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Factors affecting conception rate of hair ewes after laparoscopic insemination with chilled semen under tropical conditions

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ABSTRACT

The objective was to evaluate the effect of some factors on the conception rate of hair ewes using laparoscopic intrauterine insemination with chilled semen under tropical conditions. Data on 1200 inseminations carried out in Pelibuey, Blackbelly, Katahdin and Dorper ewes from 19 farms were used. Estrous was synchronized using vaginal sponges or a controlled intravaginal drug release (CIDR) device by 12 days. At the withdrawal of the device (sponge/CIDR) 200 or 250 IU of equine chorionic gonadotropin (eCG) was applied. Insemination was carried out 54–56 h after withdrawal of the device using chilled semen with 150 million spermatozoa per dose. Ultrasound conception diagnosis was carried out 35–40 d after insemination. The effects of ewe breed, age of ewe (1–4 years), body condition score (low, middle and high), type of device (sponge and CIDR), dose of eCG (200 and 250 IU), year of insemination (2010–2012), season (hot-dry, hot-humid; fresh-humid), inseminator (5 inseminators) and simple interactions on conception rate were determined using binary logistic regression. The overall conception rate was 66.4%. There was not significant interactions of main effects. Only breed, body condition score (BCS) and year of insemination influenced ($P < 0.05$) conception rate. Blackbelly (73.1%) and Pelibuey (68.9%) ewes had the highest conception rates as compared to Dorper (61.4%) and Katahdin breeds (62.4%). The conception rate was better in the ewes of middle body condition (68.1%) than ewes of low BCS (64.2%). Under the conditions of this study, the conception rate of ewes, using laparoscopic intrauterine insemination with chilled semen was influenced by ewe breed, BCS and year of insemination.

1. Introduction

Estrous synchronization and artificial insemination (AI) are tools of reproductive management that allow genetic animal improvement of economical important traits, estrous control and mating of females in a given period of time. These tools also allow the programming of lambing and weaning of lambs in the best season of the year, and make appropriated the management of animal lots (Molina-Mendoza et al., 2005; Aké-López et al., 2013). Furthermore, the percentage of pregnant ewes and lambs born per ram increase, favor the use of rams not capable of mounting and allows the mating of ewes in the non-reproductive season (Ax et al., 2002; Zeleke et al., 2005; Ataman et al., 2006).

In spite of the benefits of estrous synchronization and AI, their use in sheep production is limited, due to its relative high cost and the irregularity of results (Hill et al., 1998; Anel et al., 2006). AI results may differ due to age of ewe, breed, season of the year, gonadotropin dose, device type, inseminator, etc. (Donovan et al., 2004; Anel et al., 2005; Luther et al., 2007).

In the tropics of Mexico, most of farms use traditional production systems with poor technology; so AI is scarcely used (García et al., 2001; Sanchez et al., 2001García et al., 2001García et al., 2001; Sanchez et al., 2001). The effects of breed, age, BCS of the ewe, type of synchronization device type, eCG dose, and season of year on conception rate is poorly studied. Generating information, especially under field conditions, is of great importance to make decisions regarding the use of those reproductive biotechnologies in ewe farms with the aim of improving management practices that will be reflected in a better reproductive performance.

The main objective of this study was to evaluate the effect of some factors on the conception rate of hair ewes using laparoscopic intrauterine insemination with chilled semen, under tropical conditions.

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2. Material and methods

2.1. Localization and animals

The transversal study used 1200 inseminations carried out from June 2010 to May 2012 in Pelibuey, Blackbelly, Katahdin and Dorper ewes from 19 farms, located in the central and eastern regions of the state of Yucatan, Mexico. The climate of the zone is tropical sub-humid with rain in summer. The average annual temperature is 25.8 °C with an average rainfall of 984 mm and relative humidity ranging from 70 to 80% (INEGI, 2008).

The ewes inseminated were non-lactating females with 60–100 postpartum days and body condition score (BCS) equal or greater than 1.5, at the beginning of insemination. Ewes were further classified as with low (1.5–2.0), middle (2.5–3.5), and high BCS (4.0–4.5) using a scale from 0 to 5, where: 0 was an extremely thin ewe and 5 an extremely fat ewe (Russel, 1984). Age of the ewes was evaluated by dentary examination (1–4 years of age). Ewes were under semi-intensive systems of production, in paddocks (6–8 h) of Star grass (*Cynodon plectostachyus*) and chopped Taiwan (*Pennisetum purpureum*). Three to 4 weeks before AI ewes were given 300–400 g/day of a commercial feed with 14% CP, and received water ad libitum. The control of gastrointestinal parasites was a common practice.

2.2. Estrous synchronization and artificial insemination

Type of device and eCG doses were randomly assigned to the ewes. Estrous was synchronized with 40 mg of Fluorogestone acetate impregnated intravaginal sponges (Chronogest®; Intervet-Netherlands) (n = 930) or using a controlled intravaginal drug release (CIDR®; Pfizer-New Zealand) device with 0.3 g progesterone (n = 270), per 12 d. At the day of withdrawal of the intravaginal device (Sponge or CIDR), 200 (n = 526) or 250 (n = 674) IU of equine chorionic gonadotropin (eCG; Folligon®; Intervet- Netherlands) was applied intramuscularly to the ewes.

