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Effect of feeding crushed and entire dried *Prosopis juliflora* pods on feed intake, growth and reproductive performance of arid goats

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The use of alternative feed resources which are adaptive to long dry seasons is important for livestock production in arid areas globally (Gusha *et al.* 2015). Agro-industrial byproducts and/or unusual feeds such as *Prosopis juliflora* pods (PJP) may be economically advantageous in reducing feeding costs and can play an important role in feeding of sheep and goats under various management systems (Obeidat and Shdaifat 2013). Though many of the farmers in the dry areas of Rajasthan do not utilize these pods for livestock feeding but the goats browse these entire pods while grazing in the field or are fed by some owners in the form of concentrate.

Pasciecznik *et al.* (2001) reported that pods must be ground or milled to secure the full nutritive value as most of the protein rich seeds would otherwise pass undigested through the digestive tract of livestock. PJP up to 50% of concentrate mixture did not affect feed intake in sheep (Sharma 1997), however, reduction in weight gain was observed when sheep and goats were fed PJP at 60% (Buzio *et al*. 1972) and 85% (Ibrahim and Gaili 1985) of concentrate mixture, respectively. The hard seeds of *Prosopis* lodge between gums and teeth leading to inflammation; livestock jaws are eventually disfigured and these ill effects may sometimes result in death of the animal (Mwangi and Swallow 2005). To the best knowledge of authors, no report is available on the effects of feeding of PJP in entire form in goat diets. Therefore, the objective of this experiment was to investigate the effect of feeding concentrate diets having different forms of dried PJP on dry matter intake, growth and reproductive performance of arid goats.

Eighteen growing goats (Marwari and Sirohi breed) of similar age and body weight were divided into three groups (six in each group) based on their body weight and genetic make-up. The goats were kept under stall-feeding conditions with covered area of 2 m^2/goat. Dry roughage (chaffed dried lentil fodder) was offered *ad libitum* in weighed quantity, which was similar to all the animals of three groups. The concentrate mixture was standard for the goats of control group (PJP0), whereas, 50% dried ground PJP in PJPG group and 50% as such (entire/non-grinded) dried PJP in PJPE group were included by replacing the standard concentrate mixture. The concentrate mixture was prepared with locally available feed ingredients (wheat bran, *Citrullus colocynthis* seed cake, cluster bean meal, mineral mixture and salt). Total concentrate mixture was offered in the morning along with the roughage diet. Feed offered and residue left were weighed daily and analyzed for dry matter (DM), organic matter (OM) and CP (AOAC 1995).

Body weight of goats was recorded at fortnightly intervals in the early morning before offering feed to them. All the experimental animals in each treatment during the study period were assessed for body condition as per Spahr (2009) and were assigned a score at fortnightly interval. A teaser buck was used to detect oestrus in females twice daily during breeding season. The natural mating with breeding bucks was adopted to breed experimental females. In PJPE, goat droppings were collected from the blocks made at different locations of a pen. Number of seeds present in faeces was counted per unit weight basis. The experiment was continued for a period of seven months. The experimental data on growth performance and feed intakes were analyzed using one-way analysis of variance as per Snedecor and Cochran (1994).

Nutrient composition of the three diets fed to the goats in the present study is presented in Table 1. Based on the present cost of locally available feed ingredients, the estimated production cost of concentrate mixture was ₹ 1643, 1171.50 and 1121.50/quintal in PJP0, PJPG and PJPE groups, respectively. Fifty percent replacement of concentrate mixture from similar to that of the standard concentrate mixture of PJP0 with crushed and entire PJP made diets economical in PJPG and PJPE, respectively. In agreement to this study, Ravikala *et al.* (1995) found reduced cost of feeding without adverse effect on growth of lambs

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Table 1. Chemical composition of concentrate mixture and lentil fodder (%) offered to experimental animals

Attribute	Diet (DM basis)		
	Concentrate mixture		Lentil fodder
	PJP0	PJPG/ PJPE	
Dry matter	92.0	96.0	96.3
Organic matter	93.0	93.0	94.0
Crude protein	18.0	17.8	7.9
Crude fibre	9.0	13.0	43.1
Ether extract	4.5	3.5	3.9
Total ash	7.0	7.0	6.0

PJP0, standard concentrate mixture without PJP; PJPG/PJPE, concentrate mixture with PJP (non-grinded PJP were added in concentrate of PJPE during feeding)

fed on concentrate mixture containing PJP. This might be due to the low production and procurement cost of PJP.

Mean values of DMI, body weight gain, FCR and body condition score for goats fed various levels of PJP are presented in Table 2. Average daily dry matter intake (DMI)/ 100 kg body weight did not differ among PJP0, PJPG and PJPE groups. Feed intake results indicated that PJP either ground or intact may be included in goat diets up to 50% of the concentrate mixture and they were well consumed by the experimental goats, which indicated high palatability of mature pods (Sawal *et al.* 2004). However, increasing their proportion in the diet to 300 g/kg will reduce feed intake (Mahgoub *et al.* 2005). The presence of some anti-nutritional substances reported (phenolic compounds) in PJP, when taken in higher quantity may restrict its intake. The results of this study are in agreement with those found by Pereira *et al.* (2013), who evaluated corn replacement by mesquite pod meal at different levels in diets for lactating goats and did not observe any effect on dry matter intake.

