INTRODUCTION

Physical fitness is dependent from several major components including cardiovascular fitness, flexibility, body composition, muscle strength and muscle endurance.

Since long, muscle strength and muscular endurance training was done in individual sessions, whereas subjects after a preliminary assessment of their fitness level have attended a program designed with specific volume, intensity, density, using weight machines, barbells, rubber bands, bodyweight exercises, etc. In the last couple of decades emerged new muscle strength and muscle endurance training programs that are not done individually but in group fitness classes. Most of these programs adopt as main equipment the barbell to improve the muscle strength and muscle endurance. There are a great number of exercise routines done in each class to train a specific muscle group (e.g., 10 muscle groups per session). Each exercise routine should be done following the cadence metrics of the music the barbell being played. Subjects can choose subjectively if they want to use 5, 10 or 20 [kg] as external load inserted in the barbell. Added to that, instructors are able to use exercise repetitions based in the muscle cadence. E.g., perform one full exercise cycle within one, two or four musical beats. So, muscle cadence is a strategy used on regular basis to achieve a given intensity of exertion.

It seems to exist little research done about the kinematic and neuromuscular activity performing basic muscle strength exercises as done in group fitness classes.

The aim of this paper was to assess the interaction between kinematics and neuromuscular responses of subjects performing the rowing exercise, with barbell in the upright position, in group fitness classes, with different external loads and cadences. It was hypothesized that kinematical behavior and neuromuscular activation will be affected by the external load and the cadence imposed.

METHODS

Neuromuscular data was collected with superficial electromyography (Biopac Systems, MP100A, Santa Barbara, USA) at a sampling rate of 16 [Hz]. Data was collected from the biceps brachii, triceps brachii (long head), latissimus dorsi, trapezius (middle portion) and erector spinae with bipolar active electrodes (Biopac Systems, 150A, Santa Barbara, USA) at a sampling band of 12-500 [Hz]. Electrodes were placed according to literature suggestions (1, [9]; [10]) in one side of the body, since the exercise is a symmetrical one (2) (Fig. 1). Skin was prepared, cleaned and shaved to reduce bio-impedance and artifacts. After being digitally processed (i.e., filtered, fully rectified, smooth and create the linear envelope) it was computed the EMG amplitude (aEMG), the EMG root mean square (RMS) and the activation time. The aEMG and RMS data were normalized to the three maximal dynamical values obtained, in each muscle group, during the data collection.

RESULTS AND DISCUSSION

Standard deviations of both aEMG variables were quite high for all conditions. This can mean that the training load (external load plus cadence) did not take into account the individual fitness level of the subjects. So, probably as happens in individual muscular strength sessions, in the group fitness class an individual assessment of the training load should be done as well, instead of the subjects selected subjectively the load they want to use in the session.

Taking into account the cadence effect, the period had a significant interaction (F = 40.64, p = 0.001). Significant data was observed for biceps brachii (F = 70.59, p = 0.001), triceps brachii (F = 791.47, p = 0.001), latissimus dorsi dorsal (F = 540.65, p = 0.001), Trapezius (F = 787.38, p = 0.001) and erector spine (F = 790.84, p = 0.001). Increasing cadence decreased the absolute duration of the exercise cycle. There were no significant interaction between the joint angle and the external load (F = 0.018, p > 0.05) nor the cadence (F = 0.02, p > 0.05).

The significant interaction is period related to the fact that subjects strictly followed the music cadence as used by the instructor. The non-significant interaction in the angular kinematics is explained by the fact that subjects had a high expertise and background participating in this kind of strength training programs and were able to increase the angular velocity to follow the appropriate music cadence. Otherwise, subjects with less expertise and/or in fatigue would decrease the elbow range of motion throughout the protocol.

Regarding the RMS variable, it was verified significant interactions based in the external load and the muscle groups assessed (F = 0.031, F = 3.96, p < 0.01). Significant differences were observed in the biceps brachii (F = 10.84, p = 0.001), triceps brachii (F = 17.56, p < 0.001) and erector spine (F = 10.75, p < 0.01). Anova test verified significant effect of the cadence for the biceps brachii (F = 4.27, p = 0.01). In all these situations, increases in the external load and in the cadence imposed a RMS increase as well.

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As reported on regular basis the increase of the external load and/or the increase of the exercise cadence will affect the neuromuscular activity (e.g., 4).

REFERENCES