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## Application of ultrasonic doppler technique for pregnancy diagnosis in local Assam goat

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#### Abstract

The study was conducted on local Assam goats for pregnancy diagnosis and to find the accuracy by using ultrasonic Doppler technique in field condition. Doppler ultrasonic technique was used to detect the movement of uterine arterial pulse, umbilical arterial pulse, foetal heartbeat and foetal movement. This technique is applicable in field condition as it is painless, noninvasive, easy to handle and also it could be carried anywhere comfortably. In the present study using this technique uterine arterial pulse, umbilical arterial pulse, foetal heart beat and foetal movement having different audible sounds were first detected on days 45, 50, 45 and 60 respectively, after breeding.

**Keywords:** Doppler, pregnancy diagnosis, Assam local goat

#### 1. Introduction

A variety of examination methods have evolved over the years. Hormonal assay, radiography, and ultrasonography method like B-mode ultrasonography, ultrasonic Doppler method have emerged as the most useful methods utilized today. Older described methods of laparotomy, cervical palpation, abdominal palpation or ballottement, and rectal- abdominal palpation with a rod (Karen *et al.*, 2006) [17] have limited utility or have been abandoned. Although non-return to estrus following breeding is suggestive of pregnancy, pathologic conditions of the uterus and ovaries, physiologic anestrus late in the breeding season, and out of season breeding may cause postbreeding anestrus in non pregnant does. Many does also exhibit estrous behavior during pregnancy, making this an unreliable means of pregnancy diagnosis (Dawson, 2002) [5]. As a result pregnancy diagnosis in goats is essential for better efficacy and management of reproduction (Doize *et al.*, 1997) [6], providing information about conception rates after artificial insemination (Matsas, 2007) [21], gestation course (Amer, 2010) [1], time for drying-off and parturition date (Doize *et al.*, 1997; Gonzalez *et al.*, 2004) [6, 15]. The utilization of an accurate and easily applicable method for pregnancy diagnosis allows the timely repeated insemination, breeding or culling of non-pregnant animals (Amer, 2010) [1]. But, non availability of sophisticated laboratories facilities in the field condition offer the used of B-mode ultrasonography and Doppler ultrasound required for confirmation of pregnancy. Ultrasonography as a method for monitoring of the reproduction status in small ruminants is becoming increasingly important and popular (Medan & Abd El-Aty, 2010; Erdogan, 2012) [22, 7]. But when all these sophisticated laboratories facilities along with B-mode ultrasonography is not possible in the field condition, in this case Doppler technique is preferable for foetal viability (B.A. Ganaiea, 2009) [11]. Their accuracy and usefulness under field conditions is various (Goel and Agrawal, 1992; Ishwar, 1995) [14, 16]. Transcutaneous approach of doppler for pregnancy diagnosis was higher during the third gestation months (Lindahl, 1971; Wani, 1981; Watt *et al.*, 1984; Serin *et al.*, 2010) [19, 34, 27]. Diagnosis of pregnancy by the doppler ultrasonic involves the principle of detecting the movements as an indication of pregnancy such as fetal heart beat, fetal circulation and fetal movements (Shabir A.L. *et al.*, 2016) [28] in which the difference in frequency is converted to audible pulsed of pregnancy. The differences in the frequency in blood flow in the middle uterine artery could sometime be confused with hydrometra the way how blood is flowing whether to know the pregnancy is risk or not in comparison to foetal sound (I.G. Petridisa *et al.*, 2017) [24]. The ultrasonic doppler instrument which is noninvasive, painless has been found equally popular among the field workers for routine use in the field condition (Wani and Sahni, 1980, Goel and Agrawal, 1990) [12, 31]. This is because of the fact that Doppler instrument is simple, portable, easy to operate and applicable in both large and small animals. In ewes and does, external application of the ultrasonic

Doppler has been used for detection of pregnancy and approaches an accuracy of 100% during last half of gestation (Fraser and Robertson, 1968) <sup>[10]</sup> but is not effective 50 days or earlier (Lindahl, 1969) <sup>[19]</sup>. With the use of intrarectal Doppler technique accuracy of 90.00 per cent can be achieved during the second trimester of pregnancy and by the use of external Doppler technique, accuracy of 100.00 per cent can be achieved during the third trimester of pregnancy (Watt *et al.*, 1984) <sup>[34]</sup>. Fetal viability can be detected but accurate detection of multiple fetuses is difficult with Doppler technique (Shabir A.L.*et al.*, 2016) <sup>[28]</sup>. The Doppler technique resulted in greater accuracy in ewes, which were at least 65 days pregnant (Lindahl, 1969) <sup>[19]</sup>. It was found that Doppler ultrasonography is not possible for determination of gestational age according to Russel & Goddard (1995) <sup>[25]</sup>, Karadaev, M., 2015.

