Berseem Fodder (Trifolium alexandrinum) as roughage and its Effect on Growth and Milk Production of Black Bengal Goats Available in Haor Region of Habiganj District, Habiganj

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Abstract

This study was conducted to know the effectiveness of berseem in growth and milk production of Black Bengal Goat in Habiganj. A Total 15 goat was selected randomly (Completely randomized design-CRD) and group into three experimental groups (T0, T1, T2) 30 days before their expected kidding date and continued for 90 days after parturition during the lactation period. Among this three-treatment group, Control- 60% road sided grass + 40% concentrate; NP- 60% Napier + 40% Concentrate; BS- 60% Berseem + 40% concentrate was provided daily basis. Initial weight of Black Bengal goat was T0, T1, and T2 was 10.75 kg, 10.70kg, 10.73 kg and Final weight was 14.80 ± 0.54kg, 12.52 ± 0.06 kg, 18.86 ± 0.49 kg respectively. Highet weight gain was found in BS (berseem formulated ration- 8.32 ± 0.43kg) with differ significantly and also better FCR was observed in T2(6.15 ± 0.52). Proximate component of berseem fodder possesses highest DM, CP, CF, EE, NFE rather than roughage source of other two group. In consideration of Milk analysis highest milk yield was found in T2 (0.95 ± 0.01 L/day) comparing to T0 (0.60 ± 0.08L/day) and T1 (0.75 ± 0.10L/day). And also, the proportion of Total Solid, Milk fat, protein, Lactose also found higher in T2. In conclusion Berseem fodder can be the best source of roughage in winter season for milk production of Black Bengal goat.

1. Introduction

One of the most prized native small ruminant breeds in Bangladesh is the Black Bengal goat (Capra hircus), which is especially common in the Habiganj district's haor marshes. High reproductive efficiency, excellent meat quality, and environmental adaptability make this breed highly valued(Das et al., 2024; El-Santiel et al., 2011). Its nutritional management under smallholder systems in haor ecosystems has received little attention despite its economic significance. Goat growth performance and milk yield are heavily influenced by nutrition, which has a direct impact on farmers' lives(Malvi et al., 2019; Nazarian et al., 2022; Singh, 2019; Tufail et al., 2020). Goats are mostly utilized to produce meat and milk in Bangladesh, but their skin is also a valuable byproduct that generates a respectable amount of foreign income. The only food source for goats raised in Bangladeshi communities is grass, which has a greater percentage of crude fiber. Berseem clover (Trifolium alexandrinum L.) is an erect, cool-season annual legume grasses. This species has the advantage over other annual species, including annual medics and peas, of providing multiple harvests during the growing season(Adnan et al., 2025; Kale & Takawale, 2025; Kumar, 2025; Rashid, 2025; Shakil et al., 2025). The well-known green fodder crop increases dairy cows' milk production. Because the crop may regenerate quickly and is available for a long time (November to April) as nutrient-rich green fodder. This forage is quite nutrient-dense; it has 15.8–26.7% crude protein, 14.9–28.3% crude fiber, 1.4–3.0% ether extract, 1.40–2.58% calcium, 2.52–4.25% nitrogen, and around 0.14–0.20% phosphorus. The optimum temperature for successful growth is 18–25 C but if temperature falls to 6–8℃ crop severely affected(Adnan et al., 2025; H.H. et al., 2000; Malvi et al., 2019; Pal & Jain, 2024a, 2024b; Pandey et al., 2025; Patel & Rajagopal, 2003; Samanta & Kumar, 2023; Shakil et al., 2025). The growth and development of plant depends on nutrient availability and increase in yield of crop linked with proper nutrient management in crop production systems. The forage productivity enhanced by applying fertilizers and chemical fertilizers have fast effect and only small amounts required for crop growth as they have high nutrient content(Adnan et al., 2025; Chaichi et al., 2015; De Santis et al., 2004; Kale & Takawale, 2025; Karamany et al., 2021; KD et al., 2025; Kumar, 2025; Mahmood et al., n.d.; Malvi et al., 2019; Musa et al., 2021; Nazarian et al., 2022; Pandey et al., 2025; Rashid, 2025; Samanta & Kumar, 2023; Singh, 2019; Tufail et al., 2020; Yadav, 2022). Rearing of goat is the one kind of earning source of haor people, where goat meat and milk is creating direct and indirect employment opportunity. Nowadays the demand of goat milk is increasing because of its nutritional content as well as feeding of newborn infant. Goat milk’s fat contains approximately 30–35% medium chain triglycerides (compared to cow’s 15–20%). This milk production is enhanced by feeding ad libitum roughage such as berseem fodder(El-Santiel et al., 2011lüm, Kamile; Akgün, 2011; Khattab et al., 2025; Wagh et al., 2020). Considering the higher nutritive value and its effect on milk production berseem should be fed largely on goat farms, not only for milk production but also for growth and maintenance. Milk production is the main objective of dairy producers which mainly depends upon the dry matter intake (DMI) of goats. Various factors can affect the DMI, such as goat feeding behaviours, chop length of fodder and feeding frequency. Compare to other ruminant milk, goat’s milk contains higher concentrations of essential fatty acids.

