Article

Pregnancy diagnosis in goats (*Capra hircus*) using barium chloride and progesterone-based kit in Bangladesh

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Abstract: The study was conducted to develop a technique for early diagnosis of pregnancy in goats from July 2016 to June 2017. About 100 goats of different age groups were randomly selected for the trial and goats were categorized under four groups according to their gestation lengths (0.5 to 1 month, >1 to 1.5 months, >1.5 to 2 months and >2 to 2.5 months). Blood from jugular vein and morning urine samples were collected from four groups and brought to the laboratory, and serum was separated from the clotted blood. Then 1%, 1.5% and 2% barium chloride solution were prepared and test was done by using 1 ml barium chloride of each concentration mixing with 1 ml of urine sample, and allowed for 5 and 10 minutes for interpretation. Presence of precipitation was interpreted as negative for pregnancy and absence of precipitation was interpreted as positive for pregnancy. For each blood sample, 3-5 drops of serum was added in each sample insertion hole of the Bovipreg kit and 5 minutes was allowed to observe the presence of one or two red line in the kit. One red line was interpreted as negative pregnancy and two red lines were interpreted as positive pregnancy. In our study 1% barium chloride, showed 93.5% accuracy, whereas 1.5% barium chloride provided 92% accuracy for the goats having 0.5 to 1 month of gestation. In case of 2% barium chloride, the highest accuracy was 91.5% for the goats having >1 to 1.5 month of gestation. Conversely, the accuracy for progesterone-based early pregnancy diagnostic kit was 96.5%. Therefore, 1% barium chloride can be utilized for the diagnosis of pregnancy in goats.

Keywords: pregnancy diagnosis; goats; barium chloride; progesterone-based kit

1. Introduction

Among livestock species, nowadays, goats are considered important and promising animal resources in Bangladesh. Bangladesh possesses 26.71 million goats at present (BBS, 2018). The popularity of goats rearing is being increased in Bangladesh to fulfill the growing demand of animal protein. Goat is called a poor man's house and some poor and landless farmers are largely depends on it to bear their livelihood challenges. Many goat kids are died every year due to lack of proper management and little knowledge of the farmers about the goats with pregnancy diagnosis (Garcıa-Ispierto *et al*., 2013; Commun *et al*., 2016). Without proper diagnosis identification of pregnant and non-pregnant animals is difficult which may lead to problem with treatment and re-insemination regarding abortion. Pregnancy diagnosis in small ruminants is very difficult and attempts have been taken to detect pregnancy of ewes from every years but there was no easier techniques to detect it. Most of

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the techniques required sophisticated instrument, expensive or required skilled personnel. After coitus early pregnancy diagnosis is needed to assimilate the non-pregnant doe and ewe which will help to minimize losses from animal with infertility or appropriate treatment cost and for efficient culling (Green *et al*., 2005; Kaya *et al*., 2016). Early detection of pregnant goats with proper management can reduce the kid mortality every year. Pregnancy diagnosis can help to improve the reproductive management that helps goat farms to run profitably (Holness *et al*., 1991). Choice of method for diagnosing pregnancy in goats depends on the stage of gestation. Some methods give a higher degree of accuracy at the early stage of gestation, others at the late stage of gestation (Goel and Agrawal, 1992). Different methods like hormonal assays of blood plasma, serum or milk, and estimation of pregnancy-specific antigens or proteins, ultrasonic pregnancy detectors, real time ultrasound scanners, laparoscopy, determination of estrone sulfate assay, determination of progesterone, vaginal biopsies are too expensive to acquire or too complicated for the small holder, illiterate farmers. Older techniques such as palpation of the cervix (Richardson, 1972), mammary secretion (Webb, 1942) and increase in body weight (BW) (Domanski and Lipecka, 1966) have been replaced. Researchers continue attempting to find inexpensive, accurate, and practical methods that can detect pregnancy in cattle in a short time. Examination of ovary, uterus and vagina, laboratory tests and use of rapid milk progesterone test kits are mainly reviewed by Purohit *et al*., 2010 to detect pregnancy diagnosis. Ohazurike (1990) reported a cheap procedure with 2% barium chloride in goats and sheep and Maslov and Smornov (1965) reported 95% to 100% accuracy for pregnancy diagnosis in cow. Similar works has been done by Ndu (2005) in case of sow where they found 100% and 81% accuracy in case of non -pregnant and pregnant sows. Therefore we are trying to develop a cost effective, easily accessible, uncomplicated and accurate methods that are very easy for the farmers in terms of pregnancy diagnosis of their animals. This method is very simplified where sample can be tested easily by taking small amount of urine with barium chloride. However, considering the context of Bangladesh, this study was undertaken to develop a low-cost technique for early diagnosis of pregnancy at field level. Purohit (2010) reviewed that pregnancy diagnosis might be done by observing signs of pregnancy exhibited by female, examination of ovary, uterus and vagina, laboratory tests and use of rapid milk progesterone test kits. However there are very few studies for early diagnosis of pregnancy in ewes and does (Lone *et al*., 2016; Thakchos, 2011; Mayura *et al*., 2009). Therefore, this study was undertaken to develop a technique that can diagnose pregnancy in early stage of gestation in goats.

