

# WORK PERFORMANCE OF CAMEL IN ROTARY MODE OF OPERATION

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## ABSTRACT

Studies were conducted to assess the work performance of camel in rotary mode of operation. A loading cart was used to vary the load on animal in rotary mode of operation. Three camels were operated at a single level of draught (16% of body weight) with 3 different work rest cycles viz., WR<sub>1</sub>: 4h (W)- 5h (R)-4h (W); WR<sub>2</sub>: 3h(W)-1h (R)-2h (W)-4h (R)-3h (W) and WR<sub>3</sub>: 2h (W)-1h (R)-2h (W)-4h (R)-2h (W)-1h (R)-2h (W). Physiological responses such as pulse rate, respiration rate, rectal temperature and speed of operation were recorded at hourly interval. The physical symptoms like leg incoordination, water from nostrils, tears from eyes, frothing from mouth, tongue protrusion and refusal to move forward were also observed visually.

The pulse rate, respiration rate and rectal temperature increased with increase duration of work with all work rest cycles. Further, speed of operation decreased with increase in duration of work. The rate of increase in pulse rate was higher as compared to other physiological responses. The changes in physiological responses were minimum with work rest cycle WR<sub>3</sub> as compared to other work rest cycles. The fatigue score of camels was calculated by using fatigue score card with 4 point scale assigned for 7 physiological and physical parameters. The fatigue score was found minimum and within permissible limit of fatigue with work rest cycle WR<sub>3</sub> in rotary mode of operation.

**Key words:** Camel, fatigue score, loading cart, rotary mode, work performance, work rest cycle

The present level of mechanisation is far from satisfactory level and it is seen that in most of the rural areas draught animals are still playing a very good role in agricultural production. It is an appropriate, affordable and sustainable technology requiring very low external inputs. Draught animals not only reduce drudgery and intensify agricultural production but also raise living standards of rural community. The most widely-used draught animals in Rajasthan are camel, ox, donkey and horse but camel is widely used as draught animal in desert tract of Rajasthan.

However, 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, threshing (tramping), winnowing and several other operations (Singh and Singh, 1987). It needs to be developed work rest cycles on scientific lines to ensure minimum fatigue to the animal and operator in rotary mode of operation. The objective of study is to provide description of fatigue endurance limit of camel in rotary mode of operation.

## Materials and Methods

The study was conducted by using 3 camels weighing 587-640 kg body weight (8-10 years) to assess the work performance of camels in rotary mode of operation. A loading cart (Fig 1) was used to vary the load on animal in rotary mode of operation. Camels were operated at a single level of draught (16% of body weight) with 3 different work rest cycles viz., WR<sub>1</sub>: 4h (W)- 5h (R)- 4h (W); WR<sub>2</sub>: 3h (W)- 1h (R)- 2h (W)- 4h (R)- 3h (W) and WR<sub>3</sub>: 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 access the recovery. The physical symptoms like leg in-coordination, water from nostrils, tears from eyes, frothing from mouth, tongue protrusion and refusal to move forward were also observed visually. A modified score card was adopted to access the fatigue level in camels and based on physiological and physical symptoms, the fatigue score was calculated.

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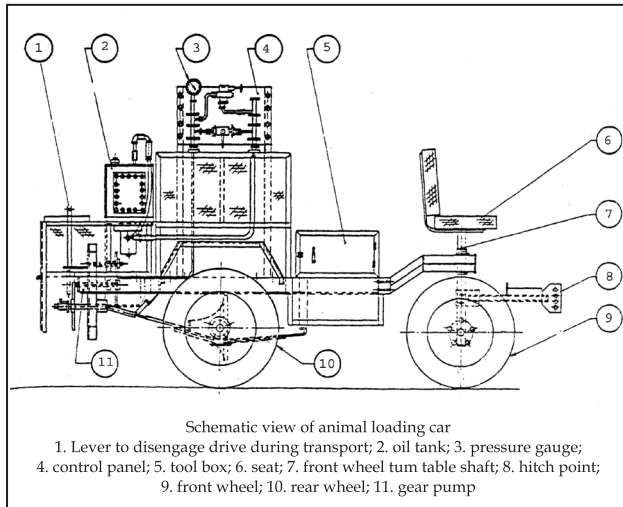


Fig 1. Loading car

## Results and Discussion

The physiological responses of the camels *viz.* pulse rate, respiration rate and rectal temperature increased with duration of work in all work rest cycles, whereas speed of operation decreased with duration of work. The pulse rate of the camels increased when undergoing hard exercise with duration of work. Physical work puts muscles into action which need more oxygen and energy for their proper action. The increased energy demand is met by increase in blood supply. The cardiac output is increased sufficiently to meet increased energy requirements thus resulting in increase in pulse rate.

