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Effect of utilization of corn cobs in total mixed ration on haematological, serum biochemical and rumen parameters of growing goats

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Abstract

The study involved 18 Osmanabadi growing goats of 4-5 months of age which were divided into three equal groups viz., T₀ (Control), T₁ and T₂, having six goats in each group. The goats in the control group (T₀) were fed total mixed ration (Concentrate: 30 parts, Dry roughages- Jowar straw (*Kadbikutti*): 50 parts and Green roughages- DHN₆: 20 parts) to provide nutrients as ICAR (2013) [8], whereas in the T₁ group, goats were fed total mixed ration as per Group T₀ where in *Kadbikutti* of dry roughage was replaced by corn cobs at 25% level, while in T₂ group, the goats were fed total mixed ration as per Group T₁ + fibrolytic enzymes @ 300 g/ton of feed. The trial lasted for 90 days duration. The average haematological and serum biochemical parameters revealed no significant effect of feed treatments, except serum glucose levels which were significantly ($p < 0.01$) higher in group T₂ than group T₀ and T₁. All the rumen parameters were comparable among different groups. Thus, it is concluded that replacement of *Kadbikutti* by 25% corn cobs in TMR along with supplementation of fibrolytic enzymes @ 300 g/ton of feed showed no adverse effect on haematological, serum biochemical and rumen parameters of growing Osmanabadi goats.

Keywords: Osmanabadi goats, replacement, Jowar straw, corn cob, growth, blood biochemical

Introduction

Deforestation, urbanization, and global population expansion are some of the causes of the scarcity of grazing area. There is an urgent need of diverse approaches for the state to alleviate the demand and supply gap of fodder. Therefore, unconventional feeds might lessen human-animal competition for food and partially narrow the feed supply gap. The cost of production can be decreased by substituting unconventional feed resources for conventional feed (Dey *et al.*, 2020) [6]. Non-conventional feed resources (NCFR) are any feeds that have traditionally not been utilized for animal nutrition, either by feed manufacturers or farmers in commercial feeds (Amata, 2014) [1]. In To overcome the scarcity of dry fodders there is an urgent need for tapping some unconventional dry roughage sources.

Corn cobs, a byproduct of maize production obtained after harvesting of maize grains, are a good alternate roughage source and can be utilized in ruminant rations. It can serve as an alternate source of feed. It is among the most accessible and plentiful agricultural wastes (Kategile *et al.*, 1981) [9]. They have low nutritional value, but in the agricultural sector they are used as fuel, bedding for chickens and other animals, and even as feed for ruminants. These cobs are abundant in hemicellulose and cellulose but low in crude protein, making them a viable alternative feed source for ruminants. When fibre digestion is impaired and energy is the diet's first-limiting nutrient, animals respond more strongly to enzyme supplements (Beauchemin *et al.*, 2003) [5]. Forage fed with exogenous enzymes decreased pH value, ammonia nitrogen, and CH₄ production while increasing the digestibility of dry matter, neutral detergent fibre, and total volatile fatty acid yield. However, depending on the forage, their optimal dose rate changed.

Thus, crop waste like corn cobs could be used as a roughage source in total mixed ration of ruminants which will act as good alternative roughage source during scarcity situation when there is a shortage of conventional roughage sources. Further, the utilization and nutritional value of such crop wastes can be enhanced by supplementation of fibrolytic enzymes. However, it is important to evaluate the effect of inclusion of crop waste like corn cobs in the ration on the health of growing goats which can be learnt by analyzing the haematological, serum biochemical and rumen parameters of growing goats.

Considering the above facts in mind and huge availability of corn cobs in the area of research work, present research work was planned to evaluate the effect of utilization of corn cobs in total mixed ration on the haematological, serum biochemical and rumen parameters of growing Osmanabadi goats.

Materials and Methods

All the experimental procedures were as approved by the Institutional Animal Ethical Committee constituted by Committee for the Purpose of Control and Supervision of Experiment on Animals (CPCSEA), Department of Animal Welfare, Ministry of Forest, Environment and Climate Change, Government of India which is established under chapter 4 Section 15 (1) of the Prevention of Cruelty to Animals Act, 1960. (Approved No. XV/24, Dated. 14/08/2024). The present experiment was carried out during for three months at the Livestock Farm Complex, College of Veterinary and Animal Sciences, Udgir, Maharashtra, having latitude 18.3942886, longitude 77.1176 and altitude 2086 ft. During the trial period, maximum 30 °C and minimum 24 °C temperature and 823 mm precipitation was recorded.

