DOI : 10.5958/2277-8934.2017.00032.7 *Vol 24 No 2, p 199-202*

EFFECT OF FEEDING DIFFERENT LEVELS OF ENERGY AND PROTEIN ON DRAUGHT PERFORMANCE AND PHYSIOLOGICAL PARAMETERS OF DROMEDARY CAMELS (*Camelus dromedarius*)

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ABSTRACT

The experiment was carried out to study the effect of feeding different levels of energy and protein along with groundnut haulms (*Arachis hypogaea*) on performance of dromedary camels. Three concentrate mixtures were formulated *viz*., high protein and low energy (T_1); high energy and low protein (T_2) and medium protein and energy (T_3). The digestible dry matter intake (DDMI) was 6.86, 6.61 and 7.5 kg/day, respectively in T_1, T_2 and T_3 which did not differ significantly from each other. The difference for DCP and TDN contents were significant between the treatment groups. There was significant difference for digestible crude protein intake (DCPI) and total digestible nutrient intake (TDNI) among the treatment groups. The power output and speed of operation was significantly ($P<0.05$) higher in T_3 as compared to others, but there was non-significant difference for draught (kgf). The camels in all the treatments were within the safe limit of physiological responses but there was significant ($P<0.05$) increase in the pulse and respiration rates after carting. The results of the study concluded that the performance of camels was higher in T_3 treatment as compared to either high protein or high energy supplementation.

Key words: Camels, draught performance, energy, protein

Camels are remarkable animals that have evolved with a ruminant like digestive system to enable them to survive on low quality, fibrous feeds. Being browsers, camels are able to select high quality diets, which they can efficiently digest. Camels have lower energy requirements than ruminants and have evolved an efficient mechanism for nutrient recycling. Camels have the ability to perform muscular functions such as racing at a level of intensity that exceeds the ability of horses. This unique capacity reflects the lower energy requirements for locomotion, the higher glucose supply, the lower oxygen demand and preferential dependence on slow twitch muscle fibres which in turn rely on aerobic metabolic pathways.

The one humped camel (*Camelus dromedarius*) are adapted themselves to the ecosystem of dry and arid zones where are subjected to harsh conditions in addition to the severe fluctuations in the nutritional status, which in turn affect their general performance (Nazik *et al*, 2015). Guidelines for camel feeding have often been extrapolated from the feeding standards for cattle, assuming that the digestibility of foods by camels and their efficiency of utilisation of nutrients for various functions do not differ significantly from those of true ruminants (Hashi and Kamoun, 1995). The present investigation was carried out to study the effect of feeding different levels of energy and protein on draught performance and physiological parameters of dromedary camels (*Camelus dromedarius*).

Materials and Methods

The experiment was conducted using 9 Bikaneri male camels of 8-9 years of age with an average body weight of 590 to 640 kg. Three concentrate mixtures were formulated *viz*., high protein and low energy (T_1); high energy and low protein (T_2) and medium protein and energy (T_3). The groundnut haulms (*Arachis hypogaea L.*) was offered free of choice to all the camels as basal roughage. Concentrate mixtures were formulated on the farm by using wheat bran (*Triticum aestivum*), groundnut cake (*Arachis hypogaea*), barley (*Hordeum vulgare*), moth meal (*Vigna aconitifolia*), salt and mineral mixture. While preparing concentrate mixtures, groundnut cake and barley were first ground in hammer mill and then all the ingredients were mixed evenly. Concentrate mixtures were prepared at monthly intervals using

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the ingredients from the same lot purchased at the start of experiment. Feeding was done twice daily i.e. in the morning as well as in the evening and feed refusal was weighed once daily prior to morning feeding. The amount of concentrate fed was calculated on the basis of estimated requirement of camels as per Indian Council for Agricultural Research (1985). During the metabolic trial, the representative samples of feeds and faeces were pooled and analysed for proximate principals (AOAC, 2000). The camels were housed in well ventilated shed having sandy floor, asbestos roofing and provision for manger for individual feeding. Before the start of the experiment, the animals were vaccinated, wormed and adapted to the feeds. The camels were weighed fortnightly after 16 hours fasting to reduce the gut-fill, thereby minimising the weight fluctuations.

