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Effect of feeding of hydroponic maize on growth performance osmanabadi goats

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Abstract
The hydroponic maize fodder diets were evaluated in Osmanabadi goats for 84 days. The six goats (8-10 month age) was divided into three groups in switch over design and fed T_1: dry roughages *ad lib* + green fodder, T_2: dry roughages *ad lib* + 30% hydroponic green maize + 70% green maize and T_3 :dry roughages *ad lib* + 40% hydroponic green maize + 60% green maize with concentrate mixture to all groups. It was observed that hydroponic green maize containing 18.20, 15.05, 10.93, 06.84, 64.46 and 02.72 per cent DM, CP, CF, EE, NFE and Total Ash respectively. The average daily DM intake was higher in T_3 (929.99 g) followed by T_2 (827.98 g) and T_1 (773.00 g) whereas, DMI was observed as 4.27, 4.42 and 4.74 kg/100kg BW in T_1, T_2 and T_3 groups, respectively. The mean daily body weight gain was observed highest in T_3 (56.33 g) followed by T_2 (46.50g) and T_1 (39.83 g). The mean gain in body length, chest girth and wither height were observed to be highest in T_3 (5.70, 6.15 and 6.81 cm) followed by T_2 (5.22, 5.55 and 6.33 cm) and T_1 (4.71, 4.71 and 6.00 cm). The total cost of feeding per kg body weight gain was found lowest in T_3 followed by T_1 and T_2. The treatment (T_3) 40% hydroponic maize fodder fed showed better and desirable result as compared with T_1 and T_2 treatment. Thus, feeding of 40% hydroponic maize fodder with concentrate and roughages improve the growth performance of Osmanabadi goats in terms of body weight gain and economical.

Keywords: Body weight, dry matter intake, feeding, goats, hydroponic fodder

Introduction
The Vidarbha region comprise of eleven districts having different climatic zones and different cropping pattern. The region provides number of goats; however the constraints like summer temperature non availability of irrigation facilities for growing fodder crop have given at setback for improvement of dairy industry in the region. The conventional method of rearing goats in the rural area is to allow them for grazing on community grazing land or common village grazing forests. Such common grazing areas are diminishing day by day due to urbanization or encroachments, creating pressure on this sector. Further, land under cultivation for green fodder in the country is less than 4 percent. (Dikshit and Brithal, 2010) [6] estimated India would require 526, 855 and 56 million tons of dry fodder, green fodder and concentrate, respectively and hence would be difficult to make use of greens in feeding of goats, as the productive and reproductive efficiency is adversely affected due to unavailability of good quality green fodder.

Sprouting is a simple technique to germinate the seeds for the improvement of their nutritive value (Amal *et al*., 2007) [3]. Development of this planting system has enabled the production of fresh fodder from Oats, Barley, Wheat and other grains (Rodriguez *et al*., 2004) [13]. Nutritional value of sprouted grain improves due to the conversion of complex compounds into simpler and essential form and by minimizing the effect of anti-nutritional factors during germination (Chavan and Kadam, 1989) [5]. Sprouting of grains can be used efficiently as it has resulted not only in increased protein quantity but quality also. This is further complemented by increased sugars, certain minerals and vitamin contents. However, sprouting reduces total starch and dry matter content of grains (Lorenz, 1980) [9]. Germination eliminates the effect of phytic acid by the production of phytase enzyme and increases the plant enzyme contents (Shipard, 2005) [15]. During germination, Protease enzymes are activated that convert the protein polymers into amino acids and small peptides (Shewry *et al*., 1995) [14].

Hydroponic green fodder plays an important role in conservation of soil, water and time. It requires only about 3-5% of water needed to produce same amount of forage produced under field condition (AI-Karaki *et al*., 2012) [2]. For producing one kg of hydroponic maize fodder, about 1.50 liters to 3.0 liters of water is required (Naik *et al*., 2013) [13]. Thus, the low productivity of animal is an account of under feeding and lack of knowledge for balanced feeding.

There is a great nutritional benefit provided by hydroponic sprouted fodder to optimize the general health and performance of young animals while minimizing the feed cost. In India, a limited research has been done on feeding value of hydroponic fodder for livestock's.

