

Morphometrical Studies on the Hooves of Pandharpuri Buffaloes

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Received : 30.01.2026; Accepted: 12.04.2026

ABSTRACT

The present research work was carried on the hooves of 18 female Phandhapuri buffaloes of 5-6 years of age, 7-8 years of age and 9-10 years of age. Each group consisted of six animals. The hooves were the covering over the third phalanx of each digit. The colour of hoof of both digits was grayish black in all the age groups. The toe of the hoof was pointed, while the heel was rounded in all the age groups. Each hoof consisted of coronary band, surfaces and borders. The coronary band was soft, flat band, surrounds the coronary border of the hoof. The sole surface was concave, caudally board and continued with heel. The average values for the biometrical measurements showed significant difference between the forelimbs and hind limbs of all the age groups. These values were higher in the forelimbs as compared with those of the hind limbs in all the age groups. It was observed that the hooves of the forelimbs were larger than the hooves of the hind limbs in all the age groups. The average values for the measurements of the hooves of the forelimb and hind limb were low in the age group 5-6 years and significantly higher in the age group 9-10 years. The average values for biometrical parameters were higher in the medial digit of both forelimbs in all the age groups. While the average values for biometrical parameters were higher in the lateral digits of both hind limbs in all the age groups.

Key words: Buffalo, Hoof, Morphometry

INTRODUCTION

The physical measurements of animal body that are indicators of an animal's production performance. Dairy buffaloes are quite large animals weighing above 500 kg on average, and with this large body mass, it becomes difficult to measure some major body measurements and longer measuring tapes and personnel's support are required. Whereas, among several body measurements, hoof circumference is easily determined. Certain body measurements (body length, wither height, rump height, chest girth) have been extensively used in the prediction of live weight in animals and their relationship with milk production. The hoof circumferences of different feet, when averaged, could serve as a predictor of body weight and/or milk production in buffaloes. As the population of cattle is exceeding, newer and easier tools and methods are needed for quicker

prediction and phenotypic selection of animals. Therefore, the present work was designed to study the measurement of hooves in different ages of female buffaloes.

MATERIAL AND METHODS

The present research work was carried on the hooves of 18 female Phandhapuri buffaloes. All the experimental animals were in lactation and grouped according to their age. For this experiment, the age groups were 5-6 years of age, 7-8 years of age and 9-10 years of age. Each group consisted of six animals. The gross anatomical observations were recorded in respect of all the limbs. The biometrical measurements were recorded on various parameters of hoof with the help of non-stretchable thread and measurements were taken on scale viz., toe length, toe height, heel width, heel height, hoof solar length, hoof with coronary circumference and basal, border circumference. The data obtained was statistical analyzed for better illustration of results.

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RESULT AND DISCUSSION

The present research work was carried on the hooves of the 18 female Phandhapuri buffaloes of different age. All the experimental animals were in lactation and grouped according to their age. For this experiment, the age groups were 5-6 years of age, 7-8 years of age and 9-10 years of age. Each group consisted of six animals.

The hooves were the covering over the third phalanx of each digit. The colour of hoof of both the digits was grayish black in all the age groups. The toe was pointed anterior end of the hoof in all the age groups. Similar observations were recorded by the Sasidharan *et al.* (2019) in buffalo. The heel was rounded posterior portion, which consisted of soft tissue in all the age groups. Each hoof consisted of the coronary band, surfaces and borders. The coronary band was soft, flat band, surrounds the coronary border of the hoof. The abaxial surface was convex, showed transverse ridges. The axial surface was slightly concave and small. Similar observations were recorded by the Sasidharan *et al.* (2019) in buffalo and Dhoolappa *et al.* (2017) in cow. The sole surface was concave, caudally board and it continued with heel. The coronary border was thin, while the solar border was thick and longer in all the age groups. These findings were in agreement with Khan and Khan (2016) in Sahiwal cows of Pakistan.

