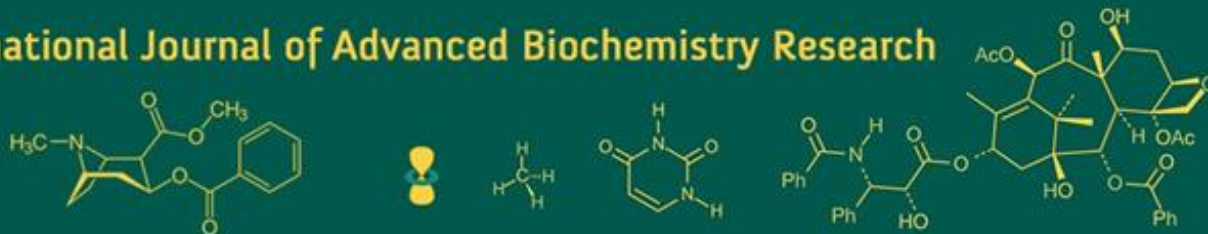


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Effect of dietary feed supplementation on growth performance, feed conversion efficiency and economic returns of goats

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Abstract

The present study was conducted to evaluate the effect of feed supplementation and strategic deworming on the growth performance, feed conversion efficiency and economic returns of goats reared under farmers' field conditions. A total of 50 goats maintained by five farmers were included in the study. Each farmer maintained ten goats, comprising five goats in the control group and five goats in the treatment group. Goats in the treatment group received feed supplementation along with deworming, whereas goats in the control group were maintained under the existing farmers' feeding and management practices. The farmer-wise average was considered as one experimental unit ($n = 5$), and the data were analyzed using appropriate statistical procedures. The average initial body weight did not differ significantly between the two groups, indicating comparable baseline characteristics. However, the intervention significantly increased the average final body weight, average daily weight gain and total body weight gain compared with the control group. Feed conversion ratio was significantly improved (lower) in the treatment group, indicating more efficient feed utilization. Although the benefit:cost ratio was numerically higher in the treatment group, the difference was not statistically significant. The results demonstrated that feed supplementation along with strategic deworming enhanced growth performance and feed efficiency under field conditions by improving nutrient utilization and productive efficiency. Therefore, adoption of these interventions may be recommended as a practical and economically feasible strategy for improving goat productivity under smallholder farming systems.

Keywords: Goat, mineral mixture, growth performance, average daily gain, feed conversion ratio, body weight gain, benefit-cost ratio

Introduction

Goat farming is an important livelihood activity for small and marginal farmers in India due to its low initial investment, adaptability to diverse agro-climatic conditions and ability to provide regular income through the sale of meat, milk and breeding stock. According to the 20th Livestock Census, the goat population in India reached 148.88 million, reflecting the growing importance of this species in the rural economy. Despite its economic significance, productivity of goats under traditional production systems remains below potential because of inadequate nutrition and health care practices. Most goats in India are reared under extensive or semi-intensive production systems where nutritional and health management practices are inadequate, resulting in poor growth performance and economic returns.

In district Chandauli, goat farming is widely practiced by smallholder farmers; however, poor growth rate in goat kids remains a major constraint. The major causes of reduced growth are heavy gastrointestinal parasitic infestation and inadequate supplementation of essential nutrients due to improper feeding practices. Farmers generally depend upon grazing and locally available feed resources and rarely provide feed supplements or adopt regular deworming programmes. Consequently, goat kids exhibit lower body weight gain, poor feed conversion efficiency and reduced profitability. Studies have reported that feeds and fodders alone are often deficient in several macro and micro minerals required for optimum growth and health of goats.

