The Effect of Growth Hormone Secreted by Mild Exercise on Fatty Acid Mobilization in Patients with Diabetes Mellitus

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It is known that GH stimulates fatty acid mobilization [1]. However, it remains to be clarified whether GH-induced lipolysis plays an important role physiologically in vivo. Recently, it has been reported that visceral fat accumulation is a risk of arteriosclerosis [2]. It is also observed that visceral fat increases in patients with GH deficiency, and that GH administration decreases the visceral fat [3]. These reports suggest that GH might be a regulatory factor for visceral fat. We previously reported that GH had a stimulatory effect on lipolysis in rat visceral adipose tissues in vitro. In this paper, to clarify the physiological role of GH in the lipolysis in vivo, we studied the relationship between the GH levels secreted on mild exercise and the fatty acid mobilization in patients with non-insulin dependent diabetes mellitus (NIDDM). Furthermore, GH-induced lipolysis in human visceral and subcutaneous adipose tissues were studied in vitro.

Materials and Methods

In vivo study

The subjects were 10 patients with NIDDM (4 men, 6 women; mean age, 54). At 2 h after a meal, they took mild exercise corresponding to 50% of the maximum oxygen consumption for 20 min by treadmill. Blood samples were obtained just before and after the exercise, and serum GH, adrenaline, free fatty acid, glycerol, ketone body, insulin and glucose were measured.

In vitro study

Subcutaneous and visceral adipose tissues were obtained from patients at gastrotectomy and cut into pieces (2 mm³). One hundred mg of subcutaneous and visceral adipose tissues was put into the tefron tube containing 4.0 ml of Dulbecco's modified Eagle medium, 20 mM Tris HCl, pH 7.4, and 4% fatty acid-free bovine serum albumin (Sigma) with human GH (Sumitomo Pharmaceuticals Co., Ltd/Pharmacia AB) 10 ng/ml or adrenaline (Daichi Pharmaceutical Ltd.) 100 ng/ml. After incubation for 1 h at 37 °C, free fatty acid levels in the incubation medium were measured.

Results and Discussion

It is known that exercise stimulates GH secretion in normal subjects. The present study showed that patients with NIDDM were devided into two groups: one group (n=6) were GH-responders whose serum GH levels increased more than 1 ng/ml, and the other group (n=4) were GH-nonresponders whose serum GH levels increased less than 1 ng/ml (Fig. 1). In GH-responders, increases in serum FFA, glycerol and ketone body were much more remarkable than those in GH-nonresponders (Fig. 2). AFFA was correlative with OGH rather than with Aadrenaline (Fig. 3). These results indicate that fatty acid mobilization could occur dominantly in GH-responders, because an increase in FFA was associated with increases in...
Glycerol and ketone body. Furthermore, it is suggested that fatty acid mobilization on mild exercise could be dependent on GH.

A decrease in serum glucose and an increase in serum lactate were more remarkable in GH-responders than those in GH-nonresponders, and glucose was reversely correlated with GH. These results suggest that secreted GH during exercise did not work as insulin antagonist, but worked as the agonist. This mechanism is unclear and should be further studied.

To clarify whether FFA induced on mild exercise is generated from subcutaneous adipose tissues or visceral one, GH-induced lipolysis was studied in vitro (Fig. 4). GH (10 ng/ml) preferentially enhanced the release of FFA from the visceral adipose tissues compared with subcutaneous adipose tissues (P<0.01). The addition of adrenaline released FFA in both tissues, and there were no differences between these tissues.

From these results, we conclude that GH secretion on mild exercise could play a role in fatty acid mobilization, and that GH-induced lipolysis occurs dominantly in visceral adipose tissues.
References