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In vivo Assessment of Muscle Protein Synthesis as Affected by Exogenous Somatotrophin

Growth is a complex and integrated process, which is generally assumed to involve an increase in protein mass (17). In this context, protein deposition can be achieved by various combinations of changes in protein synthesis and breakdown, which are under endocrine and nutritional regulation (17). The endogenous hormones controlling growth include somatotrophin, glucocorticoids, oestrogenic and androgenic steroids, insulin, thyroid hormones and a number of peptides known as growth factors (11).

Somatotrophin or growth hormone (GH) is a protein secreted by the anterior pituitary with wide effects on fat and carbohydrate metabolism (4, 7, 9). The growth-promoting activity of exogenous administration of GH and the effects on muscle protein synthesis have been difficult to demonstrate in intact rats by the lack of reliable techniques, the scarcity of pure preparations of this hormone and the complexity of the factors to be considered such as dose, stage of development, sex, nutritional and endocrine situations (3, 8, 9). Surprisingly though, little is known of the action of somatotrophin on *in vivo* protein turnover in normal rodents, since all studies conducted to date have been carried out in GH sensitive animals (hypophysectomized or dwarfish) or *in vitro* conditions (1, 2, 5).

Our aim was to evaluate further the effect of GH on *in vivo* muscle protein biosynthesis in young female rats.

Eighteen female intact Wistar rats weighing 50-55 g were used. The animals were fed a standard commercial diet while free access to water was allowed being killed between 10 and 12 h a.m. after an overnight fasting period of 14-16 h. Protein synthesis rate (Ks) was *in vivo* assessed in the gastrocnemius muscle by using the phenylalanine flooding dose method (6) as validated for i.p. injection (13). They received a single s.c. dose (60 μg) of Rat GH (rGH) 40 min before the kinetic determinations were performed.

It has long been recognized that exogenous GH promotes protein synthesis in tissues from hypophysectomiced rats (5, 16). However, all those effects have been demonstrated in GH sensitive animals or *in vitro* preparations (1, 2, 12). Our measurements indicate that the *in vivo* mean of fractional protein synthesis in the gastrocnemius muscle was significantly increased in the somatotrophin-treated (16.9 ± 3.4 %/day) female rats as compared to controls (13.3 ± 2.6 %/day). The consistency and magnitude of responsiveness to GH depends upon developmental, hormonal and nutritional interactions (3, 11, 15). Thus, GH is elevated during fetal life and in early postnatal periods in many species (9), while females display more continuous secretion of GH with lower irregular peaks and higher baseline values than males (12). Furthermore, somatotrophin seems to play an important role in the partitioning of nutrients between muscle and adipose tissue and for preserving protein reserves during nutritional deficiency and fasting (1, 3).

In spite of the fact that recent findings

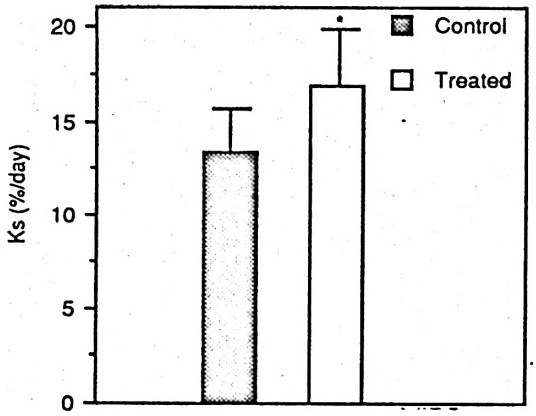

Fig. 1. *Gastrocnemius muscle fractional protein synthesis from control and trated rats with rGH.* Mean values ± SD (n=9). Student «t» test was used (*$p < 0.01$).

support the assumption that somatomedins mediate the anabolic functions of GH (10, 14), we are tempted to argue that the observed immediate effects are due to GH itself, since synthesis of somatomedins takes some 6-8 h to become apparent and 24-36 h to reach maximal concentration after somatotrophin administration (9, 15).

The evidence suggests, for the first time by using an *in vivo* approach, a permissive action of GH on muscle protein turnover from normal rats, which might be indicative of a role for somatotrophin in short-term control of protein synthesis in muscle.

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Key words: Somatotrophin, Muscle protein synthesis.

Palabra clave: Hormona de crecimiento, Síntesis proteica muscular.

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