2. Materials and method
2.1. Study area and period
This study was conducted at Goat and Sheep Research Farm of Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka, Bangladesh from July 2016 to June 2017.

2.2. Grouping of the animals
About 100 goats of different age groups were randomly selected and categorized under four groups according to their gestation length such as group-1 included 0.5 to 1 months of gestation, group- 2 included >1 to 1.5 month of gestation, group -3 included >1.5 to 2 months of gestation and group- 4 included >2 to 2.5 months of gestation. Length of gestation of goats were detrmined from the record book of the goat research farm.

2.3. Collection of samples
Blood from jugular vein and urine samples were collected as per requirement of the test protocols.

2.4. Detection of pregnancy with conventional techniques
1 ml of barium chloride solution (1%, 1.5% and 2%) was mixed with 1 ml of urine sample and allowed for 5 and 10 minutes for interpretation. Presence of precipitation was interpreted as negative pregnancy and absence of precipitation interpreted as positive pregnancy. For each blood sample 3 to 5 drops of serum were added in each Bovipreg kit and allowed for 5 minutes to observe the result. Appearance of one red line was considered negative pregnancy and two red lines considered positive pregnancy.

3. Results and Discussion
The present study was undertaken to observe the capability of barium chloride solution to detect pregnancy of goats. In this study, in case of 0.5 to 1 month of gestation 1%, 1.5% and 2% barium chloride solution gave 93.5%, 92% and 90.5% mean accuracy within 5 and 10 minutes (Table 1) with the absence and presence of precipitation (Figure 1) which is validated with the Bovipreg kit where one red line give negative pregnancy and two red line give positive pregnancy (Figure 2). In case of >1 to 1.5 month of gestation 1%, 1.5% and 2%

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barium chloride solution gave 92.5%, 92% and 91.5% mean accuracy within 5 and 10 minutes (Table 2) with the absence and presence of precipitation. Pregnancy diagnosis in goats with >1.5 to 2 months of gestation 1%, 1.5% and 2% barium chloride solution provided 92%, 91.5% and 91% accuracy within 5 and 10 minutes (Table 3) with the absence and presence of precipitation. Goats with >2 to 2.5 months of gestation 1%, 1.5% and 2% barium chloride solution gave 91%, 90.5% and 90% average accuracy (Table 4).

