Sonographic changes during gestation in primiparous chinchilla rabbit does

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Abstract

Sonographic changes during gestation were evaluated in ten primiparous female Chinchilla rabbits with mean weight 1.9±0.1kg**.** The rabbits were synchronized with 2mg/kg intramuscular injections of prostaglandin$F_2\alpha$, mated naturally and thereafter examined sonographically on day 7, 14, 21 and 27 after mating using an ultrasound machine. Measurements of diameters of gestational sac, embryonal sac and fetal sac were obtained. Heart beats of at least two fetuses were also counted manually and the average determined. Descriptive statistics were used to analyze the sonographic measurements. The results showed that the earliest sonographic feature of pregnancy observed in the rabbit was the gestational sac observed by day 7 after mating and was characterized by oval shaped anechoic sac containing bipolar hyperechoic band. The mean diameters of the gestational sacs in the rabbits were 7.3±0.71mm. The embryonal sac was observed by day 14 after mating, which was characterized by an oval shaped hyperechoic band with central anechoic cavity and some hyperechoic structures. The mean diameter of the embryonal sacs was 16.1±1.79mm. Fetal sac, fetal skeletal structures, fetal movement and fetal heartbeat were first detected on day 21 and 27 after mating. The mean diameter of the fetal sac on day 21 and 27 were 21.8±1.39mm and 36.4±3.20mm respectively, the mean fetal heart rate on day 27 after mating was 125.3±14.3beats per minute. It was thus concluded that sonographic changes during pregnancy in rabbits is valuable in predicting gestational length and fetal viability. The values obtained in this study can serve as baseline reference for comparison with other breeds.

Keywords: Sonographic changes, fetal sac, hyperechoic, gestation, Chinchilla

Introduction

Accurate prediction of the date of parturition in the rabbit is clinically useful to prevent or minimize reproductive losses by timely intervention.[1] This is because accurate parturition dates may assist with monitoring animals at high risk for dystocia, thus allowing for intervention and decreased kit mortality. For rabbits with a history of abortion, embryonic resorption, or insufficient luteal phase, accurate assessment of gestational age can assist in therapeutic decision making. Finally, progress in assisted reproductive techniques in rabbits, such as estrus synchronization and embryo transfer, require accurate prediction of ovulation, gestational age, and parturition date.[2]

Undoubtedly, the conventional method of pregnancy diagnosis in rabbit is digital palpation of the abdomen. Abdominal palpation reportedly is accurate in a window from 14- to 21-days after mating.[3] Prior to about seven days, the individual amniotic gestational sacs are small and difficult to palpate, especially in obese or tense rabbits. In dogs, palpation is accurate for positive pregnancy diagnosis 87-88 percent of the time during the second trimester of pregnancy and is 73 percent accurate for negative pregnancy diagnosis; with veterinarians more likely to err with a false positive diagnosis.[4]

B-mode ultrasonography has been reported in rabbits to be 94-98 percent accurate for pregnancy diagnosis when used after 14-21 days of gestation, and 99 percent accurate for pregnancy diagnosis at greater than 22 days from the last breeding.[5] Fetal heartbeats have been reported visible from 15 days of gestation, while fetal movement has been reported to be visible from 12 days of gestation.[5] Measurement of bi-parietal head diameter of fetuses, with or without measurement of dorso-ventral trunk diameter, has been demonstrated to be accurate for the estimation of gestational age in dogs,[6] however this is yet to be determined in rabbits. Also, the sonographic measurements of different gestational structures in the rabbit

are yet to be reported in the literature. The aim of this study was to determine the sonographic features and measurements at different stages of gestation in primiparous Chinchilla rabbits.

Materials and methods

Animals

Ten nulliparous female Chinchilla rabbits mean weight (1.9±0.1kg) and four sexually mature Chinchilla male rabbits with mean weight (2.1±0.1kg) were used. They were purchased from breeders located within the Abeokuta metropolis and housed singly in wooden cages. The animals were fed with pelleted grower ration (Guinea Feeds Ltd, Benin, Nigeria) ad-libitum and forages (*Tridax procumbens*), while water was provided ad-libitum. They were maintained on twelve hours of daylight and darkness cycle. Prior to commencement of the study, they were dewormed with 2.5% albendazole syrup (Shanu-zole, Jawa International Limited, Lagos, Nigeria) at 22 mg/kg. All the rabbits were judged to be in good general health based on the result of complete blood counts and physical examination.

