

Feeding effect of Mesquite (*Prosopis juliflora*) Pods on Growth Performance in Marwari Goats

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Abstract

Feeding of non-conventional feed stuffs (NCFR) into the feeding system can serve as one of the alternatives in arid region of Rajasthan. Vilayati babul or Mesquite (*Prosopis juliflora*) pods have also been identified as potential non-conventional feed resources. The ripen pods are highly palatable, which are having moderate in crude protein (12%) and rich in free sugar (15-17%) giving sweet taste to it feeding to the animals. The present experimental study was conducted in Marwari goats at Bikaner. In first phase of the study *in vitro* experiment was carried out using seven treatment groups of dewbean (Moth chara) straw based complete feed containing *P. juliflora* pods at 0, 5, 10, 15, 20, 25 and 30% level of complete feed, respectively in place of equal proportions of de oiled rice bran and barley to decide optimum level of integration of *P. juliflora* pods in the whole feed. The kids were randomly distributed in two groups viz., control (T1) and treatment (T2). A study was conducted to estimate the efficacy of Mesquite (*Prosopis juliflora*) pods as a non conventional feed resource in animal feeding system. The *in vitro* analysis of complete feeds revealed that the feed containing 20% levels of *P. juliflora* pods had significantly ($P < 0.01$) higher values of IVDMD, IVOMD and IVTGP. Thus, this level was selected for *in vivo* experiment. In the second phase, incorporation of *P. juliflora* pods in the diet of experimental goat kids at the level of 20% of complete feed significantly ($P < 0.05$) improved total weight gain and average daily weight gain ($P < 0.01$) of kids. No significant difference was observed in the values of dry matter intake, organic matter intake and feed conversion ratio of kids between two groups. Therefore, it could be concluded that incorporation of *Prosopis juliflora* pods in the diet at 20% level in place of DORB and barley had no adverse effect on performance and nutrient utilization..

Keywords: Mesquite (*Prosopis juliflora*); Goat; Body weight; Feed

Introduction

The cost of concentrate feed is a major issue for farmers in rural areas. The incorporation of low-cost feed components with high nutritional value in animal feed can serve as a helpful strategy to overcome this issue without influencing animal production potential. Complete feeding scheme enables non-conventional feeding stuffs to be incorporated into the livestock ration for reducing feeding costs and improving animal outcome.

In India animal feed shortage is the main problem which is responsible for low animal productivity [2] The incorporation of non-conventional feed stuffs (NCFR) into the feeding system can serve as one of the alternatives to this situation. Feed acquired from multipurpose trees and agro-industrial products can be used as a source of non-conventional resources for cattle feeding [5].

Vilayati babul or Mesquite (*Prosopis juliflora*) pods have also been identified as potential feed resources in arid region of Rajasthan. The production of pods in our country was estimated at two

million tons showing the accessibility of a large feed resource that can be used by livestock feed processing units. *Prosopis* pods are sweet and have excellent nutritional value, low tannin (1.50%) and other unpalatable chemicals, and moderate to elevated digestibility [11]. The ripen highly palatable pods, which are moderate in crude protein (12%) and rich in free sugar (15-17%) giving sweet taste to it. In natural grazing lands where seed pods of *P. juliflora* are abundant, livestock consume the seedpods voluntarily during grazing and browsing, and in many species the seedpods contain a sweet, dry yellow pulp and the seed alone is a rich source of protein 34-39% [15]. The Mesquite pods are rich source of energy. Its nutritive value is well comparable to cereal grains and their by-products, as it has DCP 7% and TDN 75%. Feeding of *P. julifloras* pods after grinding is important as there is no chance of germination.

So, keeping the view of aforesaid facts in mind, the present study was planned to assess the potential benefits of *P. juliflora* pods on the nutrient utilization as well as growth performance in goats.

Materials and Methods

Description of the study site

The present experiment was conducted at Department of Animal Nutrition, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner (Rajasthan), India. Sixteen Marwari male kids of almost the same age group (3-4 months age) and of uniform conformation were obtained from local breeders for conducting feeding trial. The animals were given a prophylactic dose of albendazole suspension as anthelmintic. Individual feeding of kids was undertaken during digestion and metabolic trial. Measured quantity of experimental feed and *ad lib* water were provided to kids throughout the experimental period. Approval of IAEC/CPCSEA was taken prior to conducting the experiment. The experimental kids were separated into groups T₁ and T₂ by randomized block design having eight kids in each group. Group T₁ and T₂ served as control and treatment respectively. Average body weights of both groups were similar at the beginning of experimental period. Dry matter consumption of experimental feeds in terms of g/d, kg/100 kg BW and g/kg W^{0.75} were calculated from the dry matter intake and body weight records of the animals. Body weight records were maintained during entire experimental period. At the end of experiment, total body weight gain (kg) and average daily gain (g/d) of each group were calculated. The values of feed conversion ratio and feed conversion efficiency provide indication about the efficiency of feed. The feed conversion ratio was calculated as amount of DM consumed per kg of weight gain.

