

EVALUATION OF TOTAL MIX RATION WITH DIFFERENT PROPORTIONS OF ROUGHAGES IN DRAUGHT CAMELS

Lokesh Gupta

Department of Animal Production Rajasthan College of Agriculture
Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

ABSTRACT

An experiment was conducted using 3 dromedary camels (498-531 kg b.wt) aged 8-10 years in latin square design to evaluate the effect of feeding different proportions of roughages on nutrient utilisation, physiological responses and draught performance under sustained working. Animals were fed total mix ration (TMR) containing roughages and concentrate mixture in the ratio of 70:30. In roughages, soybean straw (*Glycine max* L.) and gram straw (*Cicer arietinum* L.) were mixed in one of the three ratios 75:25, 50:50 and 25:75 which were designated as T₁, T₂ and T₃, respectively. The DCP and TDN contents were higher in camels fed on total mix ration containing 50:50 proportion of soybean straw (*Glycine max* L.) and gram straw (*Cicer arietinum* L.) as compared to other treatment groups. The nutrient intake was higher in T₂ while, T₁ and T₃ were at par with each other. The difference for DDMI and DOMI was also significant between the treatment groups. The CPI, DCPI and TDNI (g/kgW^{0.75}) were significantly higher in T₂ whereas, T₁ and T₃ exhibited non-significance difference. A four wheel cart was used as a loading device for applying load cell between the body of cart and the beam for measuring the draught capacity. There was non-significant difference between the treatments for initial body weight, final body weight, body weight gain, average daily gain and draught (kgf). However, the speed of operation and power (hp) was significantly higher in T₂ as compared to T₁ and T₃. The results may conclude that feeding of 50:50 proportions of soybean and gram straw in TMR has positive effect on nutrient utilisation and draught performance in dromedary camels without any detrimental effect on physiological responses under sustained working.

Key words: Camels, draught, feeding, nutrient utilisation, physiological responses, TMR

Camels with poor feeding methods and conditions in their native habitat have lower productivity compared to other animals (Topps, 1975; Mousa *et al*, 1983). Fibrous crop residues and agro-industrial by-products play an important role as a source of feed for ruminants, but the utilisation of these feeds is limited because of poor nutrient content and digestibility. Furthermore, the availability of straws is widespread and they play a strategic role particularly in times of scarcity. Crop residues is a by-product from the main agriculture produce and feeding value of these crop residues can be increased by incorporating them into total mixed rations (TMR) by fortifying them with required nutrients (Sharma *et al*, 2010). Present study was therefore planned to observe the effect of total mix ration with different proportions of soybean straw and gram straw on digestibility, nutrient intake, body weight changes, draught performance and physiological responses in draught camels.

Materials and Methods

This study was conducted in 3x3 latin square design using 3 adult (~8-10 years) dromedary Mewari draught camels weighing 498-531 kg to investigate the effect of total mix ration with different proportions of soybean straw and gram straw on nutrient utilisation, draught performance and physiological responses. The animals were fed on total mix ration (TMR) containing roughages and concentrate mixture in the ratio of 70:30. In roughages, soybean straw (*Glycine max* L.) and gram straw (*Cicer arietinum* L.) were mixed in one of the three ratios 75:25, 50:50 and 25:75 which were designated as T₁, T₂ and T₃, respectively. The concentrate mixture was fed as per requirement of draught camels (ICAR, 1985). Concentrate mixture prepared by grinding of feeds ingredients in hammer mill and feed mixer was used for evenly mixing of all the ingredients. Concentrate was prepared at monthly intervals in which ingredients purchased at the start of experiment were used.

SEND REPRINT REQUEST TO LOKESH GUPTA [email: lok Gupta76@gmail.com](mailto:lok Gupta76@gmail.com)

The experiment was conducted for a period of nine weeks having three different phases of three weeks each. Each animal was offered one of the treatments at a time for a period of 3 weeks. The 3rd week of each phase under each treatment was considered as experimental period for collection of data. During the collection period, the daily feed consumption, leftover as well as faeces voided during preceding 24h were recorded at 9.00 hrs. The total dung voided by each camel during digestibility period (3rd week of each phase) for 24 hours was collected with the help of specially designed faecal collection bags. The representative samples of feeds and faeces were pooled and analysed for proximate principals (AOAC, 2005).

The camels were operated at a draught level of 14 per cent of their BW with a work (W)-rest (R)-cycle of 2h W-1h R-2h W-4h R-2h W-1h R-2h W during the experimental period (Gupta *et al*, 2014). The animals were trained for carting and were developed endurance of working for 4-6 hr daily. For applying the load cells (Dynamometer of 500 kg Ecl, UK) between the body of the cart and the beam for measuring the draught, four wheeled camel cart was used as a loading device. The cart was pulled on track to cover an approximate distance of 25.5 km daily in 4 to 5 hrs. The camels were allowed to pull payload in such way that the experimental camels could exert an average draught of 18 per cent of their body weight. The speed (km/h) and draught (kgf) were recorded for 5.1 km span and cumulative 25.5 km distance 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)

Physiological responses such as respiration rate, pulse rate and rectal temperature of the camels were recorded before and after carting. The data obtained

were analysed by using one-way ANOVA as per the procedure prescribed by Snedecor and Cochran (1994).