### Effect of draught and duration of work on pulse rate

Fig 2 shows the effect of draught and duration of work on pulse rate of camels in rotary mode of operation with different work rest cycles. The graph clearly indicates that the pulse rate increased simultaneously with the increase in duration of work. It has been observed that increase in pulse rate was lower in second session than that of increase in first session. During the rest, the pulse rate decreased gradually but could not attain the initial value at the time of starting.

During the first session of 4 hours of continued work, the pulse rate was found to increase from 55 to 62 beats/min in  $WR_1$  and likewise, in second session of work, the pulse rate increased from 57 to 62 beats/min which confirms the findings of Tiwari *et al* (2003).

In  $WR_2$ , increase in pulse rate was from 52 to 58 beats/min during the first session of 3 hours of working. The increase in pulse rate varied from 59 to

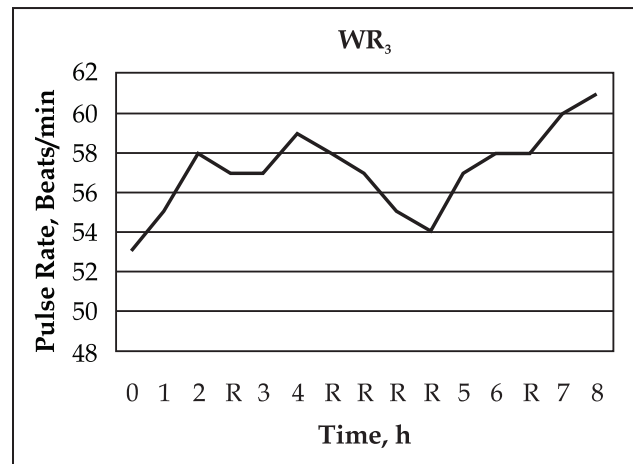
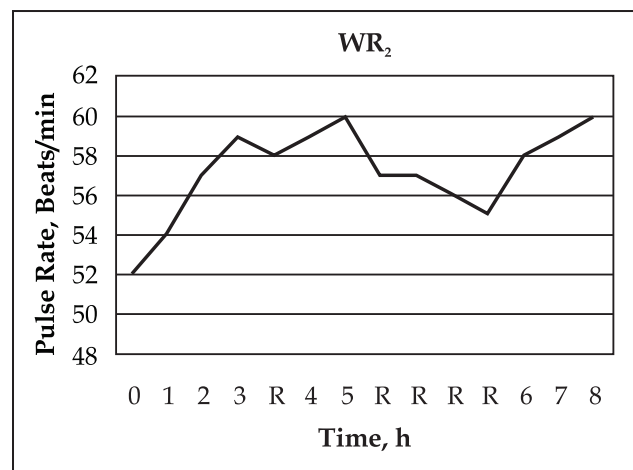
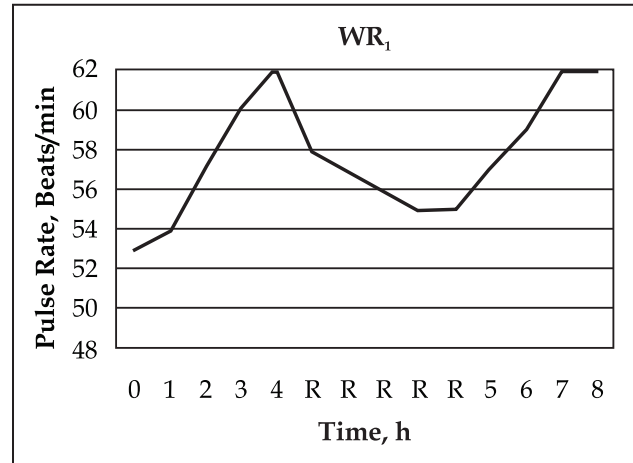


Fig 2. Effect of draught and duration of work on pulse rate.

