

ASSESSMENT OF PHYSIOLOGICAL AND FATIGUE ENDURANCE LIMIT OF DROMEDARY CAMEL IN ROTARY MODE OF OPERATION WITH OPTIMAL FEEDING RATION

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ABSTRACT

The studies was conducted on 3 dromedary camels (545-640 kg body weight; 8-10 years age) to assess their work performance and physiological endurance limit with optimum feeding ration in rotary mode of operation. The camels were offered gram straw (*Cicer arietinum*) as sole ration in all the treatments but in T₂ and T₃ camels were supplemented with concentrate mixture having 65 and 75% TDN, respectively. A loading car was used to apply and vary the load on the camels in rotary mode of operation. The camels were operated at a draught level of 14% of their body weight with work rest cycle of 2h (W)- 1h (R)- 2h (W)- 4h (R)- 2h (W)- 1h (R)-2h (W). The nutrient utilisation was significantly ($P<0.05$) higher in T₁ followed by T₂ and T₃. 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. The speed varied in range 2.97 to 2.75 km/h, 2.5 to 2.43 km/h and 2.26 to 2.2 km/h in I, II, III and IV session and the rate of decrease was 7.4, 3, 7.6 and 2.6%, respectively. Fatigue score was found to increase with duration of work which might be due to increase in the physiological response and appearance of physical symptoms with increase in duration of work. It was concluded from results that the physiological responses and fatigue score increased with duration of work where as, speed of operation decreased with duration of work in dromedary camels fed with optimal ration.

Key words: Camel, draught, feeding, physiological responses, rotary mode

Camels are the important animals of arid ecosystem because of their unique features of adaptability, survivability and draught performance under adverse climatic conditions (Nagpal and Jabbar, 2005). There is considerable scope for using the available draught animal power during idle periods on stationary jobs such as cane crushing, oil extraction, water lifting, winnowing and several other operations (Singh and Singh, 1987). By using animals in rotary mode of operation, the surplus/ idle animal power available after tillage, sowing and other field operations can be utilised efficiently for different agro processing operations. This will reduce the dependency of farmers on the electricity and fossil fuels. It will also enable farmers to generate extra income when they are not engaged in agriculture operations. Though camels have been used as draught animal for years, not much information is available on draught and physiological behaviour of camels in sustained working in rotary mode of operation when

maintained on optimal feeding ration. Therefore, the present investigation was planned to assess the physiological endurance limit of draught camels with optimal feeding ration in rotary mode of operation.

Materials and Methods

The studies were conducted using 3 Mewari dromedary camels weighing 545-640 kg (8-10 years) to assess their work performance and to identify the optimum feeding ration in rotary mode of operation (Fig 1). Three dietary treatments T₁, T₂ and T₃ were formulated and animals were offered gram straw (*Cicer arietinum*) as sole ration in all the treatments but in T₂ and T₃ camels were supplemented with concentrate mixture having 65 and 75% TDN, respectively. All other management practices were kept same for all the groups. The feed and faecal samples were analysed as per the procedure described by A.O.A.C. (1995). A loading car was used to apply and vary the load. Camels

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were operated at a draught level of 14% of their body weight with work rest cycle of 2h (W)- 1h (R)- 2h (W)- 4h (R)- 2h (W)- 1h (R)-2h (W). The physiological responses- such as pulse rate, respiration rate, rectal temperature and speed of operation were recorded at the beginning and hourly interval on rotary mode of operation. These parameters were also recorded while the camels were in rest to assess the recovery. The physical symptoms like leg incoordination, water from nostril, tears from eyes, frothing from mouth, tongue protrusion and refusal to move forward were also observed visually. Fatigue scorecard was adopted to assess the fatigue level in camels. The data obtained were analysed statistically (Snedecor and Cochran, 1967).

Results and Discussion

Physiological endurance limit of draught camels with optimal feeding ration in rotary mode of operation was assessed and results are presented in different sections.

