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Comparative study on the performances of local and their crosses with Boer goats

S DAS[1], G P MOHANTY[2], S K MISHRA[3], C R PRADHAN[4], S K DASH[5] and S P SAHOO[6]

Orissa University of Agriculture and Technology, Bhubaneswar, Odisha 751 003 India

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ABSTRACT

For this comparative study, 50 kids of each of both Boer crossbred goats and local goats were supplemented with concentrate @100g, 150g and 200 g / head / day during 3–4 months, 4–6 months and 6–9 months of age, respectively. The birth weight and fortnight interval body weight of the goats were recorded. The biometric measurements of the goats were recorded at birth and at 3 monthly intervals. At 9 months of age, serum minerals and biochemical profile of the goats were determined. The body weight of Boer crossbred goats was significantly higher than that of local goats. The body length, height at withers, height at croup, chest girth, and paunch girth values of Boer cross goats and local goats differed significantly between the breeds in all the ages of study except the oblique body length of Boer crossbred and Local female kids at birth, oblique body length of Boer crossbred and local male kids at 3 months. The serum protein, serum glucose, serum albumin and serum globulin levels between male and female goats of local and Boer crossbred goats did not differ significantly. The serum calcium, phosphorus, magnesium, copper and zinc levels between male and female goats of local and Boer crossbred goats did not differ significantly. The economics of production of Boer crossbred goats were found to be better than that of local goats. From this experiment, it may be concluded that Boer crossbred goats have higher growth rate with better net return per animal than that of local goats.

Key words: Biochemical profile, Boer cross, Economics, Growth, Kid

Boer goat is one of the best known meat breeds in South Africa and is well known for its fast growing nature and higher production of muscle in the carcass than any other breed (Warmington and Kirton 1990) which is widely exploited in crossbreeding programmes. Cameron *et al.* (2001) showed that Boer breed improved meat production of local goat breeds through crossbreeding. A few studies have been done to improve the performance of the local breeds through crossbreeding of this exotic breed (Keskin *et al*. 2006). Goat genotype had a significant influence on the growth rate of kids (Dhanda *et al*. 2003). Considering the better performances as observed by many authors, the crossbreeding programme with use of Boer goat was undertaken and the present research work undertaken to compare the production potential of local and their crosses with Boer goats in Odisha.

MATERIALS AND METHODS

For the present study, 50 kids of each of both Boer crossbred goats (G_1) and local goats (G_2) were selected in the State livestock breeding farm, Chiplima, Sambalpur, Odisha. The kids in both the groups were housed under semi-intensive system of management. The kids were maintained in wooden batten flooring combined with sand flooring. Clean drinking water was made available throughout the day. The floor space provided was @ 6 sq.ft/ kid. Initially, mother milk was the only source of nutrition for the kids till weaning and after weaning of kids, all the study groups were fed with concentrate @100g / head / day during 3–4 months of age, 150g / head / day during 4–6 months of age and 200 g / head / day during 6–9 months of age. The concentrate feed with crude protein (CP) 18% and total digestible nutrient (TDN) 72% (calculated) was provided in the afternoon i.e. at 4 PM. The ingredient composition and proximate composition of the experimental feed is presented in Table 1. All the experimental animals were allowed for grazing/browsing for 8 h daily from 8 AM to 4 PM. The body weight of the goats was recorded at birth and subsequently at fortnightly intervals up to 9 months of age. Body weight was recorded in morning hours before the animals were taken for grazing with the help of a weighing balance.

The biometric/ body measurements, viz. straight body length, oblique body length, chest girth, paunch girth, height at withers and height at croup were recorded with a standard measuring tape of 5 m with accuracy of 1mm after the

Present address: [1]Ex-P.G. student (subhrajitdas.bapi @gmail.com), [2]Professor, [4]Professor and Head, Department of Livestock Production and Management, [3]Associate Professor (sumantakmishra@gmail.com), Department of Animal Nutrition, [5]Professor (susantdash46@gmail.com), Department of Animal genetics and Breeding College of veterinary Science and Animal Husbandry. [6]M.V.Sc. Scholar, Punjab Agricultural University, Ludhiana.