60 beats/min in second session as compared to first session. After 4 hours of rest, in third session, pulse rate rose from 56 to 59 beats/min, however, the rate of increase was maximum in first session at 13% over the initial values.

In  $WR_3$ , pulse rate increased from 53 to 58 beats/min, 57 to 59 beats/min, 54 to 58 and 58 to 61

beats/min during I, II, III and IV session, respectively. However, Din *et al* (2004) assessed different work rest cycles for camel under sustained working at 6 levels of draught (16, 18, 20, 22, 24 and 26% BW) and reported that camel should be operated in 2 sessions i.e., early in the morning and late in the evening in summer session to avoid excessive thermal stress. The increase in pulse rate in camels after work might be due to fact that physical work puts muscle into action which needs more energy for their proper action (Chaudhary *et al*, 2008).

**Effect of draught and duration of work on respiration rate**

Fig 3 shows the effects of draught and duration of work on the respiration rate of the camels with different work rest cycles. The respiration rate increase with increase in duration of work in the first session of work, the respiration rate increased at the higher rate in the beginning whereas in rest the rate of increase was lower. In the second session of work after rest, 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 rate at rest. The initial respiration rate was also observed to be affected by atmospheric temperature, relative humidity and other environmental conditions.

In first session of work with WR<sub>1</sub>, the respiration rate increased from 7 to 12 breaths/min and after rest from 9 to 12 breaths/min. Likewise, Khanna and Rai (2000) reported an increase in respiration rate after carting in draught camels and this increase in respiration rate might be due to higher heat stress on the animals.

During first session with WR<sub>2</sub>, the increase in respiration rate was lower as compared to WR<sub>1</sub>. The increase in respiration rate was 7 to 11 breaths/min, 10 to 11 breaths/min and 9 to 11 breaths/min in first, second and last session of work.

It was observed that the increase in respiration rate in WR<sub>3</sub> was lower than that of WR<sub>1</sub> and WR<sub>2</sub>. 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. The per cent variation in respiration rate was 71.57 and 37.5% in WR<sub>1</sub>, WR<sub>2</sub> and WR<sub>3</sub>, respectively. Dharm *et al* (2006) studied the influences of work rest cycles on physiological behaviour of camel and found that the respiration rate increased with duration of work and draught with all work rest cycles in camels.

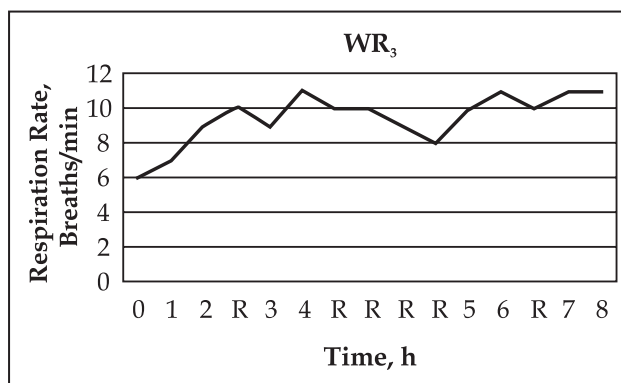
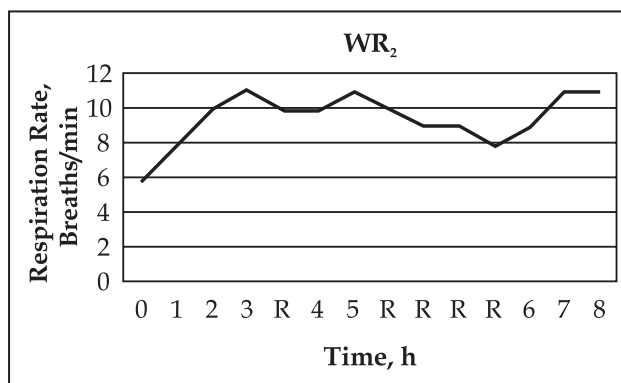
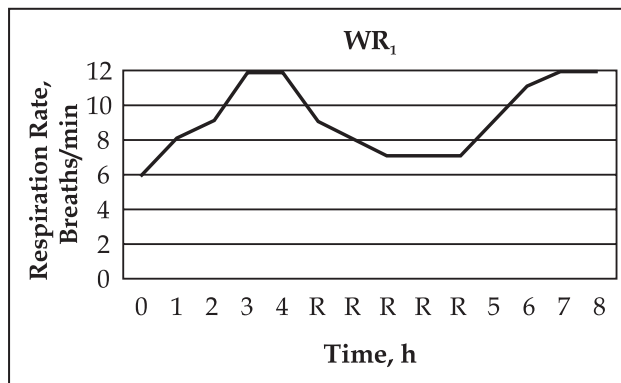


