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Monitoring of embryonic and fetal losses in different breeds of goats using real-time B-mode ultrasonography

Haney Samir [a,b,*], Aly Karen [c], Tarek Ashmawy [d], Mostafa Abo-Ahmed [a], Mohamed El-Sayed [a], Gen Watanabe [b]

[a] Department of Theriogenology, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt
[b] Laboratory of Veterinary Physiology, Department of Veterinary Medicine, Tokyo University of Agriculture and Technology, Tokyo, Japan
[c] Department of Theriogenology, Faculty of Veterinary Medicine, Kafrelsheikh University, Kafrelsheikh, Egypt
[d] Sheep & Goats Research Department, Animal Production Research Institute, Ministry of Agriculture, Giza, Egypt

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ABSTRACT

Compared to cattle and sheep, few studies had been undertaken to evaluate the incidence of embryonic and fetal losses (EFL) in goats. The objectives of the present study were to characterize the timing of EFL and to identify the factors that are associated with EFL in goats such as breed, age, parity, method of estrous synchronization, and breeding. Moreover, this study aimed to ensure whether a relationship existed between serum progesterone (P4) and EFL. Goats (n = 151) of different breeds (70 Zaraiebi, 42 Damascus, and 39 Cross goats [Baladi × Damascus]) were evaluated by ultrasonography to monitor EFL during different stages of gestation (D20–23, D26–29, D33–36, D40–45, and D47–54 after breeding). Blood samples were collected at D7, D20, and at each ultrasonographic scanning to clarify changes of serum P4 levels concurrently with EFL. Results revealed that 45 of 109 goats (41.28%) were exposed to EFL. A higher EFL % was observed between D20 to 23 and D47 to 54 (19.61%) compared with D47 to 54 to birth (11.76%). Moreover, a higher EFL % was observed in Zaraiebi goats compared with others. Age and goat parity had no significant effect on the EFL % in all goats. A high EFL % were observed in goats synchronized by P4 sponge, as well as artificially inseminated goats compared with goats with spontaneous estrus, and bred by natural mating, respectively. Serum P4 at D7 or D20 after breeding showed nonsignificant difference between normal pregnant goats and goats that experienced EFL. Unlike goats that experienced partial EFL, goats that experienced total EFL between D20 to 23 and D26 to 29 showed an abrupt P4 reduction (85.06%; $P < 0.01$) suggesting the probability of endocrine disruption of the CL. However, goats that were exposed to total EFL between D26 and 29 to D33 to 36 showed a low P4 reduction (24.90%; $P < 0.05$), which might be considered as an effect rather than a cause of EFL. In conclusion, different factors such as breed, estrous synchronization, breeding, and stage of pregnancy may be involved in EFL in goats. Therefore, improvement of the goat management in the early stage of pregnancy is important to decrease EFL % in goats. Although the P4 did not show any significant difference between normal pregnancy goats and goats that experienced EFL, CL disruption should be taken into the consideration, at least, in goats exposed to total embryonic losses.

1. Introduction

Embryonic and fetal losses (EFL) are the most important causes of reproductive losses in farm animals. The impact of economic losses resulting from EFL includes not only the

* Corresponding author. Tel.: +20-01003976362; fax: +20-35725240.
E-mail addresses: Haneyvet360@yahoo.com, Haneyvet360@cu.edu.eg (H. Samir).

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loss of potential offspring, but also a prolonged "open" period for the dam, leading to increased culling rates [1]. For example, Meyer et al. [2] estimated an increase in the costs of replacing dairy calves of $75.9 million during the period 1985 to 1996 as a result of an increase in the incidence of stillbirth from 9.5% in 1985 to 13.2% in 1996. Although the available literature about the impact of EFL in goat is very sparse, it was mentioned that EFL may have serious economic losses to the producers because it is often too late to rebreed females when they repeat, particularly, in seasonally bred reproducing animals such as sheep and goats [3].

Real-time B-mode ultrasonography provides a simple, rapid, accurate and noninvasive means for pregnancy diagnosis and counting fetal numbers, as well as, considered a good alternative method to check embryonic mortality in small ruminants on the farm [4–7]. However, unlike sheep and cow, and according to the best of our knowledge, few studies were undertaken to investigate EFL in goats [3,6]. Moreover, most previous studies that carried out on small ruminant were focused on a single ultrasonographic scanning during gestation length and comparing it to the birth records [3,6,8]. Nevertheless, no previous studies have been done to monitor the incidences of EFL during different stages of gestation in goats. In addition, the factors that are associated with these losses have not been extensively studied in the goats.