For chemical analysis, sample of feed materials provided to livestock were collected. Standard procedures as per AOAC (2012) were used to determine the proximate composition of feed stuffs. The facts obtained within the experiment were analyzed in one-way and two-way ANOVA using SPSS 20.00 statistical analysis software.

Results and Discussion

Chemical composition

P. juliflora pods contained DM 92.75%, CP 12.75%, CF 33.15%, EE 4.35%, NFE 45.80% and total ash 3.95%. CP content of *P. juliflora* pods suggested that it can safely replace barley and de oiled rice bran in the diet of goats.

Present findings of study in text are in agreement with [3,7,10]. Composition of diets was according to the requirements of goat recommend by ICAR (2013). Both the diets were nearly equal in energy and protein content. Diet for control group contained 16.18% crude protein whereas diet for treatment group contained 16.22% crude protein.

Dry matter and nutrient intake

Dry matter intake (g/day)

The values of average daily DM intake at fortnightly intervals have been presented in table 1. The mean values of DM intake in T₁ and T₂ groups were 484.01 and 501.23 g/day, respectively. The statistical analysis revealed non-significant difference between groups (Table 4). Dry matter intakes of both control and treatment groups increased with the age of goats. At each fortnight, treatment group showed higher DM intake as compared with control group but the difference was non-significant between groups. It suggested that the supplementation of *P. juliflora* pods in diet of goats improved daily dry matter intake non significantly. The present findings are in concurrence with earlier findings of [13,14,16,17] as the author reported non-significant changes in daily DM intake of animals on *P. juliflora* pods supplementation in diet. The results of present study are in disagreement with reports of [6,8,9,10,13] as they reported significant effect of *P. juliflora* pods supplementation on daily DM intake.

Dry matter intake (kg/100 kg BW)

Values of average dry matter intake kg/100 kg body weight have been presented in table 2. The average DM intake per 100 Kg body weight in T₁ group was 3.54 kg while in T₂ group it was 3.59

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall
1	447.70	456.44	452.07 ^a
2	465.77	490.25	478.01 ^{ab}
3	483.26	497.83	490.54 ^{bc}
4	486.75	503.66	495.20 ^{bc}
5	500.63	529.19	514.91 ^{bc}
6	519.98	530.01	524.99 ^c
Average	484.01	501.23	-

Table 1: Average fortnightly daily DM intake (g/day) in goats. SEM treatment- 6.83550469; Significance-NS; NS: Non Significant

kg. These results showed a non-significant change between the groups indicating that the supplementation of *P. juliflora* pods in the diet of experimental goats had no effect on their DM intake per 100 kg body weight (Table 4). The present findings fall in line with

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall
1	3.87	3.95	3.91 ^c
2	3.76	3.90	3.83 ^{bc}
3	3.65	3.69	3.67 ^b
4	3.44	3.42	3.43 ^a
5	3.32	3.37	3.34 ^a
6	3.26	3.22	3.24 ^a
Average	3.54	3.59	-

Table 2: Average fortnightly dry matter intake (kg/100 kg BW) in goats. SEM treatment- 0.03840671 Significance - NS; NS = Non significant

findings of [13,14,16,17] as they reported non-significant effect of *P. juliflora* pods supplementation on DM intake per 100 kg body weight while the findings are contrary to those of [6,8,9,10,12] as they reported significant effect of supplementation of *P. juliflora* pods on DM intake of animals expressed on 100 kg body weight.

Dry matter intake (gm/BW^{0.75})

Average DM intakes of experimental goats in terms of g/BW^{0.75} have been presented in table 3. Average values of DM intake (g/BW^{0.75}) in control and treatment groups were 68.01 and 69.31, respectively. Dry matter intake of treatment group was numerically higher than control group but the difference between both groups was statistically non significant (Table 4). The findings obtained in the present study are similar of findings of [12,14,17,16] as they reported non-significant effect of *P. juliflora* pods supplementation on dry matter intake.

