Comparison of three types of Indian donkey populations based on morphometric characteristics

Rahul Behl*, S K Niranjan, Jyotsna Behl and R K Vijh
ICAR-National Bureau of Animal Genetic Resources, Karnal 132001, India

ABSTRACT

The three populations of Indian donkeys; Spiti donkeys distributed in Spiti and Yangthang regions of Himachal Pradesh, Sindhi donkey found in Barmer, Jaisalmer and Jodhpur districts of Rajsthan and Brown type donkeys found mainly in Kurnool and Anathapur districts of Andhra Pradesh were characterized and compared to ascertain whether any significant differences exist in these three populations of Indian donkeys in the studied morphometric parameters. The results of the F-test showed that these three populations to be significantly different ($P<0.01$) from each other, both in male and female animals, at almost all morphometric parameters studied. In pairwise comparison, the Sindhi donkeys showed significant differences from Spiti as well as Brown type donkeys of Andhra Pradesh in most of the studied morphometric parameters both in male and female animals. However, the Brown type donkeys of Andhra Pradesh showed significant differences from Spiti donkeys only in limited number of biometric parameters both in male and female animals.

Keywords: Morphometry, Spiti donkey, Sindhi donkey, Andhra donkey
***Corresponding Author**: behl1969@rediffmail.com
Manuscript received: 28.3.2017; Manuscript accepted: 20.5.2017

INTRODUCTION

Donkey is a hard working animal that is used mainly for transportation as a pack animal as well as in traction. As it is easy to rear and requires very little inputs, it has been traditionally associated with weaker sections of the society (Varshney and Gupta 1994, Behl *et al*. 2009). Although good amount of work has been done to characterize the animal genetic resources in most species of the livestock, only limited information is available on Indian donkey population. Recently National Bureau of Animal Genetic Resources, Karnal has initiated work on characterization of breeds or types of donkeys available in India and characterized three populations of donkeys; Spiti donkeys of Himachal Pradesh, Sindhi donkey of Rajsthan and Brown type donkeys of Andhra Pradesh (Behl *et al*., 2013, Behl *et al*. 2015, Behl *et al*. 2016). Spiti donkeys are found in Spiti and Yangthang regions of Himachal Pradesh at an altitude of 3200-4000 m. They are well adapted to hypoxic conditions and cold arid environment of this region. Sindhi donkeys are distributed in Barmer, Jaisalmer and Jodhpur districts of Rajsthan. These donkeys are well adapted to this desert region. The Brown type donkeys of Andra Pradesh are mainly found in Kurnool and Anathapur districts located in Rayalseema region. The present study was undertaken to compare these donkeys on the basis of morphometric traits to ascertain whether any significant differences exist in these three populations of Indian donkeys in the studied morphometric parameters.

METHODS

The F-test and students t-test on the data were performed as described in Gupta *et* al. (2011) and Norman and Steiner (2000).

RESULTS AND DISCUSSION

All these three populations of Sindhi, Spiti and Brown type donkeys of Andhra Pradesh are small sized donkeys. The heights at withers of these animals varies between 88.59±3.27 cm in spiti donkeys to 98.8±3.9 cm in Sindhi donkeys in males and 88.65±3.3 cm in Spiti donkeys to 97.9±4.9 cm in Sindhi donkeys in female animals. The detailed biometric parameters for these three populations are given in tables 1, 2 and 3, respectively.

