



RESEARCH ARTICLE

URINE-BASED PREGNANCY DIAGNOSIS IN GOAT (*CAPRA HIRCUS*) USING DIFFERENT LEVELS OF BARIUM CHLORIDE

Catalonia, H.M.D*, Balbin, A.J.M. and Nayga, J.N¹

Central Graduate School, Isabela State University, Echague 3309, Isabela, Philippines

ARTICLE INFO

Article History:

Received 09th March, 2025
Received in revised form
21st April, 2025
Accepted 19th May, 2025
Published online 24th June, 2025

Key words:

Goat, pregnancy diagnosis, non-invasive method, Barium chloride.

*Corresponding author:

Catalonia, H.M.D

ABSTRACT

Efficient reproduction management is an important factor in any livestock production. Early detection helps reduce production losses, enables timely administration of optimal nutrition, and minimizes the risk of pregnancy-related metabolic disorders. Although laboratory assays and diagnostic techniques are available, they often require specialized equipment and highly skilled personnel, limiting their use in resource-constrained settings. In this context, the use of a non-invasive pregnancy detection method using barium chloride (BaCl_2) as a test solution is being evaluated as a practical and field-applicable alternative. The efficiency of determining pregnancy in 36 heads of Philippine Native goats was carried out at different levels (1.5g, 2.5g, 3.5g, and 4.5g). The time consumed before the formation of precipitate occurs (sec) was evaluated. The result shows that regardless of BaCl_2 concentration, pregnancy can be positively detected. However, from Week 1 to Week 7, highly significant differences between treatments were observed ($p < 0.01$); with 4.5g concentration recorded the shortest period at 1 sec before precipitate is formed. The result is verified by the ultrasound diagnosis at 100% rate. Therefore, utilizing BaCl_2 to detect early-stage pregnancy in goats using urine is an effective, low-cost procedure with better accuracy as compared to doppler ultrasound diagnosis.

Copyright©2025, Catalonia et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Catalonia, H.M.D., Balbin, A.J.M. and Nayga, J.N. 2025. "Urine-based pregnancy diagnosis in goat (*Capra hircus*) using different levels of barium chloride". *International Journal of Current Research*, 17, (06), 33270-33272.

INTRODUCTION

Goatraising is an important component of farming activities in developing countries (Mazinani and Rude, 2020). Goats are considered a valuable source of income and nutrition for smallholder farmers. In order to ensure profitability in any livestock production, efficient reproduction management is required. Accurate and early pregnancy diagnosis is crucial for effective reproductive management (Rahim and Paul, 2022), especially since physical signs of pregnancy are often not observable during the early stages of gestation as observed in goats. Early detection helps reduce production losses, enables timely administration of optimal nutrition, and minimizes the risk of pregnancy-related metabolic disorders (Green et al., 2005; Kaya et al., 2016). Pregnancy diagnosis methods include observing physical signs, conducting laboratory tests, and using rapid milk progesterone test kits (Purohit, 2010; Lone et al., 2016). Hormonal analysis, such as measuring progesterone levels in blood plasma or serum, can be conducted as early as 21 days after breeding (Boscós et al., 2003; Medan et al., 2004; Capezzuto et al., 2009). This method shows an accuracy rate of 75–86% in detecting pregnant goats and 90–100% for non-pregnant goats (Khadiga et al., 2005). On the other hand, milk progesterone analysis is also viable between 22- and 26-days

post-mating, with reported accuracy rates above 86%. Notably, the findings of Jack et al. (2012) demonstrated that this method could achieve 100% accuracy in distinguishing pregnant from non-pregnant goats as early as 19 days after mating. These two methods however requires sophisticated equipment and laboratory skills for proper execution. One method that has been explored for pregnancy detection in goats is the use of barium chloride (BaCl_2) (Roberts, 2023). This approach has previously been shown to be effective in detecting pregnancy in ewes, pigs, sows, and cattle (Ndu et al., 2000). The method is based on non-invasive detection of progesterone; a hormone presents in the body fluids of pregnant animals. Physiologically, progesterone is secreted continuously to support the developing embryo. When progesterone is present in the urine, it reacts with BaCl_2 , forming a visible precipitate (Holness, 1991, as cited by Lalrinthluanga and Dutta, 2009). BaCl_2 is an inorganic, water-soluble salt of barium. When mixed with urine, it reacts with sulfate radicals to form barium sulfate as a precipitate. Unlike techniques that require imaging or acoustic devices, this method does not require specialized technical skills, making it a practical option for field application. Its simplicity enhances the efficiency of estrus synchronization programs in does subject to artificial insemination. Therefore, this study was undertaken to determine the efficiency of different concentrations of BaCl_2 in detecting pregnancy using urine.