Experimental procedure

The rabbits were weighed and thereafter they were synchronized with intramuscular injections of prostaglandin $F_2\alpha$ (Lutalyse®, Upjohn Pharmaceutical Limited, Crawley, Sussex, UK) at the rate of 2mg/kg. Three days after treatment, all the rabbit does were mated naturally by introducing each doe to a proven stud four times, with an interval of two hours between each breeding to ensure maximum conception. Thus day 0 of breeding was taken to be the time the doe was first introduced to the buck.

Ultrasound examination

All the rabbits were examined sonographically on day 7, 14, 21 and 27 after mating using a portable ultrasound machine with a 10.0 MHz transducer (Kaixin KX 2000®, Xuzhou, China). The machine was fitted with a 3.5MHz curvilinear and 7.0MHz linear transducers. Each transducer has four windows of frequency range. In addition, the machine was programmed with software for obstetric and cardiac calculations, as well as having a digital imaging and communication in medicine (DICOM) facility for image storage. All the rabbits were imaged in right dorsal recumbency with leg up without prior administration of intravenous fluid. Basic preparation included clipping of the hair around the ventral abdomen and application of acoustic gel. Once the images were clear, they were frozen and measurements of the diameters of the gestational sac, embryonal sac and fetal sac were obtained. In addition, the heartbeat at least two fetuses were counted manually for each rabbit doe and the average determined. All images were saved on the ultrasound machine for further review. Ethical approval for this study was obtained from the Research Ethics Committee, College of Animal Science, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

Results

The earliest sonographic feature of pregnancy observed in the rabbit was the gestational sac. Gestational sac was observed by day 7 after mating and was characterized by oval shaped anechoic sac containing bipolar hyperechoic band (Fig. 1). Gestational sac was observed in nine of the ten rabbit does giving detection rate of 90 percent (Table 1). The mean diameters of the gestational sacs in the rabbits were 7.3 ± 0.95mm, while the values ranged from 6.0 to 8.0 mm (Table 2). Embryonal sac was observed by day 14 after mating. This was characterized by an oval shaped hyperechoic band with central anechoic cavity and some hyperechoic structures (Fig.2). Embryonal sac was detected in all the rabbits giving a detection rate of 100 percent (Table 1). The mean diameter of the embryonal sacs was 16.1 ± 1.79mm, while the values ranged from 12 to18mm (Table 2). Fetal sac, fetal skeletal structures, fetal movement and fetal heartbeats were first detected on day 21 ater mating (Fig. 3) and again at day 27 after mating. Both fetal sac and fetal skeletal structures were detected in all the rabbits, while fetal heartbeat was only measurable in eight out of the ten rabbits, (Table 1). The mean diameters of the fetal sac on day 21 and 27 after mating were respectively 21.8 ± 1.39mm and 36.4 ± 3.20mm (Table 2). Also, the mean fetal heart rate on day 27 after mating was 125.3 ± 14.1 beats per minute (Table 2).

Discussion

Different sonographic criteria have been developed in dogs and cats for pregnancy detection and estimation of fetal age. These include differential features of fetal organ development that occur in early and mid-pregnancy and the use of various ultrasonography measurement to predict gestational age.[1,7] Ultrasonographic measurements that have been described for pregnancy detection in rabbit include embryonal vesicle at day 7, fetal sac at day 20 and fetal skeletal structures by day 27 and 29.[5] In this study, the gestational sac was the earliest observable sonographic evidence of pregnancy. Other features observed include embryonal sac on day 14, fetal movement and fetal sac from day 21, fetal skeletal structures and fetal heart beat also observed from day 21 after mating.

This study showed that the gestational sac was the earliest recognizable sonographic evidence of pregnancy in rabbit and was observed by the seventh day after mating. The high detection rate of the gestational sac at day seven post mating offers advantage over traditional abdominal palpation method. The study also showed that both embryonal and fetal skeletal structures were observed as from fourteenth day after mating. The 100 percent detection rate of these structures will suggest that it may be better to check rabbits for pregnancy using ultrasound as from day 14 after mating . Even though early detection by checking for gestational sacs is possible, this requires more expertise and time so as to reduce the number of false positives. The mean values of the measurement of the sonographic parameters in this study was similar to that reported in earlier study involving New Zealand, California and Chinchilla breeds.[5] This suggests that the values obtained in the study can form a reference for use in rabbits.