Semen was obtained from Pelibuey (n = 7), Katahdin (n = 5) Dorper (n = 8) and White Dorper (n = 5) rams with 2–4 year of age and 3–4 BCS (Russel, 1984). Semen was collected at the farms in the morning of the same insemination day, using an artificial vagina. To remove the effect ram, only ejaculates with sperm concentration ≥ 2500 × 10^6 spz/ml, progressive motility greater than 80% and a maximum of 10% abnormalities were used. Semen was diluted with Triladyl® (Minitub, Germany), until getting approximately 150 million of spermatozoa per dose (0.25 mL), chilled to 4–5 °C for 2 h and kept at this temperature in a transportable refrigerator until insemination (4–6 h). The chilled semen doses were check before AI and those with less than 50% progressive motility were not used.

All ewes were inseminated by five technicians, 54–56 h (fixed time) after withdrawal of the intravaginal device (sponge or CIDR) with a help of a laparoscope Karl Storz (0.5 cm) and a specific insemination kit (Transcap-Aspic). The semen dose (straws of 0.25 mL) was deposited in the uterine lumen of the mid-section of the greater curvature of each uterine horn (half and half) (Aké-López et al., 2013). Conception diagnosis was carried out 35–40 d after laparoscopic insemination, using real time ultrasound with a linear transducer of 6–8 Mhz (Pie Medical, 100 Falco Vet).

Three seasons of the year were defined: hot-dry season (March to June; n = 484); hot-humid (July to October; n = 363) and fresh-humid (November to February; n = 353), with temperatures and humidities of 27.6 °C and 70.0%; 27.7 °C and 78.3%, and 24.1 °C and 76%, respectively (CONAGUA, 2014).

2.3. Statistical analysis

Conception rate (number of pregnant ewes/number of inseminated ewes X 100) was estimated, and the effect of some factors associated to it was determinate using binary logistic regression procedures (SAS, 2003). The studied factors were ewe breed (Pelibuey, Blackbelly, Katahdin, Dorper), age of ewe (1, 2, 3 and 4 years), ewe body condition score (low 1.5–2.0; middle 2.5–3.5; high 4.0–4.5), device type (Sponge and CIDR), dose of eCG (200 and 250 IU), year of insemination (2010, 2011 and 2012), season (hot-dry, hot-humid; fresh-humid), inseminator (A, B, C, D and E), and simple interactions. However, the final model only included the main factors because the interactions were not significant (P > 0.05).

Table 1
Conception rate (CR) and odds ratios by factor of hair ewes inseminated with chilled semen under tropical conditions.

Factor/Level	n	CR (%)	Odds ratio	CI 95%	P value
Breed					0.0327
BlackBelly	52	73.1	2.13	1.06–4.27	
Pelibuey	724	68.9	1.54	1.09–2.16	
Katahdin	157	62.4	1.12	0.73–1.72	
Dorper	267	61.4	1.00		
Age					0.8254
4	254	67.3	1.02	0.70–1.49	
3	292	66.4	0.96	0.67–1.37	
2	290	64.8	0.87	0.62–1.23	
1	364	67.0	1.00		
BCS					0.0516
High (4–5)	125	64.8	1.34	0.84–2.16	
Middle (2.5–3.5)	659	68.1	1.43	1.07–1.91	
Low (1.5–2)	416	64.2	1.00		
Device type					0.8055
CIDR	270	69.6	1.04	0.76–1.43	
Sponge	930	65.5	1.00		
eCG dose					0.0735
200	526	64.4	0.79	0.60–1.02	
250	674	67.9	1.00		
Year					0.0173
2010	288	60.4	0.62	0.37–1.03	
2011	504	69.8	1.18	0.84–1.65	
2012	408	66.4	1.00		
Season					0.4862
Hot-Dry	484	67.8	1.22	0.77–1.76	
Hot-Humid	363	64.2	1.17	0.88–1.68	
Fresh-Humid	353	66.9	1.00		
Inseminator					0.5412
A	688	65.8	0.92	0.58–1.46	
B	92	61.9	1.02	0.53–1.98	
C	119	69.7	1.39	0.75–2.56	
D	198	67.7	0.92	0.54–1.57	
E	103	67.9	1.00		

CI 95% = 95% Confidence interval; BCS = Body condition score; eCG = equine chorionic gonadotropin.

3. Results

The overall conception rate of the inseminated ewes was 66.4%. The logistic regression analysis showed significant effect (P < 0.05) only for ewe breed, BCS and year of insemination (Table 1). Conception rate odds ratios of Blackbelly and Pelibuey ewes were 2.13 and 1.54 times to Dorper, respectively; however, Dorper and Katahdin had similar odds. The conception rate was better for middle body condition score ewes than those with low condition. The odds ratio for middle BCS was 1.43 times that for low BCS ewes. However there was no significant differences between odds ratios of the low and high BCS ewes. The 2010 year had higher conception rate than 2011 and 2012, but only the difference between 2010 and 2011 was significant (P < 0.05). Age of ewe, device type, eCG dose, season, inseminator and interactions effects were not significant (P > 0.05).