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Effect of thornless cactus (*Opuntia ficus-indica*) supplementation to Tharparkar cattle on water intake and nutrient utilization in hot arid zone of Rajasthan

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Abstract

A feeding trial was conducted to assess the effect of supplementation of thornless cactus on water intake and nutrient utilization in Tharparkar young bulls in hot arid zone of Rajasthan. Eight Tharparkar young bulls were distributed randomly into two groups of four in each, as control (T_0) and treatment (T_1). The animals in each group were fed individually dried chaffed *Cenchrus ciliaris* grass *ad libitum*, 1.0 kg of pelleted concentrate mixture in T_0 , while 1.0 kg of pelleted concentrate mixture and 2.5 kg of fresh chaffed cactus cladodes in T_1 . Total dry matter intake ($\text{g/kgW}^{0.75}$) was 102.5 and 96.9 in animals of T_0 and T_1 group, respectively, whereas water intake for respective groups was 488.09 and 413.64 ml/kgW^{0.75}. Total digestible nutrient content differed significantly ($P < 0.05$) between the groups and the values were 55.95 and 70.43% in T_0 and T_1 group, respectively. The study suggested that cactus cladodes can be supplemented in the ration of cattle without any adverse effect on health status of animals.

Keywords: Bulls, Digestibility, Hot arid-zone, Thornless cactus

The hot arid zone of India is characterized by frequent droughts of moderate to severe in nature. Under such situation livestock are important source of livelihood for farmers. Farmers of arid zone practices livestock based farming system, however, the main constraint to livestock farming, is limited and fluctuating availability of feed and water resources (Mathur, 2003). Again in the changing climatic conditions and global warming with increase in concentration of atmospheric carbon dioxide, many common crops may fail (IPCC, 2014). Therefore, the future of arid regions depends on the development of sustainable agricultural systems with cultivation of appropriate crops like Thornless cactus (*Opuntia ficus-indica*), which successfully withstand water shortage and

high temperature under poor soil fertility conditions to support livestock production.

Cactus is used in livestock feeding in many dry areas like central Tunisia, Mexico, USA, Chilly, Peru and South Africa. Its cladodes are high in water and soluble carbohydrates but low in fibre and nitrogen contents. Mixing cactus with some ingredients in the form of silage holds promises as an alternative feed resource (Gusha *et al.*, 2011). It is a rich source of minerals, metabolizable energy and vitamin A for livestock in the prevailing drought conditions of arid zone and has the potential to bridge the gap between demand and supply of fodder resources. Indeed, *Opuntia* is useful as fodder for ruminant animals, primarily because it has a higher conversion efficiency of water into dry matter (Felker *et al.*, 1997). Soni *et al.* (2015) also suggested that there are possibilities of cultivation of cactus in the arid conditions of Rajasthan for enhancing income of the farming community. However, there is paucity of information on the effects of supplementation of thornless cactus in cattle. Therefore, a feeding trial was conducted by supplementing thornless cactus to Tharparkar young bulls to assess its palatability, digestibility and effect on health status.

The present study was carried out at Cattle Demonstration Unit, ICAR-Central Arid Zone Research Institute (CAZRI), Jodhpur. Eight young bulls of Tharparkar breed (age: 19 to 25 months) were divided randomly into two groups of four in each, as control (T_0) and treatment (T_1). These animals were dewormed with broad spectrum anthelmintic before initiation of experiment. The adaptation period of four weeks stall feeding followed by seven days digestibility trial during March to April 2013. The animals in each group were fed individually dried chaffed *Cenchrus ciliaris* (4.4% CP) grass *ad libitum*, and 1.0 kg of pelleted concentrate mixture (23.78% CP

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on DM basis) in T₀, while in T₁ in addition to 1.0 kg of pelleted concentrate mixture, 2.5 kg of fresh chaffed cactus cladodes were provided daily. The cladodes of clone number 1270 were procured from ICAR-Central Soil Salinity Institute, Karnal, India and were grown at ICAR-CAZRI, Jodhpur, and utilized for the study. The animals were also examined individually daily for their health status. Animals of both the groups were provided individually measured quantity of *ad libitum* drinking water daily. The observations on acceptability, daily feed and water intake were recorded. Pooled representative samples of feed offered, residues and faeces were analysed for proximate composition according to standard methods (AOAC, 1995). The data were subjected to statistical analysis using student's t test (Snedecor and Cochran, 1994).

