Evaluation of pregnancy diagnosis using ultrasonography in goats

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Abstract

Pregnancy status in 250 goats was determined by transabdominal ultrasonography. The registered hospital cases were divided into groups A (mated naturally; 88); B (postpartum reported unmated; 112) and C (pubertal unmated; 50). Animals found to be non-pregnant and free of uterine infection were labelled Group D and divided into synchronized (S) and control (NS) groups. GnRH followed by PGF2α nine days later was injected i.m. in group S, and NS group were allowed natural mating. All mated goats were checked monthly for pregnancy using ultrasonography. Pregnancy was diagnosed in 45.5, 4.5 and 0% from naturally mated, postpartum reported unmated and pubertal unmated cases, respectively. The oestrus detection and pregnancy rates varied significantly ($P<0.001$) between synchronized (n = 96; 70.8 and 54.4%, respectively) and NS group (n = 96: 54.0 and 28.6%, respectively). Pregnancy rates significantly varied in different months in gestation ($P<0.05$). Fetal viability rate was low in 1st month of pregnancy compared to other months (2nd, 3rd and >3rd). The confirmation of expected date of delivery (EDD) was low in 1st month of gestation compared to other months. Transabdominal ultrasonographic scanning helps to confirm pregnancy in goats. From 2nd month of gestation ultrasound scanning confirms pregnancy with viable fetus (83.3%). At 3rd month of pregnancy, this technique determined the EDD up to 94.2%. (*Bangl. vet.* 2019. Vol. 36, No. 1 - 2, 42 – 48)

Introduction

Ultrasound scanning is a common, reliable and comparatively cheap method for detection of pregnancy in animals (Gonzales-Bulnes *et al.*, 2010). Pregnancy diagnosis in goats is challenging particularly in early stage. A reliable technique for detection of pregnancy in goats is emerging and enabling herdsman to separate non-pregnant goats and thereby save on feed, labour, vaccination, veterinary cost. Ultrasound scanning is non-invasive and causes little stress (Gonzales-Bulnes *et al.*, 2010; Medan *et al.*, 2004). During ultrasonographic scanning, fetal heart beats, umbilical blood flow and middle uterine artery sounds resulted in 100, 100 and 72% accuracy of pregnancy diagnosis, respectively (Wani *et al.*, 1998). The fetal number (Fukui *et al.*, 1986), and estimated gestational age (Russel and Goddard, 1995) can be determined. Transrectal

or transabdominal ultrasonography applications can be used with nearly 100% accuracy (Mialot *et al.*, 1991).

Medan *et al.* (2004) suggested that early and accurate diagnosis of pregnancy and determination of fetal number increases reproductive efficiency. Pregnancy diagnosis identifies which does require repeat service or insemination and allow the separation of pregnant females. Abdominal palpation and inspection are common practices for pregnancy diagnosis in goats in Bangladesh, but are not suitable for early detection of pregnancy.

Report on ultrasonographic scanning for pregnancy diagnosis in small ruminants are scanty. This study was designed to use ultrasonographic scanning for diagnosis of pregnancy in goats registered as outdoor patients at SAQ Teaching Veterinary Hospital (SAQTVH), Chattogram Veterinary and Animal Science University (CVASU).

Materials and Methods

Animals and their grouping and management

A total of 250 goats, Black Bengal, or Jamunapri and Black Bengal crosses, were selected from cases at Theriogenology unit at SAQTVH, CVASU from July 2018 to June 2019. Owners' history was taken. The goats were divided into group A: (88) naturally mated, B: (112) postpartum reported unmated, C: (50) pubertal unmated. Of these, 192 were found to be non-pregnant and free of uterine disease. These were labelled Group D and divided into S: (96) synchronized and NS (96) non-synchronized. The goats were kept under traditional management system by farmers. Wheat bran, rice polish and common grazing with *ad libitum* water were supplied.

