

Reproductive performance of primiparous and multiparous Saanen goats after laparoscopic intrauterine insemination: a field study

Recai KULAKSIZ^{1,*}, Ali DAŞKIN²

¹Department of Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, University of Kafkas, 36300 Paşaçayırı, Kars - TURKEY

²Department of Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, University of Ankara, 06110 Dışkapı, Ankara - TURKEY

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Abstract: The objective of this study was to evaluate the reproductive performance of primiparous and multiparous Saanen goats after intrauterine laparoscopic artificial insemination with frozen semen. Twenty-four Saanen goats, divided in 2 groups: group 1 consisted of 11 primiparous goats and group 2 consisted of 13 multiparous goats. Estrus was synchronized by 20 mg fluorogestone acetate (FGA)-impregnated intravaginal sponges and the IM administration of 125 mg of cloprostenol (PGF₂α) and eCG (400 IU), 48 h before sponge removal. Intrauterine fixed time artificial insemination (AI) was carried out 55 h after removal of the FGA sponges. Results of the present study indicate that primiparous Saanen goats exhibited a higher pregnancy rate than multiparous goats. However, pregnancy and conception rate did not differ significantly between primiparous and multiparous goats (66% and 53%; P > 0.05). In conclusion, the technique of laparoscopic intrauterine insemination in multiparous and primiparous goats is used successfully under rural conditions.

Key words: Goat, primiparous, multiparous, frozen semen, laparoscopic intrauterine insemination

Primipar ve multipar Saanen keçilerinde laparoskopik intrauterin tohumlama sonrası reproduktif performans: saha çalışması

Özet: Bu çalışma, dondurulmuş teke sperması ile laparoskopik intrauterin tohumlama sonrası primipar ve multipar Saanen keçilerinin reproduktif performansını değerlendirmek amacıyla yapıldı. Araştırmada 11 adet primipar (1-1,5 yaşlı, Grup 1) ve 13 adet multipar (2-5 yaşlı, Grup 2) keçi olmak üzere iki grupta toplam 24 hayvan kullanıldı. 24 Keçiye 11 gün süre ile Fluogeston asetat (20 mg) içeren vaginal sünger uygulandı ve süngerlerin alımından iki gün öncede eCG (400 IU) ve 125 mg PGF₂α analogu olarak cloprostenol sodyum intramuskuler olarak yapıldı. Keçiler süngerlerin çıkarılmasından 55 saat sonra kızgınlık tespiti yapılmadan sabit zamanlı olarak, laparoskopik yöntemle tohumlandı. Bu çalışmada primipar Saanen keçilerinden daha yüksek gebelik elde edildi. Fakat gebelik ve doğum oranları bakımından primipar ve multipar Saanen keçileri arasında istatistiksel olarak bir fark bulunmadı (% 66, 53; P > 0,05). Sonuç olarak, saha koşullarında gerek primipar gerekse multipar keçilerde laparoskopik intrauterin tohumlama yönteminin başarıyla kullanılabileceği kaanatine varıldı.

Anahtar sözcükler: Keçi, primipar, multipar, donmuş sperma, laparoskopik intrauterin tohumlama

* E-mail: recaikulaksiz@gmail.com

Introduction

Turkey has a local breed goat population of approximately 6.5 million, with low production capacity. The indigenous goats are well known for their tolerance to the environment but they generally exhibit low reproductive performance. Saanen goats are one of the best known dairy goat breeds and have been used with success to increase milk yields of the indigenous breeds of goats, especially where adequate year-round feeding is assured. They were introduced into Turkey in 1974 in order to upgrade the local breeds (1).

Both primiparous and multiparous goats are used in artificial insemination (AI) programs, but fertility in primiparous females has been found to be lower compared to multiparous females (2). For this reason breeders prefer to use natural mating in primiparous animals. The simplest technique for AI in small ruminants consists of depositing the semen at the entrance of or within the cervix, or by the insemination pistol through the cervix, depositing the semen directly into the uterus, which is sometimes impossible (especially in young animals), due to the size and structure of the cervix. Cervical insemination offers a faster and more practical option; however, when frozen semen is used, lower conception rates are generally encountered. Superior and more consistent pregnancy rates may be accomplished when inseminating laparoscopically. The advantage of laparoscopic insemination is that the semen is deposited closer to the site of fertilization (2-5).