The animals were trained for carting and had developed endurance for working for 4-6 hr daily. A 2 wheeled camel cart was used as a loading device and load cell of 500 kg capacity was used for measuring the draught. The cart was pulled on a sandy track to cover an approximate distance of 25.5 km daily in 4 to 5 hrs. The camels were allowed to pull payload including the weight of cart and the driver in such way that the experimental camels could exert an average draught of 18 per cent of their body weight. The speed and power developed by camels were calculated for all the experimental camels.

The draught was recorded during the experiment and power was calculated using the standard formula:

$$P=\frac{dxs}{270}$$

Where,

p= Power developed, hp

d= Draught, kgf

s= Average speed, kmh^{-1}

The physiological responses such as respiration rate (flank movement), pulse rate (coccygeal pulsation) and body temperature of camels were recorded before and after the draught stress. The experiment was conducted in completely randomised design and statistical analysis of the data was carried out by one-way ANOVA as suggested by Snedecor and Cochran (1994).

Results and Discussion

The overall crude protein (CP) and total digestible nutrient (TDN) content of concentrate mixtures offered were 23.27 and 65.65, 13.13 and 74.89, 16.49 and 70.71, respectively in T_1, T_2 and T_3. The groundnut haulms offered as basal roughage contained 9.01% CP, 1.78% EE, 24.73% CF, 14.82% TA, 41.51% NDF, 29.39% ADF and 12.12% hemicelluloses. The crude protein content (9.2%) was higher in the present investigation as compared to the reports of Gupta *et al* (2012) but lower than that reported by Bui (1998) for peanut haulms. However, the crude fibre (CF) and nitrogen free extract (NFE) contents were lower than that reported by Chaudhary *et al* (2008) who fed different levels of energy along with groundnut straw to draught camels.

The DCP content was significantly ($P<0.05$) higher in T_1 as compared to T_3 and T_2 which might be due to feeding of camels on higher levels of protein (Nagpal *et al*, 2011 and Gupta *et al*, 2012). The total digestible nutrient (TDN) was higher in T_3 which was of the order of 5.17 and 10.25 per cent units over that of T_2 and T_1, respectively which was supported by Chaudhary *et al* (2008) who reported similar trend for TDN content in the ration of dromedary camels. The DMI, DDMI and DOMI (kg/day) did not differ significantly ($P<0.05$) among treatment groups which may be due the fact that the type of feed and fodder did not affect the dry matter intake (Rai *et al*, 1994; Nagpal *et al*, 2010 and Gupta *et al*, 2012). The DCP intake was higher in T_1 as compared to T_3 and T_2 which might be due to feeding of camels with higher levels of protein in T_1 (Nagpal *et al*, 2011). The TDN intake (kg/day) was significantly ($P<0.05$) higher in T_3 (7.43) as compared to T_2 (6.86) and T_1 (6.24) which was in accordance with the findings of Gupta *et al* (2008).

The average daily gain (g/day) was not affected by the treatment groups. There was non-significant difference between the treatments for draught performance (kgf). The speed of operation

Table 1. Proportion of ingredients in concentrate mixtures (%).

Feed	Treatments		
	High Protein and Low Energy (T_1)	High Energy and Low Protein (T_2)	Medium Protein and Energy (T_3)
Triticum aestivum bran	33.33	13.89	28.57
Arachis hypogaea cake	33.33	8.33	14.28
Hordeum vulgare	16.67	69.44	42.86
Vigna aconitifolia meal	16.67	8.34	14.29
Crude Protein	23.27	13.13	16.49
Estimated TDN	65.67	74.89	70.71

Table 2. Proximate composition (% DM basis) of feed and fodder offered to draught camels.

Feed	DM	OM	CP	EE	CF	TA	NFE
Triticum aestivum bran	90.29	95.2	12.25	2.96	8.89	4.8	71.1
Arachis hypogaea cake	92.91	92.8	43.2	8.79	9.2	7.2	31.61
Hordeum vulgare	90.67	95.5	9.5	2.15	6.68	4.5	77.17
Vigna aconitifolia meal	91.52	89.8	19.25	5.97	10.67	10.2	53.91
Arachis hypogaea straw	90.84	85.18	9.01	1.78	24.73	14.82	49.66

Table 3. Nutrient utilisation in dromedary camels.

