Indian Journal of Animal Sciences **89**(6): 637–639, June 2019/Short communication
https://doi.org/10.56093/ijans.v89i6.91119

Pelvimetric profiles in crossbred cows of Andaman and Nicobar Islands

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Received: 15 October 2018; Accepted: 2 November 2018

Key words: Andaman and Nicobar Islands, Body weight, Crossbred cows, Pelvimetry

Difficulty in birth (dystocia) is one of the important causes of perinatal calf loss in livestock (Bellows and Short 1994, Noakes *et al.* 2001). Pelvimetric measurement is the best and suitable method to assess the calving associated problems due to abnormally mis-shaped or small pelvices or deformed pelvices to minimise the dystocia (Deutscher 1995). Although cows/heifers with higher pelvic measurements do not parturated more easily than average sized heifers, in general, an abnormally mis-shaped or small pelvices results in a higher incidence of dystocia than in cows with normal pelvices (Noakes *et al.* 2001). Therefore, application of external pelvimetry is an important breeding tool to select the cows/heifers in a breeding programme (Bellows and Short 1994). Pelvimetric study was conducted in exotic cattle (Rice and Wiltbank 1970, Schwabe and Hall 1989), indigenous cattle (Mizoram, Lalrintluanga and Lallianchhunga 2012; Nigeria, Waziri *et al.* 2011; Nagaland, Perumal and Rajkhowa 2013), mithun (Perumal *et al.* 2012), river buffaloes (Oliveira 2001), swamp buffaloes (Thailand, Chantaraprateep *et al.* 1984; Nagaland, Perumal 2013). However, information is lacking in crossbred cows of Andaman and Nicobar Islands (ANI). Internal pelvimetry may give more accurate pelvic area than using external pelvimetry and measurement with internal pelvimetry is practically difficult in field conditions. Therefore measurement of pelvic area with external pelvimetry and associated body weights was conducted to select suitable crossbred cows for breeding purpose in Andaman and Nicobar Islands (ANI).

Crossbred cows (32) of ANI maintained in organised dairy farm of the institute were used in the present study. Average maximum and minimum temperature were 30.1°C and 23°C, respectively. Relative humidity was 82–94% in rainy season. Annual rainfall was 3,100 mm spread over a period of 7 months in a year. Seasons were classified into monsoon (April to November) and dry season (December to March) as per the rainfall availability for the 5 whole calendar years in ANI. Animals were maintained under semi-intensive system, grazing was in the forest during day time and tied them in shed during night time. Experimental animals were fed daily with *ad lib.* quantity of locally available forages with 5 kg of concentrate fortified with salt and mineral mixture. Fresh water was available throughout the day.

Age of the animals was calculated based on the birth register, dentition, and parity of the animals and cows were equally divided into four groups (in months) each of 8 cows, viz. Gr I (24–36 months), Gr II (37–48 months), Gr III (49–53 months) and Gr IV (>53 months). Body weight was calculated by using the Shaeffer's (Khan *et al.* 2003) formula by measurement of body length and girth of the animals ($L \times G^2/300 \times 2.2$; L=body length in inch and G=girth in inch). External pelvimetry was taken by measuring the external pelvic dimensions as described by Craig (1930). Distance between two angles of the haunch was measured by taking the distance between two straight wooden pieces put vertically against each haunch; distance between two ischial tuberosities was measured directly using a measuring scale and the height from the hip joint to the level of the summit (highest point) of the croup was measured. For this, one straight wooden piece was put horizontally across the summit of the croup and the other piece was put horizontally along the trochonter and the ischial tuberosities. The vertical distance between the above two straight wooden pieces was the height from the hip joint to the summit of the croup. Based on the above measurements, diameters of the pelvic outlet, pelvic inlet and pelvic area were calculated. Analysis of variance (ANOVA) was performed using a generalized liner model (Statistical Analysis System for Windows, SAS Version 9.3; SAS Institute, Inc., Cary, NC, 2001) followed by the Tukey's post hoc test to determine significant differences between the different groups for the selected pelvic parameters. Similarly student "t" test was used to study between dry and wet seasons for different age groups. Correlation between the pelvimetric parameters, age and body weight was established with correlation coefficient being done as per Pearson's method (Cilek and Tekin 2005, Choy *et al.* 2017).

Mean±SEM of pelvimetric profiles, pelvic area and body

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Table 1. Pelvimetric profiles of crossbred cows of Andaman and Nicobar Islands in different age groups during dry and rainy seasons

