GROWTH AND CARCASS CHARACTERISTICS OF BARBARI KIDS AS INFLUENCED BY CONCENTRATE SUPPLEMENTATION

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Abstract

Castrated Barbari kids with an average age of 5 months were used to evaluate effects of different feeding regimes, i.e., tree leaves mixture (TLM) ad lib (T1), TLM ad lib + C (T2) and TLM + G (1:1) ad lib + C (T3) under stall fed conditions on body weight, growth rate, body measurements, carcass yield, carcass physical composition and non-carcass components. TLM consisted of equal proportions of Pipal (*Ficus religiosa*), Gular (F. *glomerata*) and Pakar (F. *infectoria*), C was concentrate supplement primarily composed of maize, groundnut cake and wheat bran and G was natural grass given in a 1:1 ratio with TLM for Treatment 3. The TLM + concentrate group had higher ($P < 0.05$) final body weight (19.6 vs 15.4 kg) and average daily gain (60 vs 30 g) compared with the TLM group ($P < 0.01$), and statistically T2 and T3 were similar. The overall mean final body measurements at the slaughter age of 10 months were 57.7, 51.6, 57.2, 63.2, 25.4 and 31.3 cm for height, length, heart girth, paunch girth, thigh and neck circumference. Among these measures, body length (48.3 vs 53.3 cm) and neck circumference (29.3 vs 32.3 cm) were increased ($P < 0.05$) by concentrate supplementation compared with the TLM treatment. The T1 group had highest ($P < 0.05$) shrinkage loss (10.5%) after fasting. Hot carcass weight ranged from 5.7 to 8.4 kg, dressing percentage on fasted body weight was 41.5 to 45.6 and dressing percentage on empty body weight basis was 48.2 to 49.8. Concentrate supplementation influenced carcass weight ($P < 0.05$) and dressing percentage relative to fasted body weight ($P < 0.01$). However, the effect of diet on dressing percentage relative to empty body weight was not significant. Overall mean proportions of primal cuts of the carcass were 32, 12.6, 13.2, 28.1 and 14% for leg, loin, rack, shoulder and neck and breast and shank, respectively. The proportion of lean meat was not affected by treatments. However, concentrate supplementation increased ($P<0.01$) total fat percentage and reduced total bone proportion ($P<0.05$) compared with TLM fed goats. Lean meat to bone ratio was 2.25:1, 2.42:1 and 2.36:1 for T1, T2 and T3, respectively. The corresponding value for the lean meat to fat ratio was 10.3:1, 6.66:1 and 6.06 1, respectively. Both traits were significantly affected by diet. Backfat thickness, loin-eye area and weights of liver, kindeys, spleen and non-carcass fats were also significantly affected by feeding regimes. It was concluded that stall-fed kids kept on TLM or TLM + natural grass should be supplemented with concentrate for higher growth rate and better chevon production.

1. Introduction

Poor growth rate is a major factor limiting goat production, and plane of nutrition can markedly improve weight gain. Goats spend more than 90% time in browsing on top feeds and hardly 10% on grazing, even when sufficient top feeds are not available. Natural grasses as such or as hay could serve as roughage sources for goats (Parthasarthy et al., 1998). Roughage alone does not support optimal growth, due to insufficient protein and energy levels. Top feeds are relatively rich in crude protein but poor in energy. However, supplementation with readily fermentable energy sources like concentrates has improved performance of kids (Paul et al., 1990). The present investigation was conducted to evaluate influences of concentrate supplementation on body weight, body measurements, growth rate and carcass characteristics of Barbari goats in a feeding system based on tree leaves while in stall conditions.

2. Materials and Methods

The study was carried out at the College of Veterinary Science and Animal Husbandry, Jabalpur, India. Sixteen castrated Barbari kids with an average age of 5 months and body weight of 10.7 kg were randomly

allotted to three groups of 6, 5 and 5 kids each. The T1 treatment entailed feeding of a tree leaves mixture (TLM) consisting of Pipal (*Ficus religiosa*), Gular (*F.glomerata*) and Pakar (*F.infectoria*) in equal proportions (on a fresh basis). The T2 treatment was TLM + concentrate mixture (45% maize, 31% groundnut cake, 21% wheat bran, 2% mineral mixture and 1% common salt 1%). The T3 treatment consisted of TLM + natural grass (1:1) + concentrate. The concentrate had calculated levels of 20% CP and 70% TDN and was given at the rate of 300 g/d up to 15 kg body weight and thereafter at approximately 400 g/d until slaughter.

The tree leaves mixture was made into bundles and hung for each kid in the individual pens to assist in plucking the leaves. They were let loose 3-4 hours daily in the fenced paddock for exercise. Water and feeds were given ad libitum to all animals, and mineralized salt lick was also given ad libitum to the TLM group. Feedstuffs and offered diets were analyzed for proximate constituents (AOAC, 1980) and for phosphorus and Calcium (Talapatra et al., 1940).