The average values for the biometrical measurements showed significant difference between forelimbs and hindlimbs of animals in the all the age groups. These values for biometrical parameters were higher in forelimbs as compared with those of hind limbs in all the age groups. It was observed that the hooves of the forelimbs were larger in size than the hooves of the hind limbs in

all the age groups. Similar observations were recorded by the Sasidharan *et al.* (2019) in buffalo and Mohamadnia and Khaghani (2013) in dairy cow.

The average values for the biometrical measurements of hooves of forelimb and hindlimb were low in the age group 5-6 years and high in the age group 9-10 years and showed significant difference. It indicated that as age advanced the size of the hoof was increased. The average values of biometrical measurements of hoof were significantly differ between the lateral and medial digit in both the forelimbs and hindlimbs.

The average values for these biometrical parameters were higher in medial digit of the both the forelimbs in all the age groups under study. While the average values for biometrical these parameters were higher in lateral digit of both the hindlimbs in all the age groups. It indicated that the hoof of medial digit of forelimb was larger in size than that of lateral digit in both the forelimbs, while the hoof of lateral digit of hind limb was larger than that of medial digit in both the hind limbs of the all age groups. These observations were in accordance with the findings of Sasidharan *et al.* (2019) in buffalo and Mohamadnia and Khaghani (2013) in dairy cow and Dhoolappa *et al.* (2017) in cow.

CONCLUSION

The hooves of the Pandharpuri buffaloes were grayish-black and consisted of a board sole, a convex and ridged abaxial surface, a soft flat coronary band, and rounded soft heel in all age groups.. The medial digits were larger in size than lateral digits of both the forelimbs, while the lateral digits were larger in size than medial digits of both the hind limbs of all the age groups.

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Table 1 :Statistical analysis of biometrical parameters of hooves in the forelimbs and Hind limbs in various age groups

S. No.	Parameter	Age groups											
		5-6 Years				7-8 Years				9-10 Years			
		Fore limb		Hind limb		Fore limb		Hind limb		Fore limb		Hind limb	
		Mean $\pm$ SE		Range		Mean $\pm$ SE		Range		Mean $\pm$ SE		Range	
1	Toe length (cm)	9.1 $\pm$ 0.06	8.60-9.80	8.85 $\pm$ 0.05	8.40-9.40	9.95 $\pm$ 0.09	9.20-10.50	9.79 $\pm$ 0.08	9.10-10.40	10.53 $\pm$ 0.03	10.20-10.80	10.28 $\pm$ 0.03	10.00-10.5
2	Toe height (cm)	6.27 $\pm$ 0.08	5.70-7.30	6.00 $\pm$ 0.08	5.3-6.80	7.96 $\pm$ 0.04	7.60-8.40	7.66 $\pm$ 0.06	7.10-8.30	6.8 $\pm$ 0.03	6.50-7.10	6.47 $\pm$ 0.03	6.20-6.80
3	Heel width (cm)	5.02 $\pm$ 0.03	4.70-5.30	4.95 $\pm$ 0.06	4.10-5.50	5.62 $\pm$ 0.06	5.00-6.10	5.57 $\pm$ 0.06	5.00-6.10	5.22 $\pm$ 0.04	4.70-5.50	4.92 $\pm$ 0.07	4.40-5.30
4	Heel height (cm)	4.98 $\pm$ 0.03	4.70-5.30	4.85 $\pm$ 0.03	4.50-5.10	5.90 $\pm$ 0.06	5.40-6.50	5.61 $\pm$ 0.09	4.90-6.50	5.42 $\pm$ 0.03	5.00-5.60	5.16 $\pm$ 0.02	4.80-5.40
5	Hoof solar length (cm)	10.99 $\pm$ 0.20	8.80-12.40	10.44 $\pm$ 0.12	9.40-11.70	10.95 $\pm$ 0.13	10.00-12.20	10.67 $\pm$ 0.11	10.00-11.70	11.35 $\pm$ 0.09	10.60-12.30	10.75 $\pm$ 0.08	10.00-11.4
6	Hoof width (cm) Coronary	5.23 $\pm$ 0.07	4.80-6.10	4.92 $\pm$ 0.05	4.20-5.40	5.93 $\pm$ 0.04	5.60-6.30	5.66 $\pm$ 0.05	5.20-6.20	6.22 $\pm$ 0.03	6.00-6.60	5.85 $\pm$ 0.06	5.20-6.30
7	circumference (cm)	22.07 $\pm$ 0.13	21.10-23.50	21.07 $\pm$ 0.17	19.40-22.40	23.89 $\pm$ 0.20	21.00-25.20	23.74 $\pm$ 0.21	21.20-24.70	24.11 $\pm$ 0.13	23.00-25.30	23.87 $\pm$ 0.16	22.50-25.7
8	Basal border circumference (cm)	25.32 $\pm$ 0.14	24.20-26.40	24.35 $\pm$ 0.17	23.00-25.60	25.87 $\pm$ 0.17	24.00-27.00	25.30 $\pm$ 0.16	23.80-26.50	27.12 $\pm$ 0.16	25.50-28.40	26.45 $\pm$ 0.12	25.50-27.2