To evaluate whether these three populations have

Table 1: Morphometric characteristics of Sindhi donkeys of Rajsthan

Parameter	Male		Female	
	Mean±SD (cm)	Range (cm)	Mean±SD (cm)	Range (cm)
Body length	93.05±5.02	84-103	93.4±6.45	82-105
Height at withers	98.8±3.9	89-109	97.93±4.9	87-105
Heart girth	104.3±5.35	95-118	106.52±5.97	95-116
Face length	46.5±3.22	39-52	45.77±3.1	40-52
Face width	17.5±1.19	15-20	17.34±1.5	15-21
Ear length	22.6±1.63	20-26	22.33±1.88	19.5-26
Neck length	34.2±3.18	29-40	34.06±3.95	24-46
Chest width	20.6±2.41	16-26	20.43±1.67	16-22
Tail length	52.1±4.42	43-65	51.14±4.56	43-62
Fore arm length (FL)	35.24±3.55	23-40	33.93±3.62	27-39
Canon length (FL)	19.7±1.42	16-23	19.0±1.38	16-22
Canon circumference (FL)	12.7±0.78	11-14.5	11.96±0.96	10.5-15
Pastern length (FL)	7.2±0.96	6-10	7.52±0.96	6-9
Pastern Circumference (FL)	12.98±1.20	11-17.5	12.15±0.61	11-13.5
Hoof length (FL)	5.67±0.60	4.5-7	5.96±0.62	5-7
Hoof circumference (FL)	22.45±1.29	19.5-25	21.7±1.34	19-24.5
Gaskin length (HL)	41.52±3.32	32-48	39.9±3.13	34-47
Canon length (HL)	28.39±1.51	26-32	27.33±1.62	24-30
Canon Circumference (HL)	13.3±0.84	11.5-15.5	12.7±0.75	11-14
Pastern length (HL)	7.0±0.69	6-8	7.0±0.71	6-8
Pastern circumference (HL)	13.42±1.07	12-16.5	12.57±0.99	10.5-14
Hoof length (HL)	5.59±0.63	4-7	5.77±0.53	5-7
Hoof circumference (HL)	21.51±1.28	19-25	20.86±1.26	18-24
Estimated body weight (kg)	84.95±10.12	68.66-108.37	89.54±14.57	68.89-118.51

FL-fore limb, HL-hind limb

Table 2: Morphometric characteristics of Spiti donkeys of Himachal Pradesh

Parameter	Male		Female	
	Mean±SD (cm)	Range (cm)	Mean±SD (cm)	Range (cm)
Body length	91.0 ± 2.88	86-97	90.96 ± 2.52	85-95
Height at withers	88.59 ± 3.27	84-95	88.65 ± 3.30	80-94
Heart girth	100.5 ± 5.02	90-115	98.58 ± 4.23	90-107
Neck length	31.10 ± 2.21	27-36	30.15 ± 1.52	28-33
Face length	32.10 ± 1.47	29-35	31.50 ± 1.03	30-34
Ear length	21.39 ± 1.13	19-23	21.50 ± 0.81	20-23
Tail length	54.21 ± 7.63	39-68	55.56 ± 9.26	37-70
Leg length (FL)	80.0 ± 3.46	76-87	81.00 ± 3.02	77-86
Canon circumference (FL)	12.04 ± 0.71	11-13	11.57 ± 0.70	10-13
Canon length (FL)	19.93 ± 0.84	18-21	19.96 ± 0.77	19-22
Pastern Circumference (FL)	11.51 ± 0.85	10-13	11.27 ± 0.78	10-13
Pastern length (FL)	8.66 ± 0.72	7-10	8.62 ± 0.57	8-10
Hoof length (FL)	5.83 ± 0.54	5-7	5.73 ± 0.45	5-6
Hoof circumference (FL)	20.88 ± 1.01	19-23	20.25 ± 1.03	18-22
Leg length (HL)	87.71 ± 2.93	84-91	87.50 ± 1.85	85-90
Canon Circumference (HL)	12.79 ± 0.85	11-14	12.70 ± 0.92	11-14
Canon length (HL)	26.10 ± 1.35	23-28	26.40 ± 1.00	24-28
Pastern circumference (HL)	12.36 ± 1.21	10-15	11.94 ± 1.61	10-15
Pastern length (HL)	8.68 ± 0.56	8-10	8.60 ± 0.65	8-10
Hoof length (HL)	5.53 ± 0.51	5-6	5.45 ± 0.50	5-6
Hoof circumference (HL)	20.67 ± 2.02	18-26	19.18 ± 1.13	17-21
Estimated body weight (Kg)	75.12±9.57	58.35-99.84	75.69±9.85	54.35-91.97

