ROLE OF GROWTH FACTORS IN ADAPTATIVE RESPONSES TO TRAINING AND REPAIR FROM LOCAL MUSCLE TISSUE INJURIES

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It is clear that there must be local factors regulating the repair and adaptation process of skeletal muscle. If one were to train just one muscle then it is that muscle which adapts, or hypertrophies, not all of the muscles of the body.

For a muscle to adapt there are two requisites. The first is that there must a net gain in protein and the other is that new nuclei must be provided to maintain the ratio of DNA to protein as fibre size increases. Recent work has focused on the role of insulin like growth factor I (IGF-I) as a local growth and repair factor in muscle. IGF-I was traditionally viewed as being produced in the liver under the control of growth hormone. It is now clear that many other tissues, including muscle produce IGF-I for local autocrine and paracrine action. Evidence is now emerging that the IGF-I gene may be spliced to give slightly different peptides with different physiological functions. We have recently shown that an acute bout of strength training exercise induces the increased expression of a splice variant of IGF-I termed mechano growth factor (MGF) 2•'5f hours after the exercise bout (1).

Animal studies have shown that the MGF splice variant is associated with rapid muscle growth. Whilst MGF seems to react very quickly rapidly to an exercise stimulus, it seems that the time course of expression of the IGF-I isoforms commonly found in the liver (IGF-IEa) is much slower. It seems that the role of the two isoforms may be different. MGF seems to be acting in a "rapid response" manner, probably by activating satellite cells, whilst IGF-IEa may have a dominant role in the stimulation of protein synthesis (3).

The eccentric or lengthening component of a contraction can cause considerable muscle damage and soreness. However, this effect appears not to be long lasting with some form of protection afforded by an initial bout of exercise when subsequent bouts are performed. Recent studies have shown that muscle damaging eccentric exercise is associated with a marked MGF response (2). Indeed it is possible that MGF serves not so much as a growth factor, but as a repair factor.

The upregulation by muscle of different IGF-I isoforms with different physiological roles, sits well within the hypothesis that micro damage stimulates compensatory repair mechanisms, which result in increased protein synthesis and satellite cell activation.

References

1. Hameed M et Al. Expression of IGF-I splice variants in young and old human skeletal muscle after high resistance exercise. J Physiol 547: 247-254, 2003.

2. Hameed M et Al. The effects of eccentric exercise on IGF-I isoforms expression in the muscles of young and elderly people. Journal of Muscle Research & Cell Motility 24375, 2004.

3. Yang, SY & Goldspink G Different roles of the IGF-I Ec peptide (MGF) and mature IGF-I in myoblast proliferation and differentiation. FEBS Lett 522, 156-160, 2002.