Oestrous synchronization, heat detection and hand mated by bucks:

Group D were divided into synchronized (S: n = 96) and non-synchronized (NS: n = 96) group. S group were treated with GnRH (Fertilion®, Techno Drugs Ltd, Bangladesh) and nine days later $PGF_2\alpha$ (Ovuprost® Cloprostenol, Bomac Laboratories Ltd., New Zealand) i/m injection for oestrous synchronization. Group NS were given no treatment and kept as control. Goats of both groups were monitored for oestrous behaviour and allowed to mate with bucks.

Ultrasonography for pregnancy evaluation

Transabdominal digital ultrasonic diagnostic imaging system with convex abdominal ultrasonic transducer 5 MHz (ExaGo, ECM, France) was used in standing position without sedation to diagnose pregnancy in goats. The right lower abdomen was clipped and shaved. Pregnancy was confirmed by observing the gestational sac, fetus, fetal part(s), cotyledon etc (Fig. 1). At 1st month of gestation, pregnancy was confirmed by the presence of fetus and fetal heart beats. Fetal viability was measured observing fetal movement or heart beats. Expected date of delivery (EDD) was estimated by measuring sac diameter or cotyledon size or by observing fetal parts

(Fig. 1). Evaluation of pregnancy status was done as described by Medan *et al.* (2004). EDD was compared with actual date of delivery obtained from owners. Pregnancy was recorded as 1st, 2nd and 3rd months and more.
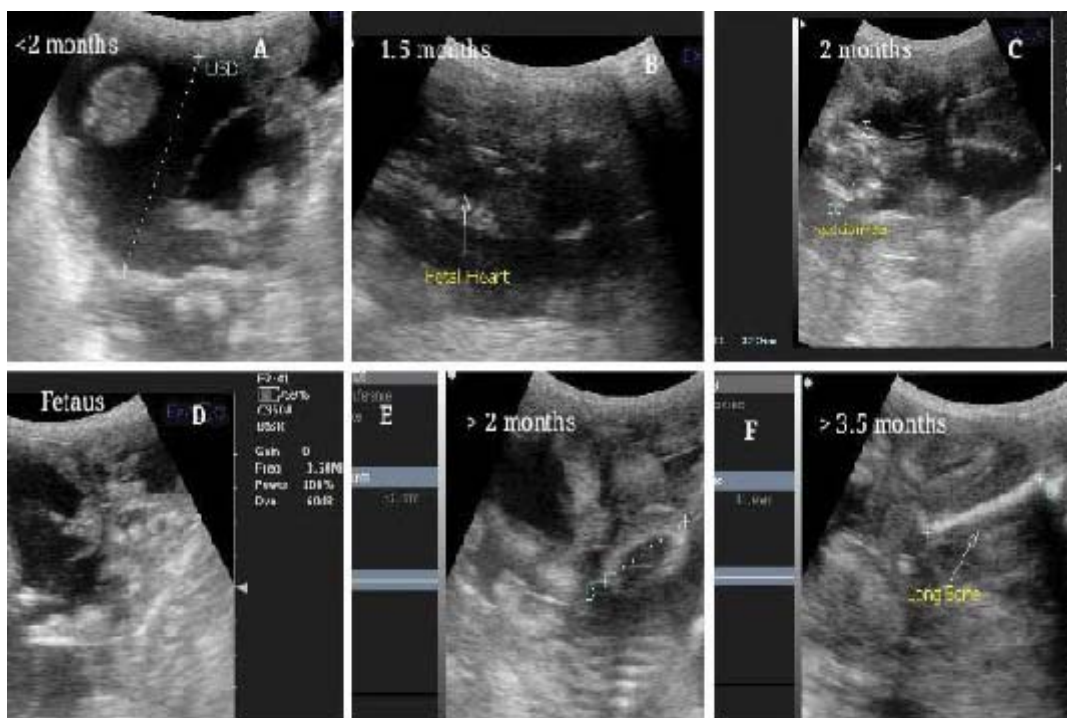

Fig. 1: Ultrasonic image of pregnancy evaluation; A. Gestational sac, B. Fetal heart, C. Head diameter, D. Fetus, E. Cotyledonesize, F. Long bone length.