Table 1. Ingredient and proximate composition (%) of the concentrate mixture

Ingredients	Per cent	Proximate	Per cent
Maize	35	Dry matter	90.0
Groundnut oil cake	20	Crude protein	18.35
Wheat bran	22	Ash	7.82
Pulse *chunni*	20	Ether extract	11.52
Salt	2	Crude fibre	3.71
Mineral mixture	1	NFE*	58.60

* Calculated.

animals were allowed to stand squarely on an even ground with its head a little high (erect) at birth, 3, 6 and 9 months of age. At 9 months of age of the goats, blood was collected for separation of serum. The serum samples were stored in deep freeze at a temperature of –20°C for analysis. The serum micro minerals like copper, iron, zinc and manganese were estimated by atomic absorption spectrophotometer (AAS) method as per Piper (1966). The concentration of serum calcium, phosphorus, glucose, cholesterol, protein and albumin were estimated by using a commercial kit. The concentration of phosphorus was also estimated by using a kit. To calculate the economics, data were collected pertaining to the aspects of expenditure on feed, labour, medicine and return from sale of animals and manure. The data were analysed statistically (Snedecor and Cochran 1973).

RESULTS AND DISCUSSION

Effect on growth: The body weights increased progressively with advance in age up to 36 weeks (Table 2). The body weight recorded at all the ages in Boer crossbreds goats were significantly (P<0.05) higher than the local goats. Singh (2002) reported better performance of crossbreds goats than that of purebred. Significantly (P<0.05) higher body weight was observed in Boer × local goats than that of local goats at 9 months of age. Similar findings were also reported by Usha *et al*. (2006). They reported that the final body weight was higher in Boer × Kanniadu kids (17.39 ± 0.90 kg), followed by Boer × local (16.20 ± 0.52 kg), Kanniadu (15.63 ± 0.53 kg) and local (13.44 ± 0.41 kg) at 9 months of age. The ADG was observed to be highly significant (P<0.05) between 2 breeds (Table 3). This might be due to difference in their genotype of both the breeds as genotype had a significant influence on the growth rate of kids (Dhanda *et al*. 2003).

Incidence of mortality: Between 6 and 9 months of age, there was no kid mortality indicating the normal health status of the animal (Table 4). The mortality was higher in Boer crossbred kids than that of local kids between both 0 and 3 and 3 and 6 month age group. The mortality of male kids was higher than female kids in both the groups. Breed with age and sex with age were independent of each other on mortality of kids up to 6 months of age. The present study revealed that age, sex and breed had no influence in incidence of mortality of kids. The mortality showed declining trend with advancement of age which corroborated with the findings of Kumar *et al*. (2002). In the present study, higher mortality in Boer crossbred kid was observed than that of local goats. This might be due to variation in birth weight, litter size, differences in immunity status and acclimatization to the existing management factors (Koul *et al*. 1988).

Table 2. Body weight of Boer CB and local male goats

Age	Male		Female	
	Boer CB	Local	Boer CB	Local
Birth weight	$1.93^{a} \pm 0.06$	$1.56^{b} \pm 0.05$	$1.69^{a} \pm 0.04$	$1.29^{b} \pm 0.07$
2 week	$2.77^{a} \pm 0.06$	$2.15^{b} \pm 0.12$	$2.45^{a} \pm 0.06$	$1.90^{b} \pm 0.08$
4 week	$3.69^{a} \pm 0.05$	$2.83^{b} \pm 0.05$	$3.32^{a} \pm 0.05$	$2.27^{b} \pm 0.04$
6 week	$4.58^{a} \pm 0.09$	$3.55^{b} \pm 0.05$	$4.18^{a} \pm 0.11$	$3.34^{b} \pm 0.08$
8 week	$5.67^{a} \pm 0.05$	$4.24^{b} \pm 0.05$	$5.26^{a} \pm 0.05$	$3.92^{b} \pm 0.05$
10 week	$6.66^{a} \pm 0.05$	$4.89^{b} \pm 0.13$	$6.11^{a} \pm 0.07$	$4.61^{b} \pm 0.07$
12 week	$7.71^{a} \pm 0.08$	$5.66^{b} \pm 0.04$	$7.21^{a} \pm 0.05$	$5.30^{b} \pm 0.15$
14 week	$8.03^{a} \pm 0.05$	$6.58^{b} \pm 0.04$	$7.53^{a} \pm 0.04$	$6.04^{b} \pm 0.05$
16 week	$8.56^{a} \pm 0.04$	$6.86^{b} \pm 0.04$	$8.03^{a} \pm 0.05$	$6.34^{b} \pm 0.05$
18 week	$9.15^{a} \pm 0.06$	$7.15^{b} \pm 0.05$	$8.61^{a} \pm 0.07$	$6.73^{b} \pm 0.05$
20 week	$9.73^{a} \pm 0.11$	$7.42^{b} \pm 0.14$	$9.16^{a} \pm 0.15$	$7.02^{b} \pm 0.05$
22 week	$10.34^{a} \pm 0.05$	$7.85^{b} \pm 0.05$	$9.72^{a} \pm 0.06$	$7.32^{b} \pm 0.06$
24 week	$10.87^{a} \pm 0.06$	$8.26^{b} \pm 0.05$	$10.23^{a} \pm 0.05$	$7.93^{b} \pm 0.18$
26 week	$11.43^{a} \pm 0.06$	$8.84^{b} \pm 0.26$	$11.21^{a} \pm 0.04$	$8.51^{b} \pm 0.04$
28 week	$12.06^{a} \pm 0.04$	$9.32^{b} \pm 0.04$	$11.72^{a} \pm 0.04$	$9.02^{b} \pm 0.04$
30 week	$12.73^{a} \pm 0.13$	$10.24^{b} \pm 0.04$	$12.44^{a} \pm 0.21$	$9.88^{b} \pm 0.05$
32 week	$13.64^{a} \pm 0.07$	$11.09^{b} \pm 0.06$	$13.34^{a} \pm 0.04$	$10.75^{b} \pm 0.04$
34 week	$14.47^{a} \pm 0.06$	$11.91^{b} \pm 0.05$	$14.13^{a} \pm 0.05$	$11.53^{b} \pm 0.05$
36 week	$15.27^{a} \pm 0.15$	$12.67^{b} \pm 0.04$	$14.99^{a} \pm 0.06$	$12.32^{b} \pm 0.06$

