



Assessment of fatigueness in donkeys during different sets of workload

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ABSTRACT

Adult Large White donkeys (6) were selected for this study and they were maintained under ideal housing and feeding conditions for the entire experimental period. Donkeys were hitched (in pair) for light work (load of 10% of body weight), moderate work (load of 20% of body weight) and heavy work (load of 30% of body weight) for 2 h work/day during morning hours. Each experiment was repeated with same work schedule for 5 days. Fatigue score was calculated based on the physiological responses such as respiration rate (RR/min), pulse rate (PR/min) and rectal temperature (RT in °C) and behavioural symptoms such as leg incoordination, tongue protrusion, excitement, frothing, sweating and panting. The fatigue scores were 0, 5 and 9 during first hour, and 6, 10 and 18 during second hour of work in light, moderate and heavy work respectively. This indicated that animals did not fatigue during first and second hour of work with a load up to 20% of their body weight. However they showed symptoms of fatigueness only at the end of second hour during heavy work (at a load of 30% of their body weight). In all the experiments the RR, PR and RT increased significantly ($P < 0.05$) as work load and duration of work increased which finally resulted in the elevation of fatigue score. Hence it may be concluded that large white donkeys can work with a load of 20% of their body weight for 2 h comfortably without showing fatigueness but at a load of 30% of their body weight they can work only up to 1 h.

Key words: Behavioral symptoms, Draught, *Equus asinus*, Fatigue score, Physiology

Indian donkeys have been identified as Small Grey and Large White (Bhat *et al.* 1981). Small grey has Zebra marking on limb and neck and has an average height of 80 cm and long ears. However, Large White donkeys are very popular in India for strengthened endurance and have an average height of 100–140 cm (Anonymous 1987) and they are useful as farm animals for agricultural field operations (Anonymous 1999). The Large White donkey is a docile and very hardy animal and its draughtability is much higher (30–32%) than bullock (14–16%) 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). However a systematic study on assessment of fatigueness in Large White donkeys during

different sets of workload is lacking. Hence the present investigation was felt essential.

MATERIALS AND METHODS

Six adult donkeys (*Equus asinus*) of Large White breed were selected based on approximately similar age (25 - 30 months), height (130–140 cm) and body weight (145–155kg) for the present study. Experimental donkeys were housed separately under tree canopy and they were fed with 1kg concentrate mixture (CP:15% and TDN:60%) along with *ad lib.* chaffed jowar straw. Clean drinking water was offered twice daily.

Donkeys were hitched in pair (Hallikeri 1996) and given light work (load of 10% of body weight), moderate work (load of 20% of body weight) and heavy work (load of 30% of body weight) as per Bhat *et al.* (2005) and Jagjiwan Ram (2007). In each experiment 3 pairs of donkeys were used at a time and the work schedule followed was 1 h work - ½ h rest - 1 h work (i.e. 2 h work/day from 6:30 AM to 9:00 AM) as per Upadhyay (1993) and Hallikeri (1996). The above schedule of experiments was repeated for 5 days.

Physiological symptoms respiration rate (RR/min), pulse rate (PR/min) and rectal temperature (RT in °C) were recorded (Shastri and Thomas 1976 and Peta Jones 2005).

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Table 1. Fatigue score card* for Large White donkey

Condition and score	Less tired= 1	Tired= 2	More tired= 3	Excessively tired= 4
RR (breaths/ min)	Ro+20	Ro+35	Ro+45	Ro+50
PR (beats/min)	Po+15	Po+30	Po+40	Po+45
BT ($^{\circ}$ C)	To+0.8	To+1.5	To+2.0	To+2.3
Tongue protrusion	Occasional opening of mouth	Occasional protrusion of tongue	Frequent protrusion of tongue	Continuous protrusion of tongue
Frothing	Dribbling of saliva started	Frequent dribbling of saliva	Continuous dribbling of saliva	Appearance of froth on upper lips
Leg in co-ordination	Occasional dragging of feet	Frequent dragging of feet	No coordination between fore and hind legs	Unable to move because of in-coordination
Excitement	Neck movement	Sudden neck movement	Disturbed	Disturbed and non-cooperation
Panting†	Slight panting, no mouth opening, chest and abdominal movements not visible	Panting with occasional mouth breathing, chest and abdominal movement visible	Panting frequently mouth complete opening, chest and abdominal movements visible, occasional sound production	Excessive panting with mouth breathing, vigorous chest and abdominal movements, vigorous sound production
Sweating†	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 parts

* 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.

The behavioral symptoms such as leg incoordination, tongue protrusion, excitement and frothing were recorded as per Verma and Singh (1990) and Bhat *et al.* (2005); and sweating and panting were recorded as per Jagjiwan Ram (2007). All observations during the experiment were recorded before start of work (0 h) and after the work (at the end of first and second hour of work separately).

Fatigue score: The fatigue score was calculated for Large White donkeys based on the physiological responses and behavioural symptoms (Table 1). The maximum marks allotted for each of the above symptoms (physiological and behavioural) is 4 (less tired, 1; tired, 2; more tired, 3; and excessively tired, 4) 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 was stopped as recommended by Jagjiwan Ram (2007).