Fetal heartbeat was first detected as an anechoic, pulsating oval shaped structure starting from day 21. Recognition of the fetal heartbeat is useful in the assessment of fetal viability and to detect fetal distress. In this study, fetal heartbeat was only detected in eight out of ten rabbits, this was probably due to uncontrolled abdominal movements of the two does because of their temperaments which made detection of the heartbeats difficult. The mean heart rate of the rabbit fetuses was lower compared with dogs, although there is no record in the literature regarding the normal heart rate of rabbit fetuses.

This result of this study also confirms the reliability of brightness (B- mode) ultrasound in the prediction of pregnancy, all the rabbits were accurately predicted as pregnant. In addition the predicted parturition date was within a window of ± 3days from the actual date of delivery.

In conclusion, the application of low intensity ultrasound is useful in rabbit production for pregnancy confirmation and prediction of fetal age. It also could help in detecting early embryonic losses, a common problem in rabbit production. In addition, the technique is not injurious to either the fetus or the doe, and can help maximize the reproductive efficiency in breeding programs by helping to access fetal viability, planning for parturition and estimation of the likelihood of fetal survival during pregnancy.

References

1. Kim BS, Son CH: Time of initial detection of fetal and extra-fetal structures by ultrasonographic examination in Miniature- Schnauzer bitches. J Vet Sci 2007;8:289-293.
2. Baracaldo M: Advanced techniques in rabbit production. Clin Therio 2013;5:152-162.
3. Ypsilantis P, Saratsis PH: Early pregnancy diagnosis in the rabbit by real time ultrasonography. World Rabbit Sci J 1999;7:93-99.
4. Kim Y, Travis AJ, Meyers-Wallen VN: Parturition prediction and timing of canine pregnancy. Theriogenology 2007;68:1177-1182.
5. Gutierrez HE, Zamora FMM: Ultrasonography study of rabbit pregnancy. Proc 8th World Rabbit Cong; 2004. p. 276-280.
6. Beccaglia M, Luvoni GC: Comparison of the accuracy of two ultrasonographic measurements in predicting the parturition date in the bitch. J Small Anim Pract 2006;47: 670-673.
7. Lenard ZM, Hopper BJ, Lester NV et al: Accuracy of prediction of canine litter size and gestational age with ultrasound. Aust Vet J 2007;85:222-225.

Table 1: Sonographic changes during gestation in chinchilla rabbits

Animals	GSD7	ESD14	FSD21	FMD21	FSKD21	FSKD27	FMD27	FHBD27
1	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	-
6	+	+	+	+	+	+	+	+
7	-	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	-
9	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+
Total (%)	9 (90%)	10(100%)	10(100%)	10(100%)	10(100%)	10(100%)	10(100%)	8(80%)

Key:
GSD7: Gestational sac day 7
ESD14: Embryonal sac day 14
FSD21: Fetal sac day 21
FMD21: Fetal movement day 21
FSKD21: Fetal skeletal structure day 21
FSKD27: Fetal skeletal structure day 27
FHBD27: Fetal heart beat day 27
FMD27: Fetal movement day 27

Table 2: Sonographic parameters during gestation in Chinchilla rabbits

Animals	GSLD7	ESLD14	FSLD21	FSLD27	FHBD27
1	7	15	22	33	120
2	8	16	20	40	110
3	7	17	22	36	124
4	6	17	24	42	114
5	8	18	22	38	ND
6	7	16	22	32	156
7	ND	15	19	33	120
8	8	12	23	36	ND
9	7	17	22	36	124
10	8	18	22	38	134
Range	6-8	12-18	19-24	32-42	110-156
Mean ± SD	7.3 ± 0.71	16.1 ± 1.79	21.8 ± 1.39	36.4 ± 3.20	125.3 ± 14.3

Key:
GSLD7: Gestational sac length (mm) day 7
ESLD14: Embryonal sac length (mm) day 14
FSLD21: Fetal sac length (mm) day 21
FSLD27: Fetal sac length (mm) day 27
FHBD27: Fetal heart rate (beats/min) day 27

