EFFECTS OF CAFFEINE ON CORPORAL CIRCULAR SMOOTH MUSCLE OF GUINEA-PIG STOMACH

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1. Effects of caffeine on the smooth muscle segments isolated from various regions of the gastrointestinal tracts of guinea-pig were investigated with special reference to the mechanisms of relaxant action of the drug on the corporal circular smooth muscle of the stomach.

2. Higher concentrations of caffeine (>5mM) produced a contraction of longitudinal muscles isolated from the corpus, ileum, taenia coli and rectum, and of circular muscles from the antrum and caecum. On the other hand, caffeine caused mainly a relaxation of the corporal circular muscle. The relaxation appeared at 20 μM and increased in magnitude with increasing concentrations until it attained a maximum at 2mM.

3. The caffeine-induced relaxation of the corporal circular muscle was not affected by tetrodotoxin (0.1 μM) or by exposure to isotonic KCl solution.

4. Omission of Mg from Krebs solution tended to inhibit the relaxation induced by lower concentrations (20 μM–0.1mM) of caffeine.

5. Nifedipine (10–100 μM) and caffeine (1–10mM) caused a dose-dependent inhibition of the contraction induced by high-K (123mM).

6. Carbachol (1 μM) produced a biphasic contraction of the corporal circular muscle. Nifedipine (100nM) and caffeine (<1mM) selectively inhibited tonic and phasic contractions, respectively.

7. In Ca-free isotonic-KCl solution, caffeine (<1mM) inhibited the contraction induced by readmission of Ca and by carbachol. However, when carbachol was applied again after the removal of caffeine, the contraction was significantly increased.

8. Caffeine (0.5 and 10mM) did not affect ^{45}Ca uptake during incubation with standard Krebs solution but tended to inhibit it during exposure to high-K (63.5mM) solution. On the other hand, ^{45}Ca efflux was apparently increased by caffeine (10mM).

9. These results suggest that caffeine causes a relaxation of corporal circular smooth muscle by decreasing Ca release from some intracellular pool in lower concentrations and by increasing Ca efflux in higher concentrations, respectively. Other possible mechanisms of caffeine-induced relaxation were also discussed.