Original Research

Economic Evaluation of *Moringa oleifera* Leaves as a Dietary Supplement in Sirohi Goat Kids

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Abstract

A 6 months study was carried out on forty kids of Sirohi goat, which were randomly divided into five groups of eight in each group on the basis of same age and uniform conformation to evaluate the economics of Moringa oleifera leaves as a dietary supplement in Sirohi goat kids. The group T_1 offered 60% Methi straw (Trigonella foenum-graecum) as a roughage and 40% commercially available readymade concentrate feed and in groups T_2, T_3, T_4 and T_5, the commercially available readymade concentrate feed were replaced by Moringa oleifera leaves at 25%, 50%, 75% and 100% levels, respectively. The economics were calculated at the end of 6 months on the basis of actual cost of feed and fodder, total feed cost per goat kid, feed cost per kg live body weight gain, income and profit from body weight gain, net profit/kg live body weight, cost – benefit ratio and input – output ratio . The results showed that the lowest feed cost per kg of live body weight gain was found in group T_4 (Rs. 131.39) followed by T_3 (Rs. 142.04), T_5 (Rs. 159.56), T_2 (Rs. 168.92) and T_1 (Rs. 204.62). The highest net profit per kg live body weight gain was found in group T_4 (Rs. 162.89) followed by T_3 (Rs. 158.61), T_5 (Rs. 142.60) and T_2 (Rs. 145.66) when compared to T_1 (Rs. 128.78). The cost – benefit ratio for group T_1, T_2, T_3, T_4 and T_5 was 0.63, 0.86, 1.12, 1.24 and 0.89, respectively and input – output ratio was 1:1.63, 1:1.86, 1:2.12, 1:2.24 and 1:1.89 for group T_1, T_2, T_3, T_4 and T_5, respectively. Thus, results indicate lowest feed cost per kg of live body weight gain and highest profit per kg of live body weight gain of goat kids when 75 per cent of readymade concentrate feed was replaced by M. oleifera leaves. It was concluded that Moringa oleifera leaves can be used as an alternate for readymade concentrate feed in the diet of goat kids due to its high crude protein contents, lower feed cost per kg of live body weight gain and higher profit per kg of live body weight gain.

Key words: Economics, *Moringa* Leaves, Sirohi Goat

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Introduction

Livestock resources in India especially small ruminants play an important role in economy of country. Goats are most important ruminant species of economic value to the small and marginal farmers and landless laborers in the country. In India, they constitute very valuable and renewable resources across all ecological zones and fulfill an important socio-economic role in traditional farming system. They are the important tool for development of rural economy as nearly 5 million (Sharma and Sen, 2001). In India, there are 135.17 million goats, 26.40% of total livestock population out of which 16.03% goats found in the state of Rajasthan (Indian livestock census - 2012). Goat is an animal of great importance to the livestock industry in India and goat farming in India is the backbone of economy of small and landless farmers. It is also well known that goat is superior then other ruminants in efficiency of nutrient utilization. Goat is most hardy animal and during draught and famine conditions the goat is the last animal to die. This ability is due to their habits of feeding on a wide variety of feed stuffs. It is not only raised for meat purpose but its milk is also of high nutritive value. So it is also called as 'mini cow' or 'poor man's cow'. It is an insurance against crop failure and provides alternate source of livelihood to farmers all the year round. As due to recurrent occurring of famine, rearing of large animal has become difficult and less economic. A major constraint to animal production in developing countries is the scarcity and fluctuating quantity and quality of the year-round feed supply. These countries experience serious shortages in animal feeds of the conventional type (Singh and Makkar, 2014).

Moringa tree is a drought-tolerant, fast-growing, multi-purpose and one of most useful tree due to its medicinal and nutritional properties in world and therefore described as a 'miracle tree' (Fuglie, 2003, Amaglo, 2006, Yisehak *et al.*, 2011, Ashfaq *et al.*, 2012). Moringa is a perennial plant that can be harvested several times in one growing season and also has the potential to reduce feed cost of livestock ration. Moringa can easily be established in field, and has good cropping ability, as well as good potential for forage production. It can reach 12 m height at maturity and yield up to 120 tonnes of fodder per hectare per year, when it is planted very densely for use as forage (Makkar and Becker, 1996). Additionally, it is not affected by any serious diseases in its native or introduced ranges (Parrotta, 2013).