There is a great nutritional benefit provided by hydroponic sprouted fodder to optimize the general health and performance of young animals while minimizing the feed cost. Hence attempt was made to evaluate the "effect of feeding of hydroponic maize on growth performance of Osmanabadi goats."

Material and Methods

The hydroponic green maize was cultivated in unit setup at livestock instructional farm using 75 per cent green shed net cover for maintaining optimum temperature (22-27˚C) and humidity (70%) equipped with semi-automated sprayer irrigation. The trays size 2X1.5 ft. with hole at the base to allow drainage of excess water. Daily requirement of maize hydroponic fodder is obtained by rotational soaking and sprouting of maize seed. Average 6-7 kg hydroponic maize fodder was produced from 1 kg maize seeds on 8th day**.** Six Osmanabadi goats (8-10 months BW.15kg) were divided into 3 groups of two and each group was allotted to one of the 3 dietary treatments in switch over design. Treatment (T_1) comprised dry roughages *ad lib* + green fodder, (T_2) dry roughages *ad lib* + 30% hydroponic green maize + 70% green maize and (T_3) dry roughages *ad lib* + 40% hydroponic green maize + 60% green maize. The concentrate mixtures were supplied to balance energy and protein to all the groups. Goats were dewormed before starting the feeding trial and fed similar ration for 84 days. All the treatments consist of 3 periods having 28 days duration with a 10 days gap period to nullify the effect of previous feeding. Daily dry matter and water consumption were recorded. Goats were weighted using weighing balance. The biometric measurements viz., body length, chest girth, and wither height of all goats were recorded weekly before access to feed and water. The sample of feed and fodder for dry matter, crude protein, crude fibre, ether extract, and total ash were analyzed (AOAC 1995) [1]. The cost of feeding was calculated by taking the prevailing ration and feed ingredients. The data were analyzed statistically as per the procedure given by Amble (1975) [4].

Results and Discussion

The proximate compositions of hydroponic green maize, green maize, gram straw, concentrate mixture are presented in Table 1. It was observed that the CP, EE and NFE content in hydroponic green maize fodder was more than green maize and lower CF content indicates higher palatability. The present findings are agreeable with previous reports (Weldegerima, 2015, Naik *et al*. 2014 and Muthuramalingam *et al*. 2015.) [18, 14, 10]

The data on DMI, growth performance, water intake and feed conversion efficiency are illustrated in Table 2. The total DMI and DMI per 100 kg body weight was significantly ($P < 0.05$) higher in group T_3 which indicates that incorporation of hydroponic maize fodder in the diet increase the palatability. Similar observation were noticed by Weldegerima, (2015) [18] reported that average DM Intake of growing goat was highest due to addition of hydroponic maize and barley fodder in T_5 (504.51 g/D) while T_2, T_1, T_3 and T_4 value were at par with each other. Tudor *et al*. (2003) [16] measured intake and live weight change in 17 steers that received low quality hay and barley sprouts over 70 days. During the first 48 days cattle ate 1.9 kg DM/head/day of sprouts (15.4 kg wet weight) and 3.1 kg DM/head/day of poor quality hay and gained 1.01 kg DM/head/day.

The daily body weight gain was observed highest in group T_3 (56.33 g) followed by T_2 (46.50) and T_1 39.83 g. The total gain in body length, chest girth and wither height were observed to be highest in T_3 (5.70, 6.15 and 6.81 cm) followed by T_2 (5.22, 5.55 and 6.33 cm) and T_1 (4.71, 4.71 and 6.00 cm). The highest body weight gain and body measurement in goats fed with experimental ration might be due to better intake and utilization of hydroponic green maize over control. The similar finding were reported by Weldegerima, (2015) [18] for hydroponic maize and Fayed *et al*. (2011) [7] for barley sprout and Kulkarni (1990) [8] on Beetal x Osmanabadi kids.

The average water intake per 100 kg body weight was lowest in group T_3 (4.56 lit.) followed by T_2 (4.81 lit.) and T_1 (5.02) over an experimental period. This might be due to highest moisture in hydroponic maize fodder.

