Effects of a Supervised Resistance Training Program on Adolescents and Young Adults With Mental Retardation

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Reference Data

ABSTRACT

The purpose of this study was to conduct a program of resistance training for persons with mild to severe mental retardation (MR) to determine what strength gains if any occurred. Twelve individuals with MR, ages 17 to 21, participated in a 30-min resistance training program twice a week for 23 weeks. Approximately 40 to 45 min of aerobics and sport skill activities supplemented each resistance training session to total 75 min of training per session. At the end of the resistance training program, the subjects with MR demonstrated significant absolute and relative strength gains in all tests of bilateral muscular strength (chest press, leg extension, and lat pulldowns) and sit-ups. It was concluded that adolescents and young adults with moderate to severe MR can participate and experience significant improvements through a supervised resistance training program. Therefore such a program should be considered an integral part of the total exercise program for individuals with MR.

Key Words: conditioning, fitness, special populations

Introduction

A major public health goal is to get more people of all ages moving and active (8). Multiple studies (13, 16, 21) on the general adult population have demonstrated that resistance training programs can improve muscular strength and endurance, physical work capacity, and metabolic function. Also, resistive training programs have been shown to decrease the risk of serious injury from a fall or accident (3). However, none of these studies have focused on persons with mental retardation (MR). Although some researchers have recently examined the cardiorespiratory endurance levels of this population, very few have examined the area of muscular strength (2, 11, 12, 14, 15, 19, 20).

It appears that no one has yet examined the effects of strength training on adolescents with MR. Ironically, this is the age group that frequently participates in weight training events such as the LiftAmerica and Special Olympics competitions; yet there is little information on strength training for MR adolescents. Therefore the purpose of this study was to investigate the effects of a supervised strength training program on this population.

Methods

Twelve adolescents/young adults with mild to severe mental retardation, ages 17 to 21, volunteered with approval from their parents or legal guardians to participate. There were 11 males and 1 female. The population studied was the older, ambulatory, and higher functioning students from the Sidney Lanier Center, a public school in the county serving students considered too mentally disabled to be mainstreamed in the other public schools. Subjects were chosen for the study on the basis of their teachers’ recommendation, parents’ consent, and their own desire to participate.

Participants were classified as having mild to severe MR, based on their scores on intelligence and adaptive behavior tests. (For example, using the Stanford-Binet scale, an IQ from 67 to 52 is classified as mild MR, 51 to 36 is moderate MR, 35 to 20 is severe MR, and 19 or below is classified as profound MR) (18). The IQs of the subjects in this study ranged from 60 to 32. Two subjects had mild MR, 6 had moderate MR, and 4 had severe MR. As probable factors in the mental retardation, 5 subjects had cerebral palsy, 3 had experienced birth anoxia, and 1 each had spinal myelodysplasia, Down syndrome, fetal alcohol syndrome, and Birdman’s syndrome (a rare genetic anomaly).
Table 1
Descriptive Characteristics of the 12 Subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>17–21</td>
<td>19.50</td>
<td>1.31</td>
</tr>
<tr>
<td>IQ</td>
<td>32–60</td>
<td>44.92</td>
<td>9.07</td>
</tr>
<tr>
<td>% Fat*</td>
<td>7.0–20.6</td>
<td>13.50</td>
<td>4.35</td>
</tr>
<tr>
<td>Height, pre (in.)</td>
<td>59–67</td>
<td>63.71</td>
<td>2.51</td>
</tr>
<tr>
<td>Height, post (in.)</td>
<td>60.5–67</td>
<td>63.88</td>
<td>2.22</td>
</tr>
<tr>
<td>Weight, pre (lbs)</td>
<td>97–284</td>
<td>158.75</td>
<td>52.00</td>
</tr>
<tr>
<td>Weight, post (lbs)</td>
<td>98–280</td>
<td>160.08</td>
<td>51.27</td>
</tr>
</tbody>
</table>

*Calculated via preparticipation evaluations; standard skinfold equations used (5).

Each subject and parent or guardian signed the appropriate institutional review board consent forms for human research participation, as well as the Florida Special Olympics Medical Release Form. Table 1 contains the descriptive information on the sample population for this study.