Results and Discussion

Chemical composition: The chemical composition of feeds and fodders fed to the draught camels during the investigation is represented in Table 1. Crude protein (CP) content was 6.97 per cent in gram straw while, it was 6.61 per cent in soybean straw. Gram straw and soybean straw had ether extract (EE) of 1.21 and 1.52 per cent, respectively. Crude fibre (CF), nitrogen free extract (NFE) and organic matter (OM) were higher in soybean straw as compared to gram straw while, total ash (TA) was more in gram straw as compared to soybean straw. These results are in confirmation with Gupta *et al* (2014) who reported similar composition of gram straw. However, Gupta and Murdia (2002) and Gupta *et al* (2011) reported lower values of CP, EE, NFE and TA in gram straw as compared to present study. Significantly higher CP contents were reported by Nagpal *et al* (2010) in guar phalgati (7.42%) and groundnut haulms (8.25%) as compared to gram and soybean straw. Similarly, higher crude protein content (14.2%) was reported by Bui (1998) in peanut haulms.

Nutrient Utilisation: The digestible crude protein (DCP) and total digestible nutrient (TDN) contents were 5.77 and 54.10; 6.12 and 55.11 and 6.09 and 53.49, respectively in T₁, T₂ and T₃ (Table 2). The DCP and TDN contents were higher in camels fed on total mix ration containing 50:50 proportion of soybean straw (*Glycine max* L.) and gram straw (*Cicer arietinum* L.) as compared to other treatment groups. The DCP and TDN contents were higher than that reported by Gupta *et al* (2011) on feeding different levels of energy diets along with gram straw based ration. Gupta *et al* (2012b) also reported lower values of DCP and TDN as compared to present study in dromedary camels fed on different proportions of groundnut haulms and cluster bean straw. However, Choudhary *et al* (2008) reported significantly higher

Table 1. Proximate chemical composition (% DM) of feed and fodder offered to draught camels.

Feed	DM	CP	EE	CF	TA	NFE	OM
Cotton seed cake (<i>Gossypium hirsutum</i>)	89.91	21.54	7.56	25.91	6.23	38.76	93.77
Barley (<i>Hordeum vulgare</i>)	90.22	10.21	2.71	6.91	2.89	77.28	97.11
Wheat Bran (<i>Triticum aestivum</i>)	90.31	10.93	3.05	9.56	5.24	71.22	94.76
Green gram churi (<i>Vigna radiata</i>)	89.82	18.21	3.08	15.42	8.2	55.09	91.80
Gram straw (<i>Cicer arietinum</i>)	90.01	6.97	1.21	37.28	12.86	40.12	89.29
Soybean straw (<i>Glycine max</i>)	90.74	6.61	1.52	42.06	11.29	40.35	91.27

values of DCP and TDN contents as compared to present investigation.

Table 2. Nutrient utilisation in draught camels.

Attribute	Treatments			SEM
	T ₁	T ₂	T ₃	
Nutrient Intake:				
DDMI (kg/d)	6.37	7.35	6.36	0.347
DOMI (kg/d)	6.42	7.04	6.53	0.617
DMI (kg/w ^{0.75})	95.42 ^b	102.07 ^a	95.80 ^b	1.012
CPI (g/kgW ^{0.75})	8.79 ^b	9.49 ^a	8.94 ^b	0.109
DCPI (g/kgW ^{0.75})	5.51 ^b	6.27 ^a	5.83 ^b	0.197
TDNI (g/kgW ^{0.75})	51.66 ^b	56.41 ^a	51.25 ^b	1.574
Nutritive Value:				
DCP (%)	5.77 ^b	6.12 ^a	6.09 ^b	1.155
TDN (%)	54.10 ^b	55.11 ^a	53.49 ^b	1.052

^{a,b,c} Values with different superscripts differ significantly from each other.

