year [g]</td>
<td>8</td>
<td>60.00c</td>
<td>7</td>
<td>73.73c</td>
<td>7</td>
</tr>
<tr>
<td>'X</td>
<td>-</td>
<td>53.63</td>
<td>-</td>
<td>61.87</td>
<td>-</td>
</tr>
</tbody>
</table>

*Means in the same row with different superscripts are significantly [P <0.05] different.*

Weaning to six months of age:

No significant difference [P<0.05] in average daily gain after weaning was found between Boer × Baladi crossbred kids [44.43 g/day] and the kids born to Baladi does [43.66 g/day], numerically having the lowest averages for all the three experimental groups, [Table, 4]. Reports from Casey and Van Niekerk [3] indicated that Boer and Boer × Spanish crossbred kids had a higher pre-weaning daily gain than pure Spanish kids. After weaning, kids of different groups lose weight as a result of weaning stress. Factors such as weaning age, weaning stress and compensatory growth can affect growth rate [27]. During weaning, kids in all dietary treatments lose weight as a result of weaning stress [28]. The average daily gain [ADG, g/day] of kids after weaning was higher [P<0.05] for Boer kids [69.54] compared to F1 Boer × Baladi crossbred kids [44.43] and Baladi kids [43.63], respectively, [Table, 4]. The rate of growth of a kid after weaning, however, is partly determined by the genetic potential of the kid and the level of environmental influence, especially during the immediate post weaning stage. In the present study, post six months gain was found to be significantly higher [P<0.05] in Baladi crossbred kids than Baladi kids. The average daily gain [ADG, g/day] of kids after six months to one year old was higher for Baladi crossbred kids [73.73 g] compared to Baladi kids [60.00 g]. Haas [29] observed slightly greater difference in ADG from 150 to 365 d of age approximately 35 g between Boer crosses and indigenous small East Africa goats; although ADG were considerably lower [i.e. 33 vs. 68 g]. Anous and Mourad [30] working with Alpine bucks and Rove does in Egypt indicated increasing heterosis in weight gain with the increase in age of kids.

Feeding trial:

Performance for male kids:

The nutritional needs of experimental goats vary according to weight and stage of growth. They can be met by a variety of feedstuffs and feeding programs. The effect of feeding programs for kids started to show at the beginning of the earlier two months post-weaning and further improvement had been recorded up to one year old age. The protein requirement of male kids declined from 18% CP on dry matter basis in the early stage of life to 16% during the last six months and from post-weaning to one year old age.

Data presented in [Table, 5] pointed out to significant [P<0.05] differences among different breed groups in the initial live body weight, final live body weight, total gain and average daily gain during 180 days feeding period. Boer × Baladi crosses indicated better performance as a positive result to crossing practice as a biological tool to improve Baladi goat's performance [14, 13 kg and 78.25 g] [Table, 5].

Table 5: Performance of male kids given the experimental rations.

<table>
<thead>
<tr>
<th>Items</th>
<th>Experimental groups</th>
<th>Pure Baladi</th>
<th>Boer × Baladi</th>
<th>Pure Boer</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of animals</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Feeding period in days</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Initial live body weight [kg]</td>
<td>11.50±0.7</td>
<td>13.50±0.4</td>
<td>16.50±0.9</td>
<td></td>
</tr>
<tr>
<td>Final live body weight [kg]</td>
<td>22.83±1.8</td>
<td>27.62±0.4</td>
<td>35.62±1.3</td>
<td></td>
</tr>
<tr>
<td>Total live body weight gain [kg]</td>
<td>11.33±0.8</td>
<td>14.13±0.6</td>
<td>19.13±0.5</td>
<td></td>
</tr>
<tr>
<td>AV. Daily gain [g/day]</td>
<td>62.00±8.8</td>
<td>78.25±2.7</td>
<td>106.25±7.7</td>
<td></td>
</tr>
<tr>
<td>Feed Intake [DMI g/h/d]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFM [16% CP]</td>
<td>387.18</td>
<td>463.76</td>
<td>587.83</td>
<td></td>
</tr>
<tr>
<td>Berseem hay [g]</td>
<td>181.66</td>
<td>217.65</td>
<td>275.88</td>
<td></td>
</tr>
<tr>
<td>Total DM Intake [g]</td>
<td>568.84±32.61</td>
<td>681.41±12.42</td>
<td>861.71±31.28</td>
<td></td>
</tr>
<tr>
<td>Feed conversion, DMI Kg/Kg gain</td>
<td>9.32±0.775</td>
<td>8.71±0.322</td>
<td>8.15±0.568</td>
<td></td>
</tr>
<tr>
<td>Av. feed cost [h/day, LE]</td>
<td>1.20±0.158</td>
<td>1.40±0.081</td>
<td>1.75±0.081</td>
<td></td>
</tr>
<tr>
<td>Av. Revenue of DG [h/day, LE]</td>
<td>1.85±0.070</td>
<td>2.35±0.008</td>
<td>3.19±0.017</td>
<td></td>
</tr>
<tr>
<td>Net feed revenue [LE/head]</td>
<td>0.65±0.011</td>
<td>0.94±0.012</td>
<td>1.44±0.081</td>
<td></td>
</tr>
</tbody>
</table>

a, b, c: Means in the same row with different superscripts are significantly [P <0.05] different.
The body weight of F1 Boer male goats was higher significant [P<0.05] than Baladi goats and crosses and indicating a more adaptation to the local environmental conditions which resulted later in higher productive performance.