To the best of our knowledge, no studies have been published concerning laparoscopic intrauterine insemination in Saanen goats under rural conditions, comparing the efficacy in primiparous and multiparous animals. The objective of this research, therefore, was to determine the efficiency of intrauterine insemination in primiparous and multiparous dairy goats.

In this study, 11 primiparous (1-1.5 years old) and 13 multiparous (2-5 years old), goats of the Saanen breed were used. The body condition of all of the animals ranged from 2.5 to 4.0, on a scale of 1 to 5, as described by Santucci et al. (6). Throughout the experimental period, the animals were fed dry hay and concentrate and were given water ad libitum. This study was carried out from 15 October to 5

November 2009 (within the breeding season) in Uşak, Turkey (29°24'E, 38°40'N; altitude of 919 m).

The semen used in this study was collected, using an artificial vagina, from 2 Saanen bucks of proven fertility. Freshly collected semen was pooled and extended to a final concentration of 300×10^6 spermatozoa/mL with diluents containing skimmed milk, egg yolk (10%), and glycerol (5%). The diluted semen was gradually cooled to 4 °C over 2-3 h. The cooled semen was frozen in 0.25-mL straws as described previously (7). In brief, the semen samples were packed in straws and kept at 4 °C. They were exposed to liquid nitrogen (LN₂) vapor (-125 °C to -130 °C) for 3-4 min, plunged into LN₂ (-196 °C), and stored in LN₂. The frozen straws were thawed at 37 °C in a water bath for 30 s and the motility of spermatozoa in each straw was evaluated. Straws with a percentage of approximately 40% motile spermatozoa were used for AI. One straw was used to inseminate each doe. All of the does were inseminated with 0.25 mL of frozen semen containing 75×10^6 sperm/straw. Each 0.25 mL straw was divided into 2 equal volumes, and each cornu was inseminated separately with equal volumes of frozen semen.

Estrus was induced in all of the goats through an 11-day intravaginal administration of 20 mg flugestone acetate-impregnated sponges (Chronogest® CR/Sünger, Intervet, İstanbul, Turkey). The goats received 125 mg of cloprostenol (Estrumate, DIF, İstanbul, Turkey) and 400 IU of eCG (Chronogest/PMSG, Intervet, İstanbul, Turkey) IM, 48 h before sponge withdrawal. Intrauterine fixed time AI was carried out 55 h after removal of the FGA sponges.

Feeding was stopped 24 h before the laparoscopic insemination was performed. For preanesthetic tranquilizing, xylazine hydrochloride at 2% (0.1 mL 10 kg⁻¹ live weight) was applied by intramuscular injection. Ketamine (0.2 mL 10 kg⁻¹ live weight) was applied intravenously as anesthetic, 10 min after administering the xylazine hydrochloride. Once anesthetized, laparoscopic insemination involved restraint of the animals in dorsal recumbency on a laparoscopy cradle, and the animals were tilted into a head-down position at an angle of at least 45°. This causes the diaphragm to be moved forward, in order to avoid harm when introducing the Veress needle and the trocar-cannula in the wall of the abdomen,

and at the same time to uncover the uterus from the major mesentery.

In the disinfected area of the abdomen, 3 incisions were made. First, a small incision (5 cm) was made on the left of the udder, where the Veress needle was introduced to insufflate slightly with a moderate amount of air into the abdominal cavity to aid with visibility. Afterwards, 2 incisions of greater size were made, parallel to the middle line of the abdomen, 4 cm to the midline of the abdomen, and approximately 8 cm to the front edge of the udder. Through the incision on the right, a trocar-cannula was inserted, through which the endoscope lens was introduced. Through the incision on the left, the trocar-cannula was embedded, and the doses of aspic were introduced with the insemination catheter containing the pipette with frozen semen to be deposited in the uterine horn.