Also known as medium-chain triglycerides, these fatty acids are easily converted into energy and are less prone to fat storage than other types of fats. Berseem is superior to grasses in protein and mineral as well as enhance the production of milk (Gülüm, Kamile; Akgün, 2011; Khattab et al., 2025; Wagh et al., 2020). Due to the global demand of milk production and socio -economic condition of Habiganj districts ensuring ad -li-bitum feeding of this type of roughage like berseem is mandatory.

Although there is a growing amount of literature on the value of berseem fodder for goat growth and maintenance, there is no reason-specific study in Habiganj regarding goat milk production. In summary, we hypothesize that, this study will be able to fill up this research gap, and its conclusions will give Bangladesh's marginal farmers useful knowledge.

2. Materials and methods

This experiment was mainly conducted to use the berseem fodder as roughage in rearing of Black Bengal Goat (Doe) and also know the effect of berseem feeding on growth and milk production. This study protocol was reviewed and approved by the Animal Experimentation Ethics Committee, Habiganj Agricultural University, Bangladesh (**License No. #ANT202601**, **Memo No.: HAU/ANT(Research-01)/Ethical-002/26/002**). Details of the experimental procedures and techniques adopted during the period of the present investigation are given below:

2.1 Cultivation and chemical composition of Berseem Fodder

In this study for preparing the experimental diet berseem fodder was cultivated with the different inclusion level of phosphorus fertilizer. 3 different plot was selected to cultivate berseem fodder P0 = Without Phosphorus Fertilizer, P1 = 60kg/ha P_2O_5, P2 = 90 Kg/ha was used. After cultivation, chemical composition of berseem fodder was analysed by following AOAC(2006)

2.2 Animals, diets, and experimental design

Fifteen pregnant Black Bengal goats, with an average weight of 18.86 ± 0.49 kg and aged between 3 and 4 years, were randomly allocated into three experimental groups 30 days before their expected kidding date. The experiment lasted 120 days, including 30 days before parturition and 90 days after parturition (lactation period). The experimental diets were combined with berseem and Napier with other concentrate mixtures. The ingredient and chemical compositions of the experimental diets are shown in Table 1. Goats were individually housed in 2×2 semi-open sheds with free access to water and fed a diet consisting of a concentrate feed mixture and forage, at a ratio of 40:60 on a DM basis, twice daily at 08:00 and 16:00. The experimental diets were formulated to meet the nutrient requirements of pregnant and lactating goats as outlined by the NRC (2007). To calculate DM intake, the amounts that remained were subtracted from those offered. Weekly samples of the diets and the remnants were collected and then dried in a forced-air oven at 60°C for 48 hours, following AOAC method 930.15 (1997).