The individual weight of the kid was recorded at fortnightly intervals in the morning before watering and feeding. Similarly, measurements were taken on the following body parts with a measuring tape: body length (point of shoulder to the pinbone), body height (base of the hoof to the highest point of the wither), heart girth, (circumference of the body immediately behind the fore-legs), paunch girth (around the circumference of the umbilicus), neck girth (circumference at the base of the neck) and thigh circumference (around the middle of the thigh)

After feeding for 5 months, kids were slaughtered at an average age of 10 months by Halal method for carcass evaluation. They were fasted for 24 hours from feed, however, water was available ad libitum. After bleeding for an average of 5 minutes, skinning and evisceration was conducted similar to routine commercial procedures. The carcass was disjointed into five primal cuts, i.e., leg, loin, rack, shoulder and neck and breast and shank as per ISI specification (1963). Weights of the hot and chilled carcass (4-6^{0}C for 24 hours), edible offal components (liver, kidneys, heart and spleen), non-edible offal components (blood, skin, head, lung with trachea, gastro-intestinal tract, hooves, gall bladder (full) and ingesta) and non-carcass fat were recorded. Measurements of loin-eye area and backfat thickness were also made using a planimeter and scale, respectively. Statistical analysis was carried out using completely randomized design (Snedecor and Cochran, 1967). Percentage values were also transformed in to arcsine units for statistical analysis.

3. Results and Discussion

3.1 Proximate Composition

Results of chemical analysis (Table 1) for individual tree leaves such as Gular, Pipal and Pakar for each of the proximate constituents were very similar to reports of Banerjee (1991) and Majumdar and Momin (1960). However, Ranjhan (1997) recorded a slightly higher CP value for Pakar. This discrepancy might have been due to variation in the stage of harvest and the fertility of the land.

3.2 Body Growth

The TLM + concentrate fed group had greater ($P < 0.05$) final body weight (19.6 vs 15.4 kg) and average daily gain (60.3 vs 30 g) compared with the TLM group ($P < 0.01$). Statistically, T2 and T3 were similar. A similar significant improvement of kid performance (41.1 vs 18.2 g/d) was reported due to concentrate supplementation of Barbari kids kept on khejri leaves (Nagpal et al.,1990). The average daily gain recorded (33 g) with Berseem hay fed to Barbari kids (Singh and Rekib, 1979) was also comparable to the value obtained from TLM feeding (Table 2) in the present study.

The kids fed T2 and T3 had higher body height, heart girth, paunch girth, thigh circumference, and body length and neck circumference than the T1 group. The latter two measurements, however, were greater ($P<0.05$) for groups receiving concentrate (53.3 for body length and 32.3 cm for neck circumference) than for the TLM fed group (48.3 and 29.3 cm, respectively; Table 3). Hence, concentrate supplementation affected skeletal development of kids. There was no statistical difference between the two supplemented

groups (Table 3). The overall mean final body measurements were 57.72, 51.64, 57.21, 63.24, 25.38 and 31.25 cm for height, length, heart girth, paunch girth, thigh circumference and neck circumference respectively when the dietary treatment values were averaged. The average values for body height, heart girth and neck circumference are in agreement with the report for male yearling goats of Kushwaha (1996)

Table 1. Proximate composition of experimental feeds (% DM basis)

Feeds	DM	CP	EE	CF	NFE	TA	Ca	P
Concentrate	90.25	21.52	4.10	9.02	57.56	7.80	0.17	0.75
N. grass	32.40	6.37	1.91	33.40	49.03	9.29	0.39	0.12
Gular	34.80	13.18	2.81	15.60	54.26	14.15	2.72	0.37
Pipal	36.80	9.23	3.20	25.20	46.27	16.10	3.25	0.20
Pakar	34.40	13.11	2.92	18.32	54.19	11.46	2.61	0.21
T1	39.70	12.08	3.07	21.70	49.75	13.40	2.60	0.23
T2	89.86	18.91	3.43	16.40	51.36	9.90	1.26	0.38
T3	91.00	16.00	3.35	19.30	51.65	9.70	0.87	0.41

Table 2. Average growth rates of Barbari kids fed different feeding regimes

Dietary Group	Body weight		Gain	% increase in BW
	Initial	Final		
	Kg		g/d	
T1	10.85 ± 0.38	15.35^{a} ±0.79	30.0^{a} ±3.4	41.5
T2	10.60 ± 1.34	19.64^{b} ±1.52	60.3^{b} ±3.3	85.3
T3	10.64 ± 1.00	18.08^{ba} ±1.11	49.6^{b} ±5.3	69.9

Column means bearing different superscripts differ significantly

Table 3. Mean final body measurements (cm) of Barbari kids under different feeding systems

