



ESTIMATION OF DRAUGHT ABILITY AND RELATED PHYSIOLOGICAL CHANGES IN KOSALI BULLOCKS IN THEIR NATIVE PLACE

^aAsit Jain, ^aDeepti Kiran Barwa, ^bTripti Jain, ^bMohan Singh, ^bKishore Mukherjee, ^cManoj K. Gendley

^aDepartment of Animal Genetics and Breeding, Molecular and Cytogenetic Laboratory, College of Veterinary Science and Animal Husbandry, Chhattisgarh Kamdhenu Vishwavidyalaya, Anjora, Durg, Chhattisgarh, India

^bAnimal Biotechnology Centre, Chhattisgarh Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh, India

^cDepartment of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Bilaspur, Chhattisgarh Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh, India

ABSTRACT

Although modern automation in agriculture caused a declining trend in the population of draught animals but they are continued to be the most important renewable and sustainable power source for Indian agriculture. Bullock cart serves as chief source of power for performing agricultural operations and carting purpose in rural parts of India. In the present study, draught performance of Kosali bullocks was evaluated by overall draught ability method. Physiological response of bullocks such as respiration rate (RR), pulse rate (PR) and rectal temperature (RT) were recorded prior and immediately after work for each carting and ploughing trial. Working capacity and heat tolerance of Kosali bullocks were also evaluated and categorized based on working capacity in a day. The overall draught ability (ODA) for Kosali bullocks with an average was 67.69% and can consider average working type of draught breed. Among the studied physiological parameters, respiration rate was most affected after the work. Majority of the bullocks were good working types and its percentage was 45% as they worked in between five to six hours a day. In conclusion, Kosali bullocks are found to have good capacity of heat tolerance and good working types with average type of draught breed.

KEYWORDS: Kosali bullocks, Draught ability, Physiological parameters, overall draught ability

INTRODUCTION

Draught animals play a dominant role in Indian rural economy. Zebu cattle (*Bos indicus*) and buffalo (*Bubalus bubalis*) are major sources of draught animals in India. In most part of the country only male bovine especially males are used for draught purposes. The draught power of our 83 million draught animals is estimated at equivalent to 30,000 MW in terms of electric power, equivalent to half the generation capacity of India. Draught animals are being used to plough around 100 million hectares of farm land in India, which forms 60 per cent of total cultivable area (reviewed in Phaniraja and Panchasara, 2009). Although an increasing mechanization is replacing the animal power in the rural areas or villages, reducing the total draught animal power (DAP), yet India has to depend on animal energy for many years to come from agricultural operations and transport of farm produce. In Chhattisgarh state, the percentage of landless, sub-marginal and marginal farmers is more than 50% and have less than 0.5 hectare land. More than 50% cattle and buffalo are reared by small and semi-medium type farmers (reviewed by Pandey et al, 2014). This asset has been cultivated using farm animals like bullocks and other livestock, where tractors and tillers, uneconomic, besides being too expensive for small farmers especially in Chhattisgarh perspective. Fragmentation of land is also continuing. In such situation DAP is important. The Kosali

is the first breed of the cattle from the Chhattisgarh state and it has been registered as the 36th breed of cattle as a draught breed and it is mainly distributed in Central Plain region of the Chhattisgarh state. In general, these animals are smaller in size with poor milk production potential but they have evolved as a result of very long period of natural selection and are well adapted to the existing agro-climatic conditions of the region. They are disease resistance and can thrive well under the poor feed stuffs available in the state. These animals are contributing to the work power needed for the various agricultural operations, transport and fuel need for cooking with very low input and also serve as source of cash income, and play significant role in the social and cultural values of the society. To the best knowledge, no information is available on draught performance of Kosali bullock. Therefore, the present study was carried out to estimate the draught ability and related physiological changes in bullock of Kosali cattle.

MATERIALS & METHODS

The draught performance of a total of 10 Kosali bullocks in between 6 to 10 years was estimated by overall draught ability (ODA; Thomas, 1995; Tomar and Joshi (2008). The ODA was obtained by measuring the capacity for carting and ploughing. The ODA was estimated as:

$$ODA = 100 - (A+B)/2,$$

Where, A and B are the abilities for draught with respect to carting and ploughing, respectively.

