

# Fatigueness and Work Efficiency of Large White Donkeys

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## Abstract

Three pairs of adult Large White Donkeys (*Equus asinus*), based on similar age, height & weight were selected for this study. The experiment was conducted in triplicate, on different set of workloads such as Light (30 kg draft), Moderate (45 kg draft) and Heavy (60 kg draft) on same set of animals for the evaluation of Fatigueness and work efficiency. The same working schedule (1 hr work - ½ hr rest - 1 hr work *i.e.* 2 hrs work /day from 6.30 am to 8.30 am) was followed in all the experiments for a period of 5 days. Physiological symptoms (RR/min., PR/min. & BT as °C) as well as behavioral symptoms (excitement, frothing, tongue protrusion, panting, leg in-coordination, & sweating) of the experimental animals were recorded at 0 hr, 1<sup>st</sup> hr and 2<sup>nd</sup> hr of the work. The results of fatigue score during light, moderate and heavy work were 0, 5 & 9 at the end of 1<sup>st</sup> hr of the work where as at the end of 2<sup>nd</sup> hour of the work they were 5, 10 and 18. The behavioral symptoms particularly panting and sweating were more pronounced and complete reluctant to work was noticed in heavy type of the work experiment whereas animals were quite normal during light & moderate type of the work experiment. It was concluded that as work load and duration of the work increases, fatigue score increases which results in decrease of work efficiency of the animals. A

pair of large white adult donkey can work comfortably up to 45 kg draft (light and moderate work) without showing fatigueness for a period of 2 hrs.

**Keywords:** *Equus asinus*, Fatigue Score, Physiology, Draft

## Introduction

Large white donkeys have been showing promise of being useful as farm animals for light field operations *viz.*, ploughing, harrowing, sowing, intercultural operations, carting etc. If appropriate harnesses and matching implements are developed, the donkey can prove to be an alternate and cheap source of farm power for small and marginal farmers (Hallikeri R.C., 1996). Donkey is a docile and very hardy animal and its draftability is much higher (30-32 per cent) than bullock (14-16 per cent) with respect to its body weight (Hallikeri *et al.*, 1995). This observation was made during a set of work and rest schedule which was based on fatigue score card (Verma and Singh, 1990). This score card took care of basic physiological responses *viz.*, temperature, pulse rate

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and respiration rate along with few behavioral symptoms *viz.* leg incoordination, tongue protrusion, excitement & frothing during work. However, some more behavioral symptoms such as sweating and panting (sound production) were included in the modified fatigue score card (Jagjiwan Ram, 2007) for the large white donkeys which will take care of all the changes during work. Even though many reports are available on different type of work load and fatigue score, a systematic study on standardization of work load on the basis of fatigueness is lacking. Hence the present investigation is carried out on large white donkeys which intern help in taking maximum work from the animal as well as to maintain their health conditions.

### **Material and Methods**

Three pairs of adult Large White Donkeys (*Equus asinus*), based on similar age, height & weight were selected for this study. The experiments were conducted in triplicate, on different set of workloads such as Light (30 kg draft), Moderate (45 kg draft) and Heavy (60 kg draft) on same set of animals for the evaluation of fatigueness and designated as light work (LW), moderate work (MW) and heavy work (HW) groups respectively. The same working schedule (1 hr work - ½ hr rest- 1 hr work for 2 hrs work /day from 6.30 am to 8.30 am) was followed as per Hallikeri (1995) in all the experiments for a period of 5 days.

Physiological symptoms such as respiration rate (RR/min.), pulse rate (PR/min.) & body temperature (BT) in degree centigrade (°C) were recorded as per Shastry and Thomas (1976) and the behavioral symptoms such as leg incoordination, tongue protrusion, excitement & frothing as per Verma and Singh (1990); and sweating and panting were recorded as per Jagjiwan Ram (2007). The marks allotted for each of the above symptoms is 4 (Less tired =1, Tired = 2, More tired = 3 and Excessively tired = 4; as shown in Table-1) and hence total fatigue score is 36. When fatigue score reaches 18 (50% of the total score), the animals were said to be fatigue and work should be stopped as recommended by Jagjiwan Ram (2007).

