EFFECT OF MODELED MICROGRAVITY CONDITIONS ON RAT INTESTINAL TRANSIT

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Exposure to weightlessness and modeled microgravity leads to modifications of several physiological processes whose mechanisms are not clearly understood. The modification or the loss of the gravitational force vector strongly affects many fundamental cellular functions (1). This study aimed to determine whether conditions of modeled microgravity, using a three dimensional clinostat (Random Positioning Machine, RPM) influence the rat intestinal transit and the expression of enzymes involved in intestinal transit and secretion such as the inducibile isoform of nitric oxide synthase (iNOS) and ciclooxygenase (COX-1 and COX-2) in rat stomach and colon. Wistar rats were individually kept for 48 hours in a transparent perspex semicylinder fixed in the center of the inner frame, rotating within a second rotating frame, driven by separate motors (RPM). Rotation of each frame is random, autonomous and regulated by computer software in order to obtain, in the center of the inner frame, 0 g simulated conditions. Since our previous experiments revealed a strong effect of stress in the induction of modeled microgravity conditions to rule out a possible effect of immobilization stress we have included 3 groups of rats: (RPM), individually kept in the semicylinder and 2 control groups on the floor of RPM with rats being individually kept either in a standard cage (CC) or immobilized in the semicylinder (CG). The effect of modeled microgravity conditions on small intestinal transit, in unanaesthetized rats, was studied using the charcoal method (2). Samples of rat colon and stomach were excised and processed for Western blot analysis for iNOS, COX-1 and COX-2. Our data indicate a reduction of rat intestinal transit in both immobilized groups, RPM and CG with respect to the control CC. To further elucidate the mechanism by which immobilization modifies rat intestinal transit time we performed Western blot analysis on rat colon and stomach to assess whether the immobilization stress or RPM could influence the expression of iNOS, COX-1 and COX-2. Data obtained from Western blot analysis showed that RPM significantly ($P<0.01$) affected iNOS but not COX-1 and COX-2 expression in rat colon and, did not influence iNOS, COX-1 and COX-2 expression in stomach. These effects seem to be related partly to RPM and partly to immobilization stress. This animal model offers the opportunity to explore gastrointestinal protein expression changes and may provide new insights into the adaptive mechanisms that take place during space shuttle missions.

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[2] Di Carlo G. et al. (1994) Phytotherapy. Research 8, 42-45.