

Effect of nutrition and superovulation on oocyte morphology, follicular fluid composition and systemic hormone concentrations in ewes

ABSTRACT

The objective was to determine the effect of dietary intake on follicle and oocyte morphology in unstimulated and superovulated ewes. Fifty-four ewes were fed grass meal at 0.5, 1.0 or 2.0 times maintenance energy requirements (M) for 32 days. Oestrous cycles were synchronized using progestagen pessaries and either unstimulated or superovulated with 200 mg pig FSH. The ewes were killed and ovaries were collected either 36 or 12 h before the anticipated LH surge. Serum progesterone concentrations in ewes on day 10 after withdrawal of the pessary were lower in ewes fed 2.0M than in ewes fed 0.5M or 1.0M ($P < 0.05$). LH pulse frequency tended to be higher in ewes fed 2M than 1M (1.0 ± 0.3 versus 0.3 ± 0.2 pulses per 8 h) on day 6 after removal of the pessary but the effect was not significant. In unstimulated ewes, more follicles (≥ 3 mm) were observed when the animals were killed in ewes fed 2.0M (3.5 ± 0.3) than in ewes fed 0.5M (2.4 ± 0.3) or 1.0M (2.4 ± 0.5 ; $P < 0.05$). Fewer follicles were observed in superovulated ewes on 0.5M (7.5 ± 1.2) than in ewes on 1.0M (12.0 ± 0.5) or 2.0M (12.3 ± 1.4 ; $P < 0.05$). Follicular fluid progesterone concentrations were higher in ewes fed 0.5M compared with those fed 1M or 2M ($P < 0.05$). Insulin-like growth factor (IGF)-I concentrations were higher in follicular fluid from ewes on 1M compared with either those on 0.5M or 2M ($P < 0.05$), whereas IGF-II concentrations were lower in follicular fluid from ewes on 2M compared with those on 1M or 0.5M ($P < 0.05$). Superovulation increased follicular fluid progesterone, oestradiol, IGF-I and IGF-II concentrations ($P < 0.01$). Concentrations of the 34, 22 and 20 kDa IGF binding proteins were lower in follicles from superovulated ewes compared with unstimulated ewes ($P < 0.05$). Oocytes from superovulated ewes showed abnormalities such as premature activation of cumulus expansion and vacuolation of the nucleolus and increased frequency of detachment of interchromatin-like granules from the nucleolar remnant. Collectively, these results indicate that both high and low dietary intakes can alter systemic and follicular fluid hormone concentrations. Relative to dietary effects, the effects of superovulation were greater and involved substantial increases in follicular fluid hormone concentrations and abnormal oocyte morphology.

Keyword: Follicular fluid; Oocyte morphology; Ewes; Ovary follicle