FEED INTAKE AND RUMEN MOTILITY IN DWARF GOATS. 
EFFECTS OF SOME $\alpha_2$-ADRENERGIC AGONISTS, 
PROSTAGLANDINS AND POSTERIOR PITUITARY HORMONES

A.S.J.P.A.M. VAN MIERT AND C.T.M. VAN DUIN
Department of Veterinary Basic Sciences, Division of Pharmacology, Pharmacy and 
Toxicology, Faculty of Veterinary Medicine, Utrecht University, PO Box 80.176, 3508 
TD Utrecht, The Netherlands

ABSTRACT

Effects of some $\alpha_2$-adrenergic agonists, prostaglandins and posterior pituitary hormones. Veterinary 
Research Communications, 15 (1), 57-67

The purpose of the present investigation was to test the hypothesis that drug-induced changes in 
rumen contractions influence feed intake in dwarf goats. Intravenous (i.v.) administration of clonidine 
(1 $\mu$g kg$^{-1}$ min$^{-1}$ for 10 min), xylazine (1 $\mu$g kg$^{-1}$ min$^{-1}$ for 10 min), and PGF$\beta_2$ (10 $\mu$g kg$^{-1}$ min$^{-1}$ 
for 15 min) caused bradycardia and inhibition of rumen contractions. However, no 
appetite-stimulating effect of these drugs was observed. Other clinical changes induced by the 
$\alpha_2$-adrenergic agonists included slight sedation and a decrease in body temperature; all clinical 
effects of clonidine and xylazine were partly antagonized by tolazoline pretreatment (10 $\mu$g kg$^{-1}$ min$^{-1}$ 
for 30 min). These results suggest that the CNS control of feeding differs in ruminants and monogastric 
species.

In dwarf goats fasted for 2 h, i.v. administration of oxytocin (0.01 IU kg$^{-1}$ min$^{-1}$ for 15 min), 
vasopressin (0.01 IU kg$^{-1}$ min$^{-1}$ for 15 min), octapressin (0.003 IU kg$^{-1}$ min$^{-1}$ for 15 min) or PGE$_2$ 
(0.8 $\mu$g kg$^{-1}$ min$^{-1}$ for 15 min) did not change feeding behaviour during the two observation periods 
(0-30 min and 180-210 min after drug infusion, respectively). In previous studies, similar doses of 
these drugs induced changes in heart rate and inhibition of rumen contraction in goats. These 
findings demonstrate that drug-induced changes in forestomach contractions do not simply cause 
changes in feeding behaviour. The i.v. infusion of the PGF$_2\alpha$ analogues etoproston (10 $\mu$g kg$^{-1}$ min$^{-1}$ 
for 15 min), luprostrol (30 $\mu$g kg$^{-1}$ min$^{-1}$ for 15 min), cloprostenol (1 $\mu$g kg$^{-1}$ min$^{-1}$ for 15 min) and 
tiaprost (1 $\mu$g kg$^{-1}$ min$^{-1}$ for 15 min) induced hypophagic effects and stimulated intestinal 
propulsion.

Keywords: $\alpha_2$-agonist, food intake, goat, rumen, posterior pituitary hormone, prostaglandin

INTRODUCTION

In ruminants, the control and co-ordination of (fore)stomach motility is more clearly 
dependent on the central nervous system (CNS) than in many other mammals. 
Salivation, eructation, rumination and reticulorumen motility are controlled through 
nervous reflexes originating partly in the rumen and reticulum. The intensity of the 
reticulorumen contractions and the rapidity with which they sequentially involve 
individual parts of the rumen differ markedly according to whether an animal is being 
fed or fasted. The rate and amplitude of the reticulorumen contractions are 
dependent, in part, on pressure within the forestomach system or on the tension in the 
musculature of its wall. If the reticulum is distended, low-threshold tension receptors 
in its wall are stimulated and the excitatory sensory input to the gastric centres is
increased. This reflexly increases the frequency, the amplitude and the duration of the reticulorumen contractions (Stevens and Sellers, 1959; Titchen, 1968; Leek, 1987).

In mammals, the control of food intake has been attributed to the hypothalamic region of the brain, which integrates both peripheral and central inputs (De Jong, 1987; Morley, 1987). In goats, diazepam significantly stimulated feeding, whereas naloxone had an inhibitory effect (Van Miert et al., 1986, 1989). Both drugs had a moderate effect on forestomach motility: stimulation of the frequency of rumen contractions by naloxone (Van Miert et al., 1985; Van Miert, 1987a) and inhibition of the frequency of these contractions by diazepam (Van Miert et al., 1985).

In laboratory species, prostaglandins $E_1$ and $E_2$ (East and Potts, 1972; Baile et al., 1973; Fargeas et al., 1984; Lal, 1984) and prostaglandin $F_{2\alpha}$ (Doggett and Jawaharlal, 1977; Lal, 1984) inhibit food intake, whereas $\alpha_2$-adrenoreceptor agonists induce hyperphagia (Broekkamp and Van Rossum, 1972; Schlemmer et al., 1979; Katz et al., 1985, 1989). The inhibitory activity of prostaglandins on food intake is probably at both peripheral and central sites. Clonidine, an $\alpha_2$-adrenoreceptor agonist, has been revealed as an effective pharmacological agent for eliciting hyperphagia when injected either centrally into the paraventricular nucleus in the medial hypothalamus or peripherally (Goldman et al., 1985; Katz et al., 1989). Administration of cholecystokinin to rats caused a dose-dependent increase in plasma levels of oxytocin and inhibition of food intake (Verbalis et al., 1986a). In sheep, cloprostenol - a PGF$_{2\alpha}$ analogue - caused a transient rise in plasma oxytocin which lasted up to 40 min (Flint and Sheldrick, 1982). However, circulating oxytocin itself did not reduce food intake or gastric emptying in rats (Verbalis et al., 1986b; McCann et al., 1989).

In goats, vasopressin and octapressin are potent inhibitors of reticulorumen motility; however, these peptides are rather inactive on isolated ruminal smooth muscles (Veenendaal, 1980). The inhibitory activity of clonidine and xylazine on forestomach motility is probably due to $\alpha_2$-adrenoreceptor activation within the central nervous system (Toutain et al., 1982). The effects of prostaglandins are partly dependent on the mode of administration. Both intracerebroventricular injection (Van Miert et al., 1983) and administration of PGE$_2$ via the coeliac artery induced a relatively long-lasting depression of the forestomach contractions (Van Miert, 1987b), whereas injection into the jugular vein caused short-lasting inhibitory effects, PGE$_1$ being more potent than PGF$_{2\alpha}$ (Veenendaal et al., 1980). Concentration-response curves obtained for contraction of goat rumen strips in vitro showed that PGE$_1$ (which has an activity equal to that of PGE$_2$) was more potent in inducing an increase in smooth muscle tone than PGF$_{2\alpha}$ (Veenendaal et al., 1980).

The effects of these drugs on reticulorumen motility add an interesting aspect to their activities in the CNS, since the CNS has been shown to regulate various aspects of forestomach contractions, which in turn could alter feeding behaviour. The principal aim of the present study was therefore to investigate the effects of some $\alpha_2$-adrenoreceptor agonists, prostaglandins and posterior pituitary hormones on feed intake in dwarf goats. Based on reticulorumen motility studies, only one single dose per drug was tested. It has previously been demonstrated that these selected drug doses cause moderate inhibition of forestomach contractions (Veenendaal, 1980; Veenendaal et al., 1980; Toutain et al., 1982).