

## RESEARCH REVIEW

### A Method for Monitoring Intensity During Aquatic Resistance Exercises

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Research in aquatic exercise has proven that aquatic resistance training does result in both neuromuscular and structural changes in the muscles. However, one of the limitations with studying the effects of resistance training in the water is that it is difficult to produce consistent resistance **when in** the water. Resistance with land-based exercise is measured by the weight lifted. The resistance in the water may change with each repetition based on the amount of force used with each rep.

#### **Purpose of the Study**

The researchers in this study wanted to identify a technique for reproducing the same intensity while performing repetitions of the same aquatic resistance training exercise. They also wanted to determine if the use of drag equipment would result in an appropriate overload for people who had experience with strength training exercises. Finally, they wanted to compare the muscular response of aquatic resistance exercises to similar exercises performed on land.

Electromyography was used to assess muscle activation of the pectoralis major during horizontal shoulder adduction and the posterior deltoid during horizontal shoulder abduction. Muscle activation of the erector spinae was also assessed to determine the amount **of** stabilization during the upper body movements.

#### **Method**

The study used four fit men with an average age of 24. All of the subjects had previous experience performing strength exercises in the water and on land. Each subject performed horizontal shoulder adduction and abduction in the water using Hydro-Tone® Hydro-Bells for resistance. Each person had to determine a cadence that allowed them to perform 15 repetitions at, or near, maximum effort while maintaining proper form and technique. The cadence was set by an acoustic metronome. They also performed horizontal shoulder adduction and abduction on land using dual adjustable pulley cable motion machine. The pulley exercises were performed at the same cadence as the water exercises and the

resistance was determined by using a weight that allowed for 15 reps at, or near, maximum effort.

A cadence and appropriate weight for the pulley machine was determined for each subject. Each subject performed one set of horizontal shoulder adduction and abduction with the appropriate cadence and weight using the pulley machine. One set of horizontal shoulder abduction and adduction with the appropriate cadence using Hydro-Tone® Hydro-Bells was performed in the water. Each subject then performed a second set in the water. The second set was performed while receiving additional resistance of 30 water currents per minute (increased turbulence).

## Results

- The muscle activation of pectoralis major was always significantly lower than the posterior deltoids in both the water and land exercises.
- The results showed no significant differences in the activation of the muscles between the subjects.
- The results showed significantly greater activation of the muscles evaluated when the exercises were performed in the water than on land.
- The results showed a significant increase in the activation of the erector spinae during the second set of water exercises. The second set included the additional currents.

## Applying the Results

- The noticeable difference between the strength of the pectoralis major and the posterior deltoids could be due to stronger pushing muscles than pulling muscles. This imbalance could limit the cadence of the movement, as the cadence will be determined by the weaker muscle group.
- The degree of muscle activation measured during an exercise is related to the intensity level of the exercise. The muscle activation was similar among the subjects, which would suggest that this method for controlling cadence would be appropriate for controlling the intensity of aquatic resistance exercise for different subjects.
- The amount of muscle activation achieved in a series of 15 repetitions at, or near, maximum effort would allow for muscle adaptations. However, the muscle activation of pectoralis major and posterior deltoids was greater in the water than on land so this method would not be an appropriate method for reproducing the same intensity on land **as produced** in the water. This method of using a predetermined cadence does provide a technique for maintaining or replicating the intensity of an aquatic resistance exercise.
- The increase in muscle activation of the erector spinae when exercising in the water indicates the increased need for stabilization and balance while performing aquatic resistance exercises.

## Conclusions

This study shows that by monitoring cadence and performing repetitions to near maximum effort the muscle activation will be great enough to achieve strength, endurance or hypertrophy goals. The intensity of an aquatic resistance exercise can be similar as long as the same cadence, same equipment and same technique are used for each repetition.