RELATIONSHIPS BETWEEN ELECTROMYOGRAPHY AND OXYGEN CONSUMPTION IN DIFFERENT WORK LOADS – ROWING EXERCISE

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INTRODUCTION

The evaluation of sport performance is imperative to athletes, especially in accordance with several identifying elements, such as oxygen uptake (VO_2), and muscle activity[1]. It is incontestable that physical fatigue is fully considered as the perplexing period during training and thus the relationship between $\dot{V}O_2$ and muscle activity can be referred to as the major determinants to predict the athlete's performance[2]. Rowing exercise has been viewed as an endurance training activity. However, the mechanism of fatigue during rowing is not fully investigated. This study aimed at differentiating the contribution of prime movers in rowing exercise at different intensities. Also, the physical fatigue time point was investigated along with changes in $\dot{V}O_2$.

METHODS

Four college students were recruited and performed rowing exercise on a rowing ergometer (Concept II, Concept Inc., Morrisville, VT). Oxygen consumption was measured by a computerized system (MetaMax 3B, Cortex, Germany). Furthermore, subjects' muscle activities were recorded by electromyography (EMG) (SX230, BioMetrics Ltd., UK) which is supported by a portable data logger. The muscles involved in rowing exercise, namely biceps brachii, triceps, flexor/extensor carpi muscle, latissimus dorsi, erector spinae, rectus femoris and hamstring were included for EMG evaluation. Subjects were first requested to row at the maximal power output (Watt) to exhaustion within 3 min. Then, they underwent rowing tests at 60%, 70% and 80% of maximal power output respectively in different days. On the day of test, work load was gradually increased to desired level and EMG signals and $\dot{V}O_2$ were recorded simultaneously. EMG variables (median frequency and mean value), was sampled at 1000Hz and analyzed by a self-developed MATLAB program.

RESULTS AND DISCUSSION

Our results showed that the activation of leg and back muscles increased in proportion to the work load increase (Fig 1).

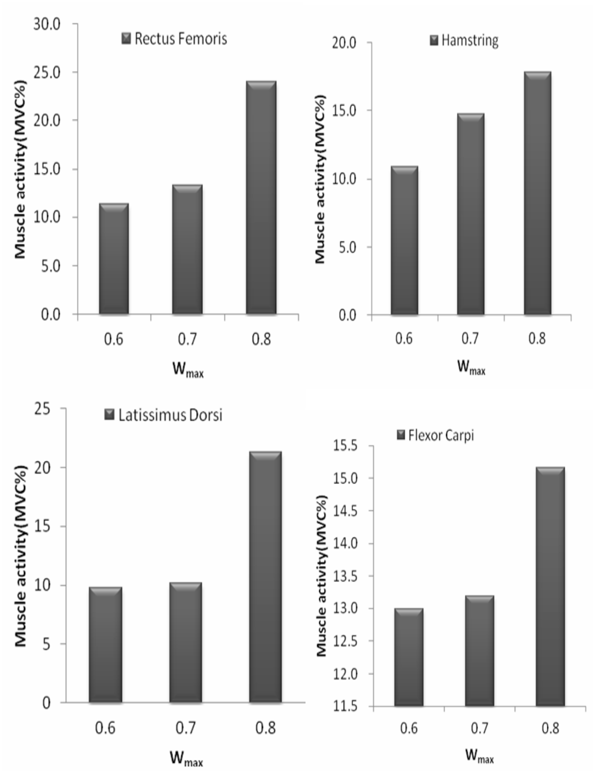

Figure 1: Electromyography (EMG) mean value at different work loads – Rectus femoris, Hamstring, Latissimus dorsi and Flexor Carpi muscle.

However, biceps brachii activity remained relative stable regardless of exercise intensities (Fig 2), suggesting that the standard rowing movement focuses mainly on the coordination of back and thigh muscles.

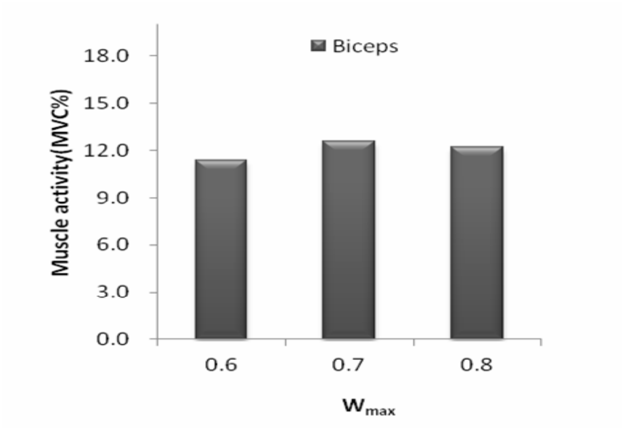

Figure 2: Electromyography (EMG) mean value at different work loads – biceps brachii.

Besides, the physical fatigue time point was found within 24.8 second according to the median frequency of muscle activity (Fig 3). Meanwhile, a concomitant change in O_2 consumption also occurred at the same time frame (Fig 4). These results indicated that oxygen consumption can reflect changes in muscle activities in rowing exercise.

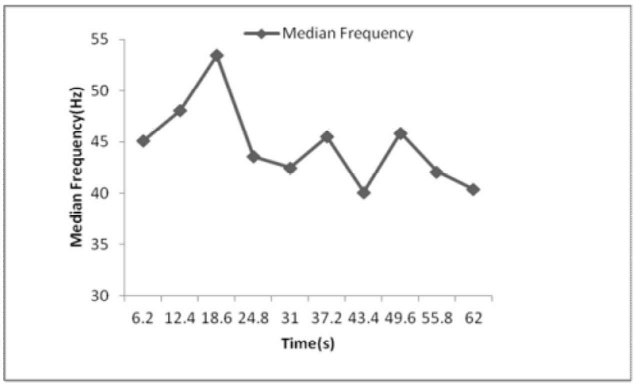

Figure 3: EMG variable, median frequency, within 80% maximal power output.

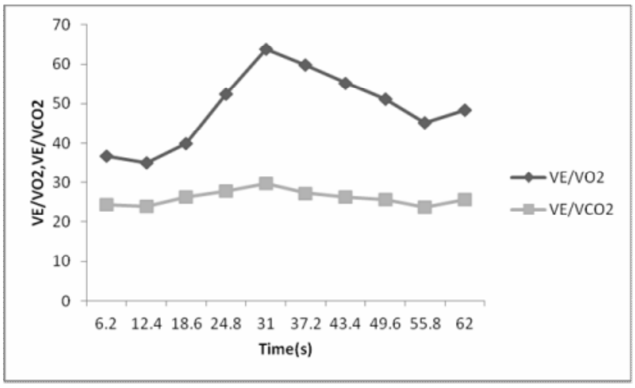

Figure 4: Physiological variable, VE/V_{O2} and VE/V_{CO2}, within 80% maximal power output

REFERENCES

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