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ORIGINAL RESEARCH ARTICLE



Comparative study of mash vs pellet feed on growth performance and feed utilization by goat

Sagun Malla¹, Devi Prasad Adhikari¹, Pratik Hamal¹ and Ayush Adhikari^{2*}

¹National Cattle Research Program (NCRP), Rampur, Chitwan, Nepal

²Nepal Polytechnic Institute, Purbanchal University, Nepal

*Corresponding author's E-mail: ayush.adhikari2000@gmail.com

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ABSTRACT

This study was conducted in Bharatpur-11, Chitwan, Nepal, to evaluate the effects of two feed forms (mash and pellet) on the growth performance and feed utilization in goats. Twenty Boer cross female goats, averaging five months in age, were assigned to either mash or pellet feed treatments, with 10 goats in each group, for a 90-day period, with two weeks of adaptation. The experimental animals were given concentrate feed at 1% of their body weight daily, along with ad libitum access to Napier grass and clean drinking water. Both feed types had a dry matter content of 90% and a crude protein level of 17%. Key parameters assessed included feed and forage intake, body weight changes, and feed wastage. Goats on pelleted feed showed a significantly higher average daily weight gain of 62.00 g/day compared to 26.11 g/day for those on mash feed. Final body weights were also greater in the pellet-fed group (28.88 kg) compared to the mash-fed group (25.04 kg). Additionally, pelleted feed led to higher intake of concentrate and forages and significantly reduced feed wastage, with pellet feed waste being 1.22 g/day versus 27.65 g/day for mash feed. These findings indicate that pelleted feed enhances growth performance, feed intake, and feed efficiency in goats. Therefore, this study indicated that pelleted feed is a more effective option for enhancing goat productivity and reducing feed wastage.

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INTRODUCTION

Goat farming is a cornerstone of rural life in Nepal, playing a crucial role in the livelihoods and nutrition of many households. As of the 2020/21 fiscal year, Nepal's goat population was recorded at 13.44 million, with chevon (goat meat) production reaching 70,755 metric tons per annum, accounting for 13.59% of the country's total meat production (DLS, 2022). Despite the substantial goat population, productivity remains low, primarily due to undernutrition caused by a significant disparity between feed demand and supply. The overall feed balance in Nepal shows a deficit of 20.05% in total digestible nutrients (TDN) (Singh & Singh, 2019). Specifically, the TDN requirement for goats stands at 753,328 metric tons, representing 6.1% of the

total annual TDN requirement for livestock in Nepal (Singh & Singh, 2019). Goats, primarily browsers and roughage feeders, often rely on concentrate feeds to supplement their diet and meet specific nutritional requirements. These concentrates are typically available in two forms: mash and pellets. While mash feed is cost-effective, its loose structure can lead to selective feeding and nutrient imbalances. In contrast, pellet feed offers advantages such as improved nutrient distribution and reduced wastage, contributing to better feed efficiency and growth performance in various livestock species (Zhang *et al.*, 2019). The form of concentrate feed can significantly impact the growth performance and feed utilization in goats. Studies have shown that pellet feeds can enhance feed efficiency, growth rates, and overall health in livestock compared to mash feeds

(Ahmed et al., 2020). Pelleted diets tend to reduce feed wastage and improve nutrient intake, leading to better growth performance and feed utilization (O'Meara et al., 2020). However, despite these known benefits in other livestock species, there is a lack of comprehensive studies comparing mash and pellet feeds in goats, particularly under the environmental and management conditions of Nepal. This research gap underscores the need for a detailed examination of the effects of feed form on goat growth performance and feed utilization. The significance of this study lies in its potential to inform better feeding practices that can help mitigate the feed deficit and enhance the productivity of goat farming in Nepal. The aim of this study is to evaluate the comparative effects of mash and pellet feeds on growth performance and feed utilization in Boer cross goats, thereby providing insights that could support improved feeding strategies and boost the sustainability of goat farming in the region.

MATERIALS AND METHODS

Study location

The study was conducted at Bharatpur – 11, Bhojad, Chitwan, Nepal, under controlled conditions to assess the impact of different feed forms on goat growth and feed utilization.

Experimental animals and grouping

Twenty female Boer cross goats, averaging five months in age, were selected for the study. The goats were randomly divided into two groups, with ten goats in each group:

Group 1: Fed with a mash concentrate feed.

Group 2: Fed with a pellet concentrate feed.

Feed composition

Mash feed: 11.38% moisture, 17.06% crude protein, 6.53% crude fat.

Pellet feed: 10.82% moisture, 16.83% crude protein, 6.32% crude fat.

Both concentrate mixtures were sourced from Apollo Feed, Chitwan.

Feeding management: Each goat received concentrate feed equivalent to 1% of its live body weight daily. Ad libitum Napier grass was provided to ensure continuous availability of forage. Regular deworming protocols were followed to maintain optimal health conditions.

