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NEUROMUSCULAR FATIGUE OF ATHLETES, ENGAGED IN ENDURANCE AND EXPLOSIVE CONTRACTION TYPE SPORTS

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Numerous animal studies reported about the relationship between innervation frequency and the muscle fibre properties (for review see Pette and Staron 1997; Gundersen 1998). However, there is little information in the literature about the relationship between electromyographical parameters and different muscle types in athletes. Kupa et al. (1995) and Gerdle et al. (1997) reported close links between the median / mean power frequency (MPF) of the EMG-signal and muscle morphology. The aim of this study was to compare the EMG pattern during muscular contraction in four different groups of athletes.

EMG and force measurements were taken from three heads of the M. quadriceps femoris of 12 volleyball players (VG), 12 sprinters (SG), 12 marathon runners (MG), and 12 control subjects (CG, not specifically trained physical education students) in isometric contractions from 10% of the maximum voluntary contraction (MVC) to 90% MVC. All subjects performed at each force level 10 trails (5 seconds of contraction) with a rest of 5 seconds in between until the required force could not be achieved any more.

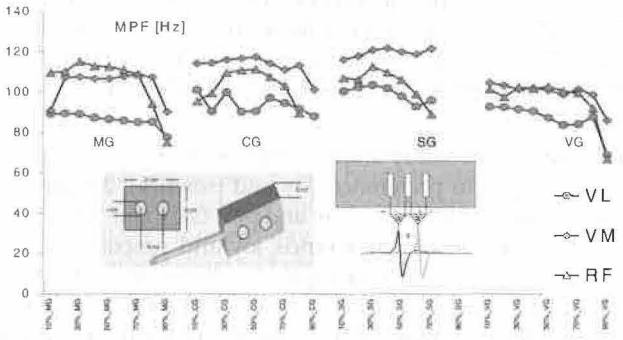

Fig.1. MPF of the vastus lateralis (VL), vastus medialis (vm) and rectus femoris (RF). VL was measured with the 2-channel electrode (right side). VM and RF were measured with normal EMG-electrodes (left side).

		N	MG[Hz]	N	CG[Hz]	N	SG[Hz]	N	VG[Hz]
MPF_VL_10%_FT	MGCG*	11	89,195	12	101,015	12	100,285	11	92,905
MPF_VL_20%_FT	MGCG* MGSG*	12	89,296	12	100,439	12	102,366	11	92,592
MPF_VL_30%_FT	MGSG*	12	89,050	12	99,962	12	103,473	11	91,356
MPF_VL_40%_FT	MGCG* MGSG*	12	87,385	12	100,248	12	102,008	11	90,478
MPF_VL_50%_FT	MGCG* CGVG* SGVG**	12	86,633	12	100,473	12	97,876	11	87,436
MPF_VL_60%_FT	CGVG* SGVG**	12	86,048	12	97,224	7	92,844	11	83,635
MPF_VL_70%_FT		11	85,111	9	94,528	4	95,990	9	84,160
MPF_VL_80%_FT		9	85,224	6	91,555			4	87,875
MPF_VL_90%_FT		5	77,521	1	88,000			3	68,841

Tab.1. MPF-Data and significant differences between groups at the M.vastus lateralis measured with a special 2-channel electrode

- The number of contractions of the sprint group (SG) was significantly reduced in comparison to the remaining three groups. The marathon group (MG) and the control group (CG) were significantly different to SG and to each other.

- The averaged mean power frequency (MPF) from the three heads of the quadriceps did not show significant differences between the groups. But for the vastus lateralis EMG, measured with the 2-channel electrode assembly, differences were found, especially between MG and CG and MG and SG (Table 1).

- The MPF-values at 10 to 40% MVC within the sprint group ($p<0.01$) as well as over all subjects ($p<0.05$) were inversely correlated to the sprint time.

- An inverse correlation ($p<0.05$) existed also between the number of achieved contractions and the sprint time over all subjects .

The results indicate a strong relationship between the ability to sustain fatigue and the MPF because MG and VG had the highest number of contractions as well as the lowest MPF-values. These results fit well into the concept that low innervation frequencies transform muscle fibre properties towards slower contraction characteristics.

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