The nutrient intake analysis indicated that dry matter intake (kg/w^{0.75}) was higher in T₂ (102.07) while, T₁ (95.42) and T₃ (95.80) were on par with each other. These results were in agreement with the findings of Rai *et al* (1994). However, Gupta *et al* (2012b) reported non-significant difference between the treatments for dry matter intake on metabolic size basis on feeding different levels of groundnut haulms and cluster bean straw in draught camels. There was significant difference between the treatments for digestible dry matter intake (DDMI) and digestible organic matter intake (DOMI). Shalash (1984) reported that DDMI and DOMI were significantly high in camels fed on 75% groundnut haulms and 25% cluster bean straw which may be due to high palatability of groundnut haulms as it has more proportion of leaves as compared to cluster bean straw which confirms the present results. The crude protein intake (g/kgW^{0.75}) was significantly higher in T₂ whereas, T₁ and T₃ exhibited non-significance difference. The digestible crude protein intake and total nutrient intake (g/kgW^{0.75}) were highest in 50:50 proportion of soybean and gram straw followed by 75:25 and 25:75 proportions but didn't differ significantly. The TDN intake also follows the same trend i.e., the values were significantly higher in T₂ but T₁ and T₃ were at par with each other. Nagpal *et al* (2005) reported significantly higher DCP and TDN intakes in camel calves fed on complete ration containing gram straw, groundnut forage and concentrate in the ratio of 60.3:25.0:14.7 in feed blocks

which confirm the results of present investigation. Likewise, Nagpal *et al* (1996), Nagalaksh and Reddy (2001) and Nagpal and Arora (2002) reported higher nutrient intake in complete ration fed animals than those fed on conventional diets.

Body Weight and Draught Performance: The results indicated non-significant difference for the initial body weight, final body weight, body weight gain and average daily gain (g/day) among the three treatments but the values were comparatively higher in 50:50 proportions of soybean and gram straw. The draught performance of camels is depicted in Table 3. The feeding of different proportions of gram and soybean straw didn't affect the draught (kgf) exerted by the camels. The speed of travel was significantly higher in T₂ (3.25 km/h) while, T₁ (3.00 km/h) and T₃ (3.04 km/h) were at par with other. Similarly, significant high power was developed in 50:50 proportions of soybean and gram straw but 75:25 and 25:75 proportions had non-significant difference. Similar results for draught and power output were confirmed by Gupta *et al* (2011). The speed varied in range from 2.97 to 2.75, 2.5 to 2.43 and 2.26 to 2.2 km/h in I, II, III and IV session and the rate of decrease was 7.4, 3.0, 7.6 and 2.6%, respectively on feeding gram straw along with supplementation (Gupta *et al*, 2014).

Table 3. Body weight and draught performance in camels.

Attributes	Treatments			SEM
	T ₁	T ₂	T ₃	
Body weight (BW)				
Initial body weight (kg)	515.33	516.67	518.33	10.645
Final body weight (kg)	560.00	563.67	562.33	7.034
Body weight gain (kg)	44.66	47.00	44.00	9.767
Average daily gain (g/day)	709.00	746.03	698.41	15.011
Draught Performance				
Draught (kgf)	100.80	101.46	101.22	1.266
Speed (km/h)	3.00 ^b	3.25 ^a	3.04 ^b	0.142
Power (hp)	1.12 ^b	1.25 ^a	1.14 ^b	0.049

^{a,b,c} Values with different superscripts differ significantly from each other.

Physiological Responses: The values of rectal temperature, pulse rate, respiration rate, breaths /minute are depicted in Table 4. There was no significant effect on the rectal temperature among the three proportions of soybean and gram straw before work while, T₁ (39°C) had significantly higher

effect on rectal temperature followed by T₂ (38.4°C) and T₃ (38.8°C) after carting. There was no significant effect on the pulse rate and respiration rate before and after work. However, the per cent increase was higher in 25:75 proportions of soybean and gram straw, followed by 75:25 and 50:50 proportions. In contrast, non-significant difference for rectal temperature and significant difference for pulse rate and respiration rate was reported by Gupta *et al* (2012a). The physiological responses of the camels viz, pulse rate, respiration rate and rectal temperature increased with duration of work where as speed of operation decreased with duration of work (Gupta *et al*, 2014).

Table 4. Physiological responses in camels and respiration rate, breaths/minute.

Attributes	Treatments			SEM
	T ₁	T ₂	T ₃	
Rectal Temperature, °C				
Before work	36.50	36.46	36.73	0.364
After work	39.00 ^a	38.40 ^b	38.80 ^b	0.226
% Increase	6.85	5.30	5.63	-
Pulse Rate, beats/minute				
Before work	45.33	46.00	45.66	1.122
After work	52.00	52.33	52.66	1.123
% Increase	14.71	13.77	15.33	-
Respiration rate, breaths/minute				
Before work	8.33	8.66	8.67	0.471
After work	16.66	16.00	16.67	0.902
% Increase	100.00	92.00	100.00	-

^{a,b,c}Values with different superscripts differ significantly from each other.

Conclusion

It can be concluded that feeding of soybean straw and gram straw in ratio of 50:50 had positive effect on nutrient utilisation and power out as compared to 75:25 and 25:75 proportions. Thus, feeding of total mix ration with equal proportions of soybean straw and gram straw may be recommended for improved nutrient utilisation in dromedary camels undergoing sustained working.

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