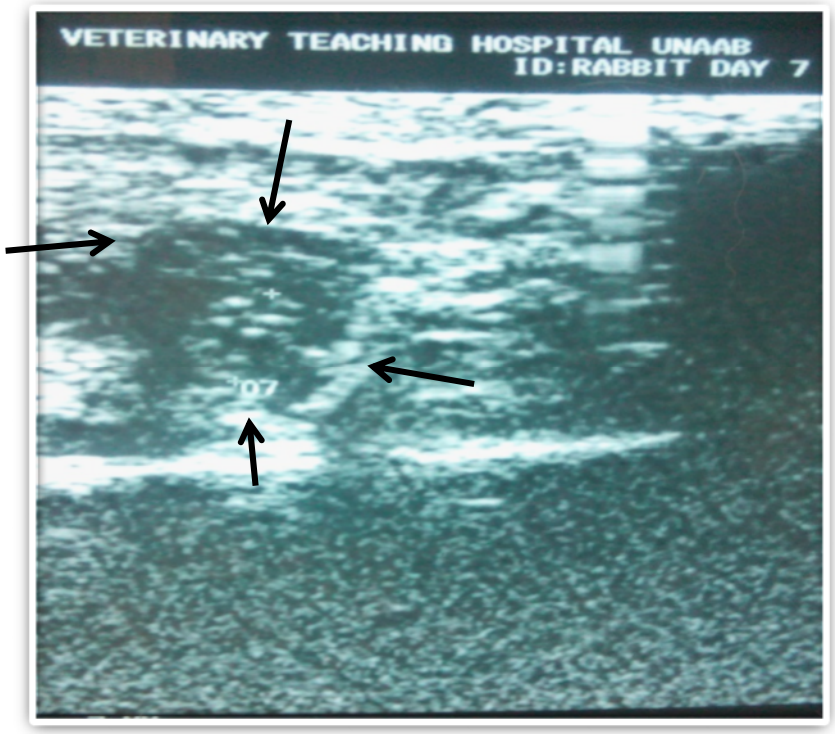

Figure. 1: Gestational sac of a 7 month old Chinchilla doe at 7 days after mating.

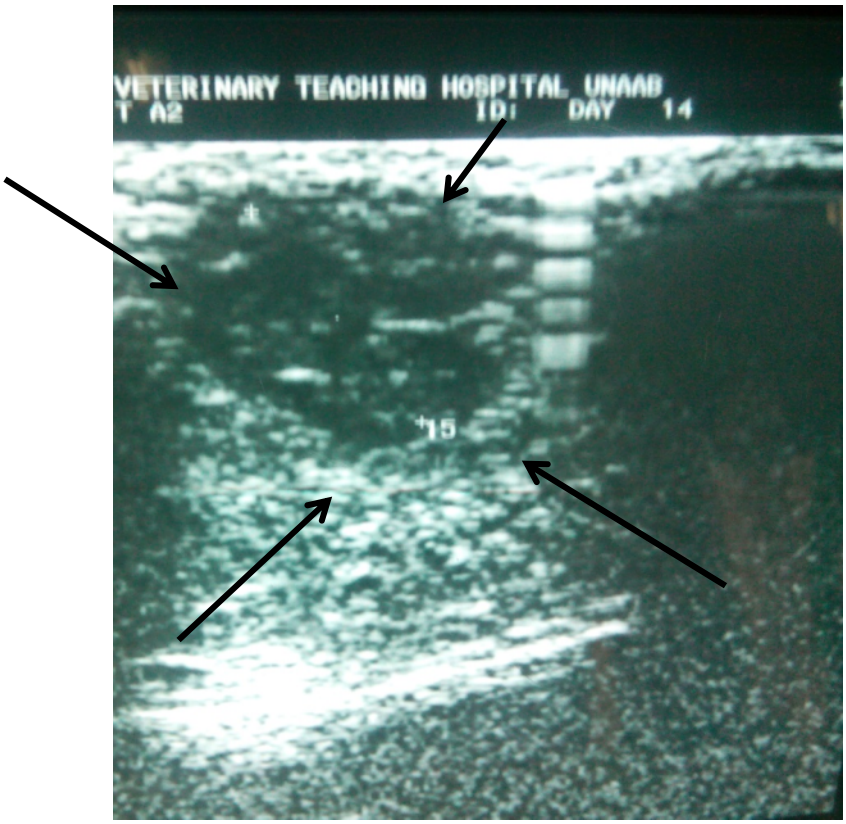

Figure 2: Embryonal sac of a 7 month old Chinchilla doe at 14 days after mating.

Figure 3: Fetal sac of a seven month old Chinchilla doe at 21 days after mating.