Table 2 :Statistical analysis of biometrical parameters of hooves of lateral and medial digits in the forelimbs in various age groups

S. No.	Parameter	Age groups											
		5-6 Years				7-8 Years				9-10 Years			
		Lateral digit		Medial Digit		Lateral digit		Medial Digit		Lateral digit		Medial Digit	
		Mean $\pm$ SE		Range		Mean $\pm$ SE		Range		Mean $\pm$ SE		Range	
1	Toe length (cm)	9.00 $\pm$ 0.08	8.60-9.50	9.20 $\pm$ 0.8	8.90-9.80	9.87 $\pm$ 0.14	9.20-10.40	10.02 $\pm$ 0.13	9.40-10.50	10.44 $\pm$ 0.3	10.20-10.60	10.62 $\pm$ 0.03	10.40-10.80
2	Toe height (cm)	6.21 $\pm$ 0.12	5.70-7.10	6.33 $\pm$ 0.12	5.90-7.30	7.85 $\pm$ 0.04	7.60-8.20	8.06 $\pm$ 0.07	7.70-8.40	6.71 $\pm$ 0.04	6.50-6.90	6.88 $\pm$ 0.04	6.50-7.10
3	Heel width (cm)	4.9 $\pm$ 0.04	4.70-5.20	5.1 $\pm$ 0.02	5.00-5.30	5.54 $\pm$ 0.09	5.00-6.10	5.57 $\pm$ 0.08	5.20-6.10	5.18 $\pm$ 0.07	4.70-5.50	5.27 $\pm$ 0.06	4.90-5.50
4	Heel height (cm)	4.95 $\pm$ 0.03	4.70-5.10	5.00 $\pm$ 0.03	4.70-5.30	5.79 $\pm$ 0.07	5.40-6.20	6.01 $\pm$ 0.08	5.50-6.50	5.34 $\pm$ 0.04	5.00-5.60	5.40 $\pm$ 0.03	5.20-5.60
5	Hoof solar length (cm)	10.80 $\pm$ 0.29	8.80-12.00	11.17 $\pm$ 0.29	9.20-12.40	10.77 $\pm$ 0.17	10.00-11.50	11.13 $\pm$ 0.18	10.40-12.20	11.25 $\pm$ 0.13	10.60-12.10	11.45 $\pm$ 0.14	10.80-12.30
6	Hoof width (cm) Coronary	5.15 $\pm$ 0.12	4.80-6.10	5.31 $\pm$ 0.08	5.00-5.90	5.82 $\pm$ 0.05	5.60-6.20	6.05 $\pm$ 0.05	5.70-6.30	6.20 $\pm$ 0.05	6.00-6.50	6.25 $\pm$ 0.04	6.00-6.60
7	circumference (cm)	21.83 $\pm$ 0.17	21.10-23.00	22.31 $\pm$ 0.19	21.40-23.50	23.73 $\pm$ 0.29	21.00-25.00	24.05 $\pm$ 0.28	22.00-25.20	24.01 $\pm$ 0.20	23.00-25.20	24.21 $\pm$ 0.18	23.20-25.30
8	Basal border circumference (cm)	25.07 $\pm$ 0.18	24.20-26.10	25.56 $\pm$ 0.19	24.50-26.40	25.67 $\pm$ 0.22	24.00-26.50	26.06 $\pm$ 0.25	24.20-27.00	26.88 $\pm$ 0.23	25.50-28.10	27.36 $\pm$ 0.21	26.10-28.40

