



Physical and physiological changes in donkeys during pack load

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ABSTRACT

Draughtability studies were carried out with adult, healthy and trained donkeys under 2 different work schemes i.e. continuous work and work-rest-work scheme with 2 different sets of loads (load equal to 40 and 50 % of their body weights). To assess their capability and work stress on them, physical observations, viz. unwillingness to continue operation, legs coordination, frothing, excitement, tongue protrusion etc. and physiological observations (rectal temperature, pulse rate, respiration rate) were recorded at fixed intervals. Under pack load equivalent to 40% of their body weight, donkeys worked for 4 h and 5 h under continuous as well as under work-rest-work cycle, respectively, while with 50% pack load, donkeys worked for 4 h under both work plans. After using standard fatigue score analysis technique, it was observed that donkeys attained a fatigue score of 6 and 4 out of 16 under continuous and work-rest-work cycle, respectively, for 40% as pack load while the fatigue score of 10 and 2 was observed under continuous and work-rest-work cycles, respectively, for 50% pack load. Intermittent rest in between work reduced the stress on these animals and resulted in increasing the work periods.

Key words: Draughtability, Donkey, Work rest cycle, Work performance

In India there are about 0.61 million horses and ponies, 0.14 million mules and 0.44 million donkeys (Livestock census 2007). During inter-census period from 2003 to 2007, population of horses and ponies, mules and donkeys decreased by 18.6%, 22.1% and 32.6%, respectively. Donkeys being the good carrier are mainly engaged in transportation of goods over short distances either as pack animal or in pulling the cart. These animals are utilized as pack animal at brick-kilns, construction sites, by nomadic herders, washer-men, potter-men, small and marginal farmers. These animals are maintained on low plain of nutrition. Keeping in view the above and for getting optimum efficiency for maximum sustainable work that may be carried out without adversely affecting the health of animal and undue stress to the animal, draughtability experiments were planned to compare the working ability of donkeys under continuous and work-rest-work cycle.

MATERIALS AND METHODS

Apparently healthy adult female donkeys (6) with average body weight of 130.7 ± 15.0 kg were selected for the experiment. All the donkeys had free access to drinking water except during working hours. One kg of concentrate feed (oat 40%, gram 30%, wheat bran 27%, mineral mixture and

common salt 3%) was offered to each donkey in the morning before work. After completion of work, lucerne as green fodder (5 kg) and wheat bhusa (*ad lib.*) was offered to each donkey.

Training of animals: Prior to the experiment, donkeys were trained for 1 month under particular load and duration of work. Physiological observations were recorded in the morning during the last 7 days of training period for further use as a part of control values.

Experimental plan

The donkeys were used under 2 different work schemes, i.e. continuous work and work-rest-work cycle with pack loads equivalent to 40 and 50% of their body weights in both the work schemes. The load in the form of bricks was kept in 2 sacks, evenly balanced with similar weight, slung on either side of the donkey's back. The donkeys walked at a normal speed of 3.5–4.0 km/h during the experiment on tar road. The speed of travel was calculated on the basis of the distance covered during the entire working period.

Under work-rest-work scheme: The donkeys worked for 2½ h followed by 1 h rest and again 2½ h work with a load equal to 40% of their body weight (scheme 1) while with 50% pack load, donkeys worked for 2 h followed by 1 h rest and again 2 h work (scheme 2). The animals were used under these schemes for 1 month under each pack load. There was a gap of 7 days between different schemes.

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Under continuous work scheme: The donkeys carried loads equivalent to 40% (scheme 3) and 50% (scheme 4) of their body weight continuously for 4 h or till onset of fatigue which ever was the earlier.

Physiological observations were taken daily in the morning and used as control values. Physiological parameters such as rectal temperature (RT), pulse rate (PR) and respiration rate (RR) were recorded at fixed intervals and physical observations, viz. unwillingness to continue operation, legs coordination, frothing, excitement, tongue protrusion etc. if any was noted to assess their carrying capacity. RT was recorded using clinical thermometer, PR was taken by palpation of maxillary artery, while RR was measured by counting the abdominal movement per minute. The stress was accessed using fatigue score card developed for donkeys (Anonymous 1990) and also to assess the draughtability and efficiency of the animals to carry the load.

Statistical analysis: The data were analyzed statistically using 't' test (Snedecor and Cochran 1967).

RESULTS AND DISCUSSION

All the donkeys remained healthy during the whole period of experiments. No appreciable change in their body weight was observed. The physiological observations recorded during the last 7 days of the training as well as taken daily in the morning before the work were almost same and their mean values were taken as control values or 0 h values for all the physiological indices.

Donkeys carrying a pack load equal to 40% of their body weight

Under this scheme, donkeys carried a pack load equivalent to 40% of their body weight for 2½ h followed by 1h rest and again 2½ h work (scheme 1) while under continuous

work plan, donkeys worked continuously for 4 h (scheme 3). Physiological parameters RT, PR and RR in both the groups before the start of the experiment are presented in Table 1. Under both the schemes, all the 3 physiological indices increased significantly as the donkeys worked. Such an increase in physiological indices due to work was also reported in donkeys (Maurya 1992) and buffaloes (Kapoor and Upadhyay 1993). In scheme 1, there was a drastic decrease in the values of these physiological indices after a rest of 1 h. Similar observations were reported in cattle (Upadhyay 1989) and they took variable periods to return to pre-work resting level. By the next morning, the physiological indices reached to normal in both the work schemes. In scheme 1, per cent change observed in relation to control RT, PR and RR was 2.18, 60 and 114, respectively, while under continuous work plan (scheme 3), it was 2.64, 75 and 103, respectively.