Parameter	T1	T2	T3	Pooled mean
Height	54.75 ±0.74	59.60 ±2.31	58.80 ±0.86	57.72
Length	48.33^{a} ±0.91	52.80^{b}±1.69	53.80^{b}±1.10	51.64
Heart girth	54.83 ±0.80	58.80 ±1.93	58.00 ±1.15	57.21
Paunch girth	61.92 ±1.22	64.50 ±2.23	63.30 ±1.02	63.24
TC	23.33 ±0.87	26.70 ±1.06	26.10 ±1.06	25.38
NC	29.25^{a}±0.44	32.90^{b}±0.94	31.60^{b} ±0.83	31.25

Means with different superscripts in a row differ significantly (P<0.05)
TC= Thigh circumference

NC= Neck circumference

3.3 Carcass Characteristics

Hot carcass weight was higher (P < 0.05) in T2 (8.39 kg) than in T1 (5.72 kg), and differences between T2 and T3 were not significant (Table 4). Concentrate supplementation of the browsing of tree leaves increased carcass weight (P < 0.01) in Beetal x Sirohi kids (Paul et al., 1990), and also in Jamunapari goats fed *L. leucocephala* leaves (Srivastava and Sharma, 1997).

Dressing percentage based on fasted body weight was 41.5, 45.6 and 45.2 for T1, T2 and T3, respectively, which was affected ($P < 0.01$) by supplementation with the concentrate mixture. However, the effect of diet on dressing percentage based on empty body weight was nonsignificant (Table 4). The dressing percentages were within the range of the reported values for Barbari kids (Agnihotri and Pal, 1997).

The mean fasting loss was 10.49, 6.20 and 5.78% in groups T1, T2 and T3, respectively, and the difference was significant ($P<0.05$; Table 4). A similar trend was observed in Muzaffarnagari lambs in which the high and low roughage groups had 13.8 and 5.6% losses, respectively (Hyder et al., 1979).

Pooled average proportions of the primal cuts were 32.0, 12.6, 13.2, 28.1 and 14.0% for leg, loin, rack, shoulder and neck and breast and shank, respectively. None of the cuts were significantly affected by dietary treatment. A similar trend was observed by Srivastva and Sharma (1997) in Jamunapari goats. Percentage lean meat in each cut was not affected by diet. However, numerically leg had the highest and breast and shank the lowest proportion of lean meat. The proportion of fat was higher ($P < 0.01$) in loin, rack, shoulder and neck for T2 and T3 vs T1 (Table 5). Similar observations also confirmed that the percentage of fat increased significantly with increase in energy level (Bhuyan et al., 1996)

Concentrate supplementation resulted in a higher ($P < 0.05$) lean meat to bone ratio (2.42:1) than sole feeding of TLM (2.25:1; Table 4). Likewise, Prasad et al. (1980) reported a significant effect of concentrate supplementation on meat:bone ratio. The lean meat to fat ratio was higher ($P<0.05$) for the TLM group than for groups supplemented with concentrate (Table 4), probably due to the lowest fat proportion in the TLM fed kids. Concentrate supplementation resulted in higher ($P < 0.01$) backfat thickness (1.36 mm) and loin eye area (9.65 cm^2) compared with the TLM group (0.5 mm and 6.23 cm^2)

The percentage of edible offal components (slaughter weight basis) was not significantly influenced by the supplementation (Table 6). Kumar et al. (1991) also reported that dietary variation did not affect the percentage of liver, kidneys, heart and spleen of Gaddi goats.

The proportions of head and ingesta with excreta were lower ($P < 0.01$) and other proportions (blood, empty alimentary tract and hooves) were also lower for concentrate supplemented groups (Table 6). Noncarcass proportions of individual parts (skin, blood, and ingesta with excreta) reported by Pal and Agnihotri (1999) for Barbari kids are in agreement with the present findings. Diet significantly influenced the weights of kidney ($P < 0.05$) and mesentric fat ($P < 0.01$; Table 6).

4. Conclusion

Concentrate supplementation significantly improved growth rate and carcass yield over the sole feeding of TLM. Thus, stall-fed Barbari kids maintained on TLM or TLM + natural grass can be supplemented with concentrate for higher growth rate and chevon production.

