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SHORT COMMUNICATIONS

A Single Dose of a Non Selective β-Adrenergic Agonist Increases Bone Protein Synthesis

Tissue protein turnover is under nutritional and neuroendocrine regulation. Thus, it has been repeatedly reported that different hormones, nutrients and growth factors may influence protein synthesis and breakdown processes.

In this context, adrenaline and other structurally related compounds may act either as neurotransmitters but also as hormones through specific receptors affecting metabolic pathways (4). Thus, some catecholamines with affinity for β-receptors have shown repartitioning properties by increasing protein deposition at the expense of fat stores (1).

The aim of this report is to present the effects of the acute administration of a non selective β-adrenergic agonist on protein synthesis of bone tissue through the incorporation of labeled amino acids into tissue protein.

Male Wistar rats were obtained from the Center of Applied Pharmacobiology (Pamplona). The animals were fasted overnight and were randomly divided into two groups of six animals. One group received a subcutaneous injection of Metaproterenol (1 mg/kg), while the control group was injected with saline. Rats were killed by cervical dislocation 15 minutes later. Tibia was excised and kept in liquid nitrogen. Blood samples were collected in EDTA and plasma was kept at –20 °C until assayed. The rate of protein synthesis (ks; % day) was *in vivo* assessed by the phenylalanine flooding dose method as validated for i. p. injection (5). Proteins and glucose in plasma were determined by conventional procedures. Results are expressed as means with the S.E. Means were compared by Student's *t* test and differences were considered significant when $p < 0.05$.

Previous studies have shown the homeorhetic properties of the chronic treatment with the non selective β-adrenergic agonist Metaproterenol by influencing body composition and muscle protein turnover (11), while the liver was not apparently affected (10). However, this current experiment was devised to evaluate protein synthesis after a single administration of the β-agonist in a tissue with a low protein turnover such as bone. Previously, experiments conducted in osteoblasts have demonstrated the occurrence of β-receptors. However, their physiological significance remains unknown (3).

The acute treatment with Metaproterenol significantly increased ($p<0.05$) the fractional rate of protein synthesis in tibia (31 %), as compared with control

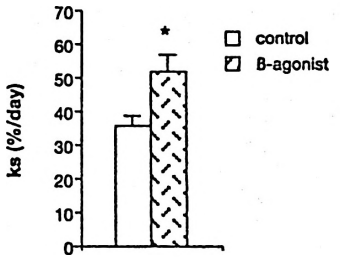

Fig. 1. *Effect of an acute treatment with a β-adrenergic agonist, metaproterenol (1 mg/kg), on fractional rate of bone protein synthesis (ks; %/day) in rats.* Mean values ± S.E. *$p < 0.05$.

group (fig 1). Likewise, glucose in plasma was significantly higher ($p<0.05$) in the animals treated with the β-agonist (127 ± 9 vs 150 ± 3 mg/dl), which is in agreement with the β-adrenergic agonists hyperglycemic effect observed by other authors (2). However, plasmatic proteins were not modified by the treatment with Metaproterenol (51.6 ± 2.9 vs 46.8 ± 1.7 g/l). Few data have been found in the literature regarding the role of the β-adrenergic receptors in bone. MINKOWITZ *et al.* (9) observed an alteration of bone properties along with a rise in endochondral ossification from rats treated with propranolol, a non specific β-blocker. Even though these results are not comparable with our data, both experiments reveal the existence of a mediated β-adrenergic receptor control mechanism on bone protein metabolism.

These results agree with the effects observed after an acute administration of other homeorhetic substances such as growth hormone (6) and insulin-like growth factor I (IGF-I) on bone protein synthesis (7). Besides, the influence of the chronic treatment with Metaproterenol on protein anabolism had been previously reported through an increase in muscle protein synthetic activity (8). The additional information that is obtained with this short-term treatment provides evidence of a direct effect of these compounds on bone growth, although indirect mechanisms mediated by hormones can also play an essential role after chronic administration with β-adrenergic agonists (12).

Key words: β-adrenergic agonist, Metaproterenol, Bone, Protein synthesis.

Palabras clave: Agonista β-adrenérgico, Metaproterenol, Hueso, Síntesis proteica.

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