Attribute	Treatments		
	T_1	T_2	T_3
DMI, kg/day	10.95±0.70	10.89±0.88	11.69±0.10
DDMI, kg/day	6.86±0.64	6.61±0.77	7.51±0.18
DOMI, kg/day	10.95±0.77	10.89±0.88	11.69±0.10
DCPI, g/day	886.62±41.51^a	693.08±58.14^b	840.73±8.90^a
TDNI, kg/day	6.24±0.32^c	6.86±0.58^b	7.43±0.16^a
DCP, %	8.11±0.29^a	6.36±0.10^c	7.19±0.05^b
TDN, %	57.06±1.52^c	60.29±0.86^b	63.58±1.15^a

^{a,b,c} Mean values in the same row that have different superscripts are significantly different from each other (P<0.05).

Table 4. Body weight and draught performance in dromedary camels.

Attributes	Treatments		
	T_1	T_2	T_3
Body weight, kg			
Initial body weight	639.00±52.30	632.33±55.32	628.66±55.07
Final body weight	650.00±48.25	642.70±52.13	640.66±51.12
Body weight change	11.00±4.27	10.36±5.91	12.00±5.95
Average daily gain, g/day	183.33±71.20	172.78±98.63	199.99±99.28
Draught performance			
Draught, kgf	117.00±8.68	115.68±9.38	115.32±9.20
Speed, km/h	2.82±0.01^c	2.88±0.09^{bc}	3.29±0.01^a
Power, hp	1.22±0.09^c	1.23±0.14^{bc}	1.44±0.11^a

^{a,b,c} Mean values in the same row that have different superscripts are significantly different from each other (P<0.05).

was significantly (P<0.05) higher in T3 but there was non-significant difference between T_1 and T_2 for speed of operation (Gupta *et al,* 2014). Likewise, the power output (hp) was 1.44, 1.23 and 1.22 in T_1, T_2 and T_3, respectively which was significantly (<0.05) higher in

Table 5. Physiological parameters in dromedary camels

Attributes	Treatments		
	T_1	T_2	T_3
Rectal Temperature, °C			
Before work	36.73±0.68	36.43±0.75	36.93±0.40
After work	38.70±0.34	38.30±0.60	37.96±0.41
% Increase	5.35	5.12	2.80
Pulse rate, beats/minute			
Before work	45.66±0.57	46.33±1.52	45.66±0.58
After work	55.33±0.56^a	53.00±0.58^b	50.00±1.15^c
% Increase	21.17	14.39	9.49
Respiration rate, breaths/minute			
Before work	8.66±0.57	9.00±1.00	8.33±1.15
After work	18.66±0.58^a	17.00±1.01^a	12.66±1.16^b
% Increase	115.38	88.89	52.00

^{a,b,c} Mean values in the same row that have different superscripts are significantly different from each other (P<0.05).

T_3 as compared to T_1 and T_2. The results for draught performance in camels were within the range as reported by Rai and Khanna (1994) who reported the similar trend.

There was non-significant difference between the treatment groups for rectal temperature but there was increase in rectal temperature when camels were put under work. The pulse rate (beats/minute) was significantly higher in T_1 followed by T_2 and T_3. The per cent increase in pulse rate in camels before and after work was of the order of 21.17, 14.39 and 9.49, respectively in T_1, T_2 and T_3. There was significant increase in the respiration rate (breaths/minute) in camels before and after work which was confirmed by Khanna and Rai (2000) who reported increase in respiration rate after carting in draught camels. Similarly, Rai and Khanna (1994) reported an increase in body temperature, pulse rate and respiration rate over the initial values in Bikaneri camels. The increase in physiological parameters might be due to higher heat stress and hard muscle exercise during carting and lower availability of energy in the body.

Conclusions

The results concluded that the dromedary camels may be fed on ration having medium level of protein and energy rather than higher energy and lower protein or high protein and low energy through concentrate mixture along with leguminous based roughages for improved draught performance without showing fatigue symptoms.

Acknowledgements

The authors are extremely thankful to Indian Council of Agricultural Research, New Delhi for providing financial support through AICRP on Increased Utilisation of Animal Energy with Enhanced System Efficiency, Udaipur centre, Rajasthan (India).

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