Data collection

Feed and forage intake: Daily intake of concentrate feed (g) and green forage (Kg) was measured, as well as feed wastage (g).

Body weight: Live body weight of the goats was recorded fortnightly (Kg) throughout the study period.

Statistical analysis

Data were organized in MS-Excel and analyzed using Minitab 17 software. An independent samples t-test was employed to compare the mean values of growth performance and feed utilization between the mash and pellet feed groups. All comparisons were made at a 5% significance level to determine statistically significant differences between the two groups.

RESULTS AND DISCUSSION

The body weight of goats over the study period for both mash and pellet concentrate treatments is presented in Figure 1. Initially, the average body weight for goats on the mash treatment was 22.69 kg, while those on the pellet treatment averaged 23.30 kg. Over time, goats fed with pellet feed exhibited a more significant increase in body weight compared to those fed with mash feed. At the end of the study, the final body weight for the pellet-fed goats reached 28.88 kg, significantly higher than the 25.04 kg recorded for the mash-fed goats. This result indicates that the pellet form of concentrate mixture more effectively promotes weight gain in growing goats. Figure 2 shows the cumulative intake of concentrate and green forage by goats over the duration of the study. The data reveal that goats in the pellet treatment group consistently consumed more concentrate feed than those in the mash treatment group. By the end of the study, the cumulative concentrate intake for the pellet treatment was 24.1 kg, compared to 18.5 kg for the mash treatment. Furthermore, the cumulative green forage intake was also higher in the pellet group, with 361.7 kg consumed compared to 297.7 kg in the mash group. These findings suggest that pellet feed enhances overall feed intake, including both concentrate and forage, which may contribute to the improved growth performance observed in this group. Table 1 provides a detailed summary of the body weight data for goats on mash and pellet diets. The initial and final body weights, weight gain over 90 days, and overall daily weight gain are all presented. The initial body weights were not significantly different between the two groups. However, the final body weights, weight gain over 90 days, and daily weight gain were all significantly higher in the pellet-fed group compared to the mash-fed group. The average final weight for goats in the pellet group was 28.88 kg, while those in the mash group averaged 25.04 kg. The total weight gain over 90 days was 5.58 kg for the pellet group and 2.35 kg for the mash group, with corresponding daily weight gains of 62.00 g and 26.11 g, respectively. These differences were statistically significant ($p < 0.05$), indicating that pellet feed significantly improves growth performance in goats compared to mash feed.

Table 2 summarizes the average daily wastage of concentrate feed over three 30-day intervals and the total wastage for the entire study period. The data show a significant reduction in

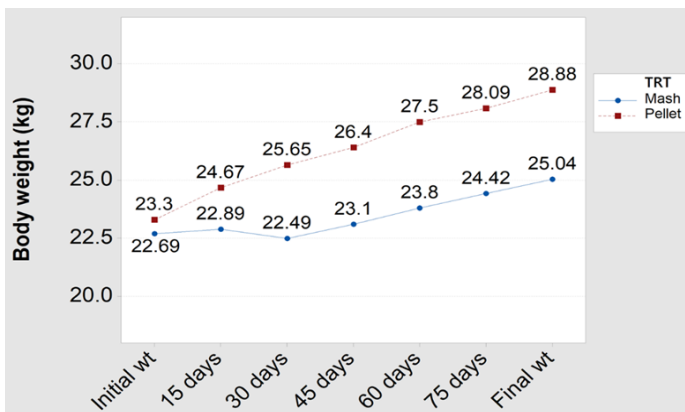


Figure 1. Body weight of goats supplied with two forms of concentrate mixture.

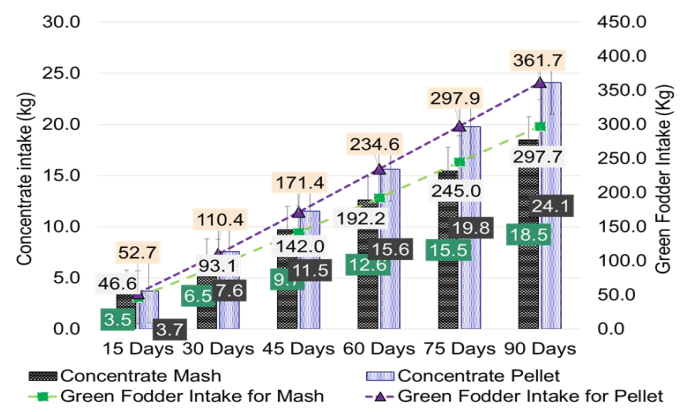


Figure 2. Cumulative concentrate and green forage intake by goat fed two forms of concentrate mixture.

Table 1. Monthly body weight (kg) of goats fed different forms of concentrate.