For measuring carting ability, each of the bullock was made to pull a total load weight (including cart) of double of its body weight over a distance of 10 km on a level tar road by a single animal cart. The time taken to cover initial one kilometre and final one kilometre was noted. The experiment was repeated three times and the average measurements on each bullock were calculated. The carting ability was computed as the ratio of increase in time to cover the final one km distance to time taken to cover initial one km distance and expressed as percentage. Similarly, for measuring ploughing ability, which measures the ability of the animal for speedy and sustained work under thermal stress, was also carried out. Bullocks were made to plough 200 meter level elliptical ploughing track which constituent approximate equal amount of sand and clay for two hours. Time taken to complete one lap in initial stage and closing stage was noted. The experiment was repeated three times and the average for each bullock was computed. The ploughing ability, expressed in percentage was calculated as the ratio of increase in time to cover one lap at the end of lap to time taken to cover one lap in the initial stage. The experiments were conducted during February-April 2016. Physiological response of bullocks such as respiration rate, pulse rate and rectal temperature were recorded prior and immediately after work for each carting and ploughing trial.

Working capacity and heat tolerance of Kosali bullocks was evaluated exclusively through farmers descriptions on 310 animals. Bullocks of Kosali breed were categorized as excellent/very good/good/average/low type of working/heat tolerance based on working capacity in a day. Statistical analysis viz. mean, standard error and range were calculated as per methods given by Snedecor and Cochran (1994).

RESULTS & DISCUSSION

Legs of Kosali bullocks or bulls are straight, short and strong. Fetlock joint are strong, hooves are hard and strong and digits well set. These features make them fit for draught purpose. The means of various physiological parameters before and after carting and ploughing, the percent increase on carting and ploughing, carting ability, ploughing ability and the overall draft ability (ODA) of the bullocks under test are presented in tables and discussed below.

Estimation of Overall Draught Ability (ODA)

During carting, the time taken to cover initial one kilometre, time taken to cover final one kilometre and increase in time taken for final kilometre by different bullocks were varied and average values are shown in the table 1. Ability for draught with respect to carting was expressed as percentage increase in time for final kilometre as compared to initial kilometre. Similarly, during ploughing, the time taken for initial lap, time taken for final lap and increase in time taken for final lap by different bullocks were varied and average values are shown in table 2.

TABLE 1: Estimation of carting ability of Kosali bullocks (n=10)

Body weight (kg)	Time taken for initial km (min) T ₁	Time taken for final km (min) T ₂	Increase in time (min) T ₃	A = (T ₃ /T ₁) x100
234.4±3.4	18.4±1.2	25.2±1.5	6.8±0.98	36.95%

TABLE 2: Estimation of ploughing ability of Kosali bullocks (n=10)

Body weight (kg)	Time taken for one lap in initial stage (min) T ₁	Time taken for one lap in closing stage (min) T ₂	Increase in time (min) T ₃	B = (T ₃ /T ₁) x100
234.4±3.4	5.1±1.09	6.5±1.1	1.4±0.71	27.66%

Ability for draught with respect to ploughing was expressed as percentage increase in time for final lap as compared to initial lap varied.

$$\text{Overall Draught Ability} = 100 - (A+B)/2$$

$$\text{ODA} = 100 - (36.95 + 27.66)/2 = 67.67$$

The ODA for Kosali bullocks with an average was 67.69. This value of ODA indicates that Kosali can consider average working type of draught breed. The overall draft force obtained in the present study was lower than Hariana (Devadattam and Maurya, 1978, Upadhyay and Madan

1985), Ongole (Vinoos et al., 2010) and Kangayam bullocks (Kumaravelu et al., 1997).

Physiological parameters to work performance

Physiological response of bullocks such as respiration rate, pulse rate and rectal temperature were recorded prior and immediately after work for each carting and ploughing trial (table 3). It was observed that immediately after work there was an increase in all the three physiological parameters as compared to their before work values but respiration rate was most affected (table 3). This is similar with other studies (Chakravarthi et al. 2004; Anil and Thomas, 1994).