Table 1
Ration formulation and proximate composition of concentrate mixture of Experimental Animal

Concentrate (Per 100 kg mixture)		Roughage (Daily basis)	
Ingredient	**Proportion (kg)**	**Type**	**Quantity /day**
Crushed maize	**35**	**Control (Road sided grass)**	**4.5 kg /day**
Wheat bran	**25**	**T1 (Napier)**	**4.5kg/day**
Mustard cake	**20**	**T2 (Berseem)**	**4.5 kg /day**
Soybean meal	**10**		
Mineral mixture	**2**		
Salt	**1**		
Proximate Composition for (Concentrate Mixture)		**DM%**	**89.90**
		CP%	**20.80**
		CF%	**10.5**
		EE%	**2.6**
		Ash%	**3.77**
		NFE%	**62.33**

Table 2
Effect of Berseem fodder on Growth performance

Parameter	Treatments			SEM	P -Value	
	T0	T1	T2		Linear	Quad
IW	10.75	10.70	10.74	0.239	0.905	0.908
FW	14.80ab	12.52b	18.86a	0.212	< 0.001	< 0.001
TWG	3.66b	3.48b	8.33a	0.374	0.020	< 0.001
FCR	7.63a	9.15a	6.15b	0.295	< 0.001	< 0.001
*ab subscript letter indicate significant differences among treatments group						
IW= Initial weight, FW = Final Weight, TWG = Total Weight gain, FCR= Feed Convertion Ratio; T0 = Control (road sided grass), T1 = Napier ,T2 = Berseem Fodder .SEM= Standard Error of Mean						

2.3. Sampling and analysis of milk

Every week, during the morning milking session, milk samples were taken from individual animals. To avoid contamination, udders were properly cleansed and dried before sample. Before being transported to the lab, about 50 milliliters of milk were gathered into sterile polypropylene tubes and kept in an icebox at 4 degrees Celsius. Samples were stored at 4°C upon arrival and

examined within 24 hours. The Association of Official Analytical Chemists' standard procedures were used to estimate the composition of milk, including fat, crude protein, lactose, total solids (TS), and solids-not-fat (SNF) (AOAC, 2019). The Kjeldahl method (N × 6.38) was used to determine crude protein, whereas the Gerber method was used to measure milk fat content. Enzymatic colorimetric techniques were used to determine the lactose concentration. SNF was computed by deducting the fat percentage from total solids, which were obtained by oven-drying at 105°C to constant weight. To guarantee analytical precision and repeatability, every analysis was carried out in triplicate. Throughout the trial, a calibrated measuring cylinder was used to

record each person's milk output every day. For every animal, weekly averages were computed. The impact of Berseem fodder (*Trifolium alexandrinum*) on lactational performance and milk quality of Black Bengal goats was assessed using the gathered data on milk yield and compositional characteristics.

2.4 Statistical Analysis

Data were analyzed using a completely randomized design. Treatment effects were evaluated using one-way analysis of variance (ANOVA). When treatment effects were significant, differences among means were considered significant at $P < 0.05$. Orthogonal polynomial contrasts were applied to determine linear and quadratic responses to increasing treatment levels. The significance of linear and quadratic trends was declared at $P < 0.05$. Results are presented as least squares means with standard error of the mean (SEM). All statistical analyses were performed using standard statistical software.

3. Results

3.1 Dietary ingredients, mixed concentrates, and mixed rations

Three dietary treatments were employed in the experiment, consisting of a control group (T0) and two treatment groups (T1 and T2). The concentrate mixture was kept constant across all treatments, whereas the roughage component differed among the dietary groups. All feed ingredients used for concentrate formulation were collected from local markets in Habiganj District, Bangladesh. The concentrate diets were formulated to be isoenergetic and isonutritive, thereby minimizing the effects of nutrient variation among treatments. The concentrate mixture was provided to the experimental does in mash form throughout the experimental period. The proximate composition and nutritional values of the concentrate mixture were subsequently determined following standard analytical procedures, and the results are presented in Table 1.

3.2. Growth performance and Feed Conversion Ratio

Animals fed the T2 diet achieved the highest FW (18.86 kg), which was 27.4% and 50.6% greater than those of T0 and T1, respectively. Similarly, WG was markedly improved in T2 (8.33 kg) compared with T0 (3.66 kg) and T1 (3.48 kg). The superior growth response observed in T2 suggests enhanced nutrient utilization and greater efficiency of dietary energy and protein conversion into body tissue. In contrast, animals receiving T1 exhibited the lowest FW and WG, indicating that the dietary modification in this treatment may have limited nutrient availability or reduced feed utilization efficiency.