Average daily gain was also; improved through crossing between Boer and Baladi goats, but the 78.25 g/day gain in Baladi crosses was below the 106.25 g/day observed in Boer goats [Table, 5]. These results are in agreement with the result obtained by Kiang [31] who reported weight gain of 78g/d for the SEA x Norwegian crosses in Mgeta highlands and this value was higher than that obtained by Safari et al. [32]. The performance of meat goats in intensive production in the European moderate climate zone is not well known [33 and 34]. Total DMI/h/d, indicated significant [P<0.05] difference among different experimental groups.

Higher significant [P<0.05] DMI was recorded by pure Boers [863.71 g/h/d] in compare with lower [P<0.05] intake for pure Baladi male kids [568.84 g/h/d]. Boer × Baladi crosses consumed intermediate DMI value [681.41 g/h/d]. This result was mainly related to significant [P<0.05] daily gain differences among different experimental groups. Safari et al [32], reported that genotype influenced weight gains with a difference of 11, 27, and 16 g/d in favor of crossbreds.

In addition, the differences in growth rate between genotypes were lowest in animals at lower ages, suggesting lowest heterosis expression at early ages. Feed conversion was found to significantly [P<0.05] different among the different experimental groups. Better feed conversion ratio for males of Boers [8.15 kg DMI/kg gain], lower feed conversion for male of pure Baladi [9.32 kg DMI/kg gain], and an improved [FC] ratio for Boer × Baladi crosses, which estimated as [8.71 kg DMI/kg gain].

The better feed conversion recorded for male Boers might be mainly related to their faster gain due to breed differences and vice versa for local male Baladi goats. The intermediate value of feed conversion of Boer × Baladi crosses [8.71 kg DMI/kg gain] cleared the positive improvement occurred in local Baladi males due to crossbreeding practice program. In a similar study, [35] found that birth weight; weaning weight and average daily gain were improved by crossing Spanish, Nubian, or Angora with Boer goats. Boer and Spanish crosses were reported to have higher dry matter intake, average daily gain than pure Spanish goats [36]. Studies conducted in the United States of America had shown that Boer × Spanish goats indicated improved feed conversion ratio over that of purebred Spanish goats [36]. Furthermore, Lewis et al. [37] reported higher body weight and body weight gain for Boer goat crosses than for pure Spanish goats, although feed conversion ratio was similar. Numerous studies had shown that feed conversion ratio is highly negatively correlated with average daily gain. This implies that the selection for lower feed conversion ratio would result in higher growth rate, or vice versa [38; 39; 40] and Sheridan et al. [41]. As expected, the average daily gain and feed efficiency were increased by the crossbreeding practice. Data of the present study [Table, 5] suggested that crossbreeding with higher genetic breeds like Boer in intensive feeding program is a necessity if maximum body weight gain is the production goal.

**Economical study of male kids of different experimental groups:**

The cost benefits were calculated by subtracting the total cost from total return and are presented in [Table, 5]. Price per kg kid goats reported by meat market for one year old age [2013], was [30 LE per kg] of kid goats. The higher feed cost/h/day [LE] was recorded by Boer male goats, due to their higher significantly [P<0.05] DMI/h/day [836.7 g/h/d], while a vice versa result was expected for Baladi male goats, due to their lower significantly [P<0.05] daily feed intake [568.84 g/h/d and 1.20 LE/h/d]. Boer × Baladi crosses indicted more economic value [1.40 LE/h/d], confirming the benefits of crossbreeding practice as a good managerial process to improve the performance of Baladi goats [Table, 5]. The gross return was found to be significantly higher [P<0.05] in the Boer kids than the other two Baladi groups. In the present study, crossbreeding between Boer and Baladi goats resulted in higher weight gain in F1 Boer × Baladi crossbred kids compared to Baladi kids who in turn led to reduce the cost of production [Table, 5 and Fig., 3], and maximized the net profit value.

**Conclusions:**

The present study shows that using Boer bucks significantly improves growth rates of crossbred kids, and might prove valuable for the overall returns of the farms that will adopt this crossbreeding scheme. Conditions in Egypt are favorable for raising Boer x Baladi crossbred kids due to increased potential for productive rate. The genetic potential of the Boer breed with regards to meat production are promising. Therefore, should be that introduction of exotic breeds with a proper study on their ability to adapt to local conditions, the Boer goat must be considered as the base for any future work aiming to enhance Egyptian goat production.

**REFERENCES**


