

BIOMETRY OF SPINAL CORD DURING PRENATAL LIFE IN INDIAN BUFFALO (BUBALUS BUBALIS)

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ABSTRACT

The present study was conducted on spinal cord of 15 buffalo foetii obtained from a slaughter house. The foetii were divided into three groups (Groups I, II and III) on the basis of their curved crown rump length. The length of spinal cord became double in group II and five times in group III as compared to group I. The coccygeal region showed a continuous decrease in the spinal cord from group I to group II and this region was not noticed in group III. Mean width of lumbar enlargement was higher than that of cervical enlargement in all age groups of buffalo foetii.

Key words : Buffalo, cervical enlargement, foetii, spinal cord

India possesses about 92 million (56.8%) of the world's buffalo population (Meena *et al.*, 2007). Most of the research on the biometry of spinal cord has been reported on the post-natal life of buffalo (Rao and Tewari, 1974; Dhingra *et al.*, 1976). Research work has also been carried out during the prenatal life; however, most of the work has been reported in goats (Taluja *et al.*, 1989; Maya, 2005). Hence, the present research was conducted on the spinal cord of buffalo foeti during prenatal life.

MATERIALS AND METHODS

The present study was conducted on spinal cord of 15 buffalo foetii obtained from pregnant non-descript buffaloes slaughtered at an abattoir in Ghazipur, New Delhi. After the collection of foetii, the foetal body length was measured as a curved line (in centimetre) with the help of inelastic thread along the vertebral column between the most anterior part of frontal bone to the rump at ischiatic tuberosity and designated as curved crown rump length (CVRL; Edward, 1965). The approximate age of the foetii was calculated by using the formula given by Soliman (1975):

$$Y = 28.66 + 4.496 X \text{ (CVRL} < 20 \text{ cm)}$$

$$Y = 73.544 + 2.256 X \text{ (CVRL} > 20 \text{ cm)}$$

where Y is age (in days) and X is CVRL (in cm).

Based on CVRL, the foetii were divided into three groups: group I (foetii of CVRL between 0-20 cm), group II (foetii of CVRL above 20 cm and upto 40 cm) and group III (foetii of CVRL above 40 cm).

After removing skin and fascia, the vertebral column was exposed and the spinal cord was subjected to biometrical analysis. The total length and regional length (cervical, thoracic, lumbar, sacral and coccygeal), height and width of spinal cord were measured with a calibrated scale and an inelastic thread. The data was analysed statistically

RESULTS AND DISCUSSION

Mean total length of the spinal cord was 11.30 ± 1.08 cm in group I, 20.94 ± 2.05 cm in group II and 55.38 ± 10.22 cm in group III, respectively (Table 1). Chandna and Tyagi (1981) and Parmar *et al.* (2000) measured the length of spinal cord in postnatal calves. The correlation showed that the total length of spinal cord increased progressively from group I to III (significant at 1% level) (Table 1). Similar findings with regard to increase in length of spinal cord have been reported in goat foetii (Taluja *et al.*, 1983; Maya, 2005).

The maximum regional length of spinal cord was observed in thoracic region followed by cervical, lumbar, sacral and coccygeal regions in groups I, II and

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Table 1
Biometrical observations on the total length and length of various regions of spinal cord in buffalo foetii

Group	Spinal (cm)	Cervical (cm)	Thoracic (cm)	Lumbar (cm)	Sacral (cm)	Coccygeal (cm)
I	11.30 ±1.08	2.56 ±0.32	4.68 ±0.48	1.94 ±0.19	1.58 ±0.16	0.54 ±0.02
Corr.(r)	0.993**	0.907*	0.916*	0.932*	0.986**	-0.051
II	20.94 ±2.05	4.98 ±0.56	8.26 ±0.82	3.90 ±0.44	3.40 ±0.35	0.40 ±0.11
Corr. (r)	0.980**	0.995**	0.989**	0.974**	0.780	-0.636
III	55.38 ±10.22	14.66 ±2.82	22.50 ±3.94	11.20 ±2.36	7.02 ±1.15	0.00
Corr. (r)	0.987**	0.998**	0.986**	0.964**	0.973**	0.00

*Significant at 5% level; **Significant at 1% level; Group1=CVRL 10.5 to 19.5 cm and age 75 to 116 days; Group 2=CVRL 22.5 to 38.8 cm and age 124 to 161 days; Group3=CVRL 43.0 to 108.0 cm and age 171 to 317 days.

III, respectively. The coccygeal region showed a continuous decrease in the spinal cord from group I to group II. The present findings are in accordance with those of Taluja and Shrivastava (1982) and Ghazi and Gholami (1993) in goat and sheep foetii, respectively.

Mean cervical length also increased from group I to group III with significant increase in groups II and III as compared to group I (Table 1). Similar observations have been made earlier by Taluja and Shrivastava (1982) and Maya (2005) in goat foetii. Per cent cervical length to total spinal cord length was 22.66 in group I, 23.71 in group II and 26.20 in group III in the study.