Nutrient Utilisation: The gram straw contained 90.03% Dry matter (DM), 6.3% Crude protein (CP), 41.86% Crude fibre (CF), 1.09% Ether extract (EE), 42.92% Nitrogen free extract (NFE) and 7.82% total ash on dry matter basis (Gupta *et al*, 2011). The digestible energy and metabolisable energy contents were higher in T₃ and lower in T₁ but there was non-significant difference between T₂ and T₃. These results were in accordance with the findings of Kohnke and Cluer (1992) and Khanna and Rai (1989). The dry matter intake (% body weight) was 1.37, 1.93 and 2.04, respectively in T₁, T₂ and T₃ which differed significantly from each other. The digestible crude protein intake (g/day) and total digestible nutrient intake (kg/day) was significantly (P<0.05) higher in T₃ followed by T₂ and T₁ (Table 1). The DDMI and DOMI (kg/d) was significantly (P<0.05) higher in T₃ as

Table 1. Nutrient utilisation in dromedary camels fed on optimal ration in rotary mode of operation.

Attributes	Treatments			S.Em
	T1	T2	T3	
DMI, %BW	1.37 ^c	1.93 ^b	2.04 ^{ab}	0.08
CPI, %BW	0.08 ^b	0.16 ^a	0.17 ^a	0.01
DCPI, %BW	0.45 ^c	0.94 ^b	1.07 ^a	0.02
TDNI, %BW	0.72 ^c	1.13 ^b	1.28 ^a	0.03
DDMI, kg/d	3.94 ^c	6.17 ^b	7.39 ^a	0.28
DOMI, kg/d	4.45 ^c	6.54 ^b	7.18 ^a	0.17
DE, M cal/kg	2.30 ^c	2.58 ^{ab}	2.77 ^a	0.09
ME, M cal/kg	1.86 ^c	2.08 ^{ab}	2.24 ^a	0.07

compared to T₂ and T₁ which is in accordance with the reports of Nagpal *et al* (1993) and Gupta *et al* (2010).

Physiological Responses: The physiological responses of the camels *viz.* pulse rate, respiration rate and rectal temperature were found to be increased with duration of work whereas, speed of operation decreased with duration of work. The pulse rate increased from 38 to 54 beats/min, 39 to 59 beats/min, 39 to 58 and 40 to 61 beats/min during I, II, III and IV sessions, respectively (Fig 2). Nagpal *et al* (1996) reported similar trend for increase in pulse rate after exercise which is in close agreement with the findings of present findings. There is an increased demand of oxygen during exercise which will be met by enhanced oxygen carriage of blood aided by an increased circulation rate and hence leads to increase in pulse rate of the animals (Rana *et al*, 1978).

The respiration rate increased with increase in duration of work in the first session of work, the respiration rate increased at the higher rate in the beginning whereas, the rate of increase was lower during rest (Fig 3). In second session of work after rate, the increase in respiration rate was slower than that of first session of work. The rate of increase in respiration was dependant on initial respiration rest at rest. The respiration rate varied from 7 to 9 breaths/min, 9 to 11 breaths/min, 10 to 11 breaths/min and 10 to 11 breaths/min during I, II, III and IV session of work, respectively. These results are supported by earlier findings of Khanna and Rai (2000). Similarly, Gupta *et al* (2010) also found an increase in respiration rate over the initial values when the camels were put under carting.

The effect of duration of work on rectal temperature of the camels in rotary mode of operation is shown in Fig 4. The rectal temperature of the camel increased with duration of work. The variation in rectal temperature was very less as compared to pulse rate and respiration rate. In the first session of