Means with different superscripts among the male and female in a row differ significantly (P<0.05).

Table 3. Three month wise average daily gain (g) in weight

Age period	Boer crossbred		Local	
	Male	Female	Male	Female
0–3 months	69.23^{a}±3.14	65.12^{c}±3.42	49.47^{b}±2.87	48.62^{d}±1.82
3–6 months	53.41^{a}±2.66	50.31^{c}±3.43	40.34^{b}±2.76	40.12^{d}±2.65
6–9 months	53.12^{a}±2.45	53.09^{c}±3.12	44.82^{b}±1.88	44.24^{d}±2.57

Means with different superscripts in a row differ significantly (P<0.05).

Table 4. Effect of age, sex and breed on the incidence of mortality

Age groups	Boer crossbred		Local	
	Male	Female	Male	Female
0–3 months	19.23%	12.5%	10.71%	9.09%
3–6 months	11.53%	8.33%	5.57%	4.54%

Body measurement: The body length, height at withers, height at croup, chest girth, and paunch girth values of Boer crossbred and local goats (Tables 5,6) differed significantly (P<0.05) between the breeds in all the ages of study except the oblique body length of Boer crossbred and local female kids at birth, oblique body length of Boer crossbred and local male kids at 3 months, height at withers of Boer crossbred male and female kids at birth, height at croup of local male and female kids at 3 months and paunch girth of Boer crossbred male and female kids at 6 months of age. All the body measurements increased with increase in live weight and age. The present results were in close agreement with the findings of Singh (2002) who reported that body weight, length, height at withers and heart girth of Jamunapari × Blackbengal and Beetal × Black Bengal crossbreds were significantly higher than Black Bengal breeds. However, Usha *et al*. (2006) did not observe any significant difference as regards to paunch girth and body length. Das *et al*. (2002) reported that the body length, height at withers and heart girth of crossbred goats were higher than that of the purebreds. This corroborated with the finding of the present study. As regards to the body measurement values, there were significant (P<0.05) differences observed between male and female goats. Verma and Dixit (2005) and Deokar *et al*. (2007) also reported significantly higher body length in male than that of female goats.

Serum biochemical profile: The serum protein, glucose, albumin and globulin levels between male and female goats of local and Boer crossbred goats did not differ significantly (P>0.05) but higher values were recorded in males than that of female goats (Table 7). This is in agreement with the reported values of Mohanasundari *et al*. (2003). The serum protein value of Boer crossed goats recorded in the present study was lower than Barbari breeds and at par with the Jamunapari goats (Bhoosan *et al*. 2008). The serum cholesterol level of male and female goats (within the breed and between the breed) differed significantly (P<0.05). Higher level of cholesterol recoded in male than female goats might be explained as physiological (Okonkwo *et al*. 2010). According to "The theory of partition of nutrients"