Pelvic parameter		Season	Experimental group			
			Gr I (n=8)	Gr II (n=8)	Gr III (n=8)	Gr IV (n=8)
Transverse pelvic diameter (cm)	Inlet	Rainy	13.19±0.42^{a}	13.91±0.87^{b}	14.96±0.69^{c}	15.72±0.76^{d}
		Dry	13.42±0.91^{a}	14.26±0.73^{b}	15.64±0.82^{c}	15.83±0.67^{c}
	Average		13.29±0.76^{a}	13.98±0.71^{b}	15.25±0.65^{c}	15.65±0.76^{c}
	Outlet	Rainy	10.85±0.31^{a}	11.41±0.78^{b}	12.36±0.74^{c}	12.78±0.59^{d}
		Dry	10.92±0.77^{a}	11.45±0.68^{b}	12.81±0.73^{c}	12.91±0.70^{c}
	Average		10.85±0.53^{a}	11.44±0.65^{b}	12.45±0.68^{c}	12.85±0.62^{c}
Vertical pelvic diameter (cm)	Inlet	Rainy	14.92±0.96^{a}	15.77±0.98^{bc}	16.13±0.86^{cd}	16.82±1.23^{d}
		Dry	15.10±0.87^{a}	16.19±0.82^{ab}	16.83±1.44^{bc}	17.444±1.37^{c}
	Average		14.89±0.88^{a}	15.86±0.66^{bc}	16.41±1.32^{cd}	17.02±1.22^{d}
	Outlet	Rainy	11.41±0.74^{a}	12.22±0.78^{bc}	12.41±0.82^{cd}	12.90±0.87^{d}
		Dry	11.54±0.76^{a}	12.43±0.87^{ab}	12.74±0.65^{bc}	13.32±0.75^{c}
	Average		11.46±0.78^{a}	12.18±0.68^{bc}	12.54±1.67^{cd}	13.06±0.90^{d}
Pelvic area (cm^2)	Inlet	Rainy	195.74±3.83^{a}	216.74±3.64^{b}	241.38±3.47^{c}	263.22±4.48^{d}
		Dry	201.57±4.64^{a}	227.27±3.44^{b}	261.55±5.43^{c}	272.82±5.54^{c}
	Average		198.74±4.43^{a}	222.33±3.64^{b}	252.45±4.85^{c}	268.93±4.91^{d}
	Outlet	Rainy	123.63±2.12^{a}	137.02±2.93^{b}	153.64±2.22^{c}	166.32±3.78^{d}
		Dry	127.21±3.44^{a}	142.78±2.74^{b}	164.81±3.78^{c}	173.95±2.42^{c}
	Average		125.49±3.85^{a}	139.57±2.89^{b}	158.44±3.64^{c}	168.11±3.63^{d}
Body weight (kg)			239.45±4.56^{a}	312.39±4.22^{b}	334.23±5.62^{c}	379.67±5.48^{d}

^{a,b,c,d}Means with different letters within rows differ significantly (P<0.05) between age groups. Gr I (24–36 months), Gr II (37–48 months), Gr III (49–53 months), Gr IV (>53 months).

weight in crossbred cows of ANI of different age groups were analysed and revealed significant difference between age groups and body weights (Table 1). The distance between the angle of haunch, distance between the two ischial tuberosities and height from the hip joint to the level of the summit (highest point) of the croup differed significantly (P<0.05) in between the age groups, but being highest in Gr IV. Similarly, diameter of inlet and outlet of the transverse, vertical diameter and pelvic area differed significantly differed (P<0.05) between different age groups and highest was in Gr IV (Table 1). These pelvimetric parameters and body weights were nonsignificantly differed between dry and rainy season in different age groups.

Various authors had reported the pelvic measurements in exotic cattle (Craig 1930, Rice and Wiltbank 1970, Roberts 1971, Schwabe and Hall 1989) and indigenous cattle (Waziri *et al.* 2011, Lalrintluanga and Lallianchhunga 2012, Perumal and Rajkhowa 2013), river buffaloes (Oliveira 2001), swamp buffaloes (Thailand: Chantaraprateep *et al.* 1984, Nagaland: Perumal 2013) and mithun (Perumal *et al.* 2012), however, no comparable report for crossbred cows of ANI. The mean pelvic inlet area was greater than the mean pelvic outlet area in crossbred cows of ANI as in other cattle (Waziri *et al.* 2011, Lalrintluanga and Lallianchhunga 2012, Perumal and Rajkhowa 2013), swamp buffaloes (Chantaraprateep *et al.* 1984, Perumal 2013) and mithun (Perumal *et al.* 2012).

The pelvic area was observed to be the most essential factor influencing the dystocia and can be successfully used to identify the mis-shaped and/or abnormally small pelvices in exotic breeds of cows (Deutscher 2011). Taken care of all available literatures, this is the first and foremost report on various pelvic dimensions and associated body weights in different age groups of crossbred cows of ANI estimated by external pelvimetry technique in live cattle. Mean vertical as well as transverse pelvic diameters were comparable with that reported in indigenous cattle of Mizoram (Lalrintluanga and Lallianchhunga 2012), in Kuri and Bunaji cows of Nigeria (Waziri *et al.* 2011), Tho Tho cattle of Nagaland (Perumal and Rajkhowa 2013) and in mithun (Perumal *et al.* 2012) and lower than that reported by Craig (1930) and Roberts (1971) in exotic cattle. Diameter of inlet and outlet of vertical, transverse pelvic diameter and pelvic area increased gradually from Gr I to IV and significantly (P<0.01) differed between the age groups. Body weight was positively correlated with pelvic area (r=0.92) and age (r=0.88). However, it is needed to standardise these pelvimetric parameters for crossbred cows of ANI by detailed study of pelvic girdle, pelvic bone measurement with commercially available pelvimetric assessment.

This study concluded that the pelvic parameters were higher in 53 month and above age group than other young animals. These parameters increased as age advanced and significantly differed between groups. Result of this study will be utilized for selection of crossbred cows of ANI for breeding purpose as the animals having the optimum or prescribed pelvic area will be selected for natural or artificial breeding purpose.

SUMMARY

A study was conducted in crossbred cows maintained at

organised dairy farm of the institute to select cows based on the external pelvimetric measurements associated with body weight for breeding purpose. Cows (32) selected were divided in to 4 groups based on age, viz. Gr I (24–36 months), Gr II (37–48 months), Gr III (49–53 months), Gr IV (>53 months) with 8 cows in each group. Overall mean area of pelvic inlet and outlet was 235.61±4.74 and 147.90±5.21 cm^2, respectively. The study concluded that pelvimetric parameters and body weight were significantly higher in Gr IV than other younger animals (Gr I, II and III). These pelvimetric parameters and body weight increased as age advanced and differed significantly between the age groups. The body weight was positively correlated with pelvic area (r=0.92) and age (r=0.88). These findings will be helpful in selection of crossbred cows for breeding purpose in Andaman and Nicobar Islands.

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