Fig 1. Draughtability assessment of camel in rotary mode of operation

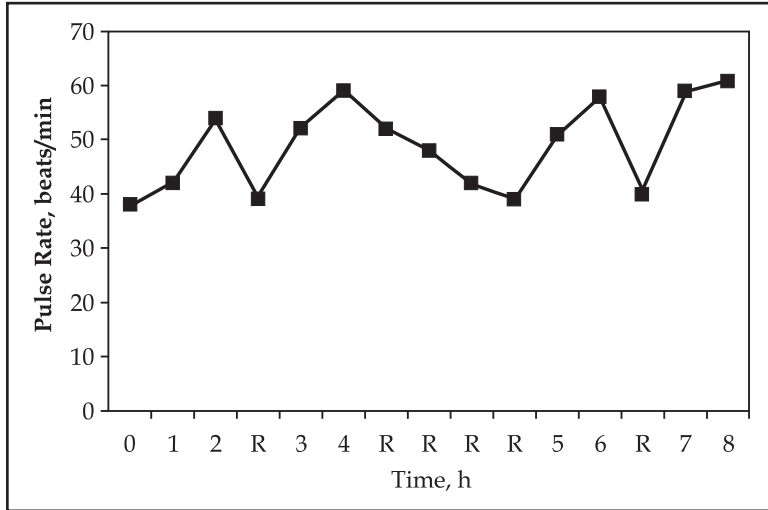


Fig 2. Effect of duration of work on pulse rate.

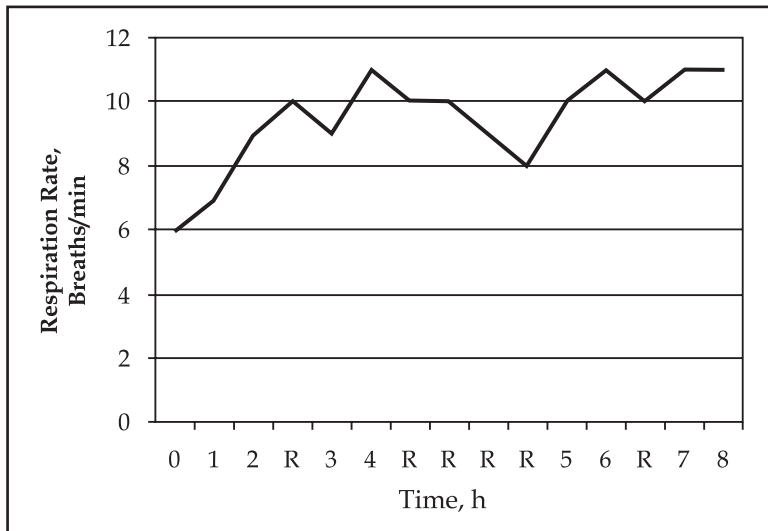


Fig 3. Effect of duration of work on respiration rate.

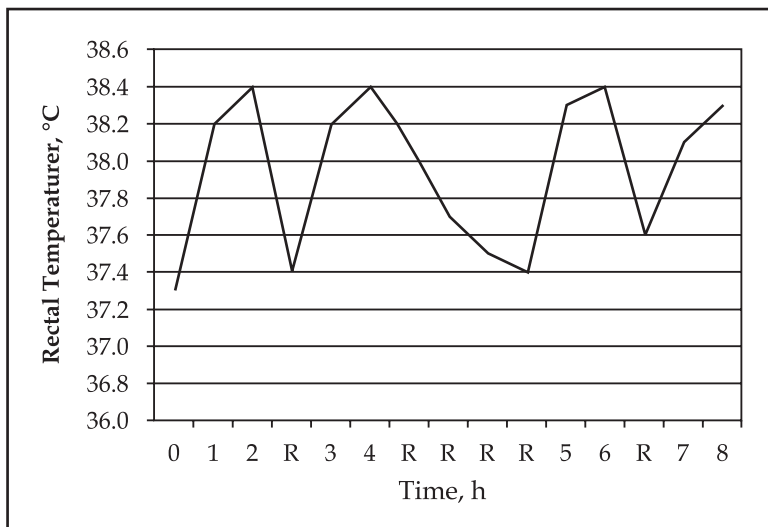


Fig 4. Effect of duration of work on rectal temperature.

work, the rectal temperature increased at higher rate in starting hours whereas, in rest hours the per cent decrease in rectal temperature was higher than that of the subsequent rest hours. In second session of work after rest, the increase in rectal temperature was lower than that of the first session. Din *et al* (2004) assessed different work rest cycles for camel under sustained working at six levels of draught (16, 18, 20, 22, 24 and 26% BW) and reported that camel should be operated in two sessions i.e., early in the morning and late in the evening in summer session to avoid excessive thermal stress. Rai and Khanna (1994) report an increase in body temperature, pulse rate and respiration rate over the initial values in Bikaneri camels which is similar to the results noted in the present investigation.