The study involved 18 Osmanabadi growing goats of 4-5 months of age which were divided into three equal groups viz., T₀ (Control), T₁ and T₂, having six goats in each group. The goats in the control group (T₀) were fed total mixed ration (Concentrate: 30 parts, Dry roughages- Jowar straw (*Kadbikutti*): 50 parts and Green roughages- DHN₆: 20 parts) to provide nutrients as ICAR (2013) [8], whereas in the T₁ group, goats were fed total mixed ration as per Group T₀ where in *Kadbikutti* of dry roughage was replaced by corn cobs at 25% level, while in T₂ group, the goats were fed total mixed ration as per Group T₁ + fibrolytic enzymes @ 300g/ton of feed. The trial lasted for 90 days duration. The trial lasted for ninety days.

The total mixed ration (TMR) comprising of 50% dry roughages -dry *kadbikutti*, 20% green fodder DHN₆ and 30% concentrate mixture, was prepared every day in the morning at farm and fed throughout the experimental period of 90 days. The corn cobs utilized in treatment groups were obtained in coarsely ground form after threshing of corn grains from grain producing crops cultivated at ILFC, COVAS, Udgir. The corn cobs were again ground to appropriate size so that it can be mixed thoroughly in TMRs of treatment groups. The fibrolytic enzyme used in the present experiment was in a free-flowing powder form, easy to mix in feed. The fibrolytic enzyme consists of cellulase and hemicellulase (xylanase) enzymes which were helpful in

efficient breakdown of cell wall and enhancing fibre digestibility. The said enzyme was procured from the market. The enzyme was supplemented to experimental animals through concentrate mixture which was included in TMR of group T₂.

The representative samples of concentrate mixtures, green fodder (DHN₆), *kadbi kutti*, corn cobs and various TMRs utilized for feeding of experimental growing goats were collected at fortnight interval throughout the experimental period, oven dried and the pooled samples were analyzed as per AOAC (2007) [2]. The chemical composition (% DMB) of concentrate mixtures, green fodder (DHN₆), *kadbi kutti* and corn cobs is presented in Table 1. Three different types of TMRs were prepared every day and used for feeding respective experimental groups to meet their nutrient requirements (ICAR, 2013) [8]. The ingredient composition of experimental TMRs is given in Table 2 and the percent chemical composition (% DMB) of total mixed ration of various experimental groups is presented in Table 3.

Blood samples were obtained from all growing goats from each treatment groups at the start of experiment and thereafter at monthly interval during the trial period i.e. on the 0,30, 60 and 90th day four ml of blood was drawn from the jugular vein of all experimental growing goats in to the syringe. For hematological analysis, the blood was collected into EDTA-containing tubes and for biochemical analysis blood samples were collected in tubes without anticoagulant. Blood samples were subjected to Haemoglobin and PCV. The serum was separated as per routine standard procedure, and was analyzed in a semi-auto analyzer using diagnostic kits for various biochemical parameters (total protein, albumin, globulin, blood glucose, total cholesterol, triglycerides, LDL and HDL). The methodology and the set of reagents used in respect of each parameter were as per the recommendation of the manufacturer of the analyzer system.

Rumen liquor samples were obtained from all growing goats from each treatment groups at the start of experiment and thereafter at monthly interval during the trial period i.e. on the 0,30, 60 and 90th day. The samples were collected at 4 hours post feeding by using stomach tube having a 0.15 mm internal diameter and 150 cm long plastic tube. Approximately 50 ml of rumen liquor was collected from individual goats. The sucked fluid was filtered through the cheese cloth and pH was measured immediately. The filtered rumen liquor was immediately processed for digestion with sulphuric acid to estimate total nitrogen. TVFA was determined using Markham apparatus as described by Bornett and Reid (1957) [4]. The total nitrogen and TCA-precipitable nitrogen in rumen liquor were determined using Kjeldhal's method (AOAC, 2007) [2]. By deducting TCA-ppt nitrogen from the total nitrogen content of SRL, the NPN content of rumen liquor was estimated.