The 12 subjects participated in two training sessions a week, approximately 75 min per session, for 23 weeks excluding school holidays. The first 30 min of the session were spent in a weight training facility using Nautilus equipment. Each participant performed one set of 10 to 15 reps of leg extensions, leg curls, lat pulldowns, pullovers, chest press, and arm cross, and then performed a set of sit-ups. When the subject could complete more than 15 reps correctly, the training weight was increased, but not to a greater load than could be lifted at eight times.

The next 15 to 20 min were spent in some type of aerobic activity—aerobic dance, jogging, or working on an aerobic apparatus such as a stationary cycle, treadmill, rower, or stair-climber. The rest of the session was devoted to a sport activity such as football, basketball, soccer, softball, track, or volleyball.

The subjects were pretested at the first session of the year in October and posttested at the last session of the year in April. Although the training program included a workout on at least six Nautilus machines, for expediency and consistency of equipment availability the chest press, lat pulldown, and leg extension tests for bilateral muscular strength were selected for both the pre- and posttests.

Reliability coefficients of ≥0.90 have been reported for one repetition maximum (RM) muscular strength tests using normal sample populations. Validity of these tests has also been established (9). Because muscular strength is influenced by body mass, each absolute strength value was then divided by the individual’s weight to obtain a relative strength factor controlling for weight. For safety, 1-RM lifts were not allowed; all stations used a maximum weight that could be lifted for three repetitions, that is, a 3-RM value.

Sit-ups as a test of abdominal muscular endurance were performed with the participant completing as many as possible in 30 sec. The 30-sec sit-up test has had test-retest reliabilities of \( r = 0.80 \) and above reported for a moderately retarded sample population (6).

In addition, other tests of physical fitness were included, although the participants were not specifically trained in these areas in the study. The tests selected were those most often used in typical, standardized physical fitness tests for the general population of this age group: sit-and-reach, 50-yr dash, and 300-m run/walk. The sit-and-reach test for low back flexibility was tested on a commercial sit-and-reach box, keeping knees straight and hands together for three trials, with the best of the three trials being recorded. The 50-yr dash was used as a test of speed, and the 300-m run/walk was used as a test of cardiovascular endurance. Both running tests were done on a grass track.

Johnson and Londeree (6) report test-retest reliability of \( r = 0.80 \) or higher on their test items, with the exception of the 300-m run/walk in which no specific reliability factor was reported. Validity of these items was not mentioned; however, Johnson and Nelson (5) list logical validity for nondisabled populations and similar reliability factors for those populations.

All pre- and posttests were administered by student volunteers who had been instructed in correct testing protocol; they were supervised by the principal investigators and comprised the staff administering the training to the students throughout the program.

The study was organized using a single-group pretest/posttest design. A dependant \( t \) test was used to test for statistical differences between pretest and posttest values for each dependant variable. The level of significance for the study was set at \( p < 0.05 \). A minimum \( t \) value of 2.20 using a two-tailed test was needed to demonstrate significance.

**Results**

There was considerable variability in IQ level among the 12 participants. However, these variations in IQ did not seem to influence strength gains. Significant strength gains were noted for the subjects in all three tests of muscular strength (Table 2). The chest press \( (t = 3.87, p < 0.05) \), leg extension \( (t = 4.80, p < 0.05) \), and lat pulldown \( (t = 5.90, p < 0.05) \) all showed a significant improvement from pretest. Also, significant relative strength gains were noted in all three tests.

The relative chest press \( (t = 3.55, p < 0.05) \), relative leg extension \( (t = 3.53, p < 0.05) \), and relative lat pulldown \( (t = 4.94, p < 0.05) \) all showed a significant improvement from pretest. Sit-ups also showed a significant improvement \( (t = 3.17, p < 0.05) \) during the training period. No significant improvements from pretest were found for the sit-and-reach test \( (t = 1.92, \)
Table 2
Results on Physical Fitness Tests for Subjects With Mental Retardation

