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APPLICATION OF RECTAL EXPLORATION TECHNIQUES FOR PREGNANCY DIAGNOSIS IN GOATS

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Abstract
This study aims to explore the practicality of rectal exploration (ER) as a method for detecting pregnancy in goats. The ER technique relies on identifying palpable gestational changes in the goat's reproductive tract, such as location, consistency, and size changes. This study used 6 female goats aged 2-3 years, with normal reproductive cycles and parturition experience, along with one fertile male goat aged 2-3 years. The goats were mated naturally, preceded by estrus synchronization through a double injection of 1.5 ml/head prostaglandin intramuscularly with an 11-day interval. Pregnancy tests were conducted at 30, 40, 50, and 60 days after mating using Real-Time B-mode ultrasonography (USG) and the ER techniques. Sensitivity and specificity of the ER method were compared to the gold standard (ultrasound's detection results). The results revealed that ER and ultrasound detected negative pregnancy for four goats on all examination days. Both methods identified two pregnant goats on days 50 and 60 post-mating. It can be concluded that the ER approach is an appropriate and practical alternative for pregnancy diagnosis in goats.
Keywords: goat, pregnancy diagnosis, rectal exploration technique

APLIKASI TEKNIK EKSPLORASI REKTAL UNTUK DIAGNOSIS KEBUNTINGAN PADA KAMBING

Abstrak
Penelitian ini bertujuan untuk mengetahui potensi penerapan teknik eksplorasi rektal (ER) pada kambing untuk tujuan praktis. Prinsip deteksi kebuntingan dalam teknik ini, didasarkan pada perubahan gestasi teraba di saluran reproduksi kambing baik letak, konsistensi dan ukurannya. Penelitian ini menggunakan 6 ekor kambing betina umur 2-3 tahun dengan siklus reproduksi normal dan pernah melahirkan serta satu ekor kambing kacang jantan fertile umur 3 tahun. Perkawinan dilakukan secara alami yang sebelumnya kambing betina telah dilakukan sinkronisasi estrus dengan injeksi ganda prostaglandin masing-masing 1,5 ml/ ekor secara intramuskuler dengan interval waktu 11 hari. Pemeriksaan kebuntingan dilakukan pada 30, 40, 50 dan 60 hari setelah perkawinan dengan menggunakan teknik Real Time B-Mode Ultrasonography (USG) dan ER. Dalam penelitian ini, USG digunakan sebagai gold standard karena metode ini lebih akurat dan dapat diandalkan untuk diagnosis kebuntingan pada ruminansia kecil. Diagnosisbility yang diamati dalam penelitian ini adalah sensitivitas dan spesifisitas teknik ER untuk mendiagnosis kebuntingan kambing dibandingkan gold standard. Hasil penelitian menunjukkan bahwa empat kambing yang negatif bunting dengan teknik ER juga menunjukkan tidak bunting dengan USG pada semua hari tahapan pemeriksaan, dan dua kambing yang positif bunting dengan USG, menunjukkan positif bunting dengan teknik ER pada pemeriksaan 50 dan 60 hari setelah perkawinan. Berdasarkan hasil penelitian ini dapat disimpulkan bahwa teknik ER dapat digunakan untuk alternatif diagnosis kebuntingan pada kambing yang praktis di lapangan.
Kata kunci: kambing, diagnosis kebuntingan, teknik eksplorasi rektal

INTRODUCTION

Goats (*Capra hircus*) are one of the oldest domesticated livestock. Its population has increased worldwide since 1990 by around 1% - 4% annually (FAO, 2020). Goats are popular farm animals, as they can effectively convert low-quality forages into quality meat, milk, and hides for local and global markets (Nye & Moore, 2002) and adapt well to various environmental conditions (Saifuddin, 2015). In Indonesia, goats are one of the most widely cultivated livestock by small-scale farmers

because they have low capital requirements and high adaptability, prolificacy, and litter sizes, averaging at 1.56 (Sutama, 2004; Sodiq and Abidin, 2008; Hastono and Bintang, 2008; Santoso et al., 2016).

Statistical data on Livestock and Animal Health (2021) shows that the national goat population reaches 19.2 million, predominantly owned by small-scale breeders (95%) with 4 to 6 goats on average. Despite their high population, Setiadi et al. (1995) reported that the kidding interval of small-scale goat breeders was relatively long, between 9 and 15 months, resulting in low reproductive and economic efficiency. Inaccuracies in estrus detection and pregnancy detection contribute to this challenge (Sutama, 2004; Santoso et al., 2016), as breeders often rely on observing estrus symptoms post-mating; if a goat does not show estrus symptoms, it is considered to be pregnant, and vice versa (Sayuti et al., 2016). This approach frequently failed since no indications of estrus can also be caused by uterine organ pathology, prolonged corpus luteum (CLP), or other hormonal symptoms aside from pregnancy, resulting in misinformation (Partodihardjo, 1992; Devi et al., 2019).