A chi-square test was performed to determine the differences between the groups, concerning the other reproductive traits measured. A value of $P < 0.05$ was chosen as an indication of significance.

In group 1 (primiparous), 2 does were not inseminated laparoscopically because the uterine cornua were not found. The overall results from the reproductive parameters are presented in the Table. No significant differences in pregnancy rate and kidding rate between the groups were recorded, but the male kid rate in group 1 was significantly higher ($P < 0.05$) compared to group 2.

Results of the present study indicate that primiparous Saanen goats exhibit pregnancy and lambing rates higher than those of multiparous goats.

This study was conducted to evaluate the feasibility of using the technique of laparoscopic intrauterine insemination in goats under field conditions, for the first time in Turkey. However, in the literature, little information related to laparoscopic intrauterine insemination in goats using frozen semen has been found. The average fertility obtained in our study (59.5%) is exactly the same as the results of Dickson et al. (8), who reported a 59.5% fertility rate in 123 Alpine and Saanen goats that were intrauterine inseminated with frozen-thawed semen. In contrast to our study Ritar et al. (9) obtained a higher fertility rate (71.2%), while Goonewardene et al. (10) obtained

Table. Reproductive responses of primiparous or multiparous Saanen goats after laparoscopic intrauterine insemination.

Parameters	Group 1 (Primiparous)	Group 2 (Multiparous)
Number of goats	11	13
Number of inseminations	9 (81%)	13 (100%)
Pregnancy rate (%)	66 (6/9)	53 (7/13)
Kidding rate (%)	100 (6/6)	100 (7/7)
Multiple birth rates (%)	83 (5/6)	71 (5/7)
Number of kids		
Single	1 (16%)	2 (33%)
Twin	2 (33%)	3 (50%)
Triplet	1 (16%)	1 (16%)
Quadruplet	2 (33%)	1 (16%)
Female kid rate (%)	32 (5/16) ^a	64 (11/15) ^b
Male kid rate (%)	68 (11/16) ^a	26 (4/15) ^b

^{a,b}Differences between treatments are statistically significant ($P < 0.05$).

a lower fertility rate (41.0%). Moreover, Lowinger et al. (11) found a variable fertility (0.0%-40.0%) in goats of different Argentinean flocks inseminated laparoscopically with frozen-thawed semen.

Goats are generally inseminated at a fixed time after the end of progestagen treatment. Moreover, cervical insemination with frozen-thawed semen decreases the fertilization rate by 30%-40%, compared to natural mating. Primiparous goats are less fertile than multiparous goats when intracervical AI is performed. The lower fertility rates observed in primiparous goats could be explained by the time of cervical AI relative to ovulation. These suggest that the AI should be performed earlier in primiparous than in multiparous goats, in order to improve their fertility rate. Moreover, the number of ovulations is one of the major factors for determining the differences in ovulation time between primiparous and multiparous goats (2,12). However, this explanation can be excluded when an intrauterine AI is performed in goats. This rate increases with the intrauterine insemination using fresh or frozen semen.

In the present study, pregnancy rates in the goats declined with increased age. This could be understandable based on the facts that aged goats have an increased risk of reproductive disorders and decreased rates of ovulation with quality ovulated oocytes compared with young goats. In contrast, lower pregnancy rates were reported by Ritar and Ball (4), while inseminating young Cashmere goats. The discrepancies regarding the pregnancy rates between the above mentioned study and the current one could be attributed to the different breeds, hormone treatment used, the synchronization and insemination methods utilized, and the concentration of semen used for inseminations (4,9,12). The finding of the current study, that the body condition score of multiparous was lower than primiparous, is thought to play a significant role for the differences observed between pregnancy

rates. In addition, the finding that the pregnancy rate is somewhat low, although it is acceptable, can be attributed to the wide span of distribution of ovulations in goats after estrus synchronization.

To the best of our knowledge, this is the first experimental laparoscopic intrauterine insemination in Saanen goats in rural conditions. Overall, the results demonstrate the feasibility of achieving an appropriate fertility rate in young goats after intrauterine insemination.

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