## 2. Material and Methods

A total of thirty healthy does with recent mating history maintained at Goat Research Station, Assam Agricultural University, Byrnihat were taken for the present study. All the animals were subjected to pregnancy diagnosis by Ultrasonic Doppler. Medata Ultrasound Pregnancy Detector was used for detection of characteristic sounds of uterine arterial pulse, umbilical arterial pulse, fetal heart beat and fetal movement following the method described by (Sharma, 1997) <sup>[29]</sup>.

The animals were examined on day 30, 35, 40, 45, 50, 60, 70, 80, 100 and 120 after mating. All the animals were examined in the morning prior to providing any feed and mostly dry feed should be given before examination as if there is presence of soft faeces there is high chances of giving false negative result. The right inguinal area upto the ventral midline was shaved and cleaned thoroughly. The animals were controlled in standing position. Liquid paraffin was used as coupling media between the scan head and skin. The shaved area was thoroughly scanned starting from inguinal area to the ventral midline for detection of the various typical sounds.

Uterine arterial sound was recognized as a whooshing sound occurring at the frequency similar to that of the heartbeat of the mother. Umbilical arterial sound could be recognized as a swishing sound occurring at the frequency similar to that of the foetal heart beat. The foetal heart beat was heard as galloping sound occurring at the frequency much higher than that of the heartbeat of the mother. Sharp, short duration sound of foetal movement (Dawson L., 2002) <sup>[5]</sup>.

## 3. Result and Discussion

Uterine arterial pulse was audible as whooshing sound and was first detected on day 45 after breeding in 20.00 per cent of animals. The percentages of animals detected positive for uterine arterial pulse were 20.00, 70.00, 100.00, 100.00, 100.00 and 100.00 on day 50, 60, 70, 80, 100 and 120 after breeding respectively (Table 1 and Figure 1). It was possible to detect uterine arterial pulse in all the animals (100%) from day 70 onwards (Table 2). The present finding was well comparable with the observation of (Sharma, 1997) <sup>[29]</sup> who could detect uterine arterial pulse at the earliest by 6 week after breeding respectively with the corresponding percentage of 20.00. and in 100% in all the animals at 9 weeks. Umbilical arterial pulse was audible as a swishing sound which could be detected on day 50 after breeding in 13.33 per cent of animals. The percentages of animals detected positive for umbilical arterial pulse were 40.00, 46.66, 66.66, 93.33 and

100.00 on day 60, 70, 80, 100 and 120 after breeding respectively (Table 1 and Figure 1). Umbilical arterial pulse could be detected in all the animals (100%) from day 120 onward (Table 2). The observation of (Sharma, 1997) <sup>[29]</sup> who could detect at the earliest by 7 week after breeding with the corresponding percentage of 20.00 and the percentages (100%) in all the animals in 16 weeks after breeding which is compared well with the present finding. Foetal heart beat could be detected for the first time on day 45 after breeding as galloping sound in 6.66 per cent of animals. The percentages of animals detected positive for foetal heart beat were 6.66, 30.00, 33.33, 60.00, 80.00 and 100.00 on day 50, 60, 70, 80, 100 and 120 after breeding respectively (Table 1 and Figure 1). It was possible to detect foetal heart beat in all the animals (100%) from day 120 onward (Table 2). The present finding was well comparable with the observation of (Sharma, 1997) <sup>[29]</sup> who could detect fetal heart beat 7 week after breeding with the corresponding percentage of 10.00 and could detect in all the animals in 16 weeks after breeding.