Statistical analysis

The data were compiled in Microsoft Excel spreadsheet 10 (Microsoft office 2010, USA) and subjected to comparative statistical analysis with respect to oestrous synchronization, and ultrasonographic examination using STATA 13.0 (Stata Corp. 2013, USA). Fisher's exact Chi-square test was done to evaluate the effect of oestrous synchronization on oestrus and pregnancy rates compared to control. Similar test was done to observe the accuracy of detection of pregnancy and its status in different gestation periods. Significant difference was accepted at $P<0.05$ level.

Results and Discussion

Out of 250 goats, 88 were naturally mated, 112 were postpartum reported unmated and 50 were pubertal unmated, respectively. In naturally mated goats, 40 (45.5%) were pregnant, 48.9% were non-pregnant, and 5.7% had uterine infection. Among postpartum reportedly unmated goats 4.5% were pregnant, 88.4% non-pregnant and 7.1% had uterine infections. All the pubertal unmated goats were diagnosed non-pregnant (Table 1). The pregnancy rates differed significantly between groups

(P<0.001). Goats confirmed pregnant when reported might be due to mating during free grazing.

Table 1. Diagnosis of pregnancy in goats registered as outdoor patients at SAQTVH using ultrasonography scanning (n = 250)

Groups	Ultrasonography scanning		
	Pregnant	Non pregnant	Uterine infection
A (88)	40(45.5%)	43(48.9%)	5(5.7%)
B (112)	5(4.5%)	99(88.4%)	8(7.1%)
C (50)	0(0%)	50(100%)	0(0%)
P value	<0.001	<0.001	0.162

A = Naturally mated goats, B = Postpartum reported unmated goats, C = Pubertal unmated goats, P≤0.05 is considered as statistically significant

In small ruminants, oestrous has been synchronized using GnRH, $PGF_2\alpha$, PMSG, FSH, and LH (Faruk *et al.*, 2006; Monika, 2001; Rekha *et al.*, 2016). A combination of GnRH and $PGF_2\alpha$ is the easiest and least time-consuming method. Synchronized goats showed higher (P≤0.01) oestrus and pregnancy rates (70.8 and 54.4%, respectively) than control (51.0 vs 28.6%) (Table 2).

Table 2. Effects of oestrous synchronization on oestrus and pregnancy rates in goats (n = 192)

Group D	No. in oestrus	Oestrous rate (%)	P value	No. of breed showed oestrus	No. of pregnancy detected by ultrasonography	Pregnancy rate (%)	P value
S (n = 96)	68	70.8	0.011	68	37	54.4	<0.001
NS (n = 96)	49	51.0		49	14	28.6	

S = Synchronized and NS = Non synchronized (Control), P<0.05 is considered statistically significant difference between S and NS.

The oestrous synchronization response is similar to others (Abdalla *et al.*, 2014; Panicker *et al.*, 2015; Riaz *et al.*, 2012; Zeuh *et al.*, 2014). Hashemi and Safdarian (2018) reported 83.3% pregnancy rate after synchronizing with two doses of prostaglandin, which was higher than the present study (54.4%). Synchronizing the goats using fluorogestone acetate-impregnated vaginal sponges induced ovulation (98.2%) and pregnancy (75.0%), which were higher than the present study (Freitas *et al.*, 1996). Variation could be due to different synchronization protocols, breed, location and husbandry. Oestrus and pregnancy rates were higher in synchronized goats than in controls.

Traditional methods for pregnancy diagnosis in small ruminants are ballottement of the abdomen and noting udder enlargement in late pregnancy. Transabdominal

ultrasonography has been used with great accuracy for pregnancy diagnosis and estimation of fetal numbers in sheep (Buckrell, 1988; Garcia *et al.*, 1993) and goats (Gonzalez *et al.*, 2004; Martinez *et al.*, 1998). It is crucial to know the stage of pregnancy, to improve feeding. The results of ultrasonography scanning are presented in Table 3: scanning identified 100% of pregnant goats from 2nd month. In the 1st month, pregnancy detection rate was 82.8%, which was significantly lower (P<0.007) than in other months. In the 1st month, pregnancy was detected by observing gestational sac or fetus or fetal heart beats, which were sometimes difficult to identify. Several studies reported that accuracy in pregnancy diagnosis from 42 days of gestation was 100% using ultrasonography (Abdelghafar *et al.*, 2010; Amer, 2008; Anwar *et al.*, 2008; Kumar *et al.*, 2015; Medan *et al.*, 2004; Omontese *et al.*, 2012), which is consistent with present study. But Fowler and Wilkins (1984) showed 95% accuracy in the diagnosis of pregnancy from 40 to 50 days.