Table 4. Carcass characteristics of stall-fed Barbari kids as affected by feeding regimes

Characteristics	T1	T2	T3
Initial body weight (kg)	10.85 ±0.38	10.60 ±1.34	10.64 ±1.00
Final body weight (kg)*	15.35^{a}±0.79	19.64^{b} ±1.52	18.08^{ba} ±1.11
Shrunk body weight (kg)*	13.75^{a} ±0.76	18.44^{b} ±1.48	17.04^{ba} ±1.07
Empty body weight (EBW) (kg)*	11.85^{a} ±0.66	16.87^{b} ±1.28	15.56^{b} ±0.97
Fasting Loss (%)*	10.49^{a} ±1.28	6.20^{b} ±0.72	5.78^{b} ±1.17
Hot carcass weight (HCW) (kg)*	5.72^{a} ±0.36	8.39^{b} ±0.66	7.71^{b} ±0.52
Chilled carcass weight (kg)*	5.69^{a} ±0.34	8.31^{b} ±0.65	7.63^{b} ±0.49
Dressing % on FBW**	41.52^{a} ±0.46	45.55^{b} ±0.28	45.18^{b} ± 0.20
Dressing % on EBW	48.19±0.48	49.75 ±0.43	49.45± 0.21
Total lean meat (%)	64.56 ±0.23	63.55 ±0.15	62.69±0.34
Total fat (%)**	6.27^{a} ±0.82	9.88^{b} ±0.89	10.52^{b} ±0.64

Total bone (%)*	28.83^{a} ±0.29	26.32^{b} ±0.50	26.63^{b} ±0.25
Meat:bone*	2.25:1^{a} ±0.04	2.42:1^{b} ± 0.07	2.36:1^{ba}± 0.04
Meat:Fat*	10.30:1^{a} ±1.18	6.66:1^{b}±0.61	6.06:1^{b}±0.40
Back fat thickness (mm)**	0.50^{a} ±0.04	1.36^{b} ±0.07	1.26^{b} ±0.08
Loin eye area (cm^{2})**	6.23^{a}±0.54	9.65^{b} ±0.94	10.0^{b}±0.98

Shrunk BW= Fasted BW= Slaughter body weight
^{a,b} row values with different superscript differ significantly. *P<0.05; **P<0.01
EBW= Fasted BW-GIT contents

Table 5. Mean proportion of lean meat, fat and bone of different primal cuts (%)

Traits	Tr	Leg	Loin	Rack	Shoulder and Neck	Brea
Meat	T1	68.86± 0.25	67.95± 0.37	64.30 ±0.27	64.75 ±0.42	56
	T2	69.64 ±0.59	65.13 ±0.55	61.92± 0.81	63.83 ±0.15	57
	T3	67.40 ± 0.70	65.00 ±0.50	61.83 ±0.34	64.48 ±0.50	54
Fat	T1	4.85 ±0.94	7.69^{a}±0.76	3.23^{a} ±0.84	7.18^{a} ±1.16	8
	T2	6.89 ±1.47	14.46^{b}±0.83	7.07^{b}± 0.95	11.09^{b} ±0.79	9
	T3	6.75 ± 0.76	14.46^{b}±0.68	7.95^{b}± 1.35	11.14^{b} ±1.19	12
Bone	T1	26.17^{a}±0.47	23.55^{a}±0.31	32.47 ±0.48	27.31 ±0.67	34
	T2	22.95^{b}±0.26	20.16^{b}±0.08	31.00 ±1.29	24.74 ±0.68	32
	T3	25.06^{ba}±0.29	20.54^{b}±0.13	30.23± 0.81	24.38 ±0.92	32

ab values with different superscript in a column for each cut and trait differ significantly (P<0.01)

Table 6. Average offals (%) and weight of noncarcass fat (g) of Barbari kids under different feeding regimes

Traits	T1	T2	T3
Liver	1.90 ±0.07	1.93 ±0.24	2.07 ±0.13
Kidneys	0.38 ±0.07	0.37 ±0.07	0.40 ±0.06
Heart	0.44 ±0.07	0.46 ±0.13	0.45 ±0.10
Spleen	0.19 ±0.08	0.25 ±0.16	0.22 ±0.14
Edible offals (total)	2.91 ±0.03	3.01 ±0.23	3.14 ±0.08
Blood	5.20 ±0.34	4.81 ±0.41	4.98 ±0.18
Head**	8.22^{a} ±0.33	7.04 ±0.33	6.97^{b}±0.12
Skin	8.52 ±0.27	9.08 ±0.42	8.76 ±0.30
Ingesta + excreta **	13.82^{a}±0.67	8.39^{b}±0.74	8.64^{b}±0.35
Lung + trachea	1.21±0.16	1.21±0.20	1.20±0.23
EAT	9.67±0.42	9.15±0.52	9.29±0.54
Gall Bladder (Full)	0.08±0.10	0.10±0.09	0.10±0.10
Hooves	2.13±0.20	2.09±0.21	0.10±0.14
Kidneys fat*	36.5^{a}±8.29	133.2^{b}±32.33	111.4^{b}±22.38
Heart fat	38.17±6.04	77.4±20.00	52.2 ±6.00
Mesentric fat**	180.17^{a}±25.11	481.40^{b}±83.95	344.6^{ba}±57.15

EAT = Empty alimentary tract
ab values with different superscripts in a row differ significantly, * P<0.05; **P<0.01

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