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Research article

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2014**Neuromuscular Fatigue During 200 M
Breaststroke**Citations in
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The aims of this study were: i) to analyze activation patterns of four upper limb muscles (duration of the active and non-active phase) in each lap of 200m breaststroke, ii) quantify neuromuscular fatigue, with kinematics and physiologic assessment. Surface electromyogram was collected for the biceps brachii, deltoid anterior, pectoralis major and triceps brachii of nine male swimmers performing a maximal 200m breaststroke trial. Swimming speed, SL, SR, SI decreased from the 1st to the 3rd lap. SR increased on the 4th lap (35.91 ± 2.99 stroke·min⁻¹). Peak blood lactate was 13.02 ± 1.72 mmol·l⁻¹ three minutes after the maximal trial. The EMG average rectified value (ARV) increased at the end of the race for all selected muscles, but the deltoid anterior and pectoralis major in the 1st lap and for biceps brachii, deltoid anterior and triceps brachii in the 4th lap. The mean frequency of the power spectral density (MNF) decreased at the 4th lap for all muscles. These findings suggest the occurrence of fatigue at the beginning of the 2nd lap in the 200m breaststroke trial, characterized by changes in kinematic parameters and selective changes in upper limb muscle action. There was a trend towards a non-linear fatigue state.

Key words: Swimming, Kinematics, EMG, Mean frequency**Key Points**

- Fatigue in the upper limbs occurs in different way as it described by 100m swimming events.
- Neuromuscular fatigue was estimated by analyzing the physiological changes (high blood lactate concentrations), biomechanical changes in the swimming stroke characteristics (decreased in swimming velocity), and by the changes in the EMG amplitude and frequency parameters at the end of the swimming bout.
- The amplitude signal of EMG provided by the ARV demonstrated an increase at the end with the respect to the beginning for all muscles under study, excepted for the muscle deltoid anterior.
- The mean frequency (MNF) in our study decrease at the end of the swimming in the 4 lap relative to the 1 lap for all muscles under observation, along the 200m breaststroke.

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