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Administration of 6-methoxybenzoxazolinone (MBOA) does not augment ovulatory responses in St. Croix White ewes superovulated with PMSG

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Abstract

The objective of this investigation was to examine the effects of 6-methoxy-benzoxazolinone (MBOA), a plant compound that resembles melatonin and alters ovarian function in rodents, in combination with PMSG on superovulatory responses in the cycling ewe. In Experiment I, St. Croix White ewes ($n = 44$) were synchronized (intra-vaginal progestin sponge) for 14 days followed by hCG (750 IU) at 1 day after sponge removal (day 0). Ewes were assigned to one of six treatments administered on day −1: Control (no PMSG or MBOA; $n = 7$); PMSG (1000 IU i.m.; $n = 7$); Low MBOA (0.43 mg/kg i.m.; $n = 7$); High MBOA (1.15 mg/kg i.m.; $n = 7$); Low MBOA + PMSG ($n = 8$); High MBOA + PMSG ($n = 8$). In Experiment II, St. Croix White ewes ($n = 24$) were synchronized (progestin CIDR) for 14 days followed by hCG on day 1 after CIDR removal (day 0). Ewes were assigned to one of three treatments administered on day −1: Control ($n = 8$); PMSG ($n = 8$); Low MBOA + PMSG ($n = 8$). Laparoscopy was performed on day 9 to assess numbers of corpora lutea (CL) and visible follicles on each ovary. Blood samples were collected on day −13, −1, 0, 1, and days 6 or 7–12 for analysis of serum progesterone (P_4) by RIA. Treatment groups receiving PMSG (alone or with MBOA) exhibited greater ($P < 0.05$) serum concentrations of P_4 post-synchrony than Control and MBOA-only groups. Ovulation rate was lower ($P < 0.05$) for Control and MBOA-only treated ewes than ewes receiving PMSG. Ovulation rate in ewes treated with MBOA alone was similar ($P > 0.10$) to

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Controls, and PMSG treatment alone did not differ ($P > 0.10$) from MBOA + PMSG treatment. Ewes treated with PMSG alone did not differ ($P > 0.10$) in follicle number from High MBOA + PMSG treated ewes, however, Low MBOA + PMSG treated ewes had greater numbers of follicles at day 9 ($P < 0.05$) than the PMSG or High MBOA + PMSG groups in Experiment I; although, this was not replicated in Experiment II with numbers of follicles in the Low MBOA + PMSG group being similar ($P > 0.10$) to PMSG alone. In summary, the addition of MBOA in combination with PMSG as part of a synchronization–superovuation protocol in the ewe did not increase ovulation rate.

Keywords: MBOA; Ewe; Superovulation; PMSG

1. Introduction

Phytoanticipins are antimicrobial chemical defense compounds stored in plant cells that are converted to biologically active antibiotics by enzymes in response to pathogen attack (Butterstein and Schadler, 1988). One such phytoanticipin, 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one (DIMBOA)—glucoside, is broken down to DIMBOA and further to 6-methoxybenzoxazolinone (MBOA), specifically in response to infection or physical damage in the leaf tissue of some monocotyledonous plants (Urbanski et al., 1990). When consumed by herbivores, MBOA has been suggested to have biologically active effects in some animals, most notably influences on the reproductive system (Sanders et al., 1981; Butterstein et al., 1985; Urbanski et al., 1990). While MBOA has no direct steroidal activity (Sanders et al., 1981; Butterstein et al., 1985) it is a natural analogue of melatonin (Sanders et al., 1981; Kennaway et al., 1986). In the meadow vole, MBOA treatment increased litter size and increased the female:male ratio within litters (Berger et al., 1987). Similarly in the pine vole (Schadler et al., 1988) and Sprague–Dawley rat (Butterstein and Schadler, 1988), MBOA increased ovarian weight (pine vole and rat), increased FSH (pine vole) and the number of ova shed (rat). These data indicate that MBOA can augment gonadotropin secretion and follicular development in some species. Moreover, MBOA has been shown to override the inhibitory effects of photoperiod on reproductive activity in rodents (Korn and Taitt, 1987; Negus and Berger, 1987; Schadler et al., 1988; Rowsemitt and O'Conner, 1989); however, in the transitional mare (Ginther et al., 1985) and prepubertal gilt (Guthrie et al., 1984) MBOA treatment showed no effect on improving reproductive traits in relation to the timing and physiology of these reproductive transitions. What is unclear is whether MBOA when administered to livestock exhibiting regular estrous cycles or when administered in conjunction with hormonal treatments (e.g., synchronization and/or superovulation) might result in a different response; for example, in a manner that might enhance reproductive efficiency. To this end, the objective of this investigation was to examine the effects of single (bolus) MBOA treatment in combination with PMSG on superovulatory responses in the cycling ewe. The rationale for this study, given the promising positive MBOA effects on ovarian function in rodents, was that targeted MBOA treatment might synergize with PMSG as part of a synchronization–superovulation regimen in the ewe to increase ovulation rate.