DISTRIBUTION OF DIFFERENT FIBRE TYPES IN NUMAN SKELETAL MUSCLE AND THEIR RELATION WITH NEUROMUSCULAR PERFORMANCE

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Introduction

The physiological, morphological, and biochemical responses of skeletal muscle have been extensively studied. Several recent studies have correlated different functional capacities of the intact human skeletal muscle, such as endurance, contraction velocity and strength, to the distribution of different fibre types in the muscle. A number of these studies have indicated that the tension per cross-sectional area unit is greater for the Type II (fast-twitch) fibers than for the Type I (slow-twitch) fibres. The purpose of this study was to compare twitch, tetanic, maximal voluntary contraction (MVC) with histochemically determined fibre type parameters in the triceps surae muscle group.

Methods

Sex subjects males volunteered for the study. Five the subjects were between the age of 20 and 30 years and one male was 38 years of age. The groups represented a variety of physical activity profiles, although none were considered extremely sedentary. The initial physical activity patterns for all subjects remained unchanged over the course of the investigation. The contractile properties of the triceps surae muscle group were measured using similar methods and procedures as described by Koryak (1995). The right leg was firmly clamped in a specially designed leg dunamometer in a standard position at a knee joint angle between the tibia and the sole of the foot 90°. The isometric twitch and tetanic contractions of the triceps surae muscle were induced by electrical stimulation of the tibial nerve supramaximal rectangular electrical pulses of 1 ms duration with a frequency of 150 Hz for the tetanic contractions [Koryak, 1995]. Stimulation of the tibial nerve was by a monopolar electrode. Twitch contractile measurements was included peak-twitch tension (P_t), time-to-peak tension (TPT), and half-relaxation time (1/2RT). Tetanic tension (P_o) were recorded during stimulation at 150 Hz at 30-40 V [Koryak, 1995]. The third test consisted of three MVC. The highest force of the three trials was recorded as the MVC. Within two day of the measurement of the contractile properties, needle muscle biopsies, using the technique described by Bergstrom (1962). The sample was taken from the belly of the right lateral gastrocnemius (LG) muscle. The samples were immediately frozen in cooled isopentane (using liquid N_2) and stored at -80° C. Serial section, 10 μm in thickness, were cut from each sample using a cryostat maintained at -20° C. The sections were stained for myo-ATPase after alkaline (pH 10.4) or acid (pH 4.3) pre-incubation (Brooke, Kaiser, 1970). To classify the fibers as either Type I (ST) or Type II (FT), between 75 and 300 fibres were counted in each of the two myo-ATPase stained sections.

Results

Baseline data showed that the subjects had a significantly lower mean MVC (485.6 ± 38.3 N) compared to P_o (624.9 ± 41.2 N). Twitch tension (P_t), TPT, and 1/2RT agreed closely with values published previously (Vandervoot, McComas, 1986; Koryak, 1995). The histochemical parametrs determined from the biopsy samples of the LG indication that the average distribution of ST fibres in the biopsy samples was 49.4 ± 14.4 % with a wide range of values from 30 to 91 %. Significant positive correlations were obtained for % ST and TPT ($r = 0.61$; $p < 0.05$), % ST and 1/2RT ($r = 0.81$; $p < 0.01$), and negative correlations were obtained for % ST and P_o ($r = -0.86$; $p < 0.01$). P_t and MVC forces did not show significant relationship with % ST fibres.

Conclusions

The absence of a relationship between contractions properties and fibre type distribution in some experiments may be attributed to use the voluntary contraction the features of which are an integral reflexion of both contractile properties of the muscles and the peculiarities of their CNS.

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GENERAL AND SPECIAL WORKING CAPACITY OF TRACK AND FIELD ATHLETES SPRINTERS AND STAYERS

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Physical working capacity is referred to the number of integral showings which are widely used for trackmen's potentiality estimation. There is a multitude of methods to define physical efficiency: based on maximum oxygen consumption measurement (MOC), PWC_{170} test submission, lactic acid accumulation, anaerobic boundary, etc. The following questions arise fair-mindedly: Is only one and the same state evaluated by these methods? Are all the sides of physical efficiency diagnosed? Is it better to evaluate general or specific capability? How to define which defining method is the most suitable for physical condition evaluation?

As it is known, the work-out session in track and field is aimed at the development of either sprinter or stayer functional capabilities. In the previous work (Lazareva E.A., 2003) it was found that the defining of general physical efficiency with such a popular me-