

EFFECT OF PROSTAGLANDIN F₂ ALPHA ON THE BOVINE FETAL RUMINAL WALL IN VITRO

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ABSTRACT

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Strips of rumen wall from bovine fetuses were incubated in an organ bath with prostaglandin F₂ alpha (0.13 to 33.76 µg/ml). The highest reactivity with a submaximal dose (17.03 µg/ml) was observed in the period between 3.0 and 7.9 months of fetal age. A smaller response, but higher than in 1.0 to 2.9 months old fetuses, was observed in the 8.0 to 8.9 months fetuses. The period of the highest reactivity to prostaglandin F₂ alpha coincides with the age of onset of papillary morphogenesis and the period of highest reactivity to autonomic and putative transmitter drugs.

INTRODUCTION

It is well known that in adult ruminants ruminal motility is controlled by both extrinsic (sympathetic and parasympathetic nerves) and intrinsic (probably located in the myenteric plexus) innervation (Habel, 1956; Morrison and Habel, 1964; Taneike and Ohga, 1975; Arias, 1978). However, other mechanisms and neurotransmitters have been reported as participants in the control of gastrointestinal motility in vertebrates (Burnstock, 1979a).

In an attempt to clarify the mechanisms controlling ruminal motility and their participation in ruminal wall morphogenesis we have already studied the responses of the fetal ruminal wall to cholinergic and adrenergic drugs (Arias et al., 1979a, 1980a).

However, apart from adrenergic, cholinergic and purinergic nerves, several other putative transmitters have been proposed for autonomic nerves (Burnstock, 1979b). Among these, the effect of 5-hydroxytryptamine on fetal rumen has been analyzed by us (Arias et al., 1980b).

In the present study, particular attention is paid to the occurrence and quantity of the pharmacological reactivity of prostaglandin F₂ alpha (PGF_{2α}) during fetal rumen development.

MATERIALS AND METHODS

Pieces of ruminal wall (ventral sac) from crossbred bovine fetuses 1.0 to 9.0 months old determined according to Roberts (1956) were collected at slaughterhouses, put in flasks with dry-ice and then transferred to the laboratory. Cranio-caudal strips 2.5 x 0.5 cm long were obtained and suspended in a 30 ml organ bath using Krebs' modified solution (Arias et al., 1979a) at 39°C. The recording system consisted of a force-displacement transducer connected to a Gilson M5P polygraph.

PGF_{2α} as Dinoprost tromethamine (Lutalyse^r, Upjohn, Sussex) 5 mg/ml was used. It was added to the bath to obtain concentrations from 0.13 to 33.76 µg/ml. The successive and cumulative doses of the drug were added at one-minute intervals to the bath.

Analysis of variance was used to examine variance due to differences in fetal ages and in concentration of the drug. The Test of Least Significant Difference (LSD) was used to compare fetal age response with the submaximal dose of the drug (Calzada, 1964). Linear regression was used to establish dose-effect relation. Analysis of covariance was used to compare the regression of the dose-dependent effects of the different fetal ages.

RESULTS

Effect of PGF_{2α} on the spontaneous movements of the fetal ruminal wall

Concentrations of PGF_{2α} from 0.13 to 33.76 µg/ml did not provoke the appearance of movements in those preparations which presented no spontaneous movements (21 of 106 samples).

Effect of PGF_{2α} on the tonus of the isolated strips

An increase in tone of all the 106 preparations grouped between 1.0 to 9.0 months of age was observed (Table I). This increase was significantly different between the concentrations used (Fig. 1) and the dose-dependent effects in the different groups were similar.

Fig. 2 represents the magnitude of tonus increment produced by a submaximal dose of the drug (17.03 µg/ml). The fetuses between 3.0 and 7.9 months of age responded with the maximum tone. The 8.0 to 8.9 months old fetuses showed lesser responses as compared with the preceding ages, except with 2.0 to 2.9 months old fetuses.

According to those ages which have been described as key periods in the differentiation of the ruminal wall (Arias et al., 1978, 1980c), the observations were regrouped in 1.0 to 1.9, 2.0 to 2.9, 3.0 to 7.9 and 8.0 to 8.9 months old