Observations of various parameters recorded during experimental period were tabulated and data were statistically analyzed as per Snedecor and Cochran (1994) [13], by using Randomized block design and

Completely Randomized Design.

Table 1: Average chemical composition (%DMB) of Concentrate mixture, DHN6, Jowar straw and Corn cobs

Nutrient %	Concentrate mixture	DHN ₆	Jowar straw	Corn cobs
Moisture	8.76	72.45	8.13	5.20
Dry matter	91.24	27.55	91.87	94.80
Organic matter	95.03	89.88	92.30	95.90
Crude protein	19.22	8.45	5.88	3.20
Ether extract	3.74	2.20	1.50	0.60
Crude fibre	8.87	27.56	38.00	33.80
Nitrogen free extract	63.20	51.67	46.92	58.30
Total ash	4.97	10.12	7.70	4.10
Nutrient %	Concentrate mixture	DHN ₆	Jowar straw	Corn cobs
Moisture	8.76	72.45	8.13	5.20
Dry matter	91.24	27.55	91.87	94.80
Organic matter	95.03	89.88	92.30	95.90
Crude protein	19.22	8.45	5.88	3.20
Ether extract	3.74	2.20	1.50	0.60
Crude fibre	8.87	27.56	38.00	33.80
Nitrogen free extract	63.20	51.67	46.92	58.30
Total ash	4.97	10.12	7.70	4.10

Table 2: Percent ingredient of TMRs of various experimental groups

Ingredients	TMR T ₀	TMR T ₁	TMR T ₂
Maize	9	9	9
Groundnut extract	6	6	6
Wheat bran	7.5	7.5	7.5
Udidchuni	6.9	6.9	6.9
Mineral mixture	0.3	0.3	0.3
Salt	0.3	0.3	0.3
Corn cob	0	12.5	12.5
Jowar straw	50	37.5	37.5
DHN ₆	20	20	20
Total	100	100	100

Table 3: Percent chemical composition (% DMB) of total mixed ration of various experimental groups

Nutrient%	TMR T ₀	TMR T ₁	TMR T ₂
Moisture	22.00	21.75	21.75
Dry matter	78.00	78.25	78.25
Organic matter	92.63	93.08	93.08
Crude protein	10.40	10.06	10.06
Ether extract	2.05	1.94	1.94
Crude fibre	27.17	26.65	26.65
Nitrogen free extract	53.01	54.43	54.43
Total ash	7.37	6.92	6.92

Results and discussion

The overall performance of growing goats from different experimental groups is presented in Table 4. The values of Hb and PCV were within the normal physiological limits. The average Hb and PCV values of different experimental groups revealed non-significant effect of feed treatments. These results of present study corroborated with Ogunleke *et al.* (2014) ^[11] who observed no significant ($p > 0.05$) differences on Hb and PCV values by feeding diet containing milled corn cobs in dwarf goats. Likewise, Babale *et al.* (2018) ^[3] also observed no effect on Hb and PCV values by feeding ration containing up to 50% maize cobs to goats compared to control goats.

The average serum total protein values, serum albumin, serum globulin values, serum albumin: globulin values and serum blood urea nitrogen values of various experimental groups were comparable. Ogunleke *et al.* (2014) ^[11] who reported that serum protein, albumin and globulin values were unaffected by feeding diet containing milled corn cobs in dwarf goats. Similarly, NE *et al.* (2017) ^[10] observed no significant effect on concentration of serum globulin values when supplementation of exogenous fibrolytic enzyme @ of 2.5 g

in growing barley lambs. Likewise, Babale *et al.* (2018) ^[3] also observed no effect on serum globulin values by feeding ration containing up to 50% maize cobs to goats.

The serum glucose values of group T₂ were significantly ($p < 0.01$) higher than group T₀ and T₁, however, difference between group T₀ and T₁ was non-significant. Findings of the present study are not matching with Ogunleke *et al.* (2014) ^[11] who reported that serum glucose values were unaffected by feeding diet containing milled corn cobs in dwarf goats. Babale *et al.* (2018) ^[3] also observed no effect on serum glucose values by feeding ration containing up to 50% maize cobs to goats.