3.3 Chemical composition of berseem fodder at different cutting stage

The chemical composition of berseem fodder was influenced by treatment and harvesting stage (Tables 3 and 4). At the first cut, dry matter (DM) content remained unchanged among treatments ($P > 0.05$). However, crude protein (CP), crude fiber (CF), and ether extract (EE) increased significantly with increasing treatment level (linear, $P < 0.01$), with the highest values observed in **P2.** Nitrogen-free extract (NFE) showed both linear ($P = 0.031$) and quadratic ($P = 0.004$) responses, decreasing in **P2**, while ash content exhibited a significant quadratic effect ($P = 0.006$).At the second cut, DM content increased significantly (linear, $P = 0.018$; quadratic, $P = 0.027$), with greater values in P1and P2 compared with T0. Crude protein displayed a significant quadratic response ($P = 0.004$), reaching the highest value in T1. Crude fiber was unaffected by treatment ($P > 0.05$). Ether extract and NFE showed significant quadratic responses ($P = 0.021$ and $P = 0.006$, respectively), whereas ash content decreased linearly ($P = 0.006$) with increasing treatment level.The increased CP concentration observed at the first cut suggests enhanced nitrogen availability and improved nutrient accumulation in the treated plots. Higher CP content is indicative of improved forage quality and greater nutritional value for ruminants. The concurrent increase in EE may reflect greater synthesis and storage of cellular lipids, while the increase in CF indicates enhanced structural development of the plant. The reduction in NFE in T2 was likely due to the proportional increase in protein, fiber, and lipid fractions.

Table 3

Chemical composition of Berseem fodder (1st Cut)

Parameter(%)	Treatments			SEM	P –Value	
	P0	P1	P2		Linear	Quad
DM	11.57a	10.72b	11.55a	0.267	0.968	0.118
CP	14.90b	17.29ab	19.49a	0.482	<0.001	0.845
CF	25.34b	26.32ab	27.60a	0.345	<0.001	0.694
EE	3.20b	3.41b	4.24a	0.164	0.002	0.048
NFE	37.33a	38.21a	35.08b	0.611	0.031	0.004
Ash	13.63ab	12.23b	15.15a	0.529	0.091	0.006
*ab Subscript indicate the significant level among the treatments group						
P0= without Fertilizer ,P1= 60kg/ha P205,P2= 90kg/ha P2O5; DM= Dry Matter, CP= Crude Protein, CF= Crude Fiber, EE=Ether Extruct, NFE= Nitrogen Free Extruct ,SEM= Standard Error of Mean .						

Table 4

Chemical composition of Berseem fodder (2nd Cut)

Parameter(%)	Treatments			SEM	P -Value	
	P0	P1	P2		Linear	Quad
DM	12.58	14.57	14.58	0.498	0.018	0.027
CP	18.31	19.52	17.67	0.361	0.238	0.004
CF	25.84	26.07	25.58	0.176	0.273	0.169
EE	3.39	3.71	3.52	0.060	0.132	0.021
NFE	37.35	35.78	37.74	0.499	0.742	0.006
Ash	14.12	12.52	12.73	0.314	0.006	0.038
*ab Subscript indicate the significant level among the treatments group						
P0= without Fertilizer ,P1= 60kg/ha P205,P2= 90kg/ha P2O5; DM= Dry Matter, CP= Crude Protein, CF= Crude Fiber, EE=Ether Extruct, NFE= Nitrogen Free Extruct ,SEM= Standard Error of Mean						

3.4 Nutrient Digestibility

Figure 1 illustrates the apparent digestibility of dry matter (DM), crude protein (CP), and total digestible nutrients (TDN) among the experimental treatments. Digestibility coefficients increased progressively with treatment level. The Control group exhibited the lowest digestibility values for DM (approximately 45%), CP (65%), and TDN (50%). Treatment T1 showed intermediate values, with DM, CP, and TDN digestibility increasing to approximately 59%, 70%, and 63%, respectively. The highest digestibility coefficients were observed in T2, reaching approximately 76% for DM, 80% for CP, and 69% for TDN.The superscript letters indicate significant differences among treatments. Digestibility values in T2 (a) were significantly higher ($P < 0.05$) than those of the Control group (b), whereas T1 (ab) showed intermediate values and did not differ significantly from either Control or T2. These results suggest that the dietary treatment improved nutrient utilization, with the greatest response observed at the highest inclusion level.