Donkeys working under work-rest-work (scheme 1) did not show any visual physical symptoms of being fatigued. However, considering increase in physiological indices the fatigue score was adjudged 4 out of 16 point indicating little stress to animals under work-rest-work scheme. Under continuous work (scheme 3), occasional un-coordination of feet was also observed in few donkeys. Physiological and physical indices observed under continuous work scheme indicated a fatigue score of 6 out of 16 in the working donkeys.

Donkeys carrying a pack load equal to 50% of their body weight

Donkeys carried pack load equal to 50% of their body weight as per scheme 3 and 4. Physiological indices before initiation of experiments in both the groups are presented in Table 2. Like scheme 1 and 3, all 3 physiological indices

Table 1. Changes in physiological responses in donkeys carrying load equal to 40% of their body weight

Parameters	Work rest cycle (scheme 1)					Continuous work (scheme 3)		
	Control	2.5h work	1h rest	2.5h work	1h rest	Control	4h work	1h Rest
RT (°C)	36.65±0.05	37.32*±0.05	36.98±0.06	37.45*±0.04	37.09*±0.04	36.68±0.06	37.65±0.04	37.23*±0.04
PR (min ⁻¹)	39.17±0.72	60.90**±1.45	46.50*±1.53	62.75**±1.62	45.25±1.51	39.54±0.98	69.36**±1.24	46.50*±1.01
RR (min ⁻¹)	18.83±1.05	38.70**±1.50	21.58±1.57	40.42**±1.48	24.00*±1.23	25.50±1.31	51.20**±1.33	25.50±1.21

*Significant at P<0.05, **significant at P<0.01; h,hour.

Table 2. Changes in physiological responses in donkeys carrying load equal to 50% of their body weight

Parameters	Work rest cycle (scheme 2)					Continuous work (scheme 4)		
	Control	2h work	1h rest	2h work	1h rest	Control	4h work	1h Rest
RT (°C)	37.16±0.04	37.49*±0.05	37.54*±0.04	37.77**±0.05	37.50*±0.03	36.74±0.07	38.01**±0.04	37.61*±0.05
PR (min ⁻¹)	40.83±0.83	58.27**±1.43	52.00*±1.16	61.47**±1.82	54.50*±1.56	37.47±0.95	69.46**±1.61	44.80±1.43
RR (min ⁻¹)	28.00±1.21	35.60**±1.55	34.93*±1.06	40.93**±1.48	34.00±1.23	27.31±1.09	57.37**±1.61	28.80±1.11

*Significant at P<0.05, **significant at P<0.01.

increased significantly as compared to control values after work, but the extent was higher than the earlier ones. A slight decrease in physiological responses was observed after 1 h post work pause. Overall per cent changes in RT, PR and RR values as compared to control values under scheme 2 were 1.64, 51 and 46, respectively, while under scheme 4, these were 3.46, 85 and 110, respectively, clearly indicating stress on donkeys under work scheme 4. However, by the morning the donkeys exhibited normal levels of physiological indices. Donkeys working under work-rest-work scheme 2 in this experiment did not show any visual symptoms of being fatigued. However, on the basis of increase in physiological indices the fatigue score reached to 2 points out of 16 points indicating donkeys under least stress. Under work scheme 4 donkeys exhibited some of fatigue symptoms, viz., excitement, un-coordination of fore- and hind-limbs and sometimes fall down of working donkeys. On the basis of increase in physiological parameters and physical observations, the fatigue score reached to 10 points out of 16 points indicating donkeys being fatigued. As per the scoring system (max. 16 points), the donkey is said to be fatigued and completely fatigued if the total score reaches 8 and 16, respectively. In the present study, with 40% load, the donkeys attained fatigue scores of 4 and 6 under scheme 1 and 3, respectively, indicating that donkeys were not much fatigued. While with 50% load, the donkeys attained fatigue scores of 2 and 10 under work scheme 2 and 4, respectively, indicating that donkeys got fatigued under continuous work plan for 4 h (scheme 4). In general, the magnitude of increase in the physiological responses (under both loads i.e., 40 and 50%) was more during continuous work of 4 h as compared to work-rest-work plan. All these physiological adjustments during heavy workload particularly during summer are associated with increased metabolism to provide adequate energy to the working muscles and to dissipate extra heat. The body temperature attained by donkeys during work may be due to ambient conditions. The rise in temperature during work is described as physiological need to increase the rate of chemical process, to change internal friction resistance in muscles and to enhance supply of oxygen to the working

muscles (Astrand and Rodhal 1970). The body temperature attained by donkeys during work may be due to ambient conditions, which are responsible for stress to donkeys (Pal *et al.* 1998). Intermittent rest in between work helps in gaining the essential vitality, as well as helps in taking more output from animal. During rest period and post-work rest periods of 1 h each, PR and RR reached very close to initial value which suggests that donkeys were not very much fatigued. This study clearly indicated that with both the pack loads, work-rest-work cycle was better than the continuous work plan even for 4 h for better efficiency of donkeys as it causes less stress to the animal.

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