Betacarotene supplementation increases ovulation rate without an increment in LH secretion in cyclic goats

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Abstract

This study aimed to evaluate the effects of betacarotene (BC) supplementation on ovulation rate (OR) and luteinizing hormone (LH) secretion in adult goats during the breeding season. Additionally, total ovarian activity (TOA) comprising the total number of ultrasonographically detectable antral follicles (AF) and corpora lutea (OR) was also assessed. In early October, adult goats \[n = 22, 3.5\text{ years of age, 7/8 Sannen-Alpine}; 26^\circ\text{N, 103}^\circ\text{W at 1117 m.a.s.l.}\] were randomly assigned to: (i) BC group (BCG), orally supplemented with 50 mg of BC/goat/day \[n = 10; \text{LW} = 45.9 \pm 2.0 \text{ kg, BCS} = 3.0 \pm 0.1\], and (ii) control group (CONT) \[n = 12; \text{LW} = 46.2 \pm 2.0 \text{ kg, BCS} = 3.0 \pm 0.1\]. All animals received a basal diet of alfalfa hay, corn silage and corn grain, with free access to water and mineral salts. The whole experimental period spanned 34 days before and 17 days after ovulation. On day 23 of the experiment, estrus was synchronized with progestin-releasing intravaginal sponges; 36 h prior to estrus, an intensive blood sampling (every 15 min for 6 h) was performed to determine mean LH concentrations, pulsatility (LH-PULSE) and area under the curve (LH-AUC) for serial LH concentrations. Afterwards, by the end of the luteal phase (i.e., 17 days after the onset of estrus), an ultrasonographic scanning was performed to evaluate OR and TOA \[\text{AF + OR}\]. The average LW and BCS did not differ \((p > 0.05)\) during the experimental period. BC-supplemented goats showed an increase in OR \((3.4 \pm 0.2 \text{ versus } 2.8 \pm 0.2; p < 0.05)\) and exhibited lower \((p < 0.05)\) serum LH concentrations, LH-AUC and LH-PULSE compared to CONT. A positive correlation was recorded between OR and LW \((r^2 = 0.42, p < 0.05)\) and BCS \((r^2 = 0.47, p < 0.05)\). In addition, AF \((5.0 \pm 0.6 \text{ versus } 3.4 \pm 0.6)\) and TOA \((8.4 \pm 0.6 \text{ versus } 6.2 \pm 0.6)\) were greater \((p < 0.05)\) in the BC-supplemented group than CONT. Supplementation with BC enhanced ovarian follicular development and ovulation rate in adult female goats under decreased photoperiods through LHRH-independent pathways or direct effects of BC on ovarian function.

Keywords

Betacarotene supplementation; Goats; LH; Ovarian activity; Ovulation rate