The rearing of livestock is an integral part of the economy of most of the developing countries. The economy of the Indian farmer is based to a large extent on animal production. However, production is quite low as the animal is undernourished for a significant part of the year. The low productivity is exacerbated by long calving intervals and a late age of puberty. Crop residues and low quality forages are the major feed resources. The primary constraint to ruminant production on such feeds is the low efficiency of feed

utilization. The goat production is an important sector of agro - economy of India and in Indian sub - continents. Low capital investments and higher economic returns have been the unique features of small and marginal goat production system (Devendra, 2013). Goat products have provided health promoting constituents to health conscious consumers and thus contribution of goat is increasing to the rising demand of animal products. However, the productivity of farm animals in most tropical countries is generally low, mainly due to poor quality and inadequacy of available feeds. Usually, farmers tried to feed their animals through crop residues and poor quality hay that are little in nitrogen, high in lingo-cellulose (Sultana *et al.*, 2014) and poor in vitamin and mineral contents, which leads to low digestibility and reduced voluntary intake (Gerbregiorgis *et al.*, 2012). It is an insurance against crop failure and provides alternate source of livelihood to farmers all the year round. As due to recurrent occurring of famine, rearing of large animal has become difficult and less economic. The major sources of income from goat are milk, meat, hair, pashmina and manure.

Further, it is evident that due to the occurrence of frequent draught and famine the rearing of large ruminants have been difficult and uneconomical and therefore, small ruminants are the only means of maintaining inter and intra year economy of farmer. Hence, the present study was aimed to investigate the economical performance of Sirohi goat kids fed different levels of *Moringa oleifera* leaves.

Adegun and Aye (2013) evaluated the growth performance and economic analysis of West African Dwarf Rams fed *Moringa oleifera* and cotton seed cake as protein supplements to *Panicum maximum*. In their experiment *Moringa oleifera* leaf meal (MLM) replaced cotton seed cake (CSC) at 0, 25, 50, 75 and 100 per cent level in a concentrate supplement and denoted as Diet 1, 2, 3, 4 and 5 respectively. Their study revealed that, the cost of feeding Diet 1 was higher as compared to Diet 2, 3, 4 and 5 and the minimum cost of feeding was observed in Diet 5 that replaced 100 per cent of CSC with Moringa leaf meal. The cost per metabolic weight gain was observed to be significantly low in diets with graded levels of replacement of CSC by *Moringa oleifera* leaf meal as compared to group 1 which was maintained as control. They also observed significant reduction in cost per kg live metabolic body weight with increasing level of supplementation. They concluded that MLM can completely replace CSC as protein source in a concentrate mix fed to WAD sheep as supplement to basal *Panicum maximum* diet. Ahmad *et al.* (2017) evaluate the effect of feeding different levels of dry *Moringa oleifera* leaves (DMOL) on nutrient digestibility, some blood constituents, economic efficiency and performance of suckling buffalo calves. They resulted that DMOL contained 28 per cent crude protein, 6.23 per cent ether extract, 15.39 per cent crude fiber, 41.95 per cent NFE and 8.43 per cent ash (on DM basis). Nutrient digestibility, nutrient values, weight gain, feed conversion and economic efficiency of tested rations were significantly increased with increasing the level of DMOL in the ration up to 15 per cent and decreased afterwards at 20 per cent level, which was nearly similar to control ration.

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Ali (2017) carried out a 90 days study to evaluate the growth performance and feed economics of goats fed *Moringa oleifera* leaf meal incorporated in concentrate mixture. Twelve growing goats aged between 4 to 5 months were selected and were randomly allotted to two dietary regimes as group T0 (control) and group T1, considering their body weight, age and sex. Both the groups were offered similar green and dry roughages. The control group received standard concentrate mixture having 25 per cent CSC, while for T1 group 50 per cent of CSC proportion in standard concentrate mixture was replaced by MOLM. The economics of goat rearing was compared between the two dietary groups using the data generated during the experiment. Except the dietary difference other factors were similar for both the groups, therefore the economics of goat rearing was compared on the basis of feeding cost /kg body weight gain (Rs). It was observed that the average cost of feeding in T0 and T1 group was found to be Rs 875.56 and 790.21 respectively and the feeding cost per kg body weight gain was 195.87 and 173.67 in T0 and T1 groups respectively. The feeding cost per kg weight gain was lower for the T1 group as compared to control group (T0). Lower feeding cost in treatment group also led to higher profit of Rs 20.05 per kg body weight gain. Thus, the results of present study revealed reduced cost of feeding and more profit per kg gain in body weight of goats when 50 per cent of cotton seed cake (CSC) in concentrate was replaced by *Moringa oleifera* leaf meal.