FL-fore limb, HL-hind limb

Table 3: Morphometric characteristics of brown type donkeys of Andhra Pradesh

Parameter	Male		Female	
	Mean±SD (cm)	Range (cm)	Mean±SD (cm)	Range (cm)
Height at wither	94.57±5.24	83-106	89.82±3.36	84-96
Body length	91.67±5.67	80-103	88.36±3.36	82-95
Heart girth	101.6±6.33	87-114	99.46±5.24	91-111
Paunch girth	102.4±7.84	90-126	101.43±7.45	89-116
Face length	41.19±3.72	35-52	38.54±1.32	36-42
Face width	14.45±2.21	12-20	13.07±0.47	12-14
Ear length	22.15±1.48	19-25	21.86±0.97	20-24
Neck length	30.93±2.92	27-39	29.82±1.18	28-32
Chest width	20.49±1.87	17-24	19.52±1.05	17-21
Tail length	57.39±4.89	41-66	56.11±3.52	49-65
Fore arm length	37.57±2.21	32-42	36.85±1.21	34-39
Fore arm circumference	20.64±1.44	18-24	18.25±1.35	16-20
Canon length (FL)	18.95±1.38	16-21	17.75±1.24	16-20
Canon circumference (FL)	12.48±1.09	10-15	11.79±0.74	10-13
Pastern length (FL)	7.38±0.79	6-9	7.07±0.54	6-8
Pastern circumference (FL)	12.33±1.03	11-15	11.32±0.77	10-13
Hoof length (FL)	6.04±0.77	4-8	5.61±0.57	5-7
Hoof circumference (FL)	22.12±1.66	20-26	19.93±1.44	17-23
Gaskin length	39.48±2.88	35-48	38.0±1.05	36-40
Gaskin circumference	23.9±2.02	20-29	22.0±1.66	19-25
Canon length (HL)	22.9±2.23	20-29	21.32±0.82	20-23
Canon circumference (HL)	13.24±1.09	11-16	12.11±0.92	10-14
Pastern length (HL)	7.41±0.87	5-9	7.32±0.61	6-8
Pastern circumference (HL)	12.9±1.01	11-15	11.64±0.83	10-13
Hoof length (HL)	5.8±0.86	5-10	5.19±0.39	5-6
Hoof circumference (HL)	21.58±1.43	19-25	19.5±1.27	17-22
Estimated body weight (kg)	80.14±14.21	53.97-109.01	73.69±9.87	56.96-98.18

FL-fore limb, HL-hind limb

Table 4: Comparison of Sindhi, Spiti and Brown type donkeys for Morphometric characteristics by F-test.

Parameter	Male	Female
Height at wither	**	**
Body length	**	**
Heart girth	**	**
Face length	**	**
Ear length	**	#
Neck length	**	**
Tail length	**	*
Canon length (FL)	**	**
Canon circumference (FL)	*	#
Pastern length (FL)	**	**
Pastern circumference (FL)	**	**
Hoof length (FL)	*	#
Hoof circumference (FL)	**	**
Canon length (HL)	**	**
Canon circumference (HL)	*	*
Pastern length (HL)	**	**
Pastern circumference (HL)	**	**
Hoof length (HL)	#	**
Hoof circumference (HL)	**	**
Estimated body weight (kg)	**	**

FL – fore limb, HL – hind limb, **P<0.01, *P<0.05, # Differences not significant

Table 5: Pairwise comparison of Sindhi, Spiti and Brown type donkeys for Morphometric characteristics by t-test