3.5 Milk analysis

The chemical composition of milk under different dietary treatments (T0, T1, and T2) is presented in Fig. 2. The results demonstrated a progressive increase in all measured milk constituents with increasing treatment levels. Total solids (TS) were highest in T2 (36.5%), followed by T1 (22.0%) and T0 (10.5%). Similarly, milk fat content increased markedly from 2.8% in T0 to 6.0% in T1 and 10.5% in T2.Protein concentration also showed a positive response to dietary treatment, increasing from approximately 3.0% in T0 to 6.2% in T1 and 12.2% in T2. Lactose content followed a similar trend, with values of 4.2%, 7.8%, and 13.2% recorded for T0, T1, and T2, respectively. Ash content, representing the mineral fraction of milk, was also enhanced by treatment, increasing from 0.8% in T0 to 1.5% in T1 and 3.0% in T2.

Overall, milk produced by animals in the T2 group exhibited the highest concentrations of total solids, fat, protein, lactose, and ash, whereas the lowest values were observed in the control group (T0).

4. Discussion

The primary objective of this study was to identify the effect of berseem fodder in goat milk production when it used as the main source of roughage. In case of dietary treatments group ,the superior milk yield and milk composition of Black Bengal goat (doe) was

4.1. Effect of Berseem Fodder in Growth Performance

The absence of significant differences in initial weight among treatments confirms that the experimental groups were comparable at the commencement of the study, thereby minimizing the influence of initial body weight on subsequent growth responses. In contrast, dietary treatments significantly affected final weight, weight gain, and feed conversion ratio, indicating that the nutritional intervention exerted a substantial influence on animal performance.

The greater final weight and weight gain observed in animals receiving the T2 diet suggest improved utilization of dietary nutrients. Enhanced growth performance may be attributed to increased digestibility and availability of nutrients, which promote more efficient deposition of muscle and body tissues. Improved nutrient utilization can increase the supply of metabolizable energy and amino acids required for growth, resulting in greater body weight accretion. The significantly lower growth performance observed in T1 compared with T2 further indicates that the dietary composition of T2 provided a more favorable nutritional environment for animal development.

Feed conversion ratio is a key indicator of production efficiency, and the lower FCR recorded in T2 demonstrates that animals required less feed to produce a unit of body weight gain. This improvement in feed efficiency may be associated with enhanced nutrient digestibility, better ruminal fermentation characteristics, and increased efficiency of nutrient absorption and metabolism. Improved feed utilization reduces nutrient wastage and directs a greater proportion of consumed nutrients toward productive purposes, ultimately enhancing growth performance.

The significant linear and quadratic responses for final weight, weight gain, and FCR indicate that the effects of dietary treatment were dose dependent. The linear response suggests a progressive improvement in performance with increasing treatment level, whereas the quadratic response indicates that the magnitude of improvement was greatest in T2. Such responses are commonly observed when dietary interventions optimize nutrient availability and digestive efficiency.

Overall, the superior performance of animals fed the T2 diet demonstrates the effectiveness of the dietary strategy in enhancing growth and feed utilization. These findings suggest that the inclusion of the tested dietary component at the level used in T2 may improve productive performance by increasing nutrient-use efficiency and promoting greater body weight gain while reducing feed required per unit of growth.

4.2. Chemical Composition of Berseem Fodder at Different Cutting stage

Prior given to the experimentat animal, Berseem fodder was analysed in different cutting stage first and Second). During the first cut, comparatively ,all the values was found high at the same time cut, the increase in DM content indicates greater forage maturity and biomass accumulation. The peak CP concentration in P1suggests that moderate treatment levels may have optimized nitrogen utilization, whereas the decline in P2may reflect a dilution effect associated with increased plant growth. The absence of treatment effects on CF indicates that fiber deposition was relatively stable during regrowth. The decline in ash content with increasing treatment level may indicate reduced mineral concentration due to greater dry matter accumulation. Overall, the results demonstrate that the treatments improved the nutritional quality of berseem fodder, particularly through enhanced crude protein and ether extract contents, with responses varying between cutting stages.