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall
1	71.28	74.36	72.82 ^c
2	70.44	72.06	71.25 ^c
3	69.53	70.94	70.23 ^{bc}
4	66.70	67.88	67.29 ^{ab}
5	65.43	65.77	65.60 ^a
6	65.07	64.86	64.96 ^a
Average	68.01	69.31	-

Table 3: Average fortnightly dry matter intake (g/BW^{0.75}) in goats. SEM treatment- 0.74922642 Significance - NS; NS: Non significant

Attribute	Source	d.f.	SS	MSS	F value	Level of sig.
DMI (g/day)	Treatment	1	7113.448	7113.448	3.171741	NS
	Period	5	53058.8	10611.76	4.731567	**
	Error	84	188391.7	2242.758	-	-
DMI (kg/100 kg BW)	Treatment	1	0.046917	0.046917	0.662641	NS
	Period	5	5.788515	1.157703	16.3509	**
	Error	84	5.947504	0.070804	-	-
DMI (g/kgW ^{0.75})	Treatment	1	36.71542	36.71542	1.36264	NS
	Period	5	784.7967	156.9593	5.82532	**
	Error	84	2263.324	26.94433	-	-

Table 4: ANOVA of overall average dry matter intake.

Live-weight change

Average body weights of control and treatment groups have been presented in table 5. At the start of experiment average initial body weights of group T₁ and T₂ were 11.15 and 11.22 kg which increased up to 16.43 and 16.91 kg, respectively at the end of sixth fortnight. Body weights of both T₁ and T₂ groups showed a linear increase fortnightly. At each fortnight, the difference between both groups was non-significant. The overall mean values of body weights for group T₁ and T₂ were 13.74 and 14.08 kg, respectively. The differences between 2 groups were non-significant (Table 7). The result of the study revealed that the *P. juliflora* pods could be safely incorporated in the complete feed up to 20% level by replacing barley and de oiled rice bran without any adverse effect on body weight of goats.

Present findings are in accordance with those of [13] who reported no significant differences in final weight of control and treatment groups in which control and treatment groups fed *P. juliflora* pods at levels of 0, 100 and 200 g/kg. Similarly [1,8,9] also reported non-significant differences in fortnightly body weights of goats fed on different levels of *P. juliflora* pods. In contrary to finding of study in text [12] reported significant changes in body weights of goats on *P. juliflora* pods supplementation.

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall
0	11.15	11.22	11.19 ^a
1	12.01	12.16	12.08 ^b
2	12.81	13.10	12.95 ^c
3	13.72	14.14	13.93 ^d
4	14.62	15.06	14.84 ^e
5	15.51	15.96	15.73 ^f
6	16.43	16.91	16.67 ^g
Average	13.74	14.08	-

Table 5: Average fortnightly live body weight (kg) of experimental goats.

SEM treatment - 0.124261; Significance - NS; NS: Non significant

Metabolic body weight (kg^{0.75}) of experimental goats

Average metabolic body weights (W^{0.75}) of experimental goats have been presented in table 6.

Average fortnightly metabolic body weight was 7.13 kg in T₁ group and 7.26 kg in T₂ group. Fortnightly metabolic body weight changes in both groups were non-significant (Table 7). A linear increase was observed in both groups.

The present findings are in agreement with [10] as they reported non-significant differences in average metabolic weights of different groups of goats fed on *P. juliflora* pods meal at the level of 0, 100, 200 and 300 g/kg. No significant differences in final weight of control and treatment groups in which control and treatment groups were fed *P. juliflora* pods at levels of 0, 100 and 200 g/kg [12]. Similarly, non-significant differences in fortnightly body weights of goats fed on different levels of *P. juliflora* pods [1,8,9]. The present findings are contrary to [12] as they reported significant changes in weaning body weight and average body weight gain than control groups of goats on *P. juliflora* pods supplementation.

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall
1	6.27	6.32	6.30 ^a
2	6.61	6.70	6.65 ^b
3	6.95	7.09	7.02 ^c
4	7.30	7.47	7.38 ^d
5	7.64	7.81	7.73 ^e
6	7.99	8.16	8.07 ^f
Average	7.13	7.26	-

Table 6: Average metabolic body weight (W^{0.75}) of experimental goats.