Minerals play an indispensable role in various physiological functions including growth, skeletal development, immunity, enzymatic activities and reproductive performance in livestock. Deficiency of minerals adversely affects body weight gain, feed utilization, immune status and overall productivity of goats. Supplementation of mineral mixtures has been shown to improve haemato-biochemical parameters, growth rate and economic returns in goats under field conditions. Mineral supplementation is particularly important in grazing animals that are

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dependent upon mineral-deficient forages and crop residues. Several researchers have demonstrated the beneficial effects of mineral mixture supplementation in goats. Goklaney *et al.* (2021)^[1] reported significant improvement in haemoglobin concentration, packed cell volume, total protein and mineral status following mineral mixture supplementation in goats. Similarly, Shekhar (2020)^[2] observed significantly higher body weight gain and improved mineral profile in Black Bengal goats supplemented with concentrate and mineral mixture. Muthusamy *et al.* (2025)^[3] reported higher final body weight, average daily gain and economic returns in growing goat kids supplemented with mineral mixtures under farmers' field conditions.

Gastrointestinal parasitism is another major factor limiting goat productivity in tropical and subtropical regions. Parasitic infections reduce nutrient digestibility and feed intake, resulting in stunted growth and poor body condition. Young growing kids are particularly susceptible to parasitic burdens. Strategic deworming programmes using broad-spectrum anthelmintics such as Fenbendazole effectively reduce parasitic load, improve nutrient utilization and significantly enhance growth performance in small ruminants. Regular deworming is therefore considered an essential component of profitable goat production systems (Soulsby, 1982; Radostits *et al.*, 2007)^[4-6]. The combined use of mineral mixture supplementation and strategic deworming offers a practical and economically viable intervention for improving growth performance of goat kids under field conditions. Adoption of these technologies can substantially improve body weight gain, feed efficiency and net returns for farmers. Therefore, the present study was undertaken to evaluate the effect of Fenbendazole (@ 5 mg/kg body weight) and a nutritional feed supplement (@ 10 g/day/kid) on the growth performance and economics of goat kids under field conditions in Chandauli district.

Materials and Methods

An On-Farm Trial (OFT) was conducted by Krishi Vigyan Kendra, Chandauli, to evaluate the effect of deworming and mineral mixture supplementation on the growth performance and economic returns of goat kids under farmers' field conditions. A total of 50 goat kids (4–6 months of age) were selected from five farmers of Chandauli district. Each farmer maintained 10 goat kids, which were equally divided into two groups comprising five animals each. The goat kids assigned to T1 (Farmers' Practice) were reared under the existing feeding and management practices without supplementation of dewormer and mineral mixture. The goat kids under T2 (Technology Intervention) were supplemented with Fenbendazole @ 5 mg/kg body weight and mineral mixture @ 10 g/day/kid. The experimental trial was conducted for a period of 90 days. Initial body weight of all experimental animals was recorded at the beginning of the trial, and final body weight was recorded at the end of the experimental period. Average daily weight gain (ADG), total body weight gain, percentage increase in body weight, feed conversion ratio (FCR), net return per animal and benefit-cost (B:C) ratio were calculated to evaluate the productive and economic performance of the intervention. All goat kids were maintained under similar feeding and management conditions except for the technological intervention provided in the treatment group. The economic analysis was carried out using the prevailing market prices of inputs and outputs. The data collected during the study were

compiled and analyzed using standard statistical procedures to compare the performance of different treatments.

Prior to the commencement of the study, participating farmers were provided with training on proper animal feeding practices and the systematic recording of observations related to the experimental parameters.

Results and discussion

The average initial body weight did not differ significantly ($p > 0.05$) between the control and treatment groups, indicating that the animals in both groups were homogeneous before the initiation of the experiment. This confirms that any subsequent improvement in productive performance could be attributed to the nutritional intervention provided in the treatment group rather than pre-existing differences in body weight.

At the end of the experimental period, goats receiving feed supplementation along with deworming exhibited significantly ($p < 0.05$) higher final body weight, average daily gain (ADG), and total body weight gain compared to the control group. The improvement in growth performance may be attributed to enhanced nutrient availability and utilization resulting from feed supplementation and reduced parasitic burden following deworming. The nutrients supplied through feed supplementation support various physiological functions including metabolism, immunity, growth and efficient utilization of dietary nutrients, thereby enhancing growth performance.

