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Effect of Feeding Berseem Fodder Grown Using Natural Farming Practices on Growth, Serum Metabolites, Interleukins and Semen Qualities in Barbari Goats

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ABSTRACT

Berseem fodder (*Trifoliumalexandrinum*) was cultivated using natural farming practices and evaluated in Barbari goats for their effect on growth, serum metabolites, interleukins and semen quality. Ten growing Barbari goats (Avg. BW 19.15± 0.87) age about 10 months were divided into two groups (CON and NAT) of five each as per completely randomized design. Animals of both the groups were fed with Bengal gram Straw, concentrate pellet and green Berseem fodder. The goats of CON group was fed with green Berseem cultivated using conventional practices while goats of NAT group was fed with green Berseem cultivated using Natural farming practices The experiment was conducted for 120 days out of which 60 days was for growth study. Serum metabolites and semen quality was studied after 120 days of feeding. The average daily gain (ADG) was 90.33 g for Gr CON while 74.33 g for Gr NAT. Dry matter intake (g) was 766.71 and 759.16 for Gr CON and Gr NAT respectively. Among serum metabolites glucose, protein, albumin, triglycerides, urea was statistically similar among groups. Aspartate aminotransferase (AST) and cholesterol was lower in goats fed with naturally grown Berseem fodder. Immunity indicators like IL 1, IL6, TNF and total antioxidant was also similar among groups. No difference was reported on semen quality parameters like semen volume, mass motility, live percent and post thaw motility between groups. Present study concluded that feeding Berseem fodder grown using Natural farming practices had no significant effect on growth, metabolites and semen quality.

KEYWORDS: Berseem fodder, Goat, Growth, Natural practices, Semen, Serum

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INTRODUCTION

Green fodder is essential component of goat ration in intensive system of production. Among green fodder Berseem (*Trifoliumalexandrinum* L.) an annual leguminous fodder forms a significant portion of animals ration particularly during rabi season from November to April months. Cultivation of fodder requires input of chemical fertilizers and pesticides which can negatively affect the soil, animal health and their products. Consumption of animal products having residues of pesticides, insecticides can affect the human health and there may be increased incidence of diseases like cancer in human population. There is also involvement of money for the production of fodders with the use of chemical fertilizers and pesticides in intensive fodder production practices. Therefore farmers are now encouraged to cultivate the crop as well as fodder crops using natural farming practices which uses different decoctions like brijamrit, jeevamrit to improve soil, animal and human health. Natural farming techniques can significantly enhance fodder production by improving soil health, utilizing on-farm resources, and reducing input costs (Niti Ayog). This approach focuses on using natural methods to boost yields and the quality of fodder crops, benefiting both animal health and the environment. Work has been conducted on the fodder quality with the application of natural farming practicesin their cultivation (Arif et al., 2023), but scanty information is available about the effect of feeding these fodder crops on animal growth, blood metabolites and reproductive performance. Keeping in view the present experiment was conducted to evaluate the effect of feeding Berseem fodder grown using Natural farming practices in Barbari goats.

MATERIALS AND METHODS

Study site

This experiment was conducted at Animal Experimental unit, Animal Nutrition Management and PT Division, ICAR-Central Institute for Research on Goats, Makhdoom, Farah, Mathura, India. It is located at 27° 10'N latitude and 75° 28'E longitude and 169 m above sea level. The feeding trial was conducted from 21 Dec 2023 to 18 April 2024 (120 days)

Berseem (*Trifoliumalexandrium*) was cultivatedat Agriculture farm of ICAR-CIRG, Makhdoom during the rabi season of 2023-24.The soil of the experimental field was nearly neutral in reaction (pH 7.2) with EC of 0.27 dS/m. The soil was low in organic carbon (0.24 %) and available nitrogen (238 kg ha-1); and medium in available phosphorus (40 kg ha-1) and potassium (167 kg ha-1). Berseem fodder was cultivated using two practices. First,conventional agronomic practices (CON) and second, natural farming practices (NAT) with application of Beejamrit and Jeevamrit formulations. For natural farming, we first prepared Beejamrit and Jeevamrit formulations. Beejamrit was prepared by mixing 5 liters cow urine, 5 kg cow dung, 50 gram lime powder and one handful of soil in 20 liters of water and keeping it for 12 hours. Similarly Jeevamrit was prepared by mixing 5 liters cow urine, 10 kg fresh cow dung, 2 kg gram flour, 2 kg jaggery and one handful of soil in 200 liters of water and keeping it for 48 hours in shaded area. Berseem seed was first treated with Beejamrit solution and dried before cultivation. Jeevamrit formulation was sprayed on naturally grown Berseem fodder after each cutting. These fodders were cut and carry for feeding to goats of experimental groups.

