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Comparison of Effort for High-Velocity and Low-Velocity Bench Press

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ABSTRACT

ABLE II was used to assess momentum generation by integrating user output force times time. The momentum generated is a new concept in measuring exercise effort and is a better method then power output. Nine subjects were divided into one of two groups: a high-velocity group consisting of 24 repetitions per minute or low-velocity group consisting of 12 repetitions per minute. The subjects bench-pressed on ABLE II one day a week completing one set per workout session. The effort for each individual's workout sessions was recorded and evaluated. The goals of this study were to evaluate the difference in momentum between low-velocity and high-velocity resistance training and to provide the basis for further studies.

Keywords: *Resistance Training, Isokinetic exercise, Muscle Power, Momentum*

INTRODUCTION

People are continuously looking for ways to get an effective workout in the least amount of time possible. Resistance training has become a popular method of weight lifting, and can have beneficial effects. The key variables to think about include: the training load, the number of sets and repetitions per set, the resting period and the movement velocity (Sakamoto, Sinclair).

The velocity at which the resistance training is performed can make a difference on the strength gained. Isokinetic training at low speeds of movement (low reps-high intensity) produces substantial increases in strength only at slow movement speeds. Isokinetic training at fast speeds of movement (i.e" 8-15 reps) produces increases in strength at all speeds of movement (at rates at and below the training speed) (Paxinos).

The ABLE-II applies the motions of weight lifting and working multiple muscles and allows an individual to know how much is being lifted and the number of repetitions (Hoffman, 18). No free weights are used, but the individual is in control of the amount of force they apply through moving impingement resistance. The use of the moving bar allows the individual to concentrate of pushing with the most force they can and while not being aware of the applied force.

The ABLE-II provides immediate feedback on the amount of force an individual exerted during their workout. The data that the individual receives allows a trainer to see how the individual's body adapts to the training and can help the individual develop a workout that is appropriate for them.

The voltage output from ABLE II was converted into a measure of momentum. Momentum is the measure of the amount of force applied times the number of seconds the force is applied. The units of momentum are pounds times seconds. The idea of using momentum as a measure for the work output in a workout sessions is a new concept.

MATERIALS AND METHODS

The machine used in the study is named Able II, and it is a state-of-the-art exercise machine that allows you to maximize your workout in a shorter amount of time compared to the standard exercise machines. Able II was hooked up to a computer where data was recorded for each session.

Individuals were selected on a volunteer basis to participate in the study. A diverse group for was desired, so athletes as well as non-athletes were asked to participate in the study. Individuals who wished to participate in this study signed a waiver and agreed to not be involved in another workout program while involved in the study. Nine participants were involved, four males and five females. A measurement of each person's arm length was taken to adjust the height of the workout bench. The position at which the participant's arms were almost fully extended and the position at which the participant's arms were contracted slightly above the chest were measured also. These measurements were used to determine the height the bench needed to be for the participant to constantly apply pressure to the bench press bar in the full extension and contraction positions.

A preliminary run was done to get initial readings for all of the participants. The computer program used, recorded the data in volts and then plotted a graph that displayed the amount of resistance the individual put on the bar. The computer program read three different channels: channel A, channel B, and channel C. Channel A was a sensor the read the volts on the left side of the bar, channel B was a sensor that read the volts on the right side of the bar, and channel c read the position of the bar. Voltage readings were taken every 0.05 seconds, and this showed how much force was applied at any given time.

The nine individuals were placed in one of two

groups: the low-velocity (slow) group consisting of 12 reps per minute or the high velocity (fast) group consisting of 24 repetitions per minute. The males and females were randomly placed into the groups. Participants were asked to come in one day a week to work out and their progress was monitored week to week for seven weeks.

Each individual's workout sessions were put into Excel. The voltage readings from Channel A and Channel B were plugged into the appropriate calibration equation, which converts the voltage to pounds. The pounds for each workout session were then graphed and compared individually on a week-to-week basis.

Every graph was shifted below the zero line, so a sum of the average of the tails below zero was taken and that number was added to the sum of all the points. The sum of all the points was then multiplied by 0.05 seconds to get the units of pounds times seconds, which is momentum. Each workout session had its own average momentum measurement and each point was plotted on a graph to that gives an overall view of each participant's progress throughout the entire study.

Individual's results were analyzed separately first, and then compared to other's results. The high-velocity group's overall progress was compared to the low-velocity group's overall progress to see who had the most gains.

RESULTS

The overall momentum per session for each individual in the low-velocity group is shown collectively in Figure 1. The slow group did have three individuals who showed signs of momentum gain from the first workout to the last workout. The individual who didn't show any improvement in their momentum generation throughout the study was thought to have inadequate recovery time.

The overall individual momentum generation for the high velocity group is shown in Figure 2. There was no one in the high velocity group that generated a momentum from the beginning of the study to the end. The individuals in the high velocity group showed a tendency to lose momentum and then begin to gain it back or gained some momentum initially and then lost momentum from that point on.