MATERIALS AND METHODS

The study was conducted using 36 heads of Philippine native does, composed on 12 heads representing breeder doe at age 1, 2, and 3. The urine samples were collected at 5:00 in the morning. Different levels of BaCl₂ were diluted in 100mL of distilled water and served as test solution using urine collected from the does. The following treatments are:

T₁- 1.5% BaCl₂ solution mixed with equal parts of urine

T₂- 2.5% BaCl₂ solution mixed with equal parts of urine

T₃- 3.5% BaCl₂ solution mixed with equal parts of urine

T₄- 4.5% BaCl₂ solution mixed with equal parts of urine

The urine and BaCl₂ at the same volume were mixed. The presence of precipitate is an indication of pregnancy; while clear dilution shows negative result. The time (in seconds) consumed before precipitation developed was gathered. This non-invasive pregnancy test was conducted until the does reached 8-week of pregnancy or the early stage of pregnancy, when physical signs cannot be observed. To confirm the result of the pregnancy test using BaCl₂, an ultrasound diagnosis was conducted using DAWEITM. Total population of the experimental animals were subjected to the ultrasound detection. The data collected were subjected to Analysis of Variance (ANOVA) using the Statistical Tool for Agricultural Research (STAR) Program.

RESULTS

Formation of precipitation: Table 1 shows that the difference in time consumed for formation of precipitation (sec) across the treatments are highly significant from Week 1 to Week 7 of the study. It was observed that throughout the study period, Treatment 1 recorded the longest time consumed before precipitation occurred; while Treatment 4 recorded the shortest period. Treatment 1 recorded 9.33 secs, 7.22 secs, 5.78 secs, 4.78 secs, 3.89 secs, 3.44 secs, 2.22 secs, and 1.33 secs from Week 1 to Week 8, respectively. On the other hand, Treatment 4 recorded 3.56 secs, 2.44 secs, 1.78 secs, 1.33 secs, 1.22 secs, 1.00secs from Week 1 to Week 8.

Table 1. Formation of precipitation (in secs)

Treatments	Pregnancy stage, (weeks)							
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Treatment 1- 1.5g BaCl ₂	9.33 ^a	7.22 ^a	5.78 ^a	4.78 ^a	3.89 ^a	3.44 ^a	2.22 ^a	1.33
Treatment 2- 2.5g BaCl ₂	6.44 ^b	4.89 ^b	3.89 ^b	3.11 ^b	2.78 ^b	1.89 ^b	1.56 ^b	1.22
Treatment 3- 3.5g BaCl ₂	5.89 ^{bc}	4.22 ^{bc}	3.22 ^b	2.44 ^b	2.22 ^b	1.67 ^{bc}	1.22 ^b	1.11
Treatment 4- 4.5g BaCl ₂	3.56 ^c	2.44 ^c	1.78 ^c	1.33 ^c	1.22 ^c	1.00 ^c	1.00 ^b	1.00
ANOVA	**	**	**	**	**	**	**	ns
CV%	40.29	41.74	35.35	36.13	31.89	36.45	42.46	32.37

ns= not significant **=highly significant at 1% level note: Means with the same letter are not significantly different using LSD.

Table2. Result of pregnancy diagnosis through ultrasound confirmation

Treatment	Result	N = 36
Treatment 1 - 1.5% BaCl	+	9
Treatment 2 - 2.5% BaCl	+	9
Treatment 3 - 3.5% BaCl	+	9
Treatment 4 - 4.5% BaCl	+	9

+ positive result through ultrasound

The observation reveals that BaCl₂ can react to the hormone produced by the doe at early developing stage pregnancy. Moreover, it also reveals that concentration of BaCl₂ influenced the time consumed for the precipitation occurrence. The data also reveals that at Week 8, the difference on the time consumed between each treatment is not significant.

Ultrasound confirmation

Table 2 presents the result of ultrasound confirmation to compare the result of pregnancy diagnosis using different levels of BaCl₂ solution. The table shows that thirty-six (36) does subjected to pregnancy diagnosis utilizing barium chloride solution was confirmed positive of pregnancy through ultrasound utilizing DAWEI doppler ultrasound.

DISCUSSION

In this study, the use of barium chloride as a pregnancy detector in goats has shown demonstrated high accuracy rates, with studies reporting sensitivity and specificity values of overexceeding 90%(Dana et al., 2020).The reaction of urine and BaCl₂ is influenced by progesterone produced from the corpus luteum is critical for the establishment and maintenance of pregnancy. This hormone plays a major role in regulating endometrial secretions essential for stimulating and mediating changes in conceptus growth and differentiation throughout early pregnancy in ruminants.

The presence of progesterone metabolizessulfate conjugates, such as pregnanediol sulfate metabolites which are then excreted in the urine and bile, and when combined to BaCl₂, it forms precipitate of barium sulphate (Balbin et al., 2020), thus pregnancy is detected. Doppler ultrasonography for detection of pregnancy via the transrectal or transcutaneous approach during the second or third gestation months (Serin et al., 2010).

As shown in this study, pregnancy diagnosis was conformed 8 weeks post-breeding. However, based on the results obtained, the proposed urine-based pregnancy detection using BaCl₂ can detect pregnancy 1 week after breeding.