Fig 3. Effect of draught and duration of work on respiration rate.

**Effect of draught and duration of work on rectal temperature**

The effect of draught and duration of work on rectal temperature with different work rest cycles is shown in Fig 4. The rectal temperature of the camel increased with increased draught and duration of work in all work rest cycles. The variation in rectal temperature was very less as compared to pulse rate and respiration rate. In the first session of 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 the second session of work after rest, the increase in rectal temperature was

lower than that of the first session. Hard muscular exercise is associated with corresponding rapid heat production thus placing the temperature regulating mechanism of camel under stress (Mehta, 1998 and Bhatt *et al*, 2002).

During the first session of work in WR<sub>1</sub>, the rectal temperature increased from 37.4 to 37.6°C and similar trend was also observed in WR<sub>2</sub> for rectal temperature which increased from 37.4 to 37.8°C during I and II session, respectively. Increase in rectal temperature in first session of work with WR<sub>3</sub> was lower as compared to WR<sub>2</sub> and WR<sub>1</sub>. The results are in conformation with the findings of Tiwari *et al* (2003)

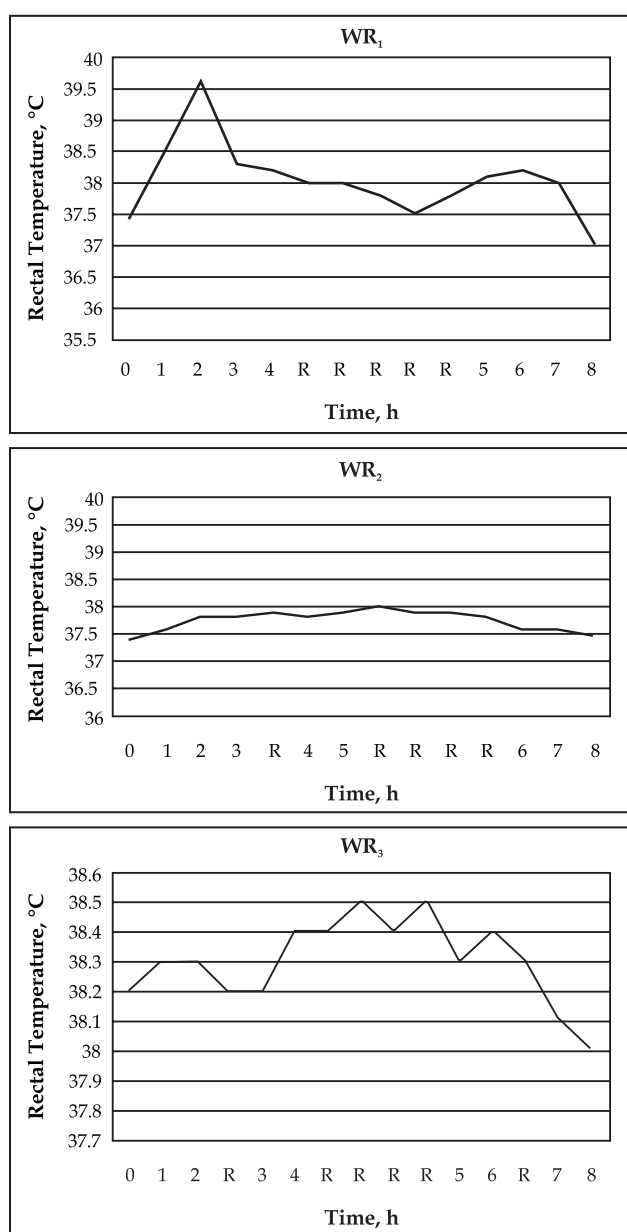


Fig 4. Effect of draught and duration of work on rectal temperature.

who found that rectal temperature increased with the duration of work and stabilised after 2 hours of work in camels.