Ensuring accurate pregnancy status is crucial to minimize production losses due to infertility (Saifudin, 2015; Inyawilert et al., 2019). Various methodologies for detecting pregnancy in goats have been investigated, including visual, immunological, and clinical approaches. This method is chosen based on its accuracy, cost, gestational age, and timeliness of diagnosis (Hafez & Hafez, 2008). Clinical methods, including Real-Time B-Mode Ultrasonography (USG) (Abdelghafar et al., 2010; Devi et al., 2019), provide accurate results but may be impractical and expensive for small-scale farmers (Padilla-Rivas, Sohnrey & Holtz, 2005; Inyawilert et al., 2019). This study explored the application of the rectal exploration (ER), as reported by Kutty (1999), to offer a practical and accessible pregnancy diagnosis technique for small-scale farmers. This study also evaluated its sensitivity and specificity in diagnosing pregnancy in goats.

MATERIALS AND METHODS

This research was conducted in Sranak Village, Trucuk District, Bojonegoro Regency. The materials used in this study were Napier grass, concentrate feed, worm medicine, multivitamins, prostaglandin hormone (Lutalyse), 70% alcohol, cotton, USG gel, and gloves. The tools used included ultrasound (WELLD, WED-9618V), probe (WELLD, C1-7/60R), clamp cage, 3 ml syringe, apron, and stationery.

Treatments

This study used 6 female local Kacang goats aged 2-3 years with normal reproductive cycles and had given birth and one fertile male goat aged 3 years. Goats were kept in separate stilt cages between males and females. The goats were fed with forage (2 kg/head/day), concentrate (0.2 kg/head/day), and ad libitum drinking water. Goats were given deworming drugs and multivitamins before the study was carried out.

Estrus Synchronization

Estrus synchronization was carried out with a double injection of lutalyse each 1.5 ml/bird intramuscularly, with an interval of 11 days. Female goats were kept in cages with male goats for natural mating after the second injection of lutalyse.

Pregnancy diagnosis

Pregnancy examinations were conducted at 30, 40, 50, and 60 days post-mating, using ultrasound and ER techniques. Ultrasound served as the gold standard due to its recognized accuracy and reliability in small ruminants pregnancy diagnosis. The ultrasound procedure was carried out with a 3.5 Mhz transcutaneous sector probe. The preparations involved positioning the ultrasound and the operator on the left side of the goat. The next step was gel application on the abdomen in front of the mammary gland, which previously had some of its hair shaved. The probe was directed to the cranial mammary gland to the sebum that filled the inguinal gland. Then, it was directed slightly dorsally caudo medial, and was gently pressed on the abdomen towards the bladder (Khan, 2004). Pregnancy confirmation relied on identifying an isoechogenic to hyperechogenic fetus surrounded by a hypoechogenic embryonic fluid (Santoso et al., 2016; Sayuti et al., 2016).

Table 1. Palpable gestational changes in the reproductive tract of goats

Pregnancy Stage	Vagina	Cervix	Uterus
Not pregnant	The wall is not tensioned	In the pelvic cavity, hard and no hypertrophy	Located in the pelvic cavity, the uterine horns are symmetrical and hard in consistency
30 days	The wall is not tensioned	In the pelvic cavity and no hypertrophy	Located at the end of the pelvic cavity, the uterine horns are asymmetrical and soft in consistency
40 days	The wall is not tensioned	In the pelvic cavity and no hypertrophy	Located in front of the pelvic cavity, the uterine horns are asymmetrical and softer in consistency
50 days	Slightly stretching the walls	Located at the end of the pelvic cavity, rather hard consistency but no hypertrophy	Located in front of the pelvic cavity, the uterus is markedly distended and softer in consistency
60 days	Slack forward	At the end of the pelvic cavity, slightly hypertrophied and soft	Located in front of the pelvic cavity, the uterus is markedly distended, its fluid-filled consistency and the uterine horns are indistinguishable.

Diagnosis of pregnancy using the ER technique is based on palpable gestational changes in the reproductive tract of goats, as described by Kutty (1999). The ER procedure involved restraining the goat in a standing position, pre-examination before feeding, and an operator on the right side of the goat's pelvic area, wearing gloves on both hands. Gel-smudged index and middle fingers of the left hand are inserted into the rectum, while the right-hand fingertips touched the ventral floor of the posterior abdomen to raise it and aid palpation. Assessment included size, shape, location, and consistency evaluation of the cervix, uterine horns, and adjoining structures. Pregnancy confirmation was based on changes in the reproductive tract, as described by Kutty (1999), with slight modifications outlined in Table 1.