All the data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Physiological responses: There was a significant increase (at $P<0.05$) in physiological responses such as RR, PR and RT from 0 h to end of second hour of work (Table 2). The increase in values of physiological responses may be due to the effect of duration of work in all the groups. Similar trends were reported by Halliker *et al.* (1995, 2000), Anonymous (1999), Bhat *et al.* (2005) and Jagjiwan Ram (2007) in their work experiments on Large White donkeys. There was also

Table 2. Physiological responses of Large White donkeys during different work loads

Particulars	LW (mean $\pm$ SE)	MW (mean $\pm$ SE)	HW (mean $\pm$ SE)
Respiration rate/min			
0 h (rest)	22.42 $\pm$ 0.58	24.19 $\pm$ 0.53	24.68 $\pm$ 0.89
1 h work	28.38 $\pm$ 0.79	39.21 $\pm$ 0.76	45.77 $\pm$ 0.93
2 h work	38.20 $\pm$ 0.95	48.54 $\pm$ 0.84	55.28 $\pm$ 0.67
Pulse rate/min			
0 h (rest)	39.01 $\pm$ 0.38	39.39 $\pm$ 0.87	39.82 $\pm$ 1.09
1 h work	46.6 $\pm$ 0.29	54.53 $\pm$ 2.31	64.11 $\pm$ 2.07
2 h work	51.96 $\pm$ 0.79	62.68 $\pm$ 1.67	76.52 $\pm$ 1.35
Rectal temperature ($^{\circ}$ C)			
0 h (rest)	36.2 $\pm$ 0.06	36.57 $\pm$ 0.10	36.37 $\pm$ 0.11
1 h work	36.82 $\pm$ 0.11	37.05 $\pm$ 0.25	37.73 $\pm$ 0.07
2 h work	37.5 $\pm$ 0.09	37.53 $\pm$ 0.22	38.47 $\pm$ 0.07

LW, Light work; MW, moderate work; and HW, heavy work. Values from 0 hour to second hour differ significantly at $P<0.05$. Values of RR and PR between LW and MW, LW and HW and MW and HW differ significantly at $P<0.05$.

increase in RR, PR and RT from light to moderate work, light to heavy work and moderate to heavy work (Table 2). The significant increase in RR and PR was found from light to moderate, light to heavy and moderate to heavy workloads ($P<0.05$). This may be due to the effect of different workloads on the experimental animals. Halliker *et al.* (1995 and 2000) and Halliker (1996) also reported similar trends in Large

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

Particulars	LW		MW		HW	
	first hour	second hour	first hour	second hour	first hour	second hour
Physiological responses						
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
Behavioral symptoms						
Tongue protrusion	0	1	1	1	1	2
Frothing	1	1	1	1	1	2
Excitement	0	1	0	1	1	2
Leg in-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). LW, Light work; MW, moderate work; and HW, heavy work.

White donkeys during harrowing, sowing and ploughing operations; Bhat *et al.* (2005) on donkey *tonga* with a work load of 10, 20 and 34% of their body weight and Jagjiwan Ram (2007) in Large White donkeys on different workloads such as light (30 kg draught), moderate (45kg draught) and heavy work (60kg draught).

In all the groups the difference in RT was not significant at 0 h and 1 h of work. However RT increased significantly ($P < 0.05$) from 0 h to 2 h of work in all the groups. Hallikeri *et al.* (1995) also observed increased RT during work and attributed it to the load carried and duration of work. Our results are in resemblance with that of their findings. The initial reading of RT (36.20–37.50°C) is also in full agreement with Kelly (1974) (36.30–38.0°C). The difference in RT values was nonsignificant at $P < 0.05$ from light to moderate, light to heavy and moderate to heavy work groups. The reason for nonsignificance in RT among all work load groups may be due to the control of body temperature through sweating by the donkeys which was observed during the present experiment.

Behavioral symptoms: Leg incoordination, tongue protrusion, excitement, frothing, sweating and panting were recorded as normal (Table 1) during the 1 h and 2 h of the work in all work groups. However sweating and panting were pronounced and complete reluctant to work was noticed at the end of 2 h during HW (Table 3). Such intensive symptoms were not noticed during LW and MW over a period of 2h. Similar symptoms were observed by Jagjiwan Ram (2007). Other workers also reported abnormal leg incoordination, frothing, excitement and tongue protrusion during ploughing operation (Hallikeri *et al.* 1995, and 2000) and in donkey *tonga* operation with work load of 34% of their body weight (Bhat *et al.* 2005) at the end of 2 h of work.

Fatigue score: During light, moderate and heavy work, the fatigue score observed at 1 and 2 h were 0 and 6; 5 and 10; 9 and 18 respectively (Table 3). As per Tables 1 and 3, donkeys were comfortable (without fatigueness) during LW and MW at 1 and 2 h of work indicating that they can take a load up to 20% of their body weight for more than 2h. However in HW donkeys were also comfortable as per Tables 1 and 3 during 1 h of work but at the end of 2 h they showed fatigueness because at this point the behavioural symptoms such as tongue protrusion, frothing, excitement, leg incoordination, sweating and panting were beyond normal as evident from the Table 1. These results are similar to those reported by Hallikeri *et al.* (1995 and 2000), Hallikeri (1996), Bhat *et al.* (2005) and Jagjiwan Ram (2007) on different workloads in Large White donkeys. The present findings about fatigue score during HW were almost similar to the report of above workers particularly at the end of 2 h. As work load and duration of the work increases, fatigue score increases. Hence it may be concluded from the above findings that Large White donkeys can work comfortably with a load up to 20% of their body weight for 2 h without showing fatigueness but at 30% of their body weight they can work comfortably only up to 1 h.

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