Table 5. Body measurement of Boer CB and Local male goats

Parameters	Birth		3 Months		6 Months		9 Months	
	Boer CB	Local	Boer CB	Local	Boer CB	Local	Boer CB	Local
Straight body length	23.10^{a}±0.14	21.74^{b}±0.07	37.43^{a}±0.08	36.22^{b}±0.09	41.43^{a} ±0.09	40.32^{b}±0.07	50.77^{a}±0.13	47.42^{b}±0.06
Oblique body length	25.34^{a}±0.13	24.50^{b}±0.07	41.29^{a}±0.07	40.16^{a}±0.11	45.76^{a} ±0.09	43.35^{b}±0.07	55.37^{a}±0.11	51.45^{b}±0.07
Height at wither	27.02^{a}±0.12	23.59^{b}±0.06	42.35^{a}±0.08	36.42^{b} ±0.10	48.45^{a} ±0.08	42.95^{b}±0.07	56.28^{a}±0.13	52.63^{b}±0.06
Height at croup	28.25^{a}±0.11	24.34^{b}±0.06	44.47^{a}±0.10	38.42^{b} ±0.10	50.36^{a} ±0.10	44.53^{b} ±0.09	57.56^{a}±0.11	53.8^{b}±0.06
Chest girth	32.04^{a}±0.11	24.99^{b}±0.07	45.23^{a} ±0.07	39.23^{b} ±0.09	49.44^{a} ±0.10	43.36^{b}±0.08	56.34^{a} ±0.12	46.34^{b}±0.08
Paunch girth	28.64^{a}±0.11	23.09^{b}±0.08	47.23^{a}±0.09	40.49^{b} ±0.09	53.12^{a} ±0.08	44.84^{b}±0.08	57.31^{a} ±0.11	47.34^{b}±0.07

Means with different superscripts in a row differ significantly (P<0.05).

Table 6. Body measurement of Boer CB and Local Female goats

Parameters	Birth		3 Months		6 Months		9 Months	
	Boer CB	Local	Boer CB	Local	Boer CB	Local	Boer CB	Local
Straight body length	21.57^{a}±0.15	20.98^{b}±0.08	35.81 ± 0.08	34.84^{b}±0.10	39.83^{a}±0.09	38.50^{b}±0.07	48.73^{a}±0.12	45.44^{b}±0.07
Oblique body length	23.90^{a}±0.13	23.87^{a}±0.08	39.53^{a}±0.07	38.96^{b}±0.12	44.10^{a}±0.09	41.85^{b}±0.07	53.53^{a}±0.11	49.75^{b}±0.07
Height at wither	26.83^{a}±0.13	23.05^{b}±0.07	41.43^{a}±0.08	35.74^{b} ±0.11	47.59^{a}±0.08	40.70^{b}±0.08	54.82^{a}±0.12	50.52^{b}± 0.07
Height at croup	27.33^{a}±0.12	23.81^{b}±0.07	43.64^{a}±0.10	38.31^{b}±0.12	49.43^{a}±0.10	42.25^{b}±0.10	55.45^{a}±0.11	51.28^{b}±0.07
Chest girth	30.93^{a}±0.11	23.13^{b}±0.08	44.27^{a}±0.07	38.89^{b}±0.10	47.34^{a}±0.10	41.93^{b}±0.08	53.37^{a}±0.11	43.73^{b}±0.09
Paunch girth	27.96^{a}±0.11	21.46^{b}±0.09	46.99^{a}±0.09	39.78^{b}±0.10	52.98^{a}±0.08	42.66^{b}±0.09	53.88^{a}±0.11	44.6^{b}±0.08

Means with different superscripts in a row differ significantly (P<0.05).

Table 7. Serum biochemical and mineral profile of Boer crossbred and local goats

Biochemical parameters	Boer crossbred			Local		
	Male	Female	Average	Male	Female	Average
Cholesterol (mg/dl)	56.86^{ag} ± 1.39	46.36^{ch}±3.24	51.61^{e} ± 2.41	46.42^{bi}± 2.13	39.24^{dj} ±0.97	42.83^{f} ± 1.62
Total protein (g/dl)	6.37±0.25	5.97±0.13	6.17±0.15	6.09 ±0.17	5.84±0.13	5.96±0.11
Serum glucose (mg/dl)	41.504±1.95	37.79±2.26	36.89 ± 1.60	38.954±2.68	36.006±2.45	40.22 ± 1.62
Serum albumin (g/dl)	2.29±0.03	2.37±0.02	2.31±0.02	2.28 ±0.06	2.26±0.03	2.29±0.02
Serum globulin (g/dl)	4.08 ± 0.24	3.60±0.13	3.59 ±0.10	3.80 ±0.16	3.58±0.16	3.94 ±0.14
Calcium (mg/dl)	6.93 ± 0.17	6.46 ± 0.05	6.71 ± 0.11	6.63 ± 0.07	6.43 ± 0.18	6.53 ± 0.09
Phosphorus (mg/dl)	4.12 ± 0.10	3.70 ± 0.08	3.91 ± 0.09	3.84 ± 0.11	3.64 ± 0.07	3.74 ± 0.07
Magnesium (mg/dl)	1.08 ± 0.09	0.90 ± 0.03	0.99 ± 0.05	1.00 ± 0.09	0.91 ± 0.05	0.96 ± 0.05
Copper (ppm)	0.96 ± 0.03	0.89 ± 0.03	0.92 ± 0.02	0.92 ± 0.07	0.84 ± 0.04	0.88 ± 0.04
Zinc (ppm)	1.53 ± 0.05	1.59 ± 0.04	1.56 ± 0.03	1.55 ± 0.06	1.46 ±0.04	1.50 ± 0.03

