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Autoclaved, previously used intravaginal progesterone devices induces estrus and ovulation in anestrous Toggenburg goats

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ABSTRACT

Intravaginal progesterone devices are used worldwide for estrus induction in goats. Reused devices are able to induce estrus; however, this can be a health risk within a flock. The objective was to compare new and previously used (and autoclaved) progesterone-releasing intravaginal devices for induction of estrus and ovulation in seasonally anestrous Toggenburg goats. Anestrous goats ($n = 42$) received new intravaginal devices containing 0.3 g progesterone (CONTROL), or similar devices previously used for either 6 (USED6) or 12 d (USED12) and subsequently autoclaved. All goats received 5 mg dinoprost at device insertion and 200 IU eCG 5 d later, and all devices were removed after 6 d. After device removal, estrus was monitored and females displaying signs of estrus were mated by fertile bucks. Transrectal ovarian ultrasonography was performed after device removal until detection of ovulation. Blood samples were collected for determination of plasma progesterone concentration at different times. There was no difference ($P > 0.05$) among groups CONTROL, USED6 or USED12 for: estrus response (87, 100 or 100%, respectively); duration of estrus (32.3 ± 2.3, 25.2 ± 3.4 or 27.3 ± 4.1 h); ovulation rate (100, 88 or 100%); number of ovulations (1.5 ± 0.2, 1.9 ± 0.3 or 1.7 ± 0.3); and pregnancy rate (60, 58 or 67%). Plasma progesterone (P4) concentrations were greater ($P < 0.05$) in CONTROL than in USED6-treated and USED12-treated goats (7.2 ± 1.2, 4.7 ± 0.7 and 4.3 ± 0.6 ng/mL, respectively) at 6 h after device insertion; these differences were maintained until 4 d after device insertion (3.4 ± 0.4, 2.3 ± 0.2, and 2.5 ± 0.2 ng/mL). Overall, plasma progesterone concentrations were greater ($P < 0.05$) in nulliparous than in lactating goats (3.1 ± 0.8 compared to 2.4 ± 0.6 ng/mL, respectively). In conclusion, autoclaved, previously used intravaginal progesterone-releasing devices resulted in significant lesser plasma progesterone concentrations than new devices, but were similarly effective in inducing estrus and ovulation in anestrous goats.

1. Introduction

Depending on latitude and breed, goats are seasonal breeders. Thus, due to physiological, commercial or technical reasons, estrous induction of goats is justifiable. Many hormonal treatments have already been described,

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varying the dose, type and/or duration of the progesterone/progestagens used, whether of gonadotropin and prostaglandin are used, as well as its time of administration (Gordon, 1997). Ungerfeld and Rubianes (1999) reported that short term (6 days) progestagen priming, that results in greater progestagen concentrations at the time of device removal, is at least as effective as traditional priming (12–14 days) to obtain an out-of-season estrus. Since these earlier publications, many papers were published using this method in goats (Fonseca et al., 2005; Menchaca et al., 2007). Thus, hormonal treatments have the advantage of efficiently inducing an earlier onset of estrus (in about 1 week). However, costs are relatively greater and this sometimes may hinder widespread use of these treatments. As a consequence, the development and/or refinement of efficient techniques that brings about cost reduction could be deemed appropriate in the case of induction.

As protocols for estrous induction shortened the time of exposure to progesterone, devices were able to be reused. Although not recommended by the manufacturer, device reuse is a common practice in dairy herds. Reuse of progesterone intravaginal devices have been reported in cows (Colazo et al., 2004), ewes (Ungerfeld, 2009) and goats (Oliveira et al., 2001; Carvalho et al., 2006; Vilariño et al., 2011), usually without decreasing fertility rate. Goats that are expressing estrous cycles in typical patterns receiving new or reused CIDR showed similar estrous response and pregnancy rates with second (Oliveira et al., 2001) or third uses (Nogueira et al., 2008). In another trial, one group of 20 goats received reused devices for 9 days and a second group of 20 received new devices. Progesterone concentrations measured every 24 h from device insertion to removal were similar in both groups, and the authors concluded that the use of reused devices was feasible (Guido et al., 2007). Similarly, Carvalho et al. (2006) cited that in anestrous goats it was possible to reuse devices three times.