Ten growing Barbari goats (Avg. BW 19.15± 0.87) age about 10 months were divided into two groups (CON and NAT) of five each as per completely randomized design. Animals of both the group were fed with Bengal gram Straw, concentrate pellet and green Berseem fodder. Goats were fed with concentrate pellet at the rate of 1.5% of body weight, one kg of green berseem and *ad lib* gram straw. Animals of both the group were offered with concentrate pellet in the morning. After complete consumption of pellet fixed quantity of Berseem fodder was fed. Berseem fodder was fed as such without chaffing. Gram straw was fed free of choice and refusal was noted in next day morning (8.00AM) daily to calculated daily dry matter intake.CON group was fed with green Berseem cultivated using conventional practices while NAT group was fed with green Berseem cultivated using natural farming practices. The different feeds were provided separately in conventional form.The duration of experimental feeding was 120 days, out of this period growth was studied up to 12 months of age (60 days of feeding) and serum metabolites and semen attributes were studied after 120 days of feeding. Goats were housed in well ventilated sheds under uniform management. Weighed quantities of concentrate pellet were offered to both the group of goats at 08:00AM daily. After complete consumption of pellet roughage portion of ration was offered to the goats. *Ad libitum* water was provided and was changed twice daily throughout the experimental period.

The serum samples were analyzed for different biochemical constituent's viz. glucose, total protein, albumin, cholesterol,urea, triglycerides and Aspartate aminotransferase (AST) using diagnostic commercial kits (Autospan, Span diagnostic LTD.). There concentrations were quantified using end-point assay using double beam spectrophotometer (UV-Vis spectrophotometer, Optizen, 3220UV, Mecasys.co. Ltd, Korea). The procedure provided by the company on kits leaflet was strictly followed for analysis. IL 1, IL6, TNF and total antioxidant were analyzed using ELISA kits of BT Labs (Bioassay Technology laboratory)

After attainment of the age of around 12 months the bucks were trained for mounting and after 4 weeks of training each animal was subjected to semen collection. Semen ejaculates from each buck were collected twice at weekly intervals with the help of artificial vagina in the morning hours. A dummy non-oestrous doe was used for buck mounting, and semen was collected into the graduated cups. Semen samples were evaluated immediately after collection for colour, consistency, mass motility. Immediately after collection, semen was maintained in hot water bath at 37°C and subjected to evaluation. Volume of each ejaculate was recorded with the graduated collection cup. Mass motility was estimated at low power magnification (10×) using a compound microscope with neat semen on thermo stage maintained at 37°C. Semen samples were diluted and after dilution evaluated for live/dead count and abnormalities. Live and dead sperm count was estimated as per standard staining procedure as

described by Hancock (1951). A drop of diluted semen mixed with 2-3 drops of stain (Eosin (0.67 g/ 100 ml) and Nigrosin (5 g/100 ml)) was incubated at 30 æ%C for 1 min. Then smears made on pre-warmed slides were allowed to dry at 30 æ%C. Then smear was observed under 400× objective lens of the phase contrast microscope. Approximately 200 sperm were counted.After that semen samples were cryopreserved in liquid nitrogen and evaluation of post-thaw qualities likePost-thaw motility, live/dead sperm count were conducted to study the effect of feeding on the semen freezability.

Nutrient composition of concentrate, gram straw and Berseem were analysed using the protocol described by AOAC (2012).Neutral detergent fiber (NDF), Acid detergent fiber (ADF) were determined as per the method of Van Soest et al (1991).

The data collected during study were analyzed by independent sample t-test as per Snedecor and Cochran (1989) according to a complete randomized design using statistical software package (SPSS version 20). Individual animals were considered as experimental units. The difference between means was significant at 95% level of significance ($P<0.05$).

RESULT AND DISCUSSION

Chemical composition of feed

The proximate principals and the fibre fractions of concentrate pellet, gram straw, and green Berseem fodder are presented in Table 1. Green Berseem cultivated using conventional and natural farming methods are containing similar dry matter (around 11%).The crude protein content (%) was 15.40 for concentrate pellet, 6.6 for Gram straw and around 17 for Berseem fodder. No significant difference was reported in crude protein content among different Berseem. The fibre fractions (neutral detergent fibre, acid detergent fibre, cellulose and hemicellulose) were also statistically similar in both types of berseem. The ether extract (%) was 6.86 for concentrate pellet, 1.81 for gram straw, 3.65 for berseem (CON) and 3.61 for berseem (NAT). The chemical composition of concentrate pellet and gram straw was within range as reported by Kumar et al (2024). The composition of Berseem fodder was also similar as reported by Arif et al (2022). No significant difference was reported in the chemical composition of fodder Berseem (CON) and Berseem (NAT).

