

Heart Rate Changes Comparing Free Weight VS Elastic Resisted Tubing

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Abstract. During lifting, heart rate and blood pressure have been shown to rise because of an increase in intra-abdominal pressure. This increase in pressure is known as a Valsalva maneuver. However, little research has been conducted to compare heart rate changes that occur with traditional weight lifting versus elastic band resistance. Changes in heart rate that occurred while lifting free weight compared to lifting with elastic band resistance were therefore examined. 30 healthy subjects with an age range of 18-40 were tested. Heart rate changes were recorded using a 12 lead ECG, with a baseline measurement established before lifts were performed. Testing consisted of subjects lifting roughly 40% of their body weight from the floor to waist height and then returning the weight to its original starting position. All subjects alternately performed lifts with both free weights and elastic bands. Subjects were required to rest between lifts to allow heart rate to return to baseline measurement. Results indicate that heart rate did increase significantly in both the free weight and elastic band resisted groups when compared to baseline measurements. There was no significant difference found when comparing the difference in change of heart rate for the second lift between free weight lifting and elastic band resistance. A mixed 2-way ANOVA was used to determine if there is a significant difference in HR changes between the 2 lifts.

Introduction

The Valsalva Maneuver (VM) has been shown to evoke rises in HR equal to the magnitude of the stimulus placed on the individual [2]. A study by Parisi et al indicated that Valsalva can cause as much as a 50% drop in left ventricular stroke output which could result in dizziness (orthostatic hypotension)[1]. It has been shown that increases in blood pressure and rate pressure product may prove to be dangerous in older individuals, individuals with heart disease, or individuals with little or no training[3]. The purpose of this study is to use an electrocardiogram (ECG) machine to characterize the heart rate response in all 4 phases of a lifting activity that is practical to everyday activities, such as lifting a suitcase, carrying groceries, or straining with a load. Our study will also address the heart rate response to determine the difference between a lift performed with free weight versus a lift performed with elastic band resisted weight. The ECG machine provides a non-invasive insight into the heart rate response during free weight lifting versus using elastic band resistance.

Experiment, Results, Discussion, and Significance

Experiment Thirty healthy adult subjects between the ages 18-37 (mean 23.65) took part in the study. Prior to enrollment in the study all subjects were required to complete a Physical Activity and Readiness Questionnaire (PAR-Q) prior to inclusion. Participants were excluded from the study if they reported a positive answer on any question in the PAR-Q questionnaire. Participants were also excluded from participation in the study if they are pregnant or reported any form of restrictive respiratory or cardiovascular conditions such as hypertension. Participants were also required to sign a consent form. All participants were students at Wichita State University. Upon inclusion into the study, participants were randomly placed using consecutive assignment in to one of two groups: (1) Free weight lifts followed by elastic band resistance lifts after return to baseline heart rate (INT), (n=16); or (2) Elastic band resistance lifts followed by free weight resisted lifts after a return to baseline heart rate (N-INT), (n=14). Participants were assigned to groups based on a consecutive assignment method.

The instrument used to monitor HR was an electrocardiogram (ECG) machine. Participants resting heart rate levels were assessed by a 12-Lead ECG reading. Both groups were asked to lift two handles resisted by elastic resistance equal to 40% of ones own body weight as determined using a tensile strength conversion chart. Two lengths of elastic resistance bands were used; one for subjects <70in tall and one for subjects who were 70in or taller. Elastic resistance bands were attached to an elastic resistance board which contained a standing circle with band attachment sites on each side. Once the participants were attached to the 12-lead ECG and a baseline HR was reached participants were asked to stand in the boards standing circle. Once HR stabilized the participant performed a single squat consisting of four components. Measurements were taken from the ECG machine throughout the entire lift. The participant was allowed to rest until they returned to their

baseline heart rate and then performed the same lift using the opposite resistance. Four measurements were recorded during each lift, one for each phase of a lifting cycle. Measurement 1 was recorded as the participant squatted down to grab the resistance just prior to performing the upward concentric portion of the lift. Measurement 2 was recorded as the participant completed the concentric movement upward with the resistance into a standing posture. Measurement 3 was recorded after the participant eccentrically lowered the weight back to the original position. Measurement 4 was taken after the participant released the resistance and returned to the standing position. The same measurements were recorded for the free weight lifts as were recorded for the elastic band lifts.

Results

Resting heart rate was significantly different between the two groups, (weight first=mean 78.18 (+/-9.7); elastic band first, mean 88.75 (+/-10.3), therefore an analysis of covariance (ANCOVA) was used to determine whether there were significant differences between groups once the effect of participant resting heart rate was removed. A mixed 2-way ANOVA then was used to determine if there were significant differences between the two groups with regard to change in heart rate. The independent variable was ‘group’ labeled elastic resistance first or weight first. The dependent variables were heart rate at times 1 and 4 of lift procedure 1, and times 1 and 4 of lift procedure 2. Alpha level was set at .05. SPSS V 13.0 was used to analyze the data. With the effect of resting heart rate removed, a significant difference was found in the change in heart rate only for the first lift (heart rate 4 minus heart rate 1). The significant difference in change of heart rate for the second lift (heart rate 4 minus heart rate 1) was not found.

Discussion

Both free weights and elastic band resistance were shown to significantly increase heart rate. These conclusions are important when working with a set of patients that have high blood pressure or cardiovascular problems. Our research shows that heart rate should be monitored closely when performing resistance training with these patients to prevent possible damage to the cardiovascular system.

Conclusions

It was initially hypothesized that there would be a significant difference in heart rate changes within groups for both the free weight lift and the elastic band resisted lift when compared to baseline measurements. Results showed that both lifts did in fact cause a significant increase in heart rate as shown in the table above. It was also hypothesized that there would be a significant difference in heart rate changes between free weight lifts and elastic band resisted lifts due to the mechanics involved in elastic band exercises. Results showed that for the initial lift, between group differences showed heart rate increased significantly greater with free weight lifting than with elastic resistance. The significant difference in change of heart rate for the second lift was not found.

Group	HR 1 (beginning)	HR 4 (end)
Weight Lift First	80.80 +/- 9.6	102.18 +/- 10.6
Elastic Resistance First	85.64 +/- 9.5	97.85 +/- 7.8

Because significant differences were not found for the second lift the results are inconclusive.

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Lift 1*

Group	HR 1 (beginning)	HR 4 (end)
Weight Lift First	78.81 +/- 11.0	99.5 +/- 11.6
Elastic Resistance First	92.73 +/- 7.9	107.3 +/- 7.3

Lift 2

*Significant change in HR (ANCOVA, set text)

The change in HR from 1 to 4 in weights first group is significantly greater than the change in HR from 1 to 4 in the elastic band group first.

References

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