CONCLUSION

It is therefore concluded that all levels of barium chloride (BaCl₂) solution can detect pregnancy using urine across different breeder doe age group as further confirmed by ultrasound diagnosis. However, the concentration of 4.5% BaCl₂ resulted to fastest time consumed to form a precipitate.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Department of Science and Technology – Graduate Study Scholarship for providing financial support for this study. Gratitude is also extended to the Semen Processing Laboratory of the Isabela State University (ISU) – Cagayan Valley Small Ruminant Research Center, Philippines, for the provision of experimental animals and access to laboratory equipment. Special thanks are given to the School of Veterinary Medicine, ISU, for their assistance in conducting the ultrasound pregnancy diagnoses.

REFERENCES

- Balbin, A. J. M., Nayga, J. N., Gaffud, O. M., Marcos, M. J. L., Sotelo, E. O., & Marcelo, D. S. 2020. Preliminary trial on the use of barium chloride for pregnancy diagnosis in goats. *Philippine Journal of Veterinary and Animal Sciences*, 46(1), 82-86.
- Boscós, C. M., Samartzi, F. C., Lymberopoulos, A. G., Stefanakis, A. & Belibasaki, S. (2003). Assessment of progesterone concentration using enzyme immunoassay for early pregnancy diagnosis in sheep and goats. *Reproduction in Domestic Animals*, 38, 170–174.
- Capezzuto, A., Chelini, M. O. M., Felipe, E. C. G., & Olivera, C. A. (2009). Correlation between serum and fecal concentration of reproductive steroids throughout gestation in goats. *Animal Reproduction Science*, 103, 78–86.
- Fatet, A., M. T. Pellicer-Rubio & B. Leboeuf, 2011. *Reproductive cycle of goats*. *Animal Reproduction Science*, 124, 211–219.
- Dana, O. I., Ghaidan, M. T., Mukhtar, R. H., and Dyary, H. O. 2020. Comparison of a barium chloride test with ELISA for pregnancy detection in cows. *De Gruyter Open*, 64(4), 567-571. <https://doi.org/10.2478/jvetres-2020-0068>.
- Green, J. A., Parks, T. E., Avallé, M. P., Telugu, B. P., McLain, A. L., Peterson, A. J., ... & Roberts, R. M. (2005). The establishment of an ELISA for the detection of pregnancy-associated glycoproteins (PAGs) in the serum of pregnant cows and heifers. *Theriogenology*, 63(5), 1481-1503.
- Kaya, M. S., Köse, M., Bozkaya, F., Mutlu, H., UÇAR, E. H., & Atli, M. O. (2016). Early pregnancy diagnosis using a commercial ELISA test based on pregnancy-associated glycoproteins in Holstein-Friesian heifers and lactating cows. *Turkish Journal of Veterinary & Animal Sciences*, 40(6), 694-699.
- Khadiga, M. G., Mohamed, K. G., Doaa, F. T. (2005). The hormonal profile during the estrous cycle and gestation in Damascus goats. *Small Ruminant Research*, 57, 85–93.
- Kumar, K., Chandolia, R., Kumar, S., Pal, M., & Sandeep, K. (2015). Two-dimensional and three-dimensional ultrasonography for pregnancy diagnosis and antenatal fetal development in Beetal goats. *Vet World*, 8(7):835-840.
- Lalrintluanga, K., & Dutta, M. (2009). Pregnancy diagnosis in swine from urine using barium chloride test. *Indian J Anim Res* 43(2):114-116.
- Lone, S. A., Gupta, S. K., Kumar, N., Prakash, K., Ganaie, B. A., Rather, H. A., & Kumar, S. (2016). Recent technologies for pregnancy diagnosis in sheep and goat: an overview. *International Journal of Environmental Science and Technology*, 3, 1208-1216.
- Mazinani, M., & Rude, B. (2020). Population, world production and quality of sheep and goat products. *American Journal of Animal and Veterinary Sciences*, 15(4), 291-299.
- Medan, M., Watanabe, G., Absy, K., Sasaki, S. Sharawy & 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.
- Medan, M. S. & Abd El-Aty, A. M. (2010). Advances in ultrasonography and its application in domestic ruminants and other farm animals' reproduction. *Journal of Advanced Research*, 1, 123–128.
- Ndu, A., Bratteand, L. & Chiboka, O. (2000). A preliminary trial on the use of barium chloride for pregnancy diagnosis in pigs. *Niger. J. Anim. Prod.*, Vol 27, No 1.
- Purohit, G. (2010). *Methods of Pregnancy Diagnosis in Domestic Animals: The Current Status*. Webmed Central Reproduction.
- Serin, G., O. Gokdal, T. Tarimcilar & O. Atay, 2010. Umbilical artery Doppler sonography in Saanen goat fetuses during singleton and multiple pregnancies. *Theriogenology*, 74, 1082–1087.
- Suguna, K., Mehrota, S., & Agarwal, S. (2008). Early pregnancy diagnosis and embryonic and fetal development using real time B mode ultrasound in goats. *Small Ruminant Research*, 80, 80-86.