Yusuf *et al.* (2018) observed a nutritional and economic evaluation of *Moringa oleifera* leaf meal as a dietary supplement in West African Dwarft goats. Eighteen WAD bucks weighing 7.0±0.33 kg were used in a completely randomized design to evaluate the effect of diluting a conventional supplement with three levels of *Moringa oleifera* leaf meals on growth performance, hematology and blood biochemical constituents. The MOLM was included in commercial supplement at a rate of 0, 50 and 100 g/kg dry matter. They resulted that the MOLM based supplements had significantly lower feed cost per kg of weight gain and higher profit per kg of weight gain. It was concluded that diluting the commercial supplement with MOLM up to 100 g/kg DM does not impair the nutritional status, growth performance and health status of the goats while reducing the feed cost per gain.

Material and Method

Forty post-weaned Sirohi goat kids of same age and uniform conformation were selected from the Livestock Research Station, Bojunda, Chittorgarh. They were allocated into five groups with eight kids per treatment using completely randomized block design. All the experimental kids were housed separate from other animals in well ventilated and protected shed and provided individual feeder and water buckets. All kids were managed under standard caring, feeding and management practices. The kids were allowed 10 days of adjustment period prior to experimental feeding. All the experimental kids were dewormed at the beginning of experiment by using albendazole as an anthelmintic and were examined periodically for

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parasitic infestation. Kids did not show any symptoms of clinical ailment or external injury and were looked quite healthy during whole experimental period. Methi straw (*Trigonella foenum-graecum*) were used as a roughage, commercially available readymade feed were used as a concentrate feed and *Moringa oleifera* dry leaves were used as experimental feed for feeding of Sirohi goat kids. *Moringa oleifera* leaves were harvested from the moringa plots of the Livestock Research Station, Bojunda, Chittorgarh. The collected moringa leaves were sun dried on thick plastic sheets and used for feeding.

The group T_1 offered roughage and commercially available readymade concentrate feed in ratio of 60:40 and groups T_2, T_3, T_4 and T_5, the readymade concentrate feed were replaced by *Moringa oleifera* leaves at 25%, 50%, 75% and 100% levels, respectively. Feeding trials of six months were conducted for all the treatment groups. During entire period of experiment, measured quantity of feed were provided to each animal every morning. The economics was calculated at the end of six months of experimental period. The feed cost was calculated based on actual cost of feed and fodder at Livestock Research Station, Bojunda, Chittorgarh, Rajasthan and Department of Livestock production Management, College of Veterinary and Animal Science, Navania, Udaipur, Rajasthan. The cost of methi straw, readymade concentrate feed and *Moringa oleifera* was Rs. 500/Qtl, Rs. 2100/Qtl and 2600/Qtl, respectively. The total feed cost per goat kids during the experimental period was calculated and from that feed cost per kg live body weight gain was worked out. The market rate of goat kid on the basis of live body weight gain was Rs. 245/Kg. The income from body weight gain was calculated from market rate of goat kid on the basis of live body weight gain and from that net profit from body weight gain and net profit/kg live body weight was worked out.

Result and Discussion

Economic consideration is most important aspect of livestock production. In present scenario, it is necessary to provide balanced feed at optimum cost, thus economizing the production. In present study, the economics of *Moringa oleifera* as a dietary supplement in goat rearing was compared between all the dietary groups using the data recorded during the experiment. Except the dietary difference other factors were similar for all the groups, therefore the economics of *Moringa oleifera* as a dietary supplement in goat rearing was compared on the basis of feed cost /kg body weight gain (Rs). The details of economics are given below in Table 1.

