Adaptation to strength training & whole-body vibration

With special emphasis on neuromuscular, hormonal and molecular responses

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ABSTRACT

The present PhD dissertation has been completed at the Institute of Sport Science and Clinical Biomechanics, University of Southern Denmark. In Study I the main intervention was suppression of endogenous production of testosterone by the use of a GnRH-analogue, which enabled us to study the role of testosterone in the adaptations to strength training. The treatment with the GnRH-analogue effectively suppressed the resting levels and blocked the acute increase in serum testosterone in response to strength training. Suppression of serum testosterone below 10% of normal levels strongly attenuated the increase in lean mass and muscle strength and increases fat mass during strength training. The absence of the acute increase of testosterone, however, had no influence on the acute mRNA expression of myoD, myogenin, myostatin, IGF-IEa, IGF-IEb, IGF-IEc, and androgen receptor after the strength training session. Similarly, the lower resting level of testosterone had no effect on the resting mRNA expression before or after the strength training period. Thus, indicating that testosterone is not a main regulator of the above-mentioned hypertrophic signalling genes.

Study II was designed to evaluate a new strength training method known as whole body vibration (WBV), thus to investigate whether WBV combined with conventional strength training induces a higher increase in neuromuscular and hormonal measures compared with conventional strength training or WBV, respectively. Combining WBV and conventional strength training did not additionally increase isometric strength and mechanical performance compared with strength training alone after a training period. Rather, the combination seemed to partly inhibit the adaptation to the training stimulus. In addition WBV alone showed no increases in isometric strength and mechanical performance after the same training period.

Prescription of strength training for hypogonadale men and/or men with metabolic syndrome or men receiving treatment with GnRH-analogues seems to be fruitful intervention for these populations, since strength training is a potent stimulus to the anabolic androgenic endocrine system and prevents loss of muscle mass and muscle strength. Furthermore, a better understanding of the gene expression underlying muscle hypertrophy may help develop effective intervention regimes for muscle wasting diseases or age related sarcopenia. As well, the same knowledge has implications for development of detection methods in future doping control, an area of heavy debate and certainly a field crying for solutions. Finally, WBV may be used in rehabilitation and in the prevention of osteoporosis.