4.3. Effect of Berseem Fodder in digestibility

The improved digestibility of DM, CP, and TDN observed in T1 and T2 indicates that the dietary treatment enhanced nutrient availability and utilization by the animals. The substantial increase in DM digestibility suggests better degradation and fermentation of feed components in the digestive tract, resulting in greater extraction of nutrients from the diet.

Crude protein digestibility increased from approximately 65% in the Control group to 80% in T2, indicating improved protein utilization. Enhanced protein digestibility may be attributed to increased ruminal microbial activity, improved synchronization of energy and nitrogen supply, or favorable changes in feed composition that facilitated protein breakdown and absorption.

Similarly, the increase in TDN digestibility reflects an overall improvement in the utilization of dietary energy. Higher TDN values are generally associated with greater digestible nutrient intake and improved animal performance. The intermediate response observed in T1 suggests a dose-dependent effect of the treatment, while the superior digestibility recorded in T2 indicates that the highest treatment level was most effective in enhancing feed utilization.

Overall, the findings demonstrate that the dietary treatment positively influenced nutrient digestibility, particularly at the T2 level, which may contribute to improved growth performance, feed efficiency, and productive responses in animals.

4.4 Effect of Berseem fodder in milk production

The present findings indicate that dietary treatment significantly improved the chemical composition of milk, as evidenced by the increased concentrations of total solids, fat, protein, lactose, and ash in T2 compared with T0 and T1. The enhancement of total solids suggests improved nutrient utilization and transfer of dietary nutrients into milk synthesis. Higher total solids are desirable because they improve the nutritional value and processing quality of milk.

The increased milk fat content observed in T2 may be attributed to improved rumen fermentation and a greater supply of volatile fatty acids, particularly acetate and butyrate, which serve as major precursors for milk fat synthesis. Similar improvements in milk fat concentration have been reported in dairy animals receiving nutritionally balanced diets rich in fermentable energy and quality forage sources.

The higher protein concentration in T2 indicates enhanced microbial protein synthesis and improved amino acid availability for mammary gland metabolism. Adequate dietary protein and energy synchronization are known to increase milk protein synthesis, resulting in superior milk quality. Similar observations have been reported in studies where improved nutritional management enhanced milk protein yield and concentration.

Lactose content also increased with dietary treatment. Since lactose is the principal osmotic regulator of milk secretion, its higher concentration may reflect improved glucose availability and mammary gland activity. Increased lactose synthesis generally contributes to greater milk volume and overall productivity.

Furthermore, the elevated ash content in T2 suggests better mineral utilization and transfer into milk. Minerals play essential roles in maintaining milk quality and supporting physiological functions in both the animal and the consumer.

Collectively, these results suggest that the dietary strategy applied in T2 improved nutrient digestion, absorption, and metabolic efficiency, leading to enhanced milk composition. The improvements in milk fat, protein, lactose, and mineral content indicate that T2 produced milk of superior nutritional quality compared with T0 and T1. Such findings are consistent with previous reports showing that optimized feeding programs can substantially improve milk composition and overall dairy performance.

5. Conclusions

The present study demonstrated that berseem fodder (Trifolium alexandrinum) can be successfully utilized as a roughage source in the diet of Black Bengal goats reared in the Haor region of Habiganj, Bangladesh. Inclusion of berseem fodder improved growth performance and enhanced milk production without adverse effects on animal health and productivity. The superior nutritive value and palatability of berseem fodder likely contributed to better nutrient utilization and productive performance. Therefore, berseem fodder may be considered a suitable and sustainable winter forage for Black Bengal goat production in Haor areas, offering a practical feeding strategy to improve animal productivity and support smallholder farming systems. Further studies are recommended to evaluate its long-term effects on reproductive performance, milk composition, and economic returns under field conditions.