Fetal viability was higher in advanced pregnancy. Samir *et al.* (2016) reported fetal viability at day 20 to day 54 (80.4%) and at day 55 to parturition (88.2%), which is similar to our study.

The EDD was estimated in different months of gestation, and it varied significantly (P<0.001). The confirmation of EDD was lower in the 1st month of gestation (45.8%) than 2nd (76.6%), 3rd (94.2%) and above (85.0%). In the 1st month, it is difficult to estimate the EDD by measuring gestational sac diameter and counting fetal heart beats.

Table 3. Status of pregnancy diagnosis by ultrasonography scanning in different months of gestation in goats (n = 96)

Arameters	Ultrasonography scanning of pregnant goats (months)				P value
	1st	2nd	3rd	>3rd	
No. of scanned goats	29	30	17	20	
Pregnant goats	24(82.8%)	30(100%)	17(100%)	20(100%)	0.007
Fetal viability	19(79.2%)	25(83.3)	15(88.2%)	18(90.0%)	0.111
EDD confirmation	11(45.8%)	23(76.6%)	16(94.2%)	17(85.0%)	<0.001

P≤0.05 is considered as statistically significant difference among different measuring parameters.

With advancing gestation fetal growth and different parts of body and cotyledons are easily visible and may help in estimating EDD.

Conclusions

Ultrasonographic scanning in goats was advantageous in pregnancy confirmation. Pregnancy was confirmed with 100% accuracy from 2nd month of gestation with fetal viability (83.3 to 90%) and estimation of EDD (76.6 to 94.2%).

Acknowledgements

References

Abdalla EB, Farrag B, Hashem ALS, Khalil FA and Abdel-Fattah MS 2014: Effect of progestagen, PGF2α, PMSG and GnRH on estrus synchronization and some reproductive and productive traits in Barki ewes. *Journal of Agroalimentary Processes and Technologies* **20** 93-101.

Abdelghafar RM, Ibrahim RM, Abdelharimi SM and Ahmed BH 2010: Sensitivity and specificity of real-time ultrasonography for pregnancy diagnosis and litter size in Saanen goats (*Capra hircus*). In: Proceedings of the 14th Scientific Congress of the Faculty of Veterinary Medicine, Assiut University, Egypt, pp. 392–401.

Amer HA 2008: Determination of first pregnancy and foetal measurements in Egyptian Baladi goats (*Capra hircus*). *Veterinaria Italia Journal* **44** 429–437.

Anwar M, Riaz A, Ullah N and Rafiq M 2008: Use of ultrasonography for pregnancy diagnosis in Balkhi sheep. *Pakistan Veterinary Journal* **28** 144-146.

Buckrell BC 1988: Application of ultrasonography in reproduction in sheep and goats. *Theriogenology* **29** 71-84.

Faruk MO, Bari FY, Shamsuddin M, Alam MGS and Islam MF 2006: Responses of the Black Bengal goat (*Capra hircus*) to PMSG and surgical embryo recovery within MOET technique. *Bangladesh Journal of Veterinary Medicine* **4** 107-115.

Fowler DG and Wilkins JF 1984: Diagnosis of pregnancy and number of fetuses in sheep by real-time ultrasonic imaging. I. Effects of number of fetuses, stage of gestation, operator and breed of ewe on accuracy of diagnosis. *Livestock Production Science* **11** 437-450.

Freitas VJF, Baril G and Saumande J 1996: Induction and synchronization of estrus in goats: the relative efficiency of one versus two fluorogestone acetate-impregnated vaginal sponges. *Theriogenology* **46** 1251-1256.