The present findings corroborate the observations of Shekhar (2020)^[2], who reported significantly higher body weight gain in Black Bengal goats supplemented with concentrate and mineral mixture under field conditions. The improvement was attributed to enhanced nutrient digestibility and better utilization of dietary nutrients.

Similarly, Yadav *et al.* (2010)^[7] observed that mineral supplementation significantly increased body weight gain in growing goats by correcting mineral deficiencies commonly encountered under grazing conditions. Niaz *et al.* (2017)^[8] also reported that concentrate and mineral supplementation enhanced growth performance and improved metabolic status in goats. Comparable findings were reported by Madibela and Segwagwe (2008), who suggested that mineral supplementation enhances feed utilization efficiency, resulting in superior live weight gain.

The significantly lower feed conversion ratio (FCR) observed in the treatment group indicates better efficiency in converting feed into body weight gain. Improvement in FCR may be associated with enhanced ruminal fermentation, increased microbial protein synthesis and improved digestibility of nutrients. These findings agree with those of Kochapakdee *et al.* (1994)^[9], who demonstrated that strategic nutrient supplementation improves feed utilization efficiency in goats maintained under grazing systems. Likewise, McDowell (2003)^[10] emphasized that mineral deficiencies reduce growth performance, whereas balanced mineral supplementation enhances nutrient utilization and productive efficiency.

Although the benefit: cost (B:C) ratio was statistically comparable between treatments, the numerically higher value in the supplemented group indicates superior economic efficiency. Increased body weight gain associated with only a marginal increase in feeding cost generally improves net returns under field conditions. Similar observations were reported by Shekhar (2020)^[2] in Black Bengal goats and by Kearl (1982)^[11], who emphasized that balanced mineral nutrition

substantially improves economic productivity of small ruminants.

Overall, the findings clearly demonstrate that feed supplementation along with strategic deworming improved growth performance, feed efficiency and economic returns of goats under field conditions. The observed responses indicate that strategic feed supplement can be recommended as an effective nutritional intervention for enhancing productivity of goats reared under farmers' management conditions.

Table 1: Effect of dietary feed supplementation on growth performance and feed conversion efficiency of goats

Parameter	Control	Treatment
Average initial body weight (kg)	8.80 ± 0.17 ^a	9.10 ± 0.18 ^a
Average final body weight (kg)	14.20 ± 0.11 ^b	16.70 ± 0.21 ^a
Average daily weight gain (g/day)	60.00 ± 1.82 ^b	84.44 ± 1.89 ^a
Average total weight gain (kg)	5.40 ± 0.13 ^b	7.60 ± 0.21 ^a
Feed conversion ratio (FCR)	6.90 ± 0.13 ^a	5.50 ± 0.13 ^b
Benefit : Cost ratio	1.76 ± 0.15 ^a	2.04 ± 0.07 ^a

Means bearing different superscripts (a, b) within the same row differ significantly ($p < 0.05$)

Conclusions

The present study demonstrated that feed supplementation along with strategic deworming significantly improved the growth performance and feed utilization efficiency of goats under farmers' field conditions. Although the average initial body weight of goats did not differ significantly between the control and treatment groups, feed supplementation along with deworming resulted in significantly higher final body weight, average daily weight gain and total body weight gain, along with a significantly lower feed conversion ratio. These findings indicate that the intervention enhanced nutrient utilization and growth efficiency. Although the benefit:cost ratio was numerically higher in the supplemented group, the difference was not statistically significant. Overall, the results suggest that feed supplementation along with strategic deworming is an effective and economically viable intervention for improving productivity of goats under field conditions. Therefore, adoption of feed supplementation along with regular deworming may be recommended to improve growth performance and production efficiency of goats, particularly under smallholder farming systems.

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