Parameter	Male			Female		
	Sindhi-Spiti	Sindhi-AP Brown	AP Brown-Spiti	Sindhi-Spiti	Sindhi-AP Brown	AP Brown-Spiti
Height at wither	**	**	**	**	**	#
Body length	#	#	#	#	**	**
Heart girth	**	*	#	**	**	#
Face length	**	**	**	**	**	**
Face width	dna	**	dna	dna	**	dna
Ear length	**	#	**	#	#	#
Neck length	**	**	#	**	**	#
Chest width	dna	#	dna	dna	*	dna
Tail length	#	**	#	*	**	#
Fore arm length	dna	**	dna	dna	**	dna
Canon length (FL)	#	*	**	**	**	**
Canon circumference (FL)	**	#	#	#	#	#
Pastern length (FL)	**	#	**	**	*	**
Pastern circumference (FL)	**	**	#	**	**	#
Hoof length (FL)	#	**	#	#	*	#
Hoof circumference (FL)	**	#	**	**	**	#
Gaskin length	#	**	dna	dna	**	dna
Canon length (HL)	**	**	**	*	**	**
Canon circumference (HL)	*	#	#	#	*	*
Pastern length (HL)	**	**	**	**	#	**
Pastern circumference (HL)	**	**	#	#	**	#
Hoof length (HL)	#	#	#	*	**	*
Hoof circumference (HL)	#	#	#	**	**	#
Estimated body weight (kg)	**	*	#	**	**	#

FL – fore limb, HL – hind limb, **P<0.01, *P<0.05, # Differences not significant, dna- data not available in one or both the breeds

significant differences in body biometric parameters, they were compared by analysis of variance (F-test) at the parameters for which data was available in all the three populations. The results of the F-test showed that these three populations to be significantly different (P<0.01) from each other, both in male and female animals, at almost all morphometric parameters studied (table 4). To have a deeper understanding, these three populations were also evaluated in pairwise comparison by students t-test (table 5). When Spiti donkeys were compared with Sindhi donkeys, both of which can be distinguished by general appearance of the animals as Spiti donkeys are covered with long hairs, also showed significant differences from each other in most body biometric parameters (table 5).

Similarly, Spiti donkeys can be distinguished from Brown type donkeys of Andhra Pradesh by general appearance of the animals. When these two populations were compared for morphometric parameters, they showed significant differences in height at wither, face length, canon length (fore and hind limb), pastern length (fore and hind limb) and ear length (P<0.01), when male animals were compared. However, when female Brown type donkeys of Andhra Pradesh and Spiti donkeys were compaed, they showed significant differences only in body length, face length, canon length (fore and hind limb), pastern length (fore and hind limb) with P<0.01 and canon circumference (hind limb), hoof length (hind limb) with P<0.05. When Sindhi donkeys and Brown type donkeys of Andhra Pradesh, which appear quite similar to each other, were evaluated, they showed significant differences in most body biometric parameters, both when male or female animals were compared (table 5).

These results indicate that the Sindhi donkeys showed significant differences from Spiti as well as Brown type donkeys of Andhra Pradesh in most of the studied morphometric parameters both in male and female animals. However, the Brown type donkeys of Andhra Pradesh showed significant differences from Spiti donkeys only in limited number of biometric parameters both in male and female animals.

ACKNOWLEDGEMENTS

We gratefully acknowledge the kind help received from the Animal Husbandry department of Himachal Pradesh, Rajsthan and Andhra Pradesh and Sri Venkteswera Veterinary University.

REFERENCES

Behl R, Behl J, Attri P N and Nadda S (2015) *Spiti Gadhe : Gun va upyogita*. *Pashudhan Prakash* 6: 19-21.

Behl R, Nirabjan S K, Vijh R K and Dharma Rao M V (2016) *Andhra Pradesh ke Bhuri kism ke gadhe*. *Pashudhan Prakash* 7: 14-16.

Behl R, Sadana D K, and Behl J (2009) Donkey – An underevaluated animal genetic resource of India. Livestock International 12: 5-8.

Behl R, Sadana D K, Behl J, Attri P N, Nadda S and Joshi B K (2011) Donkey genetic resources of India: Spiti donkey. National Bureau of Animal Genetic Resouces, Karnal Publication, monogram 74/2011.

Behl R, Sadana D K, Behl J, Kumar S, Kedar V and Joshi B K(2013) Donkey genetic resouces of India: Sindhi donkeys. National Bureau of Animal Genetic Resouces, Karnal Publication, monogram 80/2013.

Norman G R and Steiner D L (2000) Biostatistics – The Bare Essentials, 2nd edition. B C Decker Inc., Hamilton, London.

Gupta S P (2011) Statistical Methods, 41st edition. Sultan Chand and Sons, New Delhi.