A rep-by-rep analysis was done on the individual that showed the most momentum increase in the slow group. The rep-by-rep analysis was then analyzed in thirds: the first four repetitions, next four repetitions, and the final four repetitions. The results from the thirds analysis are shown in Figure 3.

A rep-by-rep analysis was also done on the individual that showed the least momentum decrease in the fast group. The reps were analyzed for each work out and separated into thirds like was done for the slow group. The results from the thirds analysis are shown in Figure 4.

A t-test was performed on an individual basis comparing the overall momentum from the first workout to the last workout. The three out of the four members of the slow group showed a statistically significant ($p=0.05$) increase in momentum. Also, two out of the four members of the fast group showed statistically significant decreases in momentum at $p = 0.05$, and one member showed a decrease at $p = 0.10$.

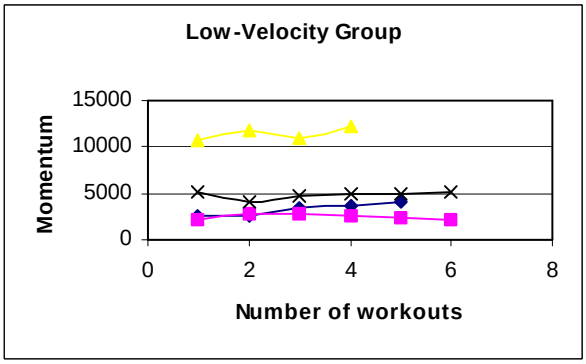

Fig 1

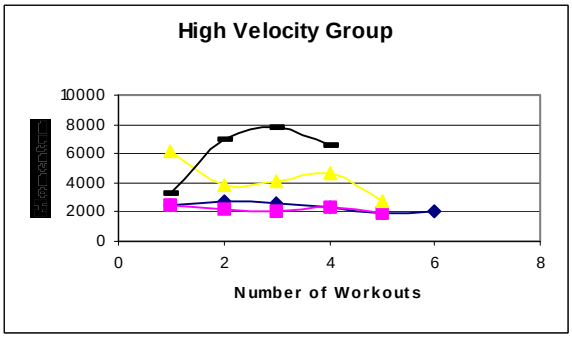

Fig 2

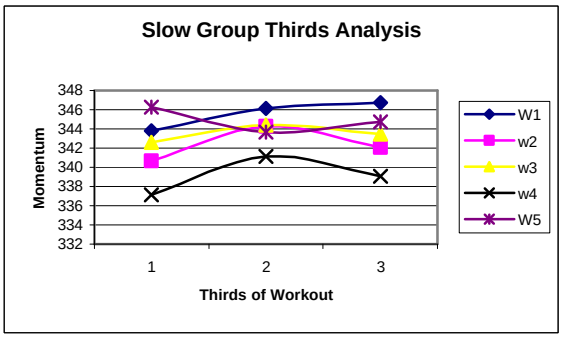

Fig 3

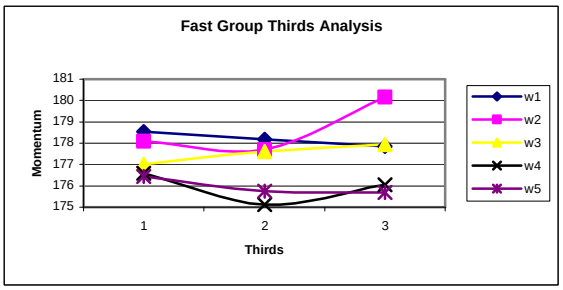

Fig 4

DISCUSSION

The intent of this study was to see if there were any observable differences in momentum generated between a group doing high-velocity resistance training and a group doing in low-velocity resistance training. Another objective of the study was to get preliminary data that could be used in future studies using the ABLE II. The final goal of this study was measure the momentum generated by individuals rather than using currently popular methods of measuring strength.

The hypothesized results for this study were that the high-velocity group would show a larger increase in momentum compared to the low-velocity group in momentum. The hypothesis was proven wrong. The low-velocity group showed an increase in momentum, where as the high velocity group showed a decrease in momentum. The high-velocity group showed more inconsistency as well. It is entirely possible that the high-velocity group simply didn't have enough recovery time.

The data that was collected gave a good foundation to build on for further studies. The results bring about several questions regarding the length of the workout, the intensity of the workout, and whether previous weight training would cause a change. The high-velocity group showed very inconsistent results. A theory is that there was not enough recovery time for these individual's muscle to recover from being "torn down." The workout involved 24 repetitions per minute and that is an intense load on the muscles, so recovery time could be a big factor in the results from this group.

There are a variety of different experiments that can be generated from this basic data. The main variables that could be changed are the intensity of the workout, the number of repetitions, the number of subjects, the variety of protocols, and the length of the study.

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