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre M</th>
<th>SD</th>
<th>Post M</th>
<th>SD</th>
<th>Mean diff (M₁ - M₀)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest press (lbs)</td>
<td>75.00</td>
<td>31.77</td>
<td>95.42</td>
<td>30.93</td>
<td>20.42*</td>
<td>5.28</td>
</tr>
<tr>
<td>Leg exten. (lbs)</td>
<td>101.67</td>
<td>55.73</td>
<td>122.50</td>
<td>48.64</td>
<td>20.83*</td>
<td>4.35</td>
</tr>
<tr>
<td>Lat pulldown (lbs)</td>
<td>76.67</td>
<td>24.99</td>
<td>100.00</td>
<td>24.86</td>
<td>23.33*</td>
<td>3.96</td>
</tr>
<tr>
<td>Chest press** (lbs)</td>
<td>0.48</td>
<td>0.13</td>
<td>0.61</td>
<td>0.16</td>
<td>0.14*</td>
<td>0.04</td>
</tr>
<tr>
<td>Leg exten.** (lbs)</td>
<td>0.65</td>
<td>0.30</td>
<td>0.79</td>
<td>0.25</td>
<td>0.14*</td>
<td>0.04</td>
</tr>
<tr>
<td>Lat pulldown** (lbs)</td>
<td>0.49</td>
<td>0.12</td>
<td>0.66</td>
<td>0.18</td>
<td>0.16*</td>
<td>0.03</td>
</tr>
<tr>
<td>Sit-ups (reps)</td>
<td>10.50</td>
<td>2.91</td>
<td>13.67</td>
<td>3.70</td>
<td>3.17*</td>
<td>0.42</td>
</tr>
<tr>
<td>Sit reach (in.)</td>
<td>1.00</td>
<td>2.99</td>
<td>1.88</td>
<td>3.54</td>
<td>0.88</td>
<td>0.46</td>
</tr>
<tr>
<td>50-yd dash (sec)</td>
<td>13.00</td>
<td>4.14</td>
<td>13.57</td>
<td>4.35</td>
<td>0.57</td>
<td>0.70</td>
</tr>
<tr>
<td>300-m run (sec)</td>
<td>129.00</td>
<td>48.02</td>
<td>130.42</td>
<td>42.76</td>
<td>1.41</td>
<td>5.01</td>
</tr>
</tbody>
</table>

*p < 0.05.

**Resistances expressed as relative strength (resistance/body weight) to control for each subject’s weight.

A review of the literature (4) finds that the majority of the limited tests done on individuals with MR are field tests such as push-ups and sit-ups, which measure muscular endurance more than strength. Fernhall found only three studies that had tested the muscular strength of persons with MR. Nordgren and Backström (10) and Pitetti et al. (12) found that adults with MR showed isometric and isokinetic strength below that of adults without MR (4, 10, 12). In another study, however, Pitetti (11) showed that adults with MR exhibited normal isokinetic knee flexion test strength (4, 11).

The reason for this discrepancy is unknown and information is scarce. The only known training study using machines rather than field tests with adults with MR was by Rimmer and Kelly (15). From their study, as well as the present study, it appears that individuals with MR experience strength gains following a training program similar to the gains experienced by people without MR (4, 15).

The literature offers a promising base on which to design future investigations. For example, Rimmer gave an impressive review of the literature on cardiovascular fitness programming for adults with MR; he noted, however, that few of the studies offered specific exercise guidelines (14). In an earlier study, Rimmer and Kelly used a 9-week progressive resistance training program to see whether a group of adults with MR could improve their muscular strength and endurance, and to determine whether they could adhere to the program and learn to use the equipment with minimal assistance (15). Rimmer and Kelly showed that a high intensity resistance training program can induce dramatic increases in muscular strength and endurance in this population in as little as 9 weeks. They also found that the subjects could learn to use the machines with minimal assistance and enjoyed participating in the program, showing disappointment when the study was completed.

Johnson and Lavay (7) listed a number of testing procedures that could be used or modified for use in the fitness testing of children with special needs, including the bench press, sit-ups, and sit-and-reach tests. Smith and Buckley (17) compared the accessibility and usability of three weight training machines for subjects with physical disabilities and found that the Keiser Cam II was more accessible and usable for persons with spinal cord injuries, and that Nautilus provided the most comprehensive upper body workout. The ease of use of these systems may be important for persons with MR, especially moderate to profound MR, as they frequently have physical limitations as well.

Since Dahlgren et al. (1) found that Special Olympians may not be engaging in sufficient training specific enough to improve performance in their events,
the present study was conceived to offer a supervised program of appropriate training in order to improve the subjects’ performance in Special Olympics. It was also the intent of the program to provide them with sufficient skills that could be integrated into their vocational and recreational pursuits, in turn contributing to their psychological well-being and self-esteem.

Practical Applications

It appears that significant strength gains can be realized by adolescents and young adults with moderate to severe MR through their participation in a twice weekly physical fitness program