The effects of caffeine on adenosine and dopamine receptor density in rat striatum

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Caffeine is an adenosine receptor antagonist with marked psychomotor stimulant effects. Substantial evidence suggests that the motor stimulant effects of caffeine are mediated, at least in part, by antagonistic interactions between specific adenosine and dopamine receptor subtypes located in the basal ganglia (Ferre *et al*, 1997). Studies have shown that treatment of pregnant rats with caffeine caused a 30-50 % down-regulation in the expression of the A_1 receptor in mothers and full-term foetuses, (Leon *et al*, 2002). This study examines the effect of caffeine on the density of A_1 A_{2A}, D_1 and D_2 receptors.

Male wistar rats (150-250 g) were injected i.p. with 100 mg/kg caffeine on four consecutive days. The control group received saline. All animals were killed 14 days post treatment and the striata were dissected out. Saturation binding experiments were used to determine the densities of A_1, A_{2A}, D_1 and D_2 receptors in both groups. [^{3}H] DPCPX (0.07-2.54 nM) was used to label A_1 receptors and 1 µM CPA was to determine non-specific binding. For the A_{2A}, D_1 and D_2 receptors [^{3}H] ZM 241385 (0.13-5.6 nM) and SCH 58261 (1 µM), [^{3}H] SCH 23390 (0.06-2 nM) and flupentixol (1 µM), and [^{3}H] spiperone (0.06-2 nM) and domperidone (1 µM) were used to determine receptor density and non-specific binding, respectively.

All radioligands bound to a single, saturable population of sites. Receptor density (B_{MAX}) and apparent dissociation constant (K_D) values were obtained for all four receptors in both groups (Table 1). Control values correlated with those found previously. No significant differences between control and caffeine treated groups were found for any receptor examined ($p > 0.05$; t test).

Table 1. Effect of caffeine on receptor density and affinity in rat striatum

	Control		Caffeine	
Receptor	B_{MAX}	K_D	B_{MAX}	K_D
A_1	30.3±1.1	0.28±0.03	30.1±1.0	0.29±0.03
A_{2A}	98.7±14.2	4.8±1.19	68.3±12.7	3.15±1.15
D_1	26.3±1.4	0.41±0.06	44.6±9.0	1.2±0.6
D_2	13.5±2.2	0.39±0.18	14.1±2.0	0.49±0.18

m±SEM, n= 4 for all conditions. B_{MAX} in fmol/mg tissue; K_D in nM

These results indicate that under the conditions employed in this study, caffeine administration to rats did not alter the density of A_1 A_{2A}, D_1 or D_2 receptors in striatal tissue.

Ferre S *et al*, (1997) Trends Neurosci 20: 482-487
Leon D *et al*, (2002) J Neurochem 82: 625-34

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