SEM treatment -0.052473 Significance: NS; NS: Non significant

Total body weight gain (kg) of experimental goats

Total body weight gain of T₁ and T₂ groups were recorded at the end of experiment by the values of initial and final body weights of goats. Average values of fortnightly body weight gain and the total body weight gain of goats have been presented in table 8. Total body weight gain in T₁ and T₂ groups were 5.28 and 5.68 kg, respectively which were significantly (P < 0.05) different with each other (Table 10). It was found that goats of T₂ group exhibited better body weight gain than goats of T₁ group. Average values of fortnightly body weight gain showed no significant difference between T₁ and T₂ groups at any fortnight. However, the values were numerically higher for T₂ group than T₁ group at each fortnight. Supplementation of *P. juliflora* pods improved total body weight gain of goats.

Body wt.	Source	d.f.	SS	MSS	F value	Level of sig.
Live body weight	Treatment	1	3.001538	3.001538	3.471232	NS
	Period	6	375.7135	62.61892	72.41782	**
	Error	98	84.73956	0.864689	-	-
Metabolic body wt.	Treatment	1	0.406323	0.406323	3.074425	NS
	Period	5	35.60748	7.121496	53.88455	**
	Error	84	11.10162	0.132162	-	-

Table 7: ANOVA of overall average body weight.

In accordance with present study as they reported significant difference in average body weight gain of different groups of goats fed on different levels of *P. juliflora* pods [12]. Disagreement with present findings as they observed non-significant difference in total body weight gain of goats on *P. juliflora* pods supplementation [13].

Fortnight	Control (T ₁)	Treatment (T ₂)	Significance
1	0.78	0.94	NS
2	0.80	0.93	NS
3	0.90	1.04	NS
4	0.90	0.92	NS
5	0.89	0.90	NS
6	0.92	0.96	NS
Total body weight gain	5.28 ^a	5.68 ^b	*

Table 8: Average fortnightly body weight gain (kg) in experimental goats.

SEM treatment -0.087411, * = Significant at 5% (P < 0.05).

Note: Mean superscripted with any one different letters within a row differ significantly from each other.

Average daily body weight gain (g/day) in experimental goats

Average daily gains (ADG) have been presented in table 9. Mean values of ADG for T₁ and T₂ groups were 58.67 and 63.19g/day, respectively. There was a significant (P < 0.01) difference between mean values of ADG for T₁ and T₂ groups while average daily gain of both groups did not differ significantly with each other at fortnightly intervals (Table 10). T₂ group showed better results for average daily gain than T₁ group. Hence supplementation of *P. juliflora* pods positively influenced ADG in goats.

Significant increase in ADG on supplementation of *P. juliflora* pods [12,16]. The present findings are not similar to the findings obtained [13,17,18] who observed non-significant differences in ADG on *P. juliflora* pods supplementation.

Fortnight	Control (T ₁)	Treatment (T ₂)	Overall	Significance
1	56.83	62.46	59.65 ^a	NS
2	53.33	62.29	57.81 ^a	NS
3	60.58	69.33	64.96 ^b	NS
4	60.25	61.42	60.83 ^{ab}	NS
5	59.58	60.00	59.79 ^a	NS
6	61.42	63.67	62.54 ^{ab}	NS
Average	58.67 ^a	63.19 ^b	60.93	**

Table 9: Average daily body weight gain (g/day) in experimental goats.

Note: Mean superscripted with any one different letter within a row differ significantly from each other.

SEM treatment-0.9263, ** = Significant at 1% (P < 0.01).

Conclusion

The present study revealed that the *P. juliflora* pods can be used as a replacement of de oiled rice bran and barley in the diet of goats up to 20% level of incorporation/replacement. The incorporation of *P. juliflora* pods in the diet at the rate of 20% of complete feed improved weight gain nutrient utilization in goats. No adverse effects were observed due to feeding of *P. juliflora* pods. It could be concluded that the incorporation of *P. juliflora* pods at the rate of 20% as a replacement of de oiled rice bran and barley, in complete feed of goats had no adverse effect on feed intake, nutrient utilization, rumen fermentation parameters and growth performance of Marwari goat male kids.

Body wt. gain	Source	d.f.	SS	MSS	F value	Level of sig.
Total body wt. gain	Treatment	1	0.664225	0.664225	10.86667	*
	Replicate	7	0.829075	0.118439	1.937657	NS
	Error	7	0.427875	0.061125	-	-
Average daily body wt. gain	Treatment	1	492.0185	492.0185	11.9464	**
	Period	5	503.9676	100.7935	2.447305	*
	Error	84	3459.583	41.18552	-	-

Table 10: ANOVA of overall body weight gain.

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