### **Results and Discussion**

#### *Physiological Responses*

The initial RR values were  $22.42 \pm 0.58$ ,  $24.19 \pm 0.53$  and  $24.68 \pm 0.89$  in Light Work (LW), Moderate Work (MW) and Heavy Work (HW) groups. These values were before start of the work and hence were representing the normal physiological values of donkeys as reported by Kelly (1974) and Shastry and Thomas (1976). After one hour work duration, the increased RR were  $28.38 \pm 0.79$ ,  $39.21 \pm 0.76$  and  $45.77 \pm 0.93$  whereas after two hours of the work, the readings of RR were  $38.20 \pm 0.95$ ,  $48.54 \pm 0.84$  and  $55.28 \pm 0.67$  in LW, MW and HW groups respectively. Many workers have reported increased in RR,

**Table 1:** Fatigue Scorecard\* for Donkey

Sl. No.	Parameter	Score Scale			
		Less tired	Tired	More tired	Excessively tired
1.	RR (Breaths/ min)	1	2	3	4
2.	PR (Beats/min)	Ro+20	Ro+35	Ro+45	Ro+50
3.	BT (C)	Po+15	Po+30	Po+40	Po+45
4.	TongueProtrusion	To+0.8	To+1.5	To+2.0	To+2.3
5.	Frothing	Occasional opening of month	Occasional protrusion of tongue	Frequent protrusion of tongue	Continuous protrusion of tongue
6.	Leg in co-ordination	Dribbling of saliva started	Frequent dribbling of saliva	Continuous dribbling of saliva	Appearance of froth on upper lips
7.	Panting†	Occasional dragging of feet	Frequent dragging of feet	No coordination between fore and hind legs	Unable to move because of un-coordination
8.	Excitement	Slight panting, no mouth opening, chest and abdominal movement not visible	Panting with occasional mouth breathing, chest and abdominal movement visible	Panting frequently mouth complet opening, chest and abdominal movement visible, occasional sound production	Excessive panting with mouth breathing, vigorous chest and abdominal movements, vigorous sound production
9.	Sweating‡	Sudden neck movement	Disturbed	Perspiration	Heavy perspiration
		Less sweating at the site of harness belt	More sweating near harness and base of the ear and tail	Profuse sweating at earlier parts and inguinal region and brisket	Wet feeling on the skin and dribbling of sweat from some part

\* Fatigue score card developed by Verma and Singh (1990) and †modified by Jagjiwan Ram (2007).  
Po = Initial pulse rate; Ro = Initial respiration rate; To = Initial rectal temperature.

during exercise or work. Hallikeri *et al.* (1995) reported that the RR of donkeys during walking on test track after two hours was 34.62 per minute. However, that experiment was without load carriage and hence minor variation with our results was observed. Hallikeri *et al.* (2000) reported a very high RR at the end of two hours of hauling *tanga*. The maximum RR after 2 hours of hauling *tanga* was 41 per minute. The difference observed with our results may be because of the different draft load and speed of the animal.

The initial PR values were  $39.01 \pm 0.38$ ,  $39.39 \pm 0.87$  and  $39.82 \pm 1.09$  in LW,

MW and HW groups. Whereas at the end of 1<sup>st</sup> and 2<sup>nd</sup> hr of the work, the values were  $46.6 \pm 0.29$ ,  $54.53 \pm 2.31$  &  $64.11 \pm 2.07$  and  $51.96 \pm 0.79$ ,  $62.68 \pm 1.67$  &  $76.52 \pm 1.35$  respectively. The initial values of PR and RR were similar to the values reported by Kelly (1974) and Shastry and Thomas (1976); whereas increased PR and RR after 1<sup>st</sup> and 2<sup>nd</sup> hour of LW, MW and HW groups may be the result of exertion which was proportional to the work load (Hallikeri *et al.*, 1995 & 2000)

The body temperature recorded in LW, MW and HW groups at '0' hour, were  $36.2 \pm 0.06$ ,  $36.57 \pm 0.10$  &  $36.37 \pm$

**Table 2:** Physiological responses of large white donkeys during different work loads

Particulars	Light Work Group Mean $\pm$ S.E.	Moderate Work Group Mean $\pm$ S.E.	Heavy Work Group Mean $\pm$ S.E.
Respiration Rate/min.			
0 Hr	22.42 $\pm 0.58$	24.19 $\pm 0.53$	24.68 $\pm 0.89$
1 Hr	28.38 $\pm 0.79$	39.21 $\pm 0.76^*$	45.77 $\pm 0.93^*$
2 Hr	38.2 $\pm 0.95^*$	48.54 $\pm 0.84^*$	55.28 $\pm 0.67^*$
Pulse Rate/min.			
0 Hr	39.01 $\pm 0.38$	39.39 $\pm 0.87$	39.82 $\pm 1.09$
1 Hr	46.6 $\pm 0.29$	54.53 $\pm 2.31^*$	64.11 $\pm 2.07^*$
2 Hr	51.96 $\pm 0.79^*$	62.68 $\pm 1.67^*$	76.52 $\pm 1.35^*$
Body Temperature ( $^{\circ}$ C)			
0 Hr	36.2 $\pm 0.06$	36.57 $\pm 0.10$	36.37 $\pm 0.11$
1 Hr	36.82 $\pm 0.11$	37.05 $\pm 0.25^*$	37.73 $\pm 0.07^*$
2 Hr	37.5 $\pm 0.09^*$	37.53 $\pm 0.22^*$	38.47 $\pm 0.07^*$