Thornless cactus had low DM content and was rich in total ash and Ca content (Table 1). The chemical composition of experimental diet was in agreement with the values reported earlier by Mathur *et al.* (2009). Other workers also observed that cladodes of thornless cactus are rich in water (Nobel *et al.*, 1987; Le Houérou, 1992; Nefzaoui, 2000), and contain higher amount of minerals viz., calcium, phosphorus, sodium and potassium (Nefzaoui, 2000; Nefzaoui and Ben Salem, 2000), which are required for proper nutrition of animals.

Table 1. Chemical composition (%) of experimental feed resources

Particulars	<i>Cenchrus ciliaris</i> grass	Pelleted concentrate mixture	Cactus cladodes
DM	95.38	91.87	8.42
CP	4.44	23.78	7.88
CF	34.5	5.5	10.01
EE	5.0	7.75	7.75
NFE	48.06	46.97	53.36
Total ash	7	16	24
Calcium	0.3	1.04	3.7

Average DM intake was not influenced by the supplementation of cactus cladodes (Table 2). Total DM intakes for T₀ and T₁ groups were 6.24 and 6.24 kg, respectively. The results were in agreement with the earlier study of Mathur *et al.* (2014). Indeed, the cactus cladodes were acceptable to all the experimental animals. Salem and Ennouri (2013) compared the palatability and nutritive value of spineless (*Opuntia ficus indica f. inermis*) and spiny (*Opuntia amyclae*) cactus cladodes in goats and observed that when offered simultaneously, goats consumed considerable amount

of both spineless cactus and spiny cactus, which might be due to the exposure of spiny cactus to fire affecting their taste and/or odour. Cactus exhibited high palatability and immediate voluntarily consumption by the livestock (Tegegne *et al.*, 2005), which was probably due to high water content in it. Abidi *et al.* (2013) reported that the ensiled mixture of spineless cactus, olive cake and wheat bran could be used to replace totally or partially oat hay without affecting lamb performances and meat quality. However, feeding of cactus reduced ($P>0.05$) daily water intake by 74.45 ml/kgW^{0.75} compared to animals maintained with grasses and concentrate feeds (488.09 ml/kgW^{0.75}).

Table 2. Daily water and dry matter intakes in animals during experimental period

Particulars	Group	
	Control (T ₀)	Treatment (T ₁)
Metabolic body weight (kgW ^{0.75})	60.87±0.09	64.38±0.07
DMI (kg)	6.24±0.11	6.24±0.08
DMI (g/kgW ^{0.75})	102.5±6.13	96.9±5.97
Water intake (L)	29.71±2.19	26.63±1.83
Water intake (ml/ kgW ^{0.75})	488.09±29.11	413.64±16.89

Digestibility of different nutrients including nitrogen free extract was comparable between the control and treatment groups. But total digestible nutrient (TDN) values differed significantly between the groups, being higher in T₁ group (Table 3). Ferreira *et al.* (2012) reported 64.33% TDN for cactus fed to dairy cattle. Costa *et al.* (2012) observed that increased levels of cactus pear in the diet of the sheep favoured for high digestibility of nutrients, improved the quality of forage, and reduced the voluntary intake of water. Sirohi *et al.* (1997) also reported that *Opuntia* was highly palatable and dry conserved fodder could sustain sheep during scarcity. Misra *et al.* (2006) opined that *Opuntia* cladodes and roughage diets required an additional supplementation of organic N source, which improved dry matter intake, apparent digestibility, nutritive value, plane of nutrition and ruminal N and NH₃-N. Chekir *et al.* (2013) reported that due to low DM and CP contents in cactus cladodes, it is not recommended as sole feed to ruminant animals. Normal mastication was observed in animals fed chaffed cactus (T₁ group). The animals also maintained normal health status, no morbidity was reported from any of animals. Similar findings were reported earlier (NRC, 2001).

Table 3. Effect of cactus supplementation on nutrient digestibility in experimental bulls

Particulars	Group	
	Control (T ₀)	Treatment (T ₁)
<i>Nutrient digestibility</i>		
Dry matter (%)	59.88±5.93	60.46±3.11
Crude protein (%)	66.35±6.82	69.88±8.37
Crude fibre (%)	67.35±5.55	68.81±3.08
Ether extract (%)	54.25±6.76	65.39±9.28
Nitrogen free extract (%)	60.86±6.99	72.74±8.31
<i>Nutritive value</i>		
Digestible crude protein (%)	5.70±0.78	6.08±0.55
Total digestible nutrients* (%)	55.95±3.03	70.43±2.97
Nutritive ratio	1: 8.81	1: 10.58

*(P<0.05)

It was concluded that cactus cladodes can be supplemented in the ration of cattle as energy source for sustainable animal production in dry arid zone of Rajasthan and it did not exhibit any adverse effect on health status of animals.

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