Endurance of low back musculature in high school athletes: A study of global and isolated low back stabilization exercises

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Abstract. Introduction: Selective muscle atrophy has been demonstrated in people with history of low back pain. Training of low back musculature has focused on global and isolated abdominal endurance. The purpose of our study was to investigate the most effective stabilization program to improve trunk musculature endurance in high school athletes due to the lack of research in this population. Our hypothesis states that there will be a significant difference between the intervention groups and the isolated group will show the greatest improvement. Experiment: The participants consisted of thirty-nine high school students participating in one of three weight conditioning classes. Each class was randomly assigned into a control, global intervention, or isolated intervention group. Trunk endurance was tested prior to and after an eight week trunk exercise intervention. Results: There was no significant difference between the isolated and global trunk endurance groups and the control group. Further data analysis showed no significant difference in endurance times between age, time, or gender.

1. Introduction

Low back pain is prevalent in society affecting 60 to 80 percent of the adult population. [1] A main cause of low back pain is weak low back musculature. [2-4] Previous research has examined global and isolated stabilization exercises for the treatment of back pain. [5]

Our research focused on high school athletes without previous or current back pain while other research has focused on subjects with low back pain or athletes ages 20-35. [6-12] The purpose of our study was to investigate the most effective trunk stabilization program, global or isolated, to improve trunk musculature endurance in high school athletes and establish normative data for this population. It was hypothesized that those subjects in the isolated trunk endurance group would have a greater increase in timed trunk endurance tests than those subjects in the global trunk endurance group or the control group.

2. Experiment, Results, Discussion, and Significance

Experiment: Thirty-nine high school students participating in one of three weight lifting/conditioning classes at a local high school were invited to participate in the study. The subjects were used as a sample of convenience and were assigned to one of three groups: a control group, and global intervention group, or an isolated intervention group, based on what weight lifting class in which they were enrolled. Prior to pre-testing, all students were given a medical screening questionnaire and parental consent forms as all subjects were minors.

Four timed endurance tests of trunk musculature were used in this study, in order of testing: extensor endurance test, flexor endurance test and the side bridge test bilaterally. All tests were completed as previously described [13] with modifications due to equipment availability. McGill, et al. found these tests to be reliable with a reliability coefficient >.97 when tested consecutively over a five day period.

A pilot study was conducted to determine if the implemented modifications to McGill's tests were reliable. In the reliability study ten subjects were used. Each subject was tested with either McGill's flexion and extension method or our modified testing procedure. [13] Each subject was then re-tested one week later with the method not used in the previous week. Statistics were calculated to determine the reliability of our modified testing procedure.

Subjects in both groups warmed up by walking from the locker rooms to the gym where the trunk exercises were performed. Global and isolated exercises were modified from exercise programs previously developed. [5] Exercises were modified due to equipment availability and time. The subjects in the stabilization group were instructed on the technique of abdominal bracing prior to initiation of each exercise. Weekly exercises were demonstrated by the researchers to both groups to ensure that the subjects understood proper technique and quantity that they were asked to complete. Handouts with pictures and instructions were left at the facility for the subjects to review as needed. Subjects were encouraged to give maximal effort during each exercise session. After completing

the trunk exercises, the subjects walked to the weight room and performed their regular workout and cool down as instructed by their weight conditioning coach.

Results: No significant differences between the isolated and global trunk endurance groups or the control group were noted. The statistics presented in the tables indicate a great deal of variation between the subjects, as shown by the range of scores. The mean times for the endurance tests are shown in tables 1-2. Further data analysis revealed no significant difference in endurance times between age, time, or gender.

Comparing our modified testing procedures to McGill's testing procedures, there was no significant difference for either flexion or extension (p=.298 for extension and p=.382 for flexion). Correlation was found to be 0.959 and 0.857 for extension and flexion respectively.

Discussion and Significance: Data analysis of this study revealed no significant difference between the isolated and global trunk endurance groups and the control group. Subjects in the isolated trunk endurance group were expected to have a greater increase in timed trunk endurance tests than subjects in the global trunk endurance group or the control group. Neither the global or isolated intervention groups made a statistically significant improvement over their pre-test scores.

Clinically, this research is relevant to those with core instability. Subjects in this age range may not fully understand the benefits associated with increased core stability, and therefore would most likely benefit from a specifically supervised training and conditioning program verses a home exercise program. If the subject does not improve core stability it is likely due to multiple variables, including compliance with the intervention program.

3. Conclusions

In terms of measuring isometric endurance times in high school athletes, our research shows there are no benefits to prescribing a isolated program as compared to a global program. Clinically, the isolated and global endurance programs may be equally beneficial to high school athletes. Therefore, professional judgment should be the guide when treating this population.

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Table 1: Mean Pre and Post Test Times(sec) for Flexion and Extension

Group	Flexion Pre-test	SD	Flexion Post-test	SD	Extension Pre-test	SD	Extension Post-test	SD
Control	172.38	56.348	175.102	90.115	103.98	62.428	92.277	37.531
Global	188.717	103.971	210.853	91.426	102.35	55.985	102.645	50.937
Isolated	173.246	56.502	196.036	78.277	109.112	49.245	114.273	39.117

Table 2: Mean Pre and Post Test Times(sec) for Right and Left Sidebend

Group	R Sidebend Pre-test	SD	R Sidebend Post-test	SD	L Sidebend Pre-test	SD	L Sidebend Post-test	SD
Control	61.27	22.114	61.725	31.007	60.36	19.681	56.23	21.629
Global	55.633	18.653	58.861	19.201	59.833	21.374	62.647	20.573
Isolated	54.073	19.437	59.995	13.139	57.527	16.740	58.578	15.788

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