Despite the desirable results, reused devices can be a health risk within a flock. Therefore, alternatives for device disinfections before reuse such as the immersion in a solution of benzalkonium chloride (Vilariño et al., 2011) were proposed. The possibility for the sterilization was reported earlier when devices were washed in physiological solution and subsequently sterilized under ultraviolet light (Oliveira et al., 2001; Carvalho et al., 2006). In cattle, the autoclaving process was reported and considered to be the most desirable option when reusing progesterone containing inserts (Zuluaga and Williams, 2008) as no difference was observed in ovarian responses after autoclaving and reuse in comparison to use of a new device (Cerri et al., 2009). The autoclaving process was more effective than ultraviolet irradiation when both techniques were compared to achieve sterilization (Gefrides et al., 2010). However, no literature was found regarding the reuse of autoclaved devices for estrous induction in goats and corresponding progesterone profiles with device reuse. If this method is considered to be functional, the use of reproductive programs could be improved, extending the use of progesterone inserts, with lesser costs and similar results. The aim of the present study was to evaluate the efficacy of reusing autoclaved intravaginal devices on induction of estrus and ovulation and fertility in Toggenburg goats, as well as to characterize the plasma progesterone (P4) profile in these animals.

2. Materials and methods

2.1. Location and experimental conditions

The study was conducted during the seasonal anestrous period in the rural area of Piau, MG, Brazil (latitude 21°35′S and longitude 43°15′W). The average altitude was 435 m with Cwa climate, according to Köppen classification (winters without or with minimum rainfall and summers with high ambient temperatures; Peel et al., 2007).

The goats were kept in an intensive system, within pens 15 m in length and 2 m wide which housed 10 goats each, providing 3 m^2 per animal, allowing an acceptable degree of animal welfare (Ribeiro, 1997). Goats were fed corn silage and *Pennisetum purpureum* as forage. Additionally, for lactating goats, a balanced concentrate supplement was given according to their milk production (NRC, 2007). Mineralized salt (Salminas Goats®, Nutriplan, Juiz de Fora, MG, Brazil) and drinking water were available *ad libidum*. This research was reviewed and approved by the Animal Care Committee of Fluminense Federal University (UFF/0048-08).

2.2. Estrous induction treatment and mating

Toggenburg nulliparous ($n = 20$) or lactating ($n = 22$) goats 8 months to 7 years of age were selected and allocated according to category, body weight (BW) and body condition score (BCS, range 1–5), respectively, into three treatments: CONTROL, USED6 and USED12. Does in the CONTROL group ($n = 17$; 8 nulliparous and 9 lactating; 41.5 ± 2.1 kg, BCS 3.4 ± 0.1) received a new, progesterone releasing device containing 0.3 g progesterone (Eazi-Breed CIDR®, InterAg, Hamilton, New Zealand). Does in the other two groups received similar devices previously used for 6 d (USED6, $n = 13$; six nulliparous and seven lactating; 43.5 ± 3.1 kg, BCS 3.5 ± 0.1) or 12 d (USED12, $n = 12$; six nulliparous and six lactating; 44.9 ± 4.6 kg, BCS, 3.5 ± 0.2). Previously used devices (used once 30 days earlier) had been thoroughly washed with water, air dried, then placed individually in special plastic bags (designed for use in an autoclave), and autoclaved for 15 min (121 °C and 1 atm pressure above standard pressure). After autoclaving, devices were stored at room temperature until use.

Concurrent with device insertion, 5 mg dinoprost (Lutalyse®, Pfizer Animal Health) was given, with a subsequent injection of 200 IU eCG (Novormon 5000®, Sintex Industries Biochemistry, Buenos Aires, Argentina) 24 h before device removal. Both dinoprost and eCG were given as submucosal injections in the latero-vulvar area. In all does, devices were removed after 6 d.

After device removal, estrus was monitored with the use of bucks twice a day (07:00 and 19:00 h) and females were considered to be in estrus when allowed to be mounted. Does displaying signs of estrus were mated by fertile bucks at the onset of estrus and 24 h later if they were still in estrus. Toggenburg bucks ($n = 7$) were used for approximately equal numbers of does from each treatment, with a