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Effect Of Plyometric Training On Mechanical Properties Of Human Single Muscle Fibres: 1520 10:30 AM - 10:45 AM

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Currently there is only limited information on the changes that occur in muscle contractile properties following plyometric training. Such training is characterized by repetitive stretch-shortening cycles (eccentric muscle contractions followed immediately by concentric contractions) of the leg extensor muscles.

PURPOSE

The aim of this study was to determine the effects of plyometric training on contractile functions of fast and slow-twitch muscle fibre.

METHODS

Muscle biopsies were obtained from the vastus lateralis of 4 men (age 23.0 ± 0.8 years, body mass 65.0 ± 9.8 kg) before and after 8 weeks of a plyometric training. The subjects performed an average of 120 maximal jumps 3 times a week. One-repetition maximal force of knee extensors (leg press), vertical jump and running speed on a shuttle run were measured 2 days before both biopsies. Single skinned muscle fibres were studied at 15°C for cross sectional area (CSA), peak force (P_o), maximal velocity of shortening (V_o), force-power relationship and calcium sensitivity. Passive characteristics were also measured by a progressive stretch protocol. MHC isoform composition was determined on each single fibre after the mechanical experiments.

RESULTS

The vertical jump performance was increased by 13% ($P < 0.05$) after training and the shuttle run by 3% ($P < 0.05$). No significant changes were measured for one-repetition maximal force. Training increased CSA of MHC I and MHC IIa by, respectively, 28% and 13% ($P < 0.05$) with no

changes for MHC IIx. P_o was not changed for any MHC isoform but peak normalized force of MHC I was decreased by 12% ($P < 0.05$). V_o was increased by 22%, 32% and 33% for, respectively, MHC I, MHC IIa and MHC IIx ($P < 0.05$). Peak power was increased by 23%, 39% and 81% for MHC I, IIa and IIx respectively ($P < 0.05$). Calcium sensitivity was increased only for MHC I (pCa_{50} : 5.89 and 6.00 before and after training, $P < 0.05$). Passive stretch characteristics were not significantly changed. No change of the MHC isoform composition was observed.

CONCLUSIONS

The plyometric training improved the subjects' performances during the vertical jump and the shuttle run. These improvements could be partly explained by an increase in the power produced by the contractile apparatus, independently of muscle fibre type. Increases in power were largely due to enhancements of the maximal shortening velocity.

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