Foetal movement could be detected for the first time on day 60 after breeding as jerking sound in 6.66 per cent of animals. The percentages of animals detected positive for foetal movement were 36.66, 76.66, 83.33 and 100.00 per cent on day 70, 80, 100 and 120 respectively after breeding (Table 1 and Figure 1). It was possible to detect foetal movement in all the animals (100%) from day 120 onward after breeding (Table 2). The present finding was well comparable with the observation of (Sharma, 1997) <sup>[29]</sup> who could detect fetal movement at the earliest by 9 weeks with the corresponding percentage of 10.00. However, accurate (100%) detection of fetal movement was possible on day 120 after breeding in the present study. Similar finding was also obtained by (Sharma, 1997) <sup>[29]</sup> who could detect uterine arterial pulse, umbilical arterial pulse, fetal heart beat and fetal movement at 9, 16, 16 and 16 weeks after breeding in 100.00 per cent of the animals. The slight differences in observation may be due to breed differences, method, environmental condition or skill applied. The present finding with regards to the earliest detectable stage of pregnancy in goats (day 70) was within the range of 50-70 days as reported in ewes by (Fraser *et al.*, 1971) <sup>[9]</sup> using foetal pulse detector, (Falk, 1980) <sup>[8]</sup> using other ultrasonic technique, (Biedermann and Canstein, 1981) using ultrasound pregnancy detector, (Goel and Agrawal, 1992) <sup>[13]</sup> using ultrasonic pregnancy detector. (Goel and Agrawal, 1990) <sup>[12]</sup>, (Bernardi and Fagundus, 1991) <sup>[3]</sup> and (Goel *et al.*, 1998) <sup>[14]</sup> using ultrasonic technique for pregnancy diagnosis reported that accuracy of positive diagnosis ranged from 98.00 to 100.00 per cent on 61 to 80 days of pregnancy. The report of (Wani *et al.*, 1998) <sup>[32]</sup> on accuracy of pregnancy diagnosis in goats using ultrasonic instrument of 100.00 and 100.00 per cent for umbilical arterial pulse and foetal heart beat, was in agreement with the present observation, but percentage of animals detected positive based on middle uterine arterial sound (72%) was lower than the present observation. (Benjaminsen and Karlberg, 1980) and (Wani and Sahni, 1981) <sup>[33]</sup> using Medata ultrasonic equipment in goat also obtained 100.00 per cent overall accuracy of positive diagnosis on 70 to 120 days as observed in the present study. Similarly (Schweizer, 1976), using Doppler instrument in ewes, was able to detect umbilical arterial pulse and foetal heart beat with 100.00 per cent accuracy from 12 and 14 weeks. Pregnancy diagnosis in doe with 100.00 per cent accuracy using ultrasonic Doppler was possible in the last half of gestation as reported by (Fraser and Robertson, 1968) <sup>[10]</sup>,

(Lindhahl, 1968; Keane, 1969) [19]; (Shone and Fricker 1969); Wani and Sahni (1980) [31]; (Watt *et al.*, 1984) [34], (Ishwar, 1995) [16] which is accurate with the present finding. After using Doppler ultrasonography for pregnancy detection in goats, Wani *et al.*, 1998) [33] reported accuracy of 100%, 100%

and 72%, for foetal heartbeats, umbilical artery and median uterine artery, respectively which is also similar to the present observation. Variation in the reports of earliest studies might be due to variation in the skill of the operator, time taken for examination and quality of machine used and method used.

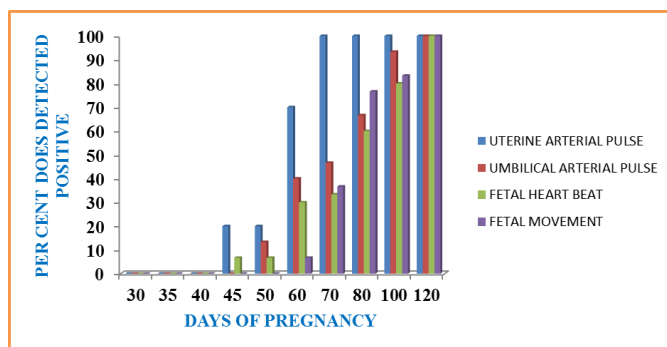
**Table 1:** Per cent does detected positive for uterine arterial pulse, umbilical arterial pulse, foetal heart beat and foetal movement using ultrasonic doppler technique at different days of pregnancy.

Days of pregnancy	Uterine arterial pulse	Umbilical arterial pulse	Foetal heartbeat	Foetal movement
30	0.00(0)	0.00(0)	0.00(0)	0.00(0)
35	0.00(0)	0.00(0)	0.00(0)	0.00(0)
40	0.00(0)	0.00(0)	0.00(0)	0.00(0)
45	20.00(6)	0.00(0)	6.66(2)	0.00(0)
50	20.00(6)	13.33(4)	6.66(2)	0.00(0)
60	70.00(21)	40.00(12)	30.00(9)	6.66(2)
70	100.00(30)	46.66(14)	33.33(10)	36.66(11)
80	100.00(30)	66.66(20)	60.00(18)	76.66(23)
100	100.00(30)	93.33(28)	80.00(24)	83.33(25)
120	100.00(30)	100.00(30)	100.00(30)	100.00(30)

Figures within the parentheses are numbers of does detected positive

**Table 2:** Earliest days of pregnancy for accurate detection of uterine arterial pulse, umbilical arterial pulse, foetal heart beat and foetal movement using ultrasonic doppler technique in does.

Parameters	Days of pregnancy
Uterine arterial pulse	70
Umbilical arterial pulse	120
Foetal heart beat	120
Foetal movement	120



**Fig 1:** Variation in per cent does detected positive for uterine arterial pulse, umbilical arterial pulse, foetal heart beat and foetal movement using ultrasonic doppler technique at different days of pregnancy.

**4. Conclusion**

The use of external Doppler over other methods is that it is cheaper, battery operated, painless, easy to operate in the field condition without complication in the latter half of pregnancy and to detect foetal viability. So detection of various foetal sounds helps in the identification of live fetus.

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