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Short Communication

CERTAIN MORPHOMETRICAL STUDIES OF THE CRANIAL BONES OF DROMEDARY CAMEL

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Skull encompasses and protects the brain and the sensory organs of sight, smell, sound, balance and taste (Konig and Liebich, 2004). The regional anatomy of the head is very useful tool that will aid in the regional anaesthesia (Olopade and Onwuka, 2003). The directions of the cranial nerves and their passages from different foramina in the skull are of clinical importance in regional anaesthesia around the head (Dyce *et al*, 2002 and Hall *et al*, 2000). The skull of the camel differs markedly in shape and structure from domesticated ruminants and resembes that of equine in outline, due to the fact that the frontal bones are relatively small while the parietal bones form the roof of cranium (Smuts and Bezuidenhout, 1987).The literature on cranio-metric indices of the camel is meagre, hence this study was done on the skulls of dromedary camels. A total of 17 morphometric measurements were done in the cranial bones of skull using scale, thread and Vernier calipers. These were adapted from Brehm *et al* (1985), Onar (2001), Endo *et al* (2002), Al-Sagair and El Mougy (2002), Olopade and Onwuka (2008, 2009). These morphometric parameters of the cranial bones of one humped Indian camel´s skulls are defined below and most of them shown in Figs 1-3.

1. Maximum width of the neurocranium (WNC): Distance from the most lateral point of the cranial cavity on the left to the most lateral point of the cranial cavity on the right.
2. Cranial length (CL): Distance from nuchal crest to the junction of the left and right naso-frontal sutures on the median plane (Fig 2).
3. Cranial index (CI): (WNC x 100) / CL.
4. External sagittal crest length (ESCL): Distance from the caudal extremity of the external crest to the origin of its cranial bifurcation.
5. Skull height (without mandible) (SH): Length from the level of the highest point of the frontal bone to the base of the jugular process (Fig 3).
6. Skull index (SI): (ZGW x 100) / SL.
7. Foramen magnum height (FMH): Mid-vertical height of the foramen magnum (Fig 1).
8. Foramen magnum width (FMW): Largest width of the foramen magnum (Fig 1).
9. Occipital triangle height (OCTH 1): Distance from the nuchal crest to the lower brim of the foramen magnum (Fig 1).
10. Occipital triangle height (without foramen magnum) (OCTH 2): Distance from the caudoventral projection of the nuchal crest to the upper rim of the foramen magnum (Fig 1).
11. Intercondylar width (ICW): Width between the lateral ends of the occipital condyles (Fig 1).
12. Interparacondylar width (IPCW): The greatest breadth between the ventromedial ends of the jugular processes (Fig 1).
13. Paracondylar process length (PCPL): Length from the tip of the paracondylar process to its junction with the squamous occipital bone (Fig 1).
14. Maximum paracondylar process thickness (PCPT): Circumference around the thickest part of the paracondylar process.
15. Occipital condyle thickness (OCT): Maximum width of single occipital condyle from the most lateral extent to the foramen magnum.
16. Foramen magnum index (FMI): (FMH x 100)/ FMW
17. Nuchal crest to occipital condyle (NCOC): Distance from the cranial end of the alveolar process of the mandible to the caudal end of the nuchal crest (Fig 3).

Results and Discussion

The data obtained for craniometric indices (mean ± SE) are shown in Tables 1. The foramen

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magnum height was larger than the width, meaning that it was elliptical with vertical major axis. Cephalic index data was less than 75, meaning that head was dolichocephalic-shaped.

Table 1. Morphometrical parameters (Mean±S.E.) of cranial bones in adult one humped indian camel.

