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Gross and Biometrical studies of Placentome in Goat (*Capra hircus*) during Different Stages of Pregnancy

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ABSTRACT

The present study was conducted on the 18 healthy and normal goat uteri of non-descript breed (*Capra hircus*) varying from day old to 150 days of gestation. The uteri were assigned in to three groups according to their gestational age; Group I (0-50 days), Group II (51 -100 days) and Group III (101-till term). The length, diameter and thickness of gravid horn, non gravid horn, body and cervix were significantly increased with the advancement of pregnancy. Weight of uterus was also significantly increased as pregnancy progressed. The thickness of endometrium, myometrium, perimetrium and total thickness of uterine wall in gravid horn was significantly increased with advancement of pregnancy. The numbers of placentomes ranged from 92 to 153, which were significantly increased from early to mid pregnancy and subsequently significantly decreased during late pregnancy. In the late pregnancy, the placentome were disc like with a shallow depression and had relatively thinner margin. The length, width and thickness of the placentome were significantly increased with the advancement of pregnancy.

Keywords: Goat, Uteri, Placentome, Pregnancy

The reproductive performance is economically important in small ruminant because of its effect on the number of offspring produced per year (Greyling, 2000). To maintain a good reproductive performance in goat a clear idea about the reproductive organs is necessary. The placenta of ruminant animals exhibits discrete areas of attachment, the placentome.

The placentome, composed of maternal caruncle and foetal cotyledons, is the organ through which respiratory gases, nutrients and wastes are transported. Normal placentome growth and development is essential for foetal growth and development (Laven and Peters, 2001). There is very little information available on the normal variability of goat placentome during different stage of pregnancy. So present study was undertaken to record the changes in individual placentome during pregnancy, particularly parameters in their anatomy to provide the basic knowledge of goat reproductive physiology and normal referenced database of placental abnormalities as a contribution to the improvement of goat reproduction.

MATERIALS AND METHODS

The present study was conducted on the uterus of 18 gravid uteri procured from healthy goats (*Ceapra hircus*) of non-descript breed. The uteri was collected from local slaughter house. An approval from the animal ethic committee DUVASU Mathura (U.P.) was obtained prior to the commencement of the study. Immediately, after collection the umbilical cord was ligated and foeti were cleaned with the help of water soaked cotton to remove the amniotic fluid. Each foeti was measured for its crown rump length (CRL) in centimeters with the help of nylon tape as per the technique described by Harvey (1959) and weighed in grams with the aid of electronic weighing balance machine. An approximate gestational age above 30 days was estimated by estimation of foeti age by using the formula derived by Singh *et al.* (1979) in goat after interpolation of formula of Hugget and Widdas (1951) in mammals. Below 30 days approximate gestational age was estimated by its crown-rump length. The experimental units/ samples were divided into three groups viz. early

Table 1: Variation of mean length, width, thickness (in mm) and total number of placentome.

Group	Length	Width	Thickness	Total placentome
I (Mean±SE) (Range)	5.73±1.28 (3.20-10.92)	4.78±0.85 (2.89-8.05)	2.12±0.17 (1.1-3.7)	110.50±6.15 (92-130)
II (Mean±SE) (Range)	19.45±2.97 (10.97-29.33)	13.68±1.89 (8.06-18.88)	3.8±0.28 (1.67-5.9)	142.66±3.19 (132-153)
III (Mean±SE) (Range)	26.62±1.36 (22.55-31.65)	21.44±0.74 (19.36-23.88)	5.93±0.33 (3.54-8.69)	113±8.01 (85-139)

gestation period (0 day-50 days), mid gestation period (51 days-100 days) and late gestation period (101 days-till full Term). Each group comprised of 6 uteri.

Uteri were dissected carefully from the ventral aspect of the apex of the horns up to the body of the uterus to expose the placentomes and foeti. The morphometrical parameters like shape, number of placentome and its patterns of distribution were noticed during different stage of pregnancy and in biometrical parameters, the mean of length, width and thickness of largest and smallest placentome were measured with the help of metric scale, non stretchable thread and venires calipers. The data generated by biometrical observations were subjected to statistical analysis (Snedecor and Cochran, 1967) with the help of SPSS 17.0 software.

RESULTS AND DISCUSSION

The placenta of the goat exhibited the typical characteristics of a cotyledonary type placenta with the discrete area of attachment between maternal and foetal tissue i.e. the placentome. Similar observation was made by Schlafer *et al.* (2000) and Igwebuiké and Ezeasor (2013) in West African dwarf goat. It was spheroid to ovoid elevation of the endometrium in of the body and horn of the uterus. The maternal caruncle formed the basal plate of the placentome, while the foetal cotyledon formed the chorionic plate of the placentome. These finding are in agreement with those reported by Igwebuiké and Ezeasor, (2013) in WAD goat and Basha *et al.* (2013) in Yameni goat. Ovine placentomes were consisted of chorionic villi fitted into maternal crypts separated from each other by septa (Igwebuiké, 2009).