0.11; 1<sup>st</sup> hour were  $36.82 \pm 0.11$ ,  $37.05 \pm 0.25$  &  $37.73 \pm 0.07$  and 2<sup>nd</sup> hour were  $37.50 \pm 0.09$ ,  $37.53 \pm 0.22$  &  $38.47 \pm 0.07$  respectively. The BT was not differing significantly at '0' hour and 1<sup>st</sup> hour of work in all the groups. However, BT increased significantly ( $P \leq 0.05$ ) after 2<sup>nd</sup> hour of work in all the group. Hallikeri *et al.* (1995) also observed increased BT during work and attributed it to the load carried and duration of work. Our results can be correlated with his finding. The initial readings of BT ( $36.20 - 37.50$  °C) is also in full agreement with Kelly, 1974 ( $36.30 - 38.0$  °C).

*Behavioral Symptoms:*

In LW no change in behavioural symptoms were observed during 1<sup>st</sup> hr

of the work but during 2<sup>nd</sup> hr, tongue protrusion, frothing, excitement, leg incoordination and sweating were observed in the less tired range and the total score was 5 (Table-3). Similarly in MW during 1<sup>st</sup> hr, the animals started showing all symptoms under less tired range except excitement and leg incoordination and hence score was 4; whereas in the same work group at the end of 2<sup>nd</sup> hr, the animals exhibited all symptoms in less tired range except sweating (which was in tired range) and thus the total score was 10. Table-3 also revealed that in HW, during 1<sup>st</sup> hr itself, animals were in less tired range and the total score was 9. However during 2<sup>nd</sup> hr these animals exhibited their behavioural symptoms in tired range and hence the total score was 12. The above

**Table 3:** Fatigue score\* of donkeys during light, moderate and heavy work

Particulars	Light work		Moderate work		Heavy work	
	1 <sup>st</sup> hour	2 <sup>nd</sup> hour	1 <sup>st</sup> hour	2 <sup>nd</sup> hour	1 <sup>st</sup> hour	2 <sup>nd</sup> hour
<b>A. Physiological Responses</b>						
Respiration Rate	0	0	0	1	1	1
Pulse Rate	0	0	1	1	1	2
Body Temperature	0	1	0	1	1	3
Total	0	1	1	3	3	6
<b>B. Behavioral Symptoms</b>						
Tongue protrusion	0	1	1	1	1	2
Frothing	0	1	1	1	1	2
Excitement	0	1	0	1	1	2
Leg un-coordination	0	1	0	1	1	2
Sweating†	0	1	1	2	1	2
Panting†	0	0	1	1	1	2
Total	0	5	4	7	6	12
Grand Total	0	6	5	10	9	18

\*based on Physiological Responses and Behavioral Symptoms as per Fatigue score card developed by Verma and Singh (1990) and †modified by Jagjiwan Ram (2007).

observations are similar to that of Hallikeri *et al.* (2000) and Jagjiwan Ram (2007).

#### *Fatigue Score*

It was observed that in LW during 1<sup>st</sup> hr, the magnitude of increase in fatigue score was negligible and hence the mark allotted was zero. However, during 2<sup>nd</sup> hour, increased physiological responses were recorded which accounted for total two points. Similarly the behavioral symptoms were above normal, which accounted for four points. Thus the total points obtained during light work at the end of 2<sup>nd</sup> hr was 6. However in MW the fatigue score during 1<sup>st</sup> and 2<sup>nd</sup> hour of work were 5 and 10 respectively; whereas the fatigue score in HW was 9 at the end of 1<sup>st</sup> hour as against 18 at the end of 2<sup>nd</sup> hour.

The behavioral symptoms particularly sweating and panting were pronounced and complete reluctant to work was noticed at the end of 2<sup>nd</sup> hr during HW. However, such intensive symptoms were not noticed during LW and MW over a period of 2 hrs. Hence it is recommended that the work should be stopped if the fatigue score reaches 18 out of 36 as per Jagjiwan Ram (2007) and the present finding about fatigue score during HW were almost similar particularly at the end of 2<sup>nd</sup> hr. Hence it was concluded that as work load and duration of the work increases, fatigue score increases

which results in decrease of work efficiency of the animals. A pair of large white adult donkey can work comfortably up to 45 kg draft (light and moderate work) without showing fatigueness for a period of 2 hrs.

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