Means with different superscripts in a row differ significantly (P<0.05). ^{ab} between breeds (males), ^{gh} between sexes (Boer crossbred), ^{cd} between breeds (females), ^{ij} between sexes (Local), ^{ef} between breeds (average of male and female).

Table 8.Statement of cost and returns of rearing per one Boer crossbred and Local goat in semi-intensive system

Sl. No.	Details of the expenditure	Boer × Local		Local	
		Male	Female	Male	Female
1.	Feed cost (₹) Concentrate feed @ 30.15 kg to each goat and feed cost @ Rs 14/kg	422.10	422.10	422.10	422.10
2.	Labour cost (₹)₹ 90/ labour / day @ 1 labour for 75 goats	324.00	324.00	324.00	324.00
3.	Veterinary and medicine cost (₹)₹ 3/ goat / month	27.00	27.00	27.00	27.00
A.	Total cost (₹)	773.00	773.00	773.00	773.00
4.	Sale of goats @ ₹ 140/ kg live weight	2,174.40	2,132.40	1,810.40	1,754.40
5.	Sale of manure @ ₹ 2/ kg (65.5 kg manure in case of Boer CB goats and 57.3 kg in case Local goats	131.00	131.00	114.60	114.60
B.	Total return (₹)	2,305.40	2,263.40	1,925.00	1,869.00
C.	Net return (B–A) (₹)	1,532.40	1,490.40	1,152.00	1,096.00

(Hammond 1957), at maturity, fat metabolism was reported to be dominant while comparing with protein metabolism. This might be the explanation for higher cholesterol and lower protein level at maturity as observed in the present study. The glucose level, recorded in the present study, was lower than the normal reported value of glucose (50.00–75.00 mg/dl) (Kaneko *et al*. 1997) but the cholesterol level was within the reported range.

Serum mineral profile: As regards to serum phosphorus level, lowest phosphorus level was observed in local female goats and highest was observed in Boer crossbred male goats (Table 7). The serum magnesium, copper and zinc levels of male and female goats of both the breeds were almost similar to each other. The serum calcium, phosphorus, magnesium, copper and zinc levels of local and Boer crossbred goats between male and female did not differ significantly (P>0.05). Also no significant (P>0.05) difference was observed in those mineral profile between these breeds. Bhoosan *et al*. (2008) reported higher calcium and phosphorus levels in Barbari and Jamunapari breeds. But Pandey *et al*. (2006) reported lower serum calcium and phosphorus level in Marwari goats than that of both local and Boer crossbred goats. Dhok and Rekhate (2008) reported higher level of copper in male than female goats. This is in agreement with the present study. However, they reported low level of serum zinc in male than that in female goats. The serum zinc level was lower than the level of zinc reported by Bhoosan *et al*. (2010), but the observed serum copper levels corroborated with their findings.

Economics of production: The feed and labour costs were the major cost in total expenditure (Table 8). Shinde *et al*. (2000) reported that the feed cost accounted nearly 63% and the labour involvement in grazing flock was a major factor in expenditure. In the present experiment, net return per animal was ₹ 1,532.40, ₹ 1,490.40 in Boer crossbred male, female and ₹ 1,152.00, ₹ 1,096.00 in local male, female goats respectively. The results were in close agreement with the findings of Shinde *et al*. (2000). Usha *et al*. (2006) reported that net return per animal was

₹ 420. 68 in local, ₹ 561.49 in Kannaidu, ₹ 600.78 in Boer × Local and ₹ 682.46 in Boer × Kannaidu. Crossbreds were fetching better economic return than pure breeds which corroborated with the present findings.

From this experiment, it may be concluded that Boer crossbred goats have higher growth rate with better net return per animal than that of local goats.

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