ER Technique Diagnostic Analysis

The diagnostic performance in this study was assessed through the sensitivity and specificity of the ER technique in diagnosing goat pregnancy compared to the gold standard. Sensitivity refers to the probability that the ER technique diagnoses pregnancy when the gold standard also confirms pregnancy. Specificity is defined as the probability that the ER technique diagnoses as negative when the gold standard are also indicate a non-pregnant status. A false positive is defined as when the ER technique diagnoses pregnancy, but the gold standard shows no pregnancy. A false negative is defined as when the ER technique indicates no pregnancy, but the gold standard confirms pregnancy (Diane, 1995). Equations (1.1) and (1.2) describe the sensitivity and specificity formulas (Akobeng, 2006).

$$Sensitivity = \frac{true\ positive}{true\ positive + false\ negative} \times 100\% \quad (1.1)$$

$$Specificity = \frac{true\ negative}{true\ negative + false\ positive} \times 100\% \quad (1.2)$$

RESULTS AND DISCUSSION

Rectal exploration is a common method for detecting pregnancy in large livestock, but practicing this method in small ruminants is more difficult. Various techniques have been developed, including external, abdominal palpation ballottement, recto-abdominal palpation or the Hulet technique, and bimanual palpation technique (Hulet, 1972; Richardson, 1972; Pratt & Hopkins, 1975; Tyrrell & Plant 1979; Trapp & Slyter 1983; Chauhan et al., 1991; Kutty, 1999). Among these techniques, bimanual palpation is considered a simple,

practical, and more reliable method with less risk (Saifudin, 2015).

ER is adapted from bimanual palpation technique (Kutty and Sudarsanan, 1996), involving digital palpation per rectum combined with abdominal palpation. The principle is to examine changes in size, consistency, shape, location, and surface characteristics of the vagina, cervix, cornua uteri, and adjacent reproductive organ structures. The bimanual palpation technique is used for the pregnancy diagnosis 30 days after mating. Pregnancy is confirmed by observing uterine distention or uterine horn asymmetry. For best results, goats should be checked before feeding and drinking. Overweight goats should fast overnight, and during the examination, the rectum should be cleaned of feces while emptying the bladder (Kutty, 1999).

The comparison of pregnancy diagnosis using rectal exploration techniques (ER) and Real Time B-Mode Ultrasonography (USG) in goats are shown in Table 2. The ER did not identify uterine distension or uterine horn asymmetry in any goats at 30 or 40 days after mating, indicating that the goats were not pregnant. This contrasts with ultrasound examinations that confirmed two pregnancies at the same time points. The accuracy of pregnancy diagnosis with this technique was reported by Kutty (1999) to be 96.2% when diagnosed 30 days after mating, but results may vary depending on the goat's body condition, handling, restraints, and the operator's experience. These two techniques used similar indication for detecting non-pregnancy: no fetal or embryonic fluid was found in the uterus for the USG technique, and no uterine distension or uterine horn asymmetry for the ER technique. Preliminary research by Saifudin (2015) showed that examination of non-pregnant goats is easier to distinguish than pregnant goats. However, the determination of pregnancy status can be hindered in overweight goats, which might contribute to a false positive diagnosis.

Sensitivity is a parameter to measure the quality of a screening test that classifies pregnant goats as genuinely pregnant. In this study, the pregnancy detection results at 50 and 60 days after mating using both the ER approach and the ultrasound technique showed 100% sensitivity and specificity (Table 3). This means that the ER technique correctly identified all truly pregnant goats and non-pregnant goats, consistent with the results obtained from the ultrasound technique.

The results show that the two goats confirmed pregnant by the ER technique were also confirmed pregnant by the ultrasound technique. Likewise, the four goats identified as not pregnant by the ER technique were also confirmed as non-pregnant by the ultrasound technique. The specificity of the study was 100%, indicating that the ER technique accurately identified goats that were genuinely not pregnant. These findings were consistent across the examinations at 30, 40, 50, and 60 days after mating.

Table 2. Results of pregnancy tests using ultrasound and ER techniques

Post Mating	Ultrasound		ER	
	Pregnant	Not pregnant	Pregnant	Not pregnant
30 days	2	4	-	6
40 days	2	4	-	6
50 days	2	4	2	4
60 days	2	4	2	4

Table 3. Sensitivity and Specificity of the ER Technique in the Diagnosis of Pregnancy in Goats

Post Mating	Sensitivity	Specificity
30 days	0 %	100 %
40 days	0 %	100 %
50 days	100 %	100 %
60 days	100 %	100 %

The ultrasound technique is used as the gold standard for evaluating the ER technique due to its accuracy, with reported sensitivities and specificities of up to 100%. Ultrasound is a fast and safe method for diagnosing goat pregnancy (Abdelghafar et al., 2010; Santoso et al., 2016; Sayuti et al., 2016). Ultrasound techniques can eliminate hydrometra and pyometra, which can be interpreted as pregnant on ER techniques, potentially leading to false positives.

CONCLUSION

The study's findings suggest that the ER approach can be used as an alternative for diagnosing goat pregnancy in the field, particularly with high sensitivity and specificity starting from 50 days after mating. It's important to note that the accuracy may be influenced by the operator's experience, goat's condition, and the overall handling during the examination. Therefore, careful and consistent application are needed for reliable results. It's recommended to conduct further research with variations in goat conditions and operator's skills to provide more insights into the practicality and generalizability of the RE technique and contribute to their effectiveness in diverse settings and conditions.

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