Effects of Dopamine on Cyclic AMP Concentration in the Anterior Pituitary Gland in vitro*

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Summary

Effects of different concentrations of dopamine on the cyclic AMP concentration in the rat anterior pituitary gland were investigated in vitro. Low concentrations of dopamine (10^{-9}–10^{-8} mol/l) were found to decrease, whereas the high concentration (10^{-5} mol/l) increased the cyclic AMP concentration in pituitaries collected from ovariectomized and estradiol-treated females. In contrast, dopamine had no effect on the anterior pituitary cAMP concentration when pituitaries were collected from ovariectomized rats which had not received estrogen replacement. These data show that the action of dopamine on the anterior pituitary cAMP largely depends on the dopamine concentration and the hormonal state of animals.

Key words: Dopamine, cyclic AMP, anterior pituitary.

Introduction

Dopamine (DA) has been shown to act directly on the anterior pituitary gland, inhibiting prolactin release (Mac Leod, Fontham, and Lehmeyer, 1970) and adenohypophysial cell proliferation (Pawlikowski et al., 1978).

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The presence of DA receptor within the anterior pituitary gland has been demonstrated by means of a specific radioligand binding (Brown et al., 1976; Creese et al., 1977; Calabre and Mac Leod, 1978). The existence of two categories of DA receptors was postulated: D1 type which increases cAMP synthesis and D2 type which seems not to involve cAMP accumulation (Kebabian and Calne, 1979). The adenohypophyseal DA receptor is considered as belonging to D2 category (Kebabian and Calne, 1979). Nevertheless, the studies of DA effects on the anterior pituitary cAMP concentration and/or formation, have produced conflicting results. Some authors did not observe any effect of DA on the pituitary cAMP (Schmidt and Hill, 1977). In the other studies, however, DA was found to suppress the adenylate cyclase activity (de Camilli et al., 1979) and to lower cAMP concentration in the anterior pituitary (Ray and Wallis, 1980). In contrast, Ahn et al. (1978) reported a stimulation of the adenohypophyseal adenylate cyclase by DA. In a previous study, we did not find any alteration of cAMP level in the male rat anterior pituitary, exposed to DA (5 × 10⁻⁶ mol/l). Nevertheless, the same DA concentration inhibited significantly the cAMP-accumulating effect of TRH (Pawlikowski et al., 1979). In the present paper we show that DA effects on the pituitary cAMP level largely depends on the DA concentration and the hormonal state of animals.

Materials and Methods

Pituitaries were obtained from female Sprague-Dawley rats (initial body weight: 140—150 g) killed by decapitation about 10 a.m. Eight days before the decapitation the animals were ovariectomized; 48 hours and 24 hours before the decapitation the rats received estradiol benzoate 250 µg or 0.5 ml of olive oil per rat, subcutaneously. The hemipituitaries were incubated in plastic tubes containing TC 199 (Difco). The incubations were performed at 37 °C under the atmosphere of 95 % O₂ and 5 % CO₂ for 20 min. Dopamine hydrochloride (Organica UCB) was added to some incubation media at different concentrations. Dopamine solutions had been freshly prepared. After the incubation, the hemipituitaries were frozen with solid CO₂ and methanol. Then they were homogenized in absolute methanol (20 µl/mg⁻¹ of tissue). The cyclic AMP was estimated by means of the Amersham Radiochemical Center Assay Kit. The results were statistically evaluated by Student's t-test or Cochran-Cox's C-test.

Results

As shown in Fig. 1, the incubation of the anterior pituitary lobes collected from ovariectomized and oil-treated rats in the presence of