S.N.	Morphometrical Parameters	Mean±SE
1.	WNC	12.60±0.18 (12-13.2)
2.	CL	30.28±0.38 (28.5-31.2)
3.	CI	62.36±0.59 (59.67-63.48)
4.	ESCL	18.05±0.25 (17.4-18.8)
5.	SH	17.45±0.41 (16.6-19.3)
6.	SI	52.00±0.42 (50.89-53.85)
7.	FMH	4.60±0.19 (4.2-5.5)
8.	FMW	3.78±0.12 (3.5-4.3)
9.	OCTH1	12.48±0.30 (11.7-13.7)
10.	OCTH2	8.00±0.32 (7.4-9.5)
11.	ICW	9.43±0.25 (8.7-10.3)
12.	IPCW	14.97±0.40 (13.9-16.6)
13.	PCPL	6.32±0.18 (5.7-6.8)
14.	PCPT	5.35±0.36 (4.6-7)
15.	OCT	3.60±0.18 (3-4.1)
16.	FMI	121.57±3.00 (107.69-127.91)
17.	NCOC	8.57±0.11 (8.2-9)

A total of 17 craniometric indices, covering almost all cranial bones of adult one humped Indian camel were determined. The results were interpreted in means. In present study CI, CL and SI were 62.36 cm, 30.28 cm and 52.00 cm, respectively. Al-Sagair and El Mougy (2002) reported a higher size for CI (72.99 cm) but they reported lower size for CL and SI 21.93 cm and 45.06 cm, respectively in Malha camel.

Yahaya *et al* (2012b) investigated SH and WNC in three breeds of adult Nigerian camels (Maiduguri, Kano and Sokoto) in which these parameters were

Fig 1. Photograph of adult one humped Indian camel (Caudal view) showing foramen magnum height (FMH), foramen magnum width (FMW), occipital triangle height (OCTH 1), occipital triangle height (without foramen magnum) (OCTH2), intercondylar width (ICW), interparacondylar width (IPCW), paracondylar process length (PCPL).

Fig 2. Photograph of adult one humped Indian camel (Dorsal view) showing cranial length (CL).

11.14 cm and 9.78 cm, respectively in Maiduguri, 10.69 cm and 9.63 cm, respectively in Kano and 10.55 cm and 9.41 cm, respectively in Sokoto; whereas

Fig 3. Photograph of adult one humped Indian camel (Lateral view) showing Skull height (without mandible) (SH) and Nuchal crest to occipital condyle distance (NCOC).

in present study these values were higher in one humped Indian camels i.e. 17.45 cm and 12.60 cm, respectively.

ESCL, in present study was 18.05 cm, whereas in adult Maiduguri, Kano and Sokoto Nigerian camels were 13.01cm, 13.42 cm and 13.05 cm, respectively (Yahaya *et al,* 2012b).

In present study NCOC and FMI were 8.57 cm and 121.57 cm, whereas in immature Nigerian camels were 1.22 cm and 103.58 cm, respectively (Yahaya *et al,* 2012c).

FMH and FMW in immature Nigerian camels were 3.29 cm and 3.18 cm (Yahaya *et al,* 2012c) but in present study both were higher, i.e. 4.60 cm and 3.78 cm, respectively.

In present study OCTH1 and OCTH2 were 12.48 cm and 8.00 cm, whereas in immature Nigerian camels were 8.21cm and 5.19 cm, respectively (Yahaya *et al,* 2012c).

ICW and IPCW in immature Nigerian camels were 8.25 cm and 7.97 cm (Yahaya *et al,* 2012c) but in present study, higher values were recorded (9.43 cm and 14.97 cm, respectively).

PCPL and PCPT in present investigation were 6.32 cm and 5.35 cm, whereas in immature Nigerian camel were 2.73 cm and 0.57 cm, respectively (Yahaya *et al,* 2012c). It was clearly visible that both parameters in Nigerian camels were much lower. It might be due to the age difference.

OCT in immature Nigerian camel was 2.53 cm but in present study it was 3.60 cm. These significant variations might be due to geographical location and age variation as most of parameters discussed here were compared with immature Nigerian camels.

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