The placentomes were generally arranged in four rows in both gravid and non gravid horns (Fig. 1). Schlafer *et al.*

(2000) in cattle and Gupta, (1984) in goat also reported similar observation. However, Hafez (2007) in cattle observed 2 to 6 rows of placentome in the uterine body and two rows at the extremities of horn. Igwebuiké and Ezeasor, (2013) in WAD goat and Liu *et al.* (2010) in Yak reported that the placentomes were randomly distributed and did not show any defined order of arrangement in the placenta. The surface of placentome varied according to stages of pregnancy. In early pregnancy, it appeared oval with convex surface (Fig. 2), concave with thick margin in mid pregnancy (Fig. 1) and disc having a shallow depression with thin margin in late pregnancy (Fig. 3). In few cases placentome were oval to elliptically flat in shape in late pregnancy. These findings are in agreement with Gupta (1984) in goat but differ markedly from McGeadey *et al.* (2006), who observed concave placentome in sheep. Amoroso (1952) described that 'cotyledons' of sheep had a concave surface. The appearance of the above described shape of placentomes in goat may not be abnormal as Abd-Elnaeim *et al.* (2003) stated that the shape of the placentome has to be changed during development in buffaloes. Each placentome had two surfaces, namely a concave surface and a convex surface (Fig. 4). The basal plate was the convex surface, the chorionic plate of same placentome was shallow, resulting in a rather flat surface in the placentomes. In late gestation, some placentome exhibited a reversal of the typical placentomal shape. In these cases the basal plate was the concave surface of the placentome, while the chorionic plate constituted the convex surface of the placentome (Fig. 4, 5 and 6). Similar observations were made by Gupta (1984) in Goat and Igwebuiké and Ezeasor, (2013) in WAD go

The surface of placentome was smooth during early pregnancy and became rough in the subsequent stages of pregnancy. The size of placentome varied in different



Figure 1: Photograph of goat uterus at 90 days of pregnancy showing (a) gravid horn, (b) non gravid horn, (c) placentome (concave shape with thick margin) and (d) inter placentomal area.

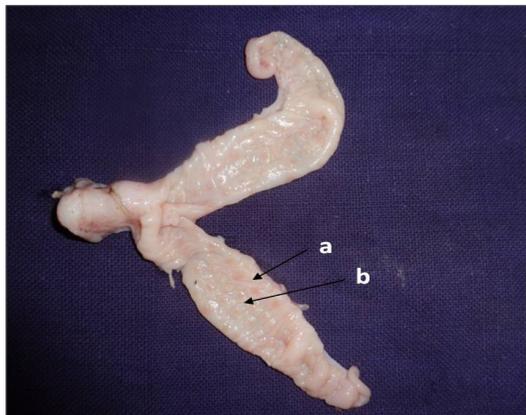


Figure 2: Photograph of goat uterus at 23 days of pregnancy showing (a) caruncle (b) intercaruncular area.

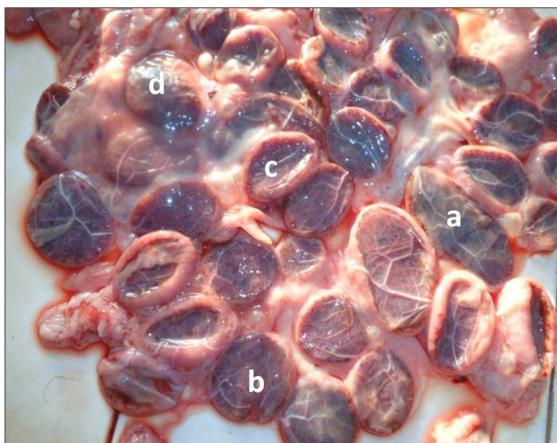


Figure 3: Photograph of goat uterus at 134 days of pregnancy showing (a) elliptical shape placentome, (b) flat placentome (c) placentome (concave shape with thin margin) and (d) placentome (convex shape).