The variation in speed with duration of work in different work rest cycle is shown in Fig 5. It indicates that the average speed of operation of camels decreased with duration of work. The speed varied in range 2.97 to 2.75 km/h, 2.5 to 2.43 km/h and 2.26 to 2.2 km/h in I, II, III and IV session and the rate of decrease was 7.4, 3, 7.6 and 2.6 percent, respectively. The results are in conformation with the findings of Dharm *et al* (2006) who reported that the speed of operation decreased with duration of work and the speed of travel decreased at slower rate in starting session of working while in the subsequent session of work after rest, the rate of decrease in speed was higher than that of the previous sessions of work.

Fatigue score assessment: Fatigue score was calculated at the end of each working hour in rotary mode of operation by using fatigue score card based on physiological responses and physical symptoms of camels exhibited during work. Fatigue level has been divided in 4 categories i.e., less tired (fatigue score less than 7), tired (fatigue score from 7 to 14), more tired (fatigue score from 14 to 21) and excessively tired (fatigue score from 21 and more) (Bhatt *et al*, 2002).

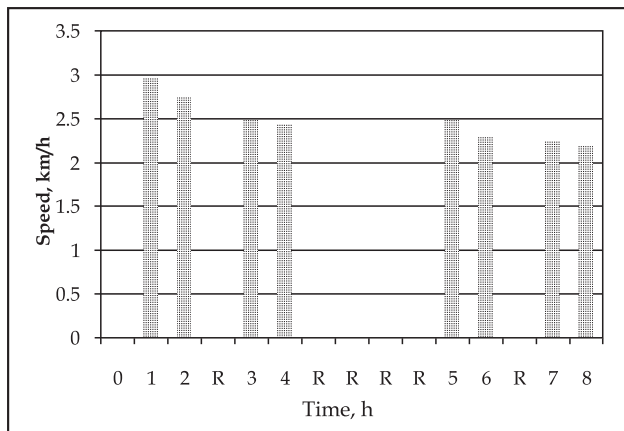


Fig 5. Effect of duration of work on speed of operation.

In general, fatigue score was found to increase with duration of work which might be due to increase in the physiological response and appearance of physical symptoms with increase in duration of work. The fatigue score increased from 2 to 5, 6 to 9 and 6 to 8 in I, II, III and IV session, respectively (Fig 6).

Conclusions

It has been concluded from the results that feeding of gram straw with 75% TDN through concentrate mixture was observed to be the optimum feeding ration for camels in rotary mode of operation. The physiological responses of the camels *viz.* pulse rate, respiration rate and rectal temperature increased with duration of work whereas, speed of operation decreased with duration of work. Further, the fatigue score was found to increase with duration of work.

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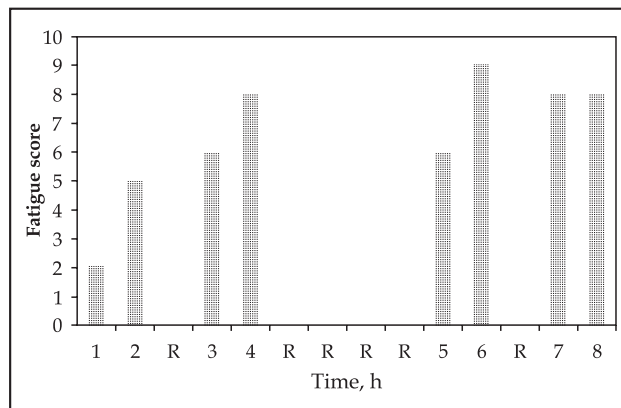


Fig 6. Effect of duration of work on fatigue score.

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