Fukui Y, Kobayashi M, Tsubaki M, Tetsuka M, Shimoda K and Ono H 1986: Comparison of two ultrasonic methods for multiple pregnancy diagnosis in sheep and indicators of multiple pregnant ewes in the blood. *Animal Reproduction Science* **11** 25-33.

Garcia A, Neary MK, Kelly GR and Pierson RA 1993: Accuracy of ultrasonography in early pregnancy diagnosis in the ewe. *Theriogenology* **39** 847-861.

Gonzalez F, Cabrera F, Batista M, Rodríguez N, Alamo D, Sulon J, Beckers JF and Gracia A 2004: A comparison of diagnosis of pregnancy in the goat via transrectal ultrasound scanning, progesterone, and pregnancy-associated glycoprotein assays. *Theriogenology* **62** 1108-1115.

Gonzalez Bulnes A, Pallares P and Vazquez MI 2010: Ultrasonographic imaging in small ruminant reproduction. *Reproduction in Domestic Animals* **45** 9-20.

Hashemi M and Safdarian M 2018: Efficiency of different methods of estrus synchronization followed by fixed time artificial insemination in Persian downy does. *Animal Reproduction* **14** 413-417.

Kumar K, Chandolia RK, Kumar S, Pal M and Sandeep K 2015: Two-dimensional and three-dimensional ultrasonography for pregnancy diagnosis and antenatal fetal development in Beetal goats. *Veterinary World* **8** 835.

Martinez MF, Bosch P and Bosch RA 1998: Determination of early pregnancy and embryonic growth in goats by transrectal ultrasound scanning. *Theriogenology* **49** 1555-1565.

Medan M, Watanabe G, Absy G, Sasaki K, Sharawy S and Taya K 2004: Early pregnancy diagnosis by means of ultrasonography as a method of improving reproductive efficiency in goats. *Journal of Reproduction and Development* **50** 391–397.

Mialot JP, Levy I and Emery P 1991: Ultrasound and management of goat herds. *Compendium of Veterinary Medicine* **168** 399-406.

Monika P 2001: Ovine reproduction. In: Compendium of Animals Reproduction. Monika P (Edn), Intervet International. BV Holand, pp. 125-145.

Omontese BO, Rekwot PI, Ate IU, Rwuaan JS, Makun HJ, Mustapha RA and Lawal M 2012: Use of ultrasonography for pregnancy diagnosis in Red Sokoto goats. *Scientific Journal of Biological Sciences* **1** 101-106.

Panicker SS, Kanjirakuzhiyil P, Koodathil R and Kanakkaparambil R 2015: Oestrous response and conception rate in Malabari crossbred goats following two different oestrus synchronization protocols. *Journal of Animal Health and Production* **3** 39-42.

Rekha A, Zohara BF, Bari F and Alam MGS 2016: Comparison of commercial Triladyl extender with a tris-fructose-egg-yolk extender on the quality of frozen semen and pregnancy rate after transcervical AI in Bangladeshi indigenous sheep (*Ovis aries*). *Small Ruminant Research* **134** 39-43.

Riaz H, Sattar A, Arshad MA and Ahmad N 2012: Effect of synchronization protocols and GnRH treatment on the reproductive performance in goats. *Small Ruminant Research* **104** 151-155.

Russel AJF, Goddard PJ 1995: *Small animal reproductive ultrasonography*. In: Goddard PG (ed.), Veterinary Ultrasonography. CAB International, Wallingford, UK pp. 257–274.

Samir H, Karen A, Ashmawy T, Abo-Ahmed M, El-Sayed M and Watanabe G 2016: Monitoring of embryonic and fetal losses in different breeds of goats using real-time B-mode ultrasonography. *Theriogenology* **85** 207-215.

Wani NA, Wani GM, Mufti AM and Khan MZ 1998: Ultrasonic pregnancy diagnosis in gaddi goats. *Small Ruminant Research* **29** 239-240.

Zeuh V, Youssouf ML, Dingamtar N and Dezoumbe D 2014: Evaluation of two methods of estrus synchronization of cattle in Chad. *Open Journal of Animal Sciences* **4** 5.