During first session of work with WR<sub>1</sub>, the variation in rectal temperature was 5.88% while it was reduced in second session by 0.7%. Further, the variation in rectal temperature was observed in the range 1.3% for WR<sub>2</sub> and 0.3% for WR<sub>3</sub>.

### Effect of draught and duration of work on speed of operation

The variation in speed with draught and duration of work in different work rest cycle is shown in Fig 5. It can be concluded from the graph that average speed of operation of camels decreased with duration of work in all the work rest cycles.

During the first session in WR<sub>1</sub>, the speed varied in the range from 2.56 to 2.15 km/h. Further after 5 hours rest, speed decreased from 2.2 to 2.15 km/h. The rate of decrease in speed was 16% in first session, whereas it was 23% in second session. The speed of camels in rotary mode of operation was comparable with the findings of Gupta *et al* (2008) who also reported the speed of camel in the range of 2.59 to 3.14 km/hr.

In WR<sub>2</sub>, speed of operation decreased from 2.79 to 2.20 km/h, 2.2 to 2.13 km/h and 2.31 to 2.15 km/h during I, II and III session, respectively. The rate of decrease was 21.3 and 7%, respectively.

In WR<sub>3</sub> (first session of work), speed varied in range 2.97 to 2.75 km/h, 2.5 to 2.43 km/h in I, II and III sessions and 2.26 to 2.2 km/h and the rate of decrease was 7.4, 3, 7.6 and 2.6%, respectively in I, II, III and IV sessions and the results are comparable 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 with different work rest cycles by using fatigue score card. The score was based on physiological response and physical symptoms of camels exhibited during work (Bhatt *et al*, 2002). 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).

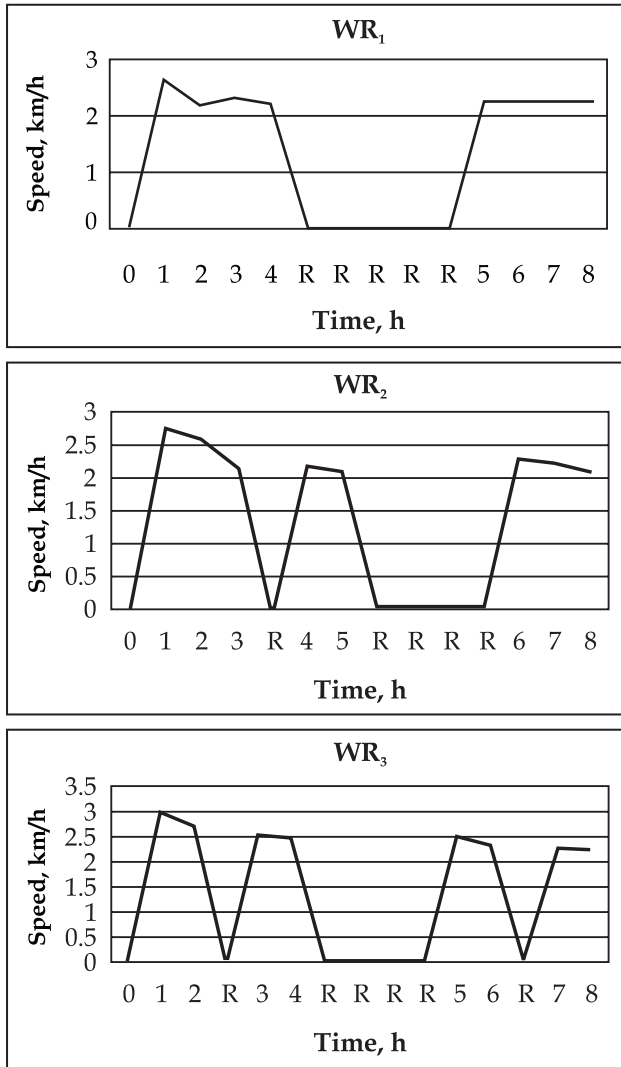


Fig 5. Effect of draught and duration of work on speed of operation.