Thus, it is observed that replacement of *kadbikutti* by 25% corn cob in TMR with or without enzyme supplementation revealed no adverse effect on blood biochemical parameters viz, serum total protein, serum globulin, serum albumin, serum blood urea nitrogen, serum glucose. However, replacement of *kadbikutti* by 25% corn cob in TMR with enzyme supplementation resulted in significant ($p < 0.01$) improvement in blood glucose levels of growing goats.

The monthly average rumen liquor pH values, rumen NH₃-N concentration, total volatile fatty acid concentration, total

nitrogen concentration, TCA-ppt-nitrogen concentration, non-protein nitrogen concentration for groups T₀, T₁ and T₂ revealed non-significant effect of feed treatments. This also indicated that rumen ecosystem and functioning was not affected due to inclusion of corn cobs in TMR of treatment groups. Findings of the present study are in line with Wachirapakorn *et al.* (2014) [14] who reported no change in rumen pH in HF cows fed with total mixed ration (TMR) containing ground corn cobs. Poonooru *et al.* (2015) [12] also reported no effect ($p > 0.05$) on rumen pH in buffaloes when supplemented with exogenous fibrolytic enzyme and/or live

yeast culture in total mixed ration. Hamad *et al.* (2010) [7] reported that feeding urea treated corn with cobs as 50% or total replacement of pelleted concentrate feed mixture compared to the conventional diets did not alter rumen total volatile fatty acid in ewes.

Contradictory to the findings of the present study, Yulistiani *et al.* (2024) [16] reported higher ($p < 0.01$) ruminal NH₃-N concentration in lambs fed a diet containing ground corn cob. Ajayi *et al.* (2016) reported that rumen total volatile fatty acid concentration differed ($p < 0.05$) significantly when corn cobs were included at 15,30 and 45% in goat ration.

Table 4: The average blood haemato-biochemical and rumen fermentation parameters of experimental goats

Blood haemato-biochemical parameters				
Haemoglobin count (g%)	10.00 ± 0.18	9.87 ± 0.19	10.00 ± 0.16	NS
PCV (%)	22.69 ± 0.14	22.31 ± 0.28	22.88 ± 0.32	NS
Serum total protein (g/dl)	6.79 ± 0.13	6.70 ± 0.07	6.87 ± 0.12	NS
Serum Albumin (g/dl)	3.92 ± 0.10	3.86 ± 0.06	3.96 ± 0.07	NS
Serum globulin (g/dl)	2.87 ± 0.20	2.84 ± 0.03	2.91 ± 0.11	NS
Serum Albumin: Globulin ratio	1.39 ± 0.14	1.36 ± 0.02	1.37 ± 0.06	NS
serum blood urea nitrogen (mg/dl)	20.57 ± 1.24	20.18 ± 1.16	20.73 ± 1.15	NS
Serum glucose values (mg/dl)	57.86 ^b ± 0.79	57.64 ^b ± 0.32	60.92 ^a ± 0.36	**
Rumen Fermentation Parameter				
pH of Rumen liquor	6.37 ± 0.05	6.34 ± 0.06	6.40 ± 0.02	NS
Rumen ammonia nitrogen (mg/dL)	14.44 ± 0.32	14.35 ± 0.15	15.20 ± 0.25	NS
Rumen total volatile fatty acids (Mm/100 ml)	17.49 ± 0.20	17.08 ± 0.17	17.89 ± 0.41	NS
Rumen total nitrogen (mg/dL)	131.63 ± 2.62	129.11 ± 2.40	133.70 ± 1.25	NS
Rumen TCA-ppt-nitrogen (mg/dL)	77.66 ± 1.20	76.16 ± 0.65	78.88 ± 0.62	NS
Rumen non-protein nitrogen (mg/dL)	53.97 ± 3.15	52.95 ± 2.45	54.82 ± 1.21	NS

Note: The means having common superscript in the same row do not differ significantly NS: Non-significant **Significant ($p < 0.01$)

Conclusion

From overall results of the present study it is concluded that the replacement of *Kadbi kutti* by corn cobs @ 25% in TMR with or without supplementation of fibrolytic enzymes has no adverse effect on haemato-biochemical and rumen fermentation parameters of growing Osmanabadi goats. The replacement of *Kadbikuttiby* 25% corn cobs can sustain goats during the feed scarcity period without any adverse effect on health of goats.

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Conflict of Interest

The authors affirms that they do not possess any known competing financial interests or personal relationship that could be perceived to impact the integrity of the work reported in this paper

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