The feed cost per kg live body weight gain of goat kids were Rs. 204.62, 168.92, 142.04, 131.39 and 159.56 for group T_1, T_2, T_3, T_4 and T_5, respectively. The difference in feeding cost per kg live body weight gain of goat kids was Rs. 35.70, 62.58, 73.23 and 45.06 in group T_2, T_3, T_4 and T_5, respectively when compared to group T_1. From the results, the feed cost per kg of live body weight gain was found lowest in group T_4 followed by T_3, T_5, T_2 and T_1. Income from body weight gain, gunny bags and dung was Rs. 1783.69, 2176.9, 2717.84, 3051.63 and 2613.65 for group T_1, T_2, T_3, T_4 and T_5, respectively. The net profit in group

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T_1, T_2, T_3, T_4 and T_5 was Rs. 688.95, 1007.96, 1433.82, 1689.13 and 1233.45, respectively and the net profit per kg live body weight gain was Rs. 128.78, 145.66, 158.611, 162.89 and 142.60 for group T_1, T_2, T_3, T_4 and T_5, respectively. The income, net profit and net profit per kg live body weight gain was highest in group T_4 followed by T_3, T_5, T_2 and T_1.

Table 1: Comparative economics of experimental groups

S. No.	Particulars	Treatment Groups				
		T1	T2	T3	T4	T5
1	Average roughage consumed/ goat kid (kg)	57.62	58.94	62.13	63.37	61.8
2	Average commercially available concentrate feed consumed/ goat kid (kg)	38.41	29.47	20.71	10.56	0
3	Average *Moringa oleifera* leaves consumed/ goat kid (kg)	0	9.82	20.71	31.69	41.2
4	Total feed consumed/goat kid (kg)	96.03	98.23	103.55	105.62	103
5	Cost of feed					
	a. In Rs/ 100 Kg	1140	1190	1240	1290	1340
	b. In Rs/kg	11.4	11.9	12.4	12.9	13.4
6	Cost of roughage consumed/goat kid (Rs) Rs 5/kg	288.09	294.69	310.65	316.86	309
7	Cost of commercially available concentrate feed consumed/ goat kid (Rs) Rs 21/kg	806.65	618.85	434.91	221.8	0
8	Cost of *Moringa oleifera* leaves consumed/ goat kid (Rs) Rs 26/kg	0	255.4	538.46	823.84	1071.2
9	Feed cost/goat kid (Rs)	1094.74	1168.94	1284.02	1362.5	1380.2
10	Body weight gain (kg)	5.35	6.92	9.04	10.37	8.65
11	Feed cost/ kg live body weight gain (Rs)	204.62	168.92	142.04	131.39	159.56
12	Income from body weight gain (Rs) Rs 245/kg	1310.75	1695.4	2214.8	2540.65	2119.25
13	Income from sale of gunny bags (Rs) Rs 2/bag	12 (6 bags)	10 (5 bags)	6 (3 bags)	4 (2 bags)	0
14	Income from sale of dung (Rs) Rs 1/kg	460.94	471.5	497.04	506.98	494.4
15	Net profit (Rs)	688.95	1007.96	1433.82	1689.13	1233.45
16	Net profit/ kg live body weight gain (Rs)	128.78	145.66	158.61	162.89	142.6
17	Cost – benefit ratio	0.63	0.86	1.12	1.24	0.89
18	Input – output ratio	01:01.6	01:01.9	01:02.1	01:02.2	01:01.9

The cost – benefit ratio for group T_1, T_2, T_3, T_4 and T_5 was 0.63, 0.86, 1.12, 1.24 and 0.89, respectively and input – output ratio was 1:1.63, 1:1.86, 1:2.12, 1:2.24 and 1:1.89 for group T_1, T_2, T_3, T_4 and T_5, respectively. The lowest feed cost and highest profit was found in group T_4 followed by T_3, T_5, T_2 and T_1. Thus, results indicate lowest feed cost per kg of live body weight gain and highest profit per kg of live body weight gain of goat kids when 75 per cent of readymade concentrate feed was replaced by *Moringa oleifera* leaves. Plant leaf meal and tree foliage have been reported to be cost effective protein source that can be used in ruminant feeding (Kholif *et al.*, 2015). The results obtained in present study are in agreement with Adegun and Aye (2013), Ali (2017) and Ahmad *et al.* (2017), they observed significant reduction in cost per kg live body weight gain with increasing level of supplementation.

Conclusion

Based on the results of present study, it was concluded that improvement in profit on replacement of

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readymade concentrate feed with *Moringa oleifera* leaves in diet of goat kids. *Moringa oleifera* leaves can be used as an alternate for concentrate feed in the diet of goat kids due to its high crude protein contents, lower feed cost per kg of live body weight gain and higher profit per kg of live body weight gain. It is recommended that replacing 75% of readymade concentrate feed with *Moringa oleifera* leaves could be used as an economical and easily available protein supplement for goat kids.

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