The purpose of the present study was to investigate the possibilities for diagnosing and monitoring of EFL in different breeds of goats using real time B-mode ultrasonography during different stages of pregnancy. We aimed also to determine the factors that contribute to EFL such as the effect of age, parity, methods of estrous synchronization and breeding of goats, and stage of pregnancy. Moreover, we identified the changes in serum progesterone (P4) concentration to ensure whether relationships existed between P4 and EFL.

2. Material and methods

2.1. Animals

A total of 153 goats of certain breeds (70 Zaraiebi, 42 Damascus, and 41 Cross goats [Baladi × Damascus]), weighing 24 to 56 kg, and aged between 1.5 and 9 years were used in this experiment during the period from the second half of August 2011 to March 2012.

Zaraiebi goats are local Egyptian breeds, and the averages of their body weight were 36.84 kg. They produce 2.3 kg of milk per day for 200 days. Damascus is an exotic breed from Syria and Cyprus, and their average body weight was 47.48 kg. They produce an average of 1.6 kg milk per day for 200 days. Cross goats (Baladi × Damascus) are crossbred, their average body weight was 36.05 kg, and they produced an average of 800 g milk per day for 150 days. All goats were housed and managed in a dairy farm located in Sheep and Goat Research Station (Sakha) belonging to Animal Production Research Institute, Agriculture Research Center, Kafr El-Sheikh governorate, Egypt. Goats were fed a diet consisting of a commercial pelleted ration containing about 16% protein, 1.5 kg/doe, twice daily. Hay and green food (Alfalfa; Berseem) were used when available. Water and blocks of mineral were available ad libitum. All goats were housed under natural daylight conditions. All goats were clinically healthy and vaccinated against important infectious diseases such as foot and mouth disease, Rift Valley fever, enterotoxaemia, and Brucella. Other immunoprophylaxis activities were regularly performed. Moreover, the goat bucks used for breeding (n = 7) were raised separately throughout the period of the study.

2.2. Estrous synchronization

Sixty-nine does (25 Zaraiebi, 25 Damascus, 19 Cross) were synchronized for estrus by using the intravaginal sponge containing 30-mg flurogestone acetate (Chronogest, Intervet International B.V., Boxmeer, the Netherlands) for 12 days. At the moment of sponge removal, each treated doe received an intramuscular injection of 300 IU ECG (Folligon, Intervet International B.V., Boxmeer, the Netherlands). The rest of does used in the experiment (n = 84) had spontaneous estrus. The detection of estrus was performed twice at early morning (6 AM) and evening (6 PM) through introducing a teaser buck with a high libido.

2.3. Breeding of the goats

Of 69 does synchronized for estrus, 32 were artificially inseminated (AI) once with fresh diluted semen (500×10^6 spermatozoa) at 48 to 52 hours after sponge removal, whereas the rest of synchronized does (n = 37) and the does which had spontaneous estruses were naturally mated with fertile bucks. Day of breeding either by AI or natural mating was considered as Day 0 for calculating the gestational age.

"For AI technique," insemination with fresh diluted semen was performed using pipette attached to a syringe. After the doe has been observed in heat, it has been suitably restrained (i.e., with lifted hind limbs), and the insemination pipette with a lubricated speculum guide was introduced in a slow and gentle manner to avoid the urethral opening. After locating the cervix, the pipette was introduced into the cervix without force. Semen was deposited into the cervix by depressing the syringe plunger. After waiting 30 seconds, the speculum was withdrawn first and then the pipette to prevent pneumovagina and backflow of the semen.

2.4. Blood sampling

Blood samples (5 mL) were withdrawn on the D7 and D20 after breeding and then every time when ultrasonographic scanning was performed. The blood samples were centrifuged at 3000 rpm for 20 minutes to separate the serum. The harvested sera were stored at −20 °C until analysis of serum progesterone concentration using enzyme immunoassays (EIAs).

2.5. Measurement of serum progesterone (P4)

Concentrations of P4 were measured by EIA using Progesterone test kits (DS-EIA-Steroid-Progesterone; DSI SrL, Saronno, VA, Italy) [9]. The sensitivity of P4-EIA was 0.3 ng/mL, and the intra-and inter-assay coefficients of variation were 7.1% and 12.6%, respectively.