Declarations

Ethical Approval

This study protocol was reviewed and approved by Animal Experimentation Ethics Committee, Habiganj Agricultural University, Bangladesh **((License No. #ANT2026001**, **Memo No.: HAU/ANT(Research-01)/Ethical-002/26/002**). **Data Availability Statement**: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest:

The authors declare no conflict-of-interest Abbreviations

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Author Contributions:

J.K.: Conceptualization, Data curation, Investigation, Methodology, Formal Analysis, Project administration, Funding acquisition, Writing - original draft, Writing - review & editing. R.D: Methodology, Data curation. S.A.: Data curation. S.T.: Data curation. S.P.: Data curation. A.H.: Methodology. A.A.: Data curation. The article was reviewed and approved by all authors.

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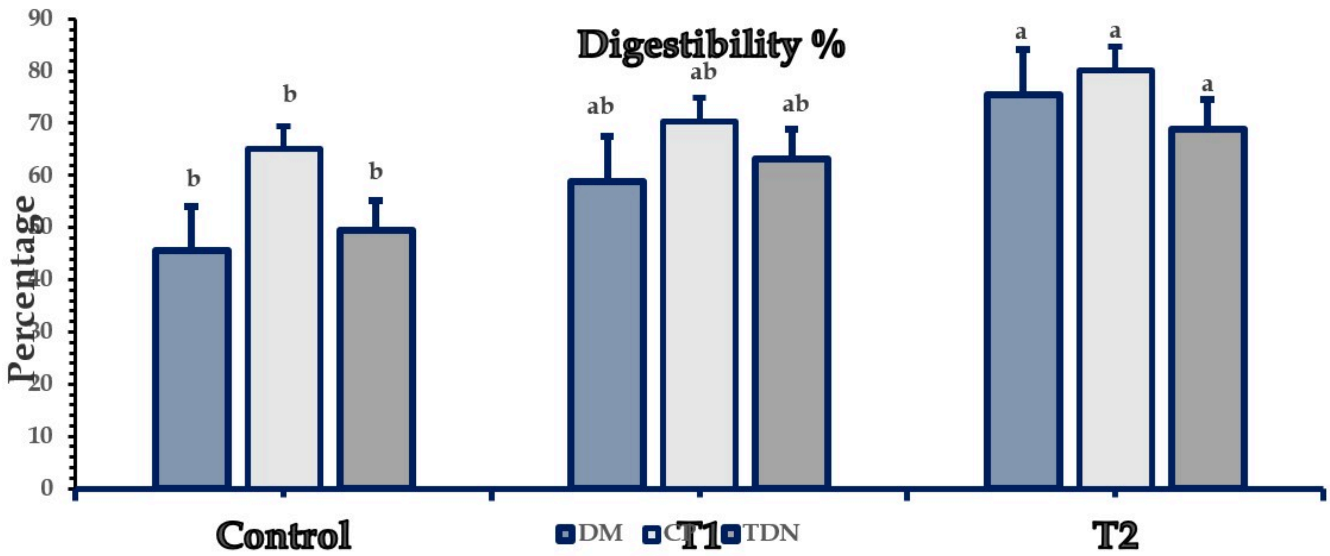
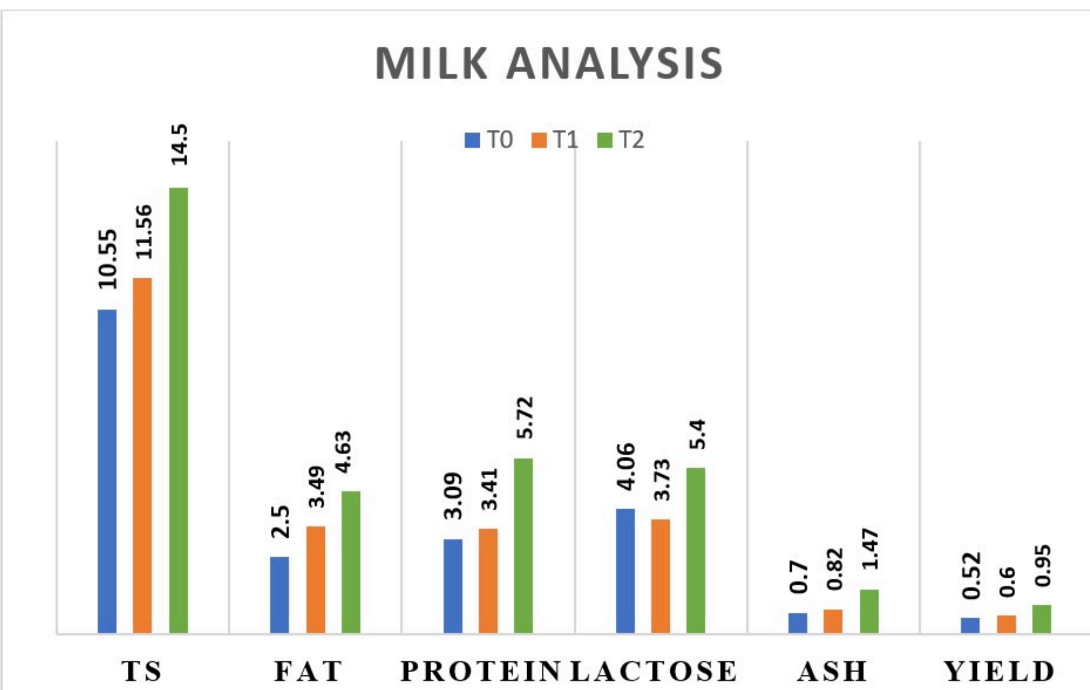
Figures