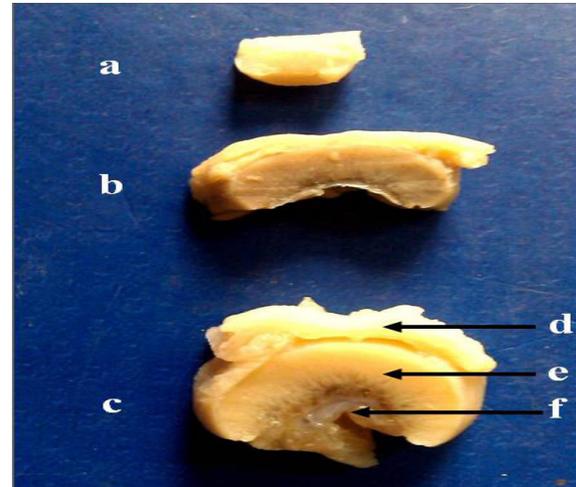


Figure 4. Photograph showing different stage of placentome in relation of attachment either uterine wall or chorionic epithelium (a) early pregnancy (b) mid pregnancy (c) late pregnancy (d) uterine wall (e) caruncle (f) chorionic membrane.

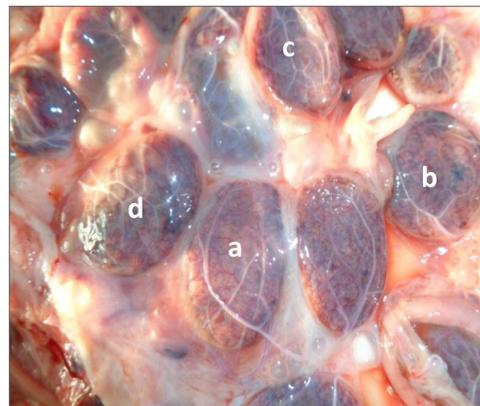


Figure 5: photograph of goat uterus at 134 days of pregnancy showing (a) elliptical shape (b) flat shape (c) concave placentome with thin margin (d) convex placentome

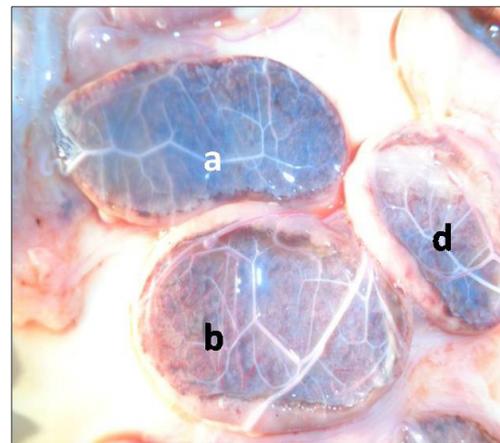


Figure 6: photograph of goat uterus at 134 days of pregnancy showing (a) elliptical shape (b) flat shape (d) convex placentome

regions of the uterus. Smallest placentome were found towards the tapering end of the uterine horns. These gradually increased in size moving towards the body of the uterus. Few small size placentome were found towards the cervix and eventually, these did not occur in the cervical mucosa (Fig.3). Largest placentomes were observed, in the vicinity of umbilical cord in mid ventral region. In bicornual pregnancy, the numbers of placentomes were more in horn having more weight of foeti as compared to other horn. The numbers of placentomes were higher in gravid horn as compared to non gravid horn. Overall right horn pregnancy was more common as compare to left horn. Similar observation was obtained by Gupta (1984) in goat, Liu, *et. al.*, (2010) in yak and Yamauchi *et al.* 1969b in cattle. These authors indicated that this might be a diffusion effect, with the concentration of growth factors being highest in the placentomes nearest the conceptus and declining with distance from the foetus.

The average number of placentomes were 110.5 ± 6.15 , which ranged from 92 to 130 during early pregnancy (Table-1 and fig.7). In the gravid horn, the number of placentomes varied from 47 to 68 and in non gravid horn varied from 45 to 62. The total numbers of placentomes were higher in gravid horn as compare to non gravid horn and number of placentome increases as pregnancy

progressed. In the mid pregnancy, average number of placentome was 142.66 ± 3.18 which ranged increased from 132 to 153 (Table-1 and fig-8). In the late pregnancy, the average number of placentome was 113 ± 8.01 (Table-1 and fig- 7). The number of placentome decreases from 139 to 85 in advance stage of pregnancy. The number of placentomes decreased in gravid horns from 73 to 45 and in non gravid horn from 66 to 40. The total number of placentome per uterus varied significantly with gestational age. Similar observation was reported by Folusho (2012) in bovine. The formed placentomes increase in number and size until the 80th day of pregnancy in ovine (Igwebuike, 2009).