The variation in fatigue score is shown in Fig 6. In general, fatigue score was found to increase with duration of work in all work rest cycles which might be due to the increase in the physiological response and appearance of physical symptoms with increase in duration of work. Further, it can be depicted for  $WR_1$  fatigue score varied in the range of 2 to 10 in first session of work, whereas it increased from 7 to 11 in evening session. The fatigue score increased with increase in duration of work and draught force which was in consonance to the reports of Sevda *et al* (2008).

In  $WR_2$ , fatigue score increased from 3 to 8, 7 to 9 and 6 to 8 in I, II and III session of work, respectively. However, in  $WR_3$ , fatigue score increased from 1 to 5, 6 to 9 and 6 to 8 in I, II, III and IV session, respectively. The results are in conformation with the findings of Bhatt *et al* (2002) who reported similar trend of fatigue score for camels in field operations. The fatigue score

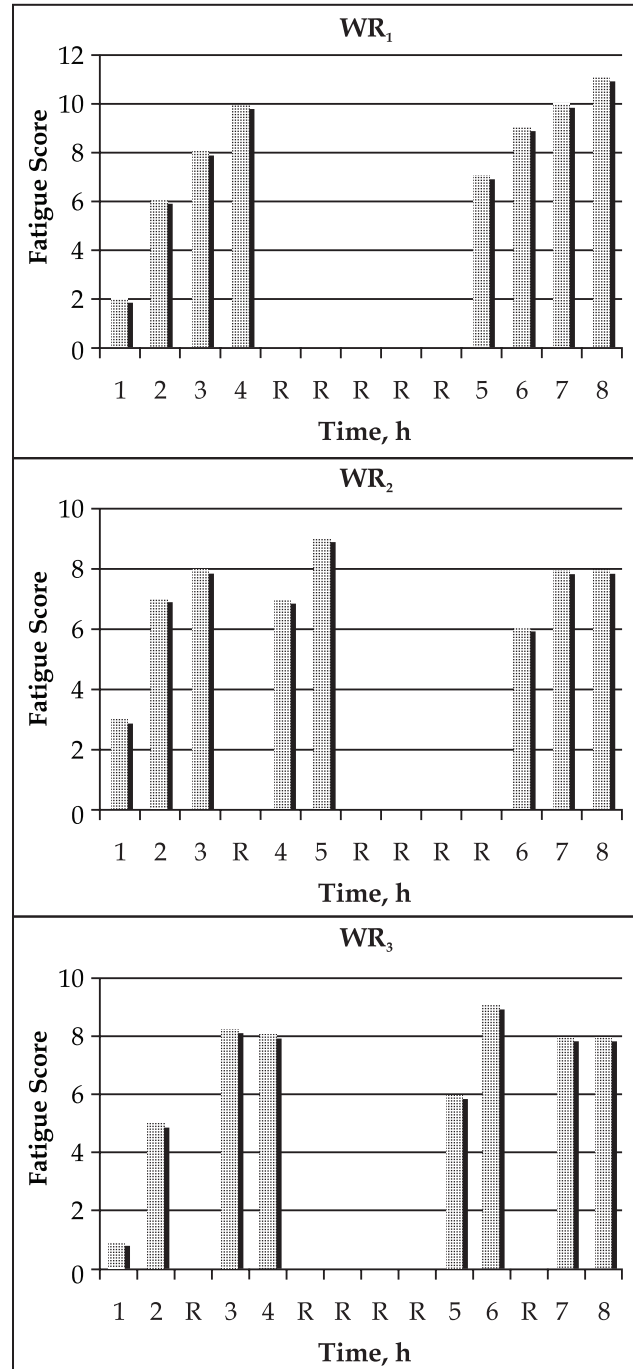


Fig 6. Effect of different work rest cycles on fatigue score.

was found to increase with increase in draught and duration of work (Dharm and Tiwari, 2006).

### Conclusions

It may be concluded that the camel exhibited less fatigue symptoms in  $WR_3$  with duration of work in rotary mode of operation. In view of less fatigue score, the work rest cycle  $WR_3$ : 2h (W)-1h (R)-2h (W)-4h (R)-2h (W)-1h (R)-2h (W) is suggested for use of camels in rotary mode of operation.



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