The feed conversion efficiency (feed per kg body weight gain) were influence significantly by different dietary treatments indicated that goats fed with 40% hydroponic maize to group T_3 significantly lowest dry matter per kg weight gain than group T_1 and T_2. This might be due to enhance digestibility of nutrients and nutritive value.

The cost of feeding presented in Table 3 indicated that cost of feed per kg body weight gain was lower in group T_3 (Rs. 200.19) than group T_2 (Rs. 213.87) and T_1 (Rs. 209.63) indicated that incorporation of 40% hydroponic green maize was found to be economical. Similar result were reported by Venkateshwarlu *et al*. (2014) [17] for maize based complete ration.

Table 1: Proximate principles of experimental feeds fed to goats (% DM basis)

Particulars	Hydroponic green maize	Green maize	Gram straw	Concentrate mixture
DM	18.20	25.35	89.30	89.70
CP	15.05	11.76	06.56	16.53
CF	10.93	31.16	31.14	07.67
EE	06.84	03.82	06.92	06.44
NFE	64.46	47.20	44.23	59.07
Total Ash	02.72	06.06	11.14	10.26

Table 2: Dry matter intake, body measurement and feed conversion efficiency for the experimental groups

Particulars		T_1	T_2	T_3	S.E.(m) ±	C.D. at 5%	F test
Initial weight (kg)		14.80	14.90	15.10	-	-	-
Final weight (kg)		18.23	18.80	19.81	-	-	-
Daily DMI /day (g)	Gram straw	362.4	399.06	467.06	-	-	-
	HMF	-	74.85	113.41	-	-	-
	Green maize	231.2	174.67	170.12	-	-	-
	Concentrate mixture	179.40	179.40	179.40	-	-	-
	Total DMI(g)	773.00	827.98	929.99	0.01	0.03	Sig
DMI /100 kg body weight		4.27	4.42	4.74	0.06	0.20	Sig
Daily weight gain (g)		39.83	46.50	56.33	0.001	0.003	Sig
Total weight gain (kg)		3.43	3.90	4.71	0.04	0.15	Sig
Total gain in body length (cm)		4.71	5.22	5.70	0.002	0.007	Sig
Total gain in chest girth (cm)		4.71	5.55	6.15	0.011	0.04	Sig
Total gain in wither height (cm)		6.00	6.33	6.81	0.01	0.03	Sig
DM to water intake ratio		1:1.17	1:1.08	1:0.96	-	-	-
Conc to roughage ratio		1:2.03	1:2.23	1:2.61	-	-	-
FCE (feed DM/kg weight gain)		19.40	17.85	16.51	-	-	-

Table 3: Economics of feeding of experimental goats under different treatments

Particulars	Treatment					
	T_1		T_2		T_3	
	Quantity (Kg)	Amount (Rs)	Quantity (Kg)	Amount (Rs)	Quantity (Kg)	Amount (Rs)
Gram straw @ 5Rs/kg	0.406	2.03	0.447	2.23	0.523	2.615
Concentrate @ 19 Rs/kg	0.200	3.80	0.200	3.80	0.200	3.80
Green maize @ 3Rs/(kg)	0.912	2.73	0.689	2.06	0.671	2.01
Hydroponic maize fodder @ 4.5 Rs/Kg including production cost	-	-	0.411	1.84	0.623	2.80
Total feed (kg)/day	1.518	-	1.747	-	2.017	-
Daily feeding cost (Rs)/animal	-	8.56	-	9.93	-	11.22
Total feeding cost for 84 days (Rs)/animal	-	719.04	-	834.12	-	942.90
Cost of feed Rs/kg gain in body wt	-	209.63	-	213.87	-	200.19

Conclusion

Based on the findings of present study, it was concluded that hydroponic green maize is superior in respect of crude protein (CP) content, ether extract (EE) and nitrogen free extract (NFE) than the green maize and lowest crude fibre content indicates higher palatability. Inclusion of 40% hydroponic green maize in the diet of Osmanabadi goats increases the DMI, improve the growth performance in terms of body weight, body length, chest girth and wither height and economics in term of body weight gain.

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