The size of placentomes varied in the different region of the uterus and also in different stages of pregnancy. During early pregnancy the average length of placentome was 5.73 ± 1.28 mm with a range of 3.2 to 10.92 mm, width 4.78 ± 0.84 mm with a range of 2.89 to 8.05 mm and average thickness of placentome 2.12 ± 0.17 mm with a range of 1.1 to 3.7 mm respectively. During mid pregnancy there was enormous increase in size with average length of placentome was 19.45 ± 2.97 mm with a range of 10.97 to 20.91 mm, width 13.68 ± 1.89 mm with a range of 8.06 to 18.88 mm and average thickness of placentome 3.80 ± 0.28 mm with a range of 1.67 to 5.9 mm respectively. The size

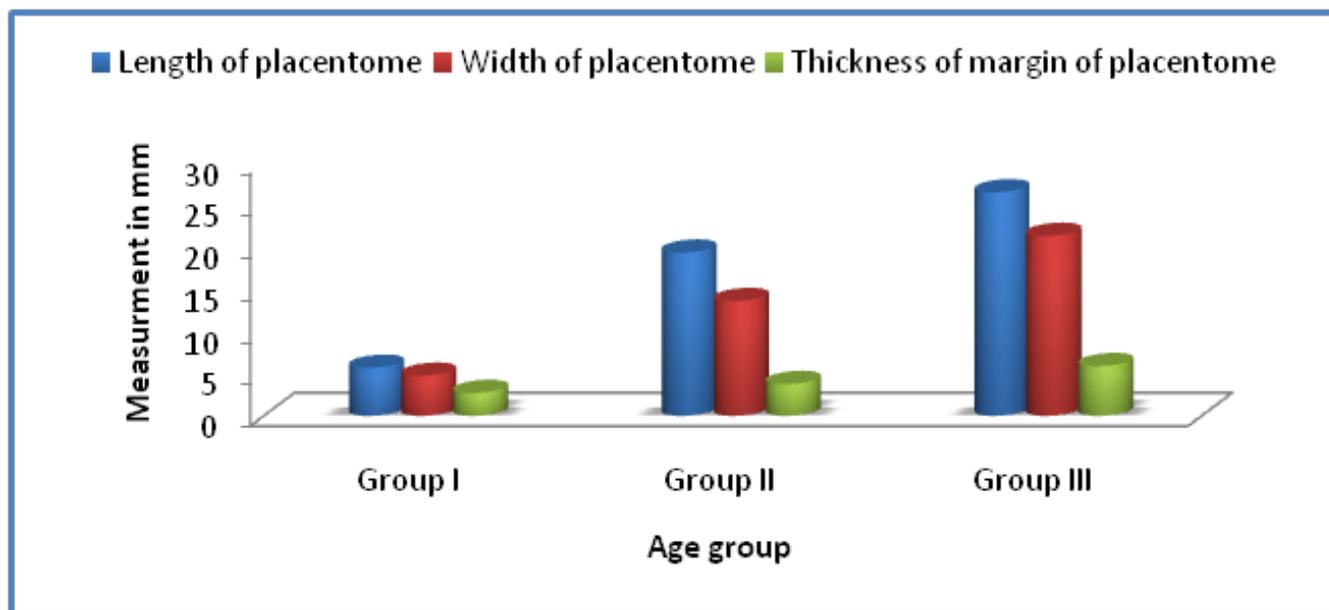


Figure 7. Showing the changes in number of placentome in gravid and Non-gravid horn and net placentome with advancement of pregnancy in goat.

of placentome continued to increase in late gestation. The average length of placentome were 26.62 ± 1.35 cm with a range of 22.55 to 29.19 mm, width 21.44 ± 0.74 mm with a range of 19.36 to 23.88 mm and average thickness of placentome 5.93 ± 0.33 mm with a range of 3.54 to 8.69 mm respectively.

There was highly significant increase in the average length, width, thickness and total number of placentome during whole pregnancy. (Table-1). These were in total agreement with observation recorded by Liu *et al.* (2010) in yak. The increased size of placentome enhanced the rate of physiological exchange between the foetal and maternal system (Reynolds and Ferrell, 1987).

During this study the smallest placentomes were observed in the apical portion of uterine horn and largest placentomes were observed in the vicinity of the umbilical cord in the mid ventral region which gradually became smaller towards the extremities. Some placentomes in body of uterus were small as compare to neighboring placentomes (Fig. 4). These finding were similar with those reported by Gupta (1984) in goat.

Attachment between cotyledons and caruncles was very much fragile during early pregnancy up to 46 days of pregnancy. A firm attachment in the gravid horns was first noticed at 53 days of pregnancy. The union between the two sides remained firm and intimate in the subsequent stages of pregnancy. However, during the late pregnancy the attachment again showed sign of detachment especially at the extremities of placentome (Fig. 1). These finding were in total agreement with those reported by Gupta (1984) in goat.

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