Control(T0) = road sided grass , T1= Napier , T2= Berseem ;DM= Dry matter digestibility , CP= Crude protein digestibility , TDN = Total Digestible Nutrient .

Figure 1

Digestibility of Experimental goat (Doe)



TS= Total Solid , T0 = road sided grass , T1= Napier , T2= Berseem ;DM= Dry matter digestibility , CP= Crude protein digestibility , TDN = Total Digestible Nutrient .

Figure 2

Milk analysis of experimental goat (doe)

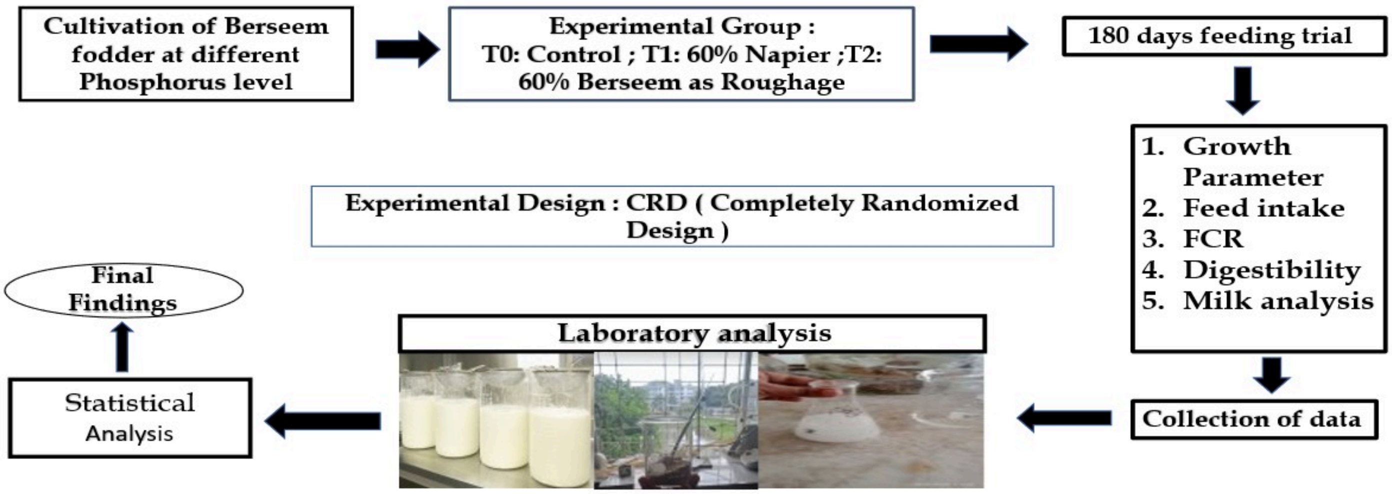


Figure 3

Legend not included with this version