TABLE 3: Average physiological response of Kosali bullocks to work

Parameters	Carting		
	Before work	After work	Change
Rectal temperature (°f)	37.92±0.81	38.50±0.86	0.58
Respiration rate /min	20.31±3.2	44.51±4.2	24.20
Pulse rate /min	50.10±4.1	70.74±4.6	20.64
Ploughing			
Rectal temperature (°f)	38.10±0.78	38.63±0.91	0.53
Respiration rate /min	20.19±3.3	40.32±4.4	20.13
Pulse rate /min	50.70±3.9	73.50±4.2	22.80

Working capacity and heat tolerance

Bullocks are disease resistance and can thrive under poor feed system. These are used for transportation and agricultural operations such as threshing, ploughing, sowing, remove weeds from crops (locally called Byasi) etc. Bullocks of Kosali breed were categorized as excellent/very good/good/average/low type of working/heat tolerance based on working capacity in a day and are shown in the table 4. Three percentage bullocks were found as excellent working types as they worked for eight or more than eight hours a

day without showing of stern indications of fatigue. Eleven percentage bullocks were found as very good working types as they worked in between six to eight hours a day. Majority of the bullocks were fall in the category of good working types and its percentage was 45% as they worked in between five to six hours a day. Twenty three percentage bullocks were found as average working types as they worked in between three to five hours a day with sign of fatigue and stress. Low working types were classified as they worked less than three hours a day and its percentage was 17%.

TABLE 4: Percentage of working capacity and heat tolerance of Kosali bullocks

Excellent	Very good	Good	Average	Low	Total
3% (n=11)	11% (n=35)	45% (n=139)	23% (n=72)	17% (n=53)	310

CONCLUSION

The present study indicated that Kosali bullock are an integral part of traditional agricultural systems as a draught animal power and have good capacity of heat tolerance and disease resistance. These animals are contributing to the work power needed for the various agricultural operation, transport and fuel need for cooking with very low input. In future, Kosali bullocks can develop better sufficient power for use as a draught animal by systematic and proper selection and breeding programmes.

ACKNOWLEDGEMENT

We acknowledge Indian Council of Agricultural Research-National Bureau of Animal Genetic Resources (ICAR-NBAGR), Karnal, Haryana for financial assistance for the studies under Network Project on Animal Genetic Resources.

REFERENCES

Anil, K. S. and Thomas, C. K. (1994) Draught performance of buffaloes compared to cattle. *Draught Animal News*, 20:5.

Chakravarthi, K., Bidarkar, D.K., Gupta, B.R., Rao, G.N., Sudhakar, K. and Babu Rao, K. (2004) Draught performance of Ongole bulls under thermal stress conditions. *Indian J. Animal Sci.* 74, 119-21.

Devadattam, D.S.K. and Maurya, N.L. (1978) Draft ability of Haryana bullocks. *Indian J. Dairy Sci.* 31, 120-27.

Kumaravelu, N., Thomas, C. K. and Kumar, S. D. (1997) Farm work performance of Kangayam bullocks in two locations. *Indian Veterinary J.* 74, 951-54.

Pandey, S.K., Siyar, D.K., Roy, G. and Dewangan, D. (2014) Animal husbandry scenario in Chhattisgarh: problems and prospects. National brainstorm workshop on strategies for enhancing livestock and fisheries production in the state of Chhattisgarh, May 12-13.

Phaniraja, K.L. and Panchasara, H.H. (2009) *Indian Draught Animals Power*. *Veterinary World* 2(10), 404-407.

Snedecor, G.W. and Cochran, W.G. (1994) *Statistical Methods*. 8th edition Iowa State University Press, Ames, USA.

Thomas, C.K. (1995) Measurement of draft capacity for genetic improvement. IV Scientists meet at Trisur, Kerala 29-30 August.

Tomar, S.S. and Joshi, S.K. (2008) Characterization of Kenkatha cattle. *JNKVV Technical Bulletin*, DRS/2008/01.

Upadhyay, R.C. and Madan, M.L. (1985) Draught performance of Haryana and crossbred bullocks in different seasons. *Indian J. Animal Sci.* 55, 50-54.

Vinoo, R., Rao, G.N., Gupta, B. R. and Babu, K.R. (2010) Estimation of Draught ability of Ongole bullocks by different methods. *Tamilnadu J. Veterinary & Animal Sci.* 6 (1), 24-30.