**Fig.01****Fig. 1.** Hoof of left forelimb of Phandharpuri buffalo (Anterior view)**Fig.02****Fig. 2.** Hoof of right hindlimb of Phandharpuri buffalo (posterior view)**Table 3 :** Statistical analysis of biometrical parameters of hooves of lateral and medial digits in the Hind limbs of various age groups

Sr. No.	Parameter	Age groups											
		5-6 Years				7-8 Years				9-10 Years			
		Lateral digit		Medial Digit		Lateral digit		Medial Digit		Lateral digit		Medial Digit	
		Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range
1	Toe length (cm)	8.98 $\pm$ 0.05	8.70-9.40	8.72 $\pm$ 0.08	8.40-9.20	9.87 $\pm$ 0.10	9.30-10.40	9.71 $\pm$ 0.14	9.10-10.40	10.33 $\pm$ 0.03	10.20-10.50	10.24 $\pm$ 0.03	10.00-10.50
2	Toe height (cm)	6.03 $\pm$ 0.09	5.70-6.50	5.96 $\pm$ 0.13	5.30-6.80	7.80 $\pm$ 0.08	7.40-8.30	7.53 $\pm$ 0.08	7.10-8.00	6.52 $\pm$ 0.04	6.30-6.80	6.41 $\pm$ 0.05	6.20-6.80
3	Heel width (cm)	5.10 $\pm$ 0.06	4.70-5.50	4.80 $\pm$ 0.11	4.10-5.40	5.64 $\pm$ 0.09	5.10-6.10	5.50 $\pm$ 0.09	5.00-5.80	4.96 $\pm$ 0.10	4.50-5.30	4.88 $\pm$ 0.10	4.40-5.20
4	Heel height (cm)	4.90 $\pm$ 0.04	4.70-5.10	4.80 $\pm$ 0.05	4.50-5.10	5.70 $\pm$ 0.14	4.90-6.50	5.52 $\pm$ 0.11	4.90-6.20	5.20 $\pm$ 0.03	5.10-5.40	5.13 $\pm$ 0.04	4.80-5.30
5	Hoof solar length (cm)	10.70 $\pm$ 0.17	10.00-11.70	10.18 $\pm$ 0.14	9.40-11.10	10.85 $\pm$ 0.16	10.10-11.70	10.49 $\pm$ 0.13	10.00-11.20	10.80 $\pm$ 0.11	10.20-11.40	10.70 $\pm$ 0.11	10.00-11.30
6	Hoof width (cm)	5.05 $\pm$ 0.05		4.79 $\pm$ 0.06	4.20-5.20	5.73 $\pm$ 0.08	5.20-6.20	5.59 $\pm$ 0.07	5.20-6.10	5.91 $\pm$ 0.08	5.40-6.30	5.79 $\pm$ 0.09	5.20-6.20
7	Coronary circumference (cm)	21.28 $\pm$ 0.22	19.80-22.40	20.85 $\pm$ 0.25	19.40-22.20	23.95 $\pm$ 0.18	22.50-24.70	23.00 $\pm$ 0.33	21.20-24.50	24.01 $\pm$ 0.24	22.90-25.70	23.70 $\pm$ 0.21	22.50-25.20
8	Basal border circumference (cm)	24.61 $\pm$ 0.29	23.20-25.60	24.09 $\pm$ 0.17	23.00-24.80	25.69 $\pm$ 0.17	24.30-26.50	25.91 $\pm$ 0.25	23.80-26.20	26.57 $\pm$ 0.16	25.70-27.20	26.32 $\pm$ 0.17	25.50-27.00

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