Maximum mean regional length was observed in thoracic region in all age groups of buffalo foetii. Average thoracic length also increased from group I to

group III (Table 1). The correlation was highly significant (at 1% level) in groups II and III, whereas in group I, it was significant at 5% level. Percent thoracic to total spinal cord length was 41.24 in group I, 39.44 in group II and 40.97 in group III. Similar findings have been reported earlier by Taluja and Shrivastava (1982) and Maya (2005) in goat foetii.

Mean lumbar length was 1.94±0.19 cm in group I, 3.90±0.44 cm in group II and 11.20±2.36 cm in group III, respectively (Table 1). Highly significant positive correlation was observed between total length and lumbar region length in all the three age groups of buffalo foetii. Mean per cent lumbar to total spinal cord length value was 17.13, 18.55 and 19.91 in groups I, II and III, respectively. Taluja and Shrivastava (1982) and Maya (2005) also observed the isometric growth rate during all stages of gestation in goat foetii.

Mean sacral length was 1.58±0.16 cm in group I, 3.40±0.35 cm in group II and 7.02±1.15 cm in group III (Table 1). The coefficient of variation showed that sacral length increased significantly in groups I and III as compared to group II. Per cent sacral to total spinal cord length was 13.92 in group I, 16.24 in group II and 12.93 in group III. These findings are consistent with the observations of Taluja and Shrivastava (1982) and Maya (2005) in goat foetii.

Mean regional length was minimum in coccygeal region in all age groups in buffalo foeti in this study. It measured 0.54±0.02 cm in group I and 0.4±0.11 cm in group II. The coccygeal region was not observed in group III (Table 1). Negative correlation

Table 2
Biometrical data on height and width of different regions of buffalo foetal spinal cord

Group	Cervical (mm)		Cervical enlargement (mm)		Thoracic (mm)		Lumbar (mm)		Lumbar enlargement (mm)		Sacral (mm)	
	Height	Width	Height	Width	Height	Width	Height	Width	Height	Width	Height	Width
I	1.91 ±0.13	1.92 ±0.13	1.96 ±0.12	2.46 ±0.16	1.57 ±0.16	1.74 ±0.18	1.99 ±0.19	2.26 ±0.15	1.92 ±0.19	2.55 ±0.20	1.68 ±0.19	1.63 ±0.12
Corr. (r)	0.925*	0.748	0.860	0.821	0.786	0.917*	0.948*	0.939*	0.872	0.932*	0.915*	0.874
II	3.33 ±0.30	3.20 ±0.21	3.22 ±0.35	3.89 ±0.22	2.85 ±0.28	2.90 ±0.12	2.94 ±0.25	3.34 ±0.15	3.20 ±0.20	4.48 ±0.23	2.75 ±0.08	2.68 ±0.15
Corr. (r)	0.972**	0.951*	0.965**	0.974*	0.836	0.901*	0.953*	0.965**	0.669	0.899*	0.542	0.861
III	6.56 ±0.44	8.70 ±1.34	7.61 ±0.65	9.51 ±1.24	6.06 ±0.18	6.13 ±0.75	6.23 ±0.20	7.05 ±0.99	6.89 ±0.31	9.87 ±1.28	4.63 ±0.78	5.60 ±1.17
Corr. (r)	0.955*	0.961*	0.813	0.935*	0.686	0.899*	0.962**	0.934*	0.987**	0.960**	0.990*	0.978**

*Significant at 5% level; **Significant at 1% level; Group1=CVRL 10.5 to 19.5 cm and age 75 to 116 days; Group 2=CVRL 22.5 to 38.8 cm and age 124 to 161 days; Group3=CVRL 43.0 to 108.0 cm and age 171 to 317 days.

was found between the regional length and the CVRL of foetii. Percent coccygeal to total spinal cord length was 5.03 in group I and 2.06 in group II. Similar findings have been reported earlier by Maya (2005) in goat foetii.

The average width of the lumbar region was the highest among all regions of spinal cord in group I and II whereas, the mean width of the cervical region was the highest among all regions of spinal cord in group III (Table 2). Mean width of sacral region was the least among all regions of spinal cord as the spinal cord tapered towards the coccygeal region. Mean width of lumbar enlargement was higher than that of cervical enlargement in all age groups of buffalo foetii. Highly significant correlation was found between the CVRL and width of spinal cord in buffalo foetii. The present finding was in agreement with the observation of Taluja *et al.* (1990) and Maya (2005) in goat foetii and Parmar *et al.* (2000) in calves.

The average height of spinal cord was maximum in lumbar region in group I whereas in group II and III it was maximum in cervical region (Table 2). The mean height of sacral region was minimum among all regions of spinal cord as the spinal cord tapered towards the coccygeal region. The mean height of cervical enlargement was higher than that of lumbar enlargement in all age groups of buffalo foetii (Table 2). This was in agreement of findings of Taluja *et al.* (1990), Parmar *et al.* (2000) and Maya (2005) in goats or calves.

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