Here, it is to be noted that 1% barium chloride showed 93.5% highest average precision and in case of 1.5% barium chloride, the highest average precision was 92% and in case of 2% barium chloride, on the other hand, the highest average precision was 91.5% for the goats of different gestation length, and all these findings are seconded by Khora and Kaikini (1992), Vhora and Kaikini (1992). Ndu *et al*. (2000) found the 1% barium chloride test 95% accurate when used from about 39 days after breeding for pregnancy diagnosis in pigs. On the other hand, the accuracy of the test in cows was described to be 70-95% (Maslov and Smirnov, 1965; Elpakov and Cyganok, 1966; Akmadeev and Vasilev, 1967) from 15 to 210 days of pregnancy; but, a later study (Kavani, 1976) noticed only a low level of accuracy (64%) with a high occurrence of false positive and false negative results. In camels, the test was considered to be 85% accurate between days 50-90 of pregnancy (Banerjee, 1974).

However, owing to the limited research works for pregnancy diagnosis using barium chloride the number of references is quite few.

Figure 1. Detection of pregnancy by barium chloride solution (precipitation indicates negative).

Figure 2. Detection of pregnancy by progesterone-based kit (double bands-positive and single band-negative).

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Table 1. Results of pregnancy diagnosis in goats with 0.5 to 1 month of gestation.

Number of goats	Barium chloride						Progesterone-based kit (Average accuracy)
n=25	1% (Average accuracy)		1.5% (Average accuracy)		2% (Average accuracy)		
	5 min	10 min	5 min	10 min	5 min	10 min	5 min
	93%	94%	91.5%	92.5%	90%	91%	97%
Mean	93.5%		92%		90.5%		-

Table 2. Results of pregnancy diagnosis in goats with >1 to 1.5 month of gestation.

Number of goats	Barium chloride						Progesterone-based kit (Average accuracy)
n=25	1% (Average accuracy)		1.5% (Average accuracy)		2% (Average accuracy)		
	5 min	10 min	5 min	10 min	5 min	10 min	5 min
	92%	93%	93%	92.5%	91%	92%	97%
Mean	92.5%		92%		91.5%		-

Table 3. Results of pregnancy diagnosis in goats with >1.5 to 2 months of gestation.

Number of goats	Barium chloride						Progesterone-based kit (Average accuracy)
n=25	1% (Average accuracy)		1.5% (Average accuracy)		2% (Average accuracy)		
	5 min	10 min	5 min	10 min	5 min	10 min	5 min
	91%	93%	90.5%	92.5%	90%	92%	96%
Mean	92%		91.5%		91%		-

Table 4. Results of pregnancy diagnosis in goats with >2 to 2.5 months of gestation.

Number of Goats	Barium chloride						Progesterone-based kit (Average accuracy)
n=25	1% (Average accuracy)		1.5% (Average accuracy)		2% (Average accuracy)		
	5 min	10 min	5 min	10 min	5 min	10 min	5 min
	90%	92%	90%	91%	90%	90%	96%
Mean	91%		90.5%		90%		-

4. Conclusions

The early pregnancy diagnosis by using 1% barium chloride can be used as a low cost technique in goats although the accuracy is not equivalent to progesterone-based kit. To minimize the cost for pregnancy diagnosis this method will be very helpful for the farmers. It is of great importance to know whether or not a female animal has become pregnant after a service. Pregnancy diagnosis assists in herd management by identifying non-pregnant animals, which can be served again or culled with minimum necessary delay. Such procedure will improve the breeding efficiency and greatly contribute towards the economy of the enterprise. Over and above this, routine pregnancy examination on herd or flock basis is a valid tool for detecting infertility and problems connected with it, at an early stage when it is likely to be amenable to treatment. Pregnancy diagnosis is helpful in proper care and feeding of pregnant animals. Pregnancy diagnosis is also very useful in selling, buying, registration and insurance of animals.

Conflict of interest
None to declare.

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Authors' contribution

Md Nuruzzaman Munsi: analysis, supervision, funding, editing; Md Habibur Rahman: sample collection, laboratory testing, reviewing, editing; Sonia Akther: sample collection, laboratory testing, manuscript writing, supervision, reviewing; Md. Zakir Hasan: reviewing, editing. All authors have read and approved the final manuscript.

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