Body weight gain and dry matter intake

The initial body weight (kg) in Gr CON and Gr NAT was 19.06 and 19.24 which increased to 24.48 and 23.70 after 60 days of experimental feeding (table 2). The fortnightly body weight changes are depicted in Fig 1.Total body weight gain (kg) was 5.42 and 4.46 in Gr CON and Gr NAT respectively. The average daily gain (ADG) was 90.33 g for Gr CON while 74.33 g for Gr NAT. There was no significant difference in body weight gain among groups. The average daily gain of goats was in agreement with 50–100 g / day reported by Ranjhan (1998) and Kumar et al. (2015).There was no significant effect on body weight gain in response to Berseem fodder cultivation. Since the nutrient composition of both the fodder is similar little variation is expected on body weight gain. Average daily dry matter intake (g) during experimental feeding period was 766.71 and 759.16 for Gr CON and Gr NAT respectively which is approximately 3.52% of mean body weight during experimental feeding period. Generally in tropical environmental condition dry matter intake ranges from 1.1 to 4.1% in growing goats (NRC 1981, Kearl 1982, Devendra and Bums 1983). The intake of Berseem fodder was 103.60g in Gr CON while 106.49 in Gr NAT and statistically similar between groups (Table 2).This clearly indicated that cultivation of Berseem fodder using natural farming practices did not affect its palatability. Kumar et al. (2015) also reported that incorporation of azolla in the complete pellet did not significantly affect its palatability.The concentrate to roughage intake was around 63:37 in both the groups showing no significant difference.

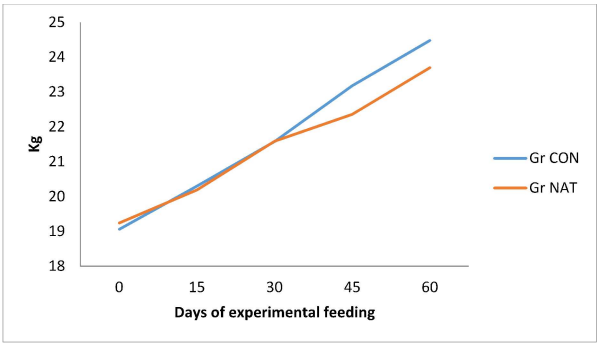

Fig 1: Fortnightly body weight changes in different group of goats

Table 1. Chemical composition of feed (% dry matter basis*)

Attributes	Concentrate pellet	Gram straw	Green Berseem (CON)	Green berseem (NAT)
DM	93.15±0.58	89.41±0.23	11.26±1.07	11.16±0.78
Moisture	6.85±0.58	11.59±0.23	88.74±1.07	88.84±0.78
Organic matter	91.28±0.19	90.10±0.30	81.14±1.79	81.14±1.47
Ether extract	6.86±0.58	1.81±0.19	3.65±0.36	3.61±0.34
Ash	8.73±0.19	9.90±0.30	18.86±1.79	18.86±1.48
Crude protein	15.40±0.36	6.60±0.02	16.58±0.19	16.93±0.27
Neutral detergent fibre (NDF)	24.07±0.14	61.05±0.77	43.58±1.10	46.33±0.88
Acid detergent fibre (ADF)	10.39±0.40	47.62±0.33	29.07±0.97	30.93±0.75
Lignin	2.90±0.25	12.77±0.26	6.90±0.49	6.64±0.30
Cellulose	7.50±0.65	34.86±0.59	22.16±0.91	24.29±0.67
Hemi cellulose	13.69±0.55	13.43±1.11	14.50±0.88	15.40±0.99

*except dry matter and moisture

Table 2. Growth and dry matter intake in different groups of goats

Attributes	Gr CON	Gr NAT
Initial body weight (Kg)	19.06±0.58	19.24±1.73
Final body weight (Kg)	24.48±0.50	23.70±1.53
Average body weight gain (g/d)	90.33±3.78	74.33±3.62
Dry matter intake (g/d)	759.16±7.05	766.71±6.14
Concentrate intake (g/d)	283.31±2.65	281.41±2.68
Berseem intake (g/d)	103.60±2.35	106.49±3.04
Gram straw intake (g/d)	372.24±5.17	378.81±4.19
Roughage intake (g/d)	475.84±6.17	485.29±4.76
Conc: roughage ratio	37.52: 62.48	36.75: 63.24