Average daily gain in body weight was the highest (P>0.05) in PJP0 than in PJPG and PJPE. Though the differences were non-significant, goats in PJPE had comparatively lower weight gain. This might be due to the low CP intake due to unavailability of protein content present in the seeds which were passed as such through faeces. Moreover, pod crushing improves the feeding value and contribute to livestock productivity as the nutrient rich seeds will be better digestible and available to animals if it is crushed (Yasin and Animut 2014). Consistent with the current study, Obeidat *et al.* (2008) reported that final body weight, ADG and FCR were not affected when PJP was included at rates of 0, 10 and 20% in lamb diets. The goats in PJPE had poor feed efficiency than in PJP0 and PJPG. Ravikala *et al.* (1995) also reported lower efficiency in lambs fed on 30% *P. juliflora* pods ration in arid region. Any trend in respect to the BCS of the experimental animals was not observed. The highest BCS in PJP0 and PJPG were obtained during 4th and 12th fortnight of the study period; however, in PJPE, it was the highest in the first fortnight. The BCS of goats in PJP0 and PJPG reached minimum in

Table 2. Mean values and standard error of feed intake and growth performance parameters in experimental goats

Attribute	Treatment group			SEM	Significance
	PJP0	PJPG	PJPE		
Initial body weight (kg)	16.02± 1.00	16.00 ± 0.75	16.55 ± 0.99	0.50	NS
Final body weight (kg)	27.67± 0.86	25.65 ± 1.44	26.17 ± 1.85	0.81	NS
Change in body weight (kg)	11.65± 0.47	9.65± 0.84	9.61± 1.05	0.50	NS
Average daily gain (g)	55.48± 2.24	45.95 ± 3.98	45.79± 4.99	2.39	NS
Total DMI (kg/100 kg body weight)	4.53± 0.19	4.68 ± 0.11	4.79 ± 0.17	0.09	NS
Initial body condition score	2.50 ± 0.29	2.33 ± 0.21	2.42 ± 0.24	0.14	NS
Final body condition score	2.33± 0.28	2.08 ± 0.27	1.92 ± 0.24	0.15	NS
Change in body condition score	-0.17± 0.21	-0.25± 0.28	-0.50 ± 0.32	0.15	NS
Feed conversion ratio	1:17.85	1:21.11	1:22.29	-	-

PJP0, group without PJP; PJPG, group with ground PJP; PJPE, group with entire/non-ground PJP.

7th fortnight of the experiment. The animals in all the three groups had lower body condition score at the end of the experiment than in the start, however, no differences (P>0.05) were found between any two groups.

The goats in all the groups exhibited normal heat signs. Five goats from each group were bred naturally, which became pregnant and delivered kids normally. In the present study, the reproductive performance of goats fed on different forms of PJP supplemented meals did not show any difference. Moreover, the reports are not available which compared reproduction in goats fed on different forms of PJP supplemented meals.

The animals were examined regularly for health status including dental check-up. None of the animals among all the groups was found suffering from any problem related with chewing the cud or any damage to the oral cavity. Some researchers (Camara *et al.* 2009, Franklin *et al.* 2012) had observed variation in the toxicity caused by the ingestion of the pods in goats. Goats offered dry mesquite pods as sole feed during 4 days suffered from partial anorexia, depression, salivation, twitching, dehydration and bloody diarrhoea (Misri *et al.* 2003). The number of seeds per kg of faeces voided in goats of PJPE was 136. Shiferaw *et al.* (2004) reported that one kg of goat droppings contained, on average 760 *Prosopis* seeds. The difference in the number of seeds per unit of faeces weight from the present study might be due to difference in feeding practices of goats.

It was concluded that feeding of concentrate mixtures containing 50% ground and entire PJP to the arid goats did

not adversely affect growth performance, reproduction and cud chewing. The replacement of concentrate mixture from similar to that of the standard concentrate mixture of PJP0 with crushed and entire PJP made diets economical in PJPG and PJPE, respectively.

SUMMARY

The present study was initiated with the objective to assess the feeding strategy comprising *Prosopis juliflora* pods (PJP) in two forms as alternative feed resource for sustainable goat production for dry season in arid areas. Eighteen growing goats (Marwari and Sirohi breed) were distributed into three groups. The roughage offered was similar to all the animals, however, concentrate mixture was standard for the goats of control group (PJP0), whereas, 50 percent ground PJP in PJPG group and 50 percent as such (entire/non-grinded) dried PJP in PJPE group were included by replacing the standard concentrate mixture. The observations on the animals were recorded for a period of seven months. Fifty percent replacement of concentrate mixture from similar to that of the standard concentrate mixture of PJP0 with crushed and entire PJP made diets economical by ₹ 471.50 and 521.50/quintal basis in PJPG and PJPE, respectively. Daily dry matter intake (DMI)/100 kg body weight was 4.53±0.19, 4.68±0.11 and 4.79± 0.17 kg in PJP0, PJPG and PJPE, respectively. The average body weight gain and body condition score of the animals did not differ significantly between the groups. Five goats from all the groups were bred, which became pregnant and delivered kids normally. The results revealed that the feeding of concentrate mixtures containing either 50% ground or entire PJP to the arid goats did not adversely affect growth performance, reproduction and cud chewing. Moreover, the adopted feeding strategy made *Prosopis juliflora* incorporated concentrate diets more economical than the commercial one.

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