Body Weight (kg)	Concentrate forms		t ratio	P value
	Mash	Pellet		
Initial Wt	22.69±0.93	23.30±0.56	0.558	0.583
Final Wt	25.04±0.73 ^b	28.88±1.40 ^a	2.420	0.026
Weight gain (0-90 days)	2.35±0.49 ^b	5.58±1.30 ^a	2.320	0.032
Overall daily Wt gain (g/day)	26.11±5.47 ^b	62.00±14.45 ^a	2.320	0.032

Table 2. Average daily wastage of different forms of concentrate fed to goats.

Intervals	Concentrate forms		t ratio	P value
	Mash	Pellet		
0-30 days (g)	15.64±5.72 ^a	0.20±0.11 ^b	2.696	0.014
31-60 days (g)	15.67±3.80 ^a	1.19±0.68 ^b	3.741	0.001
61-90 days (g)	52.31±10.53 ^a	2.32±1.13 ^b	4.719	<0.001
Total wastage (kg)	2.48±0.40 ^a	0.11±0.03 ^b	5.929	<0.001

feed wastage for goats fed with pellet concentrate compared to those fed with mash concentrate. During the first 30 days, the average daily wastage for the mash group was 15.64 g, while it was only 0.20 g for the pellet group. This trend continued throughout the study, with wastage during the 31–60-day period being 15.67 g for the mash group and 1.19 g for the pellet group, and during the 61–90-day period being 52.31 g for the mash group and 2.32 g for the pellet group. The total feed wastage over the entire study period was significantly higher in the mash group (2.48 kg) compared to the pellet group (0.11 kg). These differences were statistically significant ($p < 0.05$), highlighting the superior efficiency of pellet feed in reducing wastage. The results of this study show the clear advantages of pelleted diets over mash diets in improving the growth performance and feed utilization of goats. As shown in Figure 1 and Table 1, goats fed with pellet feed exhibited a significant increase in body weight compared to those fed with mash feed over the study period. The significant increase in body weight and daily weight gain observed in goats fed pelleted diets aligns with previous findings by Ahmed *et al.* (2020). These studies similarly attributed the enhanced growth to higher feed consumption and the uniform nutrient distribution provided by pelleted feeds. Similarly, the results from Malik *et al.* (2021) further support these observations, suggesting that the benefits of pelleted diets extend across different ruminant species. Similarly, Figure 2 shows the significant difference in concen-

trate and green forage intake between the two diet forms, with goats on the pelleted diet consuming more feed ($p < 0.001$). This finding contrasts with the findings of Rashid *et al.* (2016), who reported no significant difference in feed intake between pelleted and mash diets. However, the current study aligns with the work of Malik *et al.* (2020), which showed that goats fed pelleted total mixed rations (TMR) consumed significantly more dry matter compared to those fed chopped TMR. The increased feed intake in the pellet-fed group can be attributed to the ease of consumption and reduced selective feeding behavior. This was also observed by Zhang *et al.* (2019) in lambs, where pelleted diets not only minimized feed wastage but also ensured more consistent nutrient intake, leading to better growth and feed efficiency. Moreover, as detailed in Table 2, goats in the pellet treatment group exhibited significantly lower feed wastage compared to those in the mash treatment group throughout the study period. The significant reduction in feed wastage observed in goats fed pelleted diets emphasizes the practical advantages of this feeding strategy. During the first 30 days, the average daily wastage for the mash group was 15.64 g, whereas it was only 0.20 g for the pellet group. This significant difference ($p < 0.05$) in feed wastage can be attributed to the loose form of mash diets, which allows for selective feeding and increased spillage. Goats are known for their selective feeding behavior, and the compact nature of pelleted feed minimizes this issue, resulting in less wastage and more efficient feed utilization.

Conclusion

Over the course of a 90-day trial with twenty goats evenly divided between mash and pellet groups, the study demonstrated clear advantages of pelleted feed in terms of average daily gain, final body weight, and overall feed intake. While both feed types had similar nutrient compositions, the pelleted feed significantly outperformed mash feed in reducing feed wastage and improving feed utilization. The goats on pelleted feed achieved higher body weight gain and greater feed intake with minimal feed loss. This analysis highlights the critical role of feed form in goat farming, suggesting that farmers adopt pelleted feed to enhance growth performance, maximize feed efficiency, and minimize wastage in goat production systems.

DECLARATIONS

Authors' Contributions: Conceptualization: S.M. and A.A.; Methodology: S.M.; Software and validation: S.M. and P.H.; Formal analysis: S.M. and A.A.; Investigation: D.P.A.; Resources: D.P.A.; Data curation: S.M. and P.H.; Writing—original draft preparation: A.A.; Writing—review and editing: S.M., P.H. and D.P.A.; Visualization: S.M.; Supervision: S.M.; Project administration: D.P.A. All authors have read and agreed to the published version of the manuscript.

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