Serum metabolites and semen quality

Serum metabolites are the indicator of nutritional balance, deficit condition, clinical status and possible indication of major organ efficiency. The data pertaining to the serum metabolites concentration of experimental goats revealed that the mean values of glucose, protein, albumin, triglycerides, urea obtained in the present study was within normal physiological range (Kaneko et al., 1997). There was no significant ($P>0.05$) difference in blood biochemical parameters viz., serum glucose, total protein, albumin, globulin, triglycerides and serum urea concentration among groups. The mean serum Aspartate aminotransferase (AST) values of both the groups were within the reported normal range (66 to 230 (IU/L) suggested for goats (Fraser et al., 1986) but the concentration was lower in goats fed with naturally grown Berseem fodder. Serum cholesterol was also lower in goats fed with naturally grown Berseem fodder. IL-6, IL-1, and TNF-alpha are pro-inflammatory cytokines that play important roles in the body's immune response to injury, infection, and other stimuli. They are involved in the activation of immune cells, the production of other inflammatory mediators, and the development of fever and other acute-phase responses. While these cytokines are essential for fighting infection and tissue repair, excessive or dysregulated production can contribute to chronic inflammation and disease. Elevated serum levels of interleukin-6 (IL-6), interleukin-1 (IL-1), and tumor necrosis factor-

alpha (TNF-alpha) are often associated with inflammatory and autoimmune conditions, certain cancers, and infections. These cytokines play crucial roles in the body's immune response, and their dysregulation can contribute to the development and progression of various diseases. IL 1, IL6, TNF and total antioxidant was also similar among groups.

No difference was reported on semen quality parameters like semen volume, mass motility, live, dead percent and post thaw motility between both the groups (Table 3). The values of semen attributes were similar for 12-16 months bucks previously reported (Kumar et al., 2021). The colour was cream to yellow cream and consistency was medium. Other semen qualiy attributes were similar among both the groups. Semen qualities are influenced by the diet. The determinations made on the collected samples indicate non-significant changes ($p < 0.005$) in the fresh as well as post thaw semen qualities. The difference between the two groups has no statistical significance ($p > 0.05$). This can be explained by the fact that both groups received the balanced nutrition during experimental treatment. Have non-significant effect to improve the semen qualities as well as on post thaw seminal parameters. Therefore, in conditions where the experimental treatment was carried out, it is clear that a daily supplementation of feed played an extremely important role, positively influencing not only the quantity but also the qualities of the collected seminal material. Micro nutrients particularly trace elements and bioactive molecules stimulate growth and development of primary and secondary sex organs, spermatogenesis (Underwood and Somers, 1969). Kumar et al (2016) reported that supplementation of fresh azolla improved reaction time and progressive motility of spermatozoa in Barbari bucks without any significant effect on semen volume and live counts. Similar effect was observed in the present study indicating green fodder cultivated using conventional and natural farming practices had similar effect on semen quality attributes.

Table 3. Serum metabolites and semen qualities in different groups of goats

Attributes	Gr CON	Gr NAT
Serum metabolites		
Glucose (mg/dl)	59.53±1.55	61.99±2.69
Protein (g/dl)	6.05±0.22	6.68±0.74
Albumin(g/dl)	4.46±0.17	4.15±0.04
Globulin (g/dl)	1.59±0.07	2.53±0.11
Cholesterol (mg/dl)	90.09±4.60	82.42±6.41
Triglyceride(mg/dl)	97.20±3.13	92.96±2.25
Urea(mg/dl)	73.87±7.30	74.20±2.31
Aspartate aminotransferase (U/L)	89.15±11.46	68.98±8.20
IL1 (ng/L)	2.57±0.36	2.45±0.38
IL6 (ng/L)	1.32±0.25	1.35±0.12
TNF (ng/L)	3.01±0.27	2.65±0.25
Total Antioxidant (u/ml)	2.56±0.38	2.23±0.40
Semen attributes		
Colour	Cream	Yellow-cream
Consistency	Medium	Medium
Volume (ml)	0.75±0.05	0.73±0.09
Mass motility (%)	4.85±0.08	4.45±0.16
Fresh semen Live per cent	93.50±1.78	92.50±1.90
Fresh semen Dead per cent	06.50±0.78	07.50±0.87
Post thaw motility (%)	62.50±0.77	60.00±0.96
Post thaw Live percent	66.10±0.89	65.36±1.16
Post thaw Dead percent	33.90±0.89	34.64±1.16

CONCLUSION

Present study concluded that feeding Berseem fodder grown using Natural farming practices had similar nutrient profiles and exerted similar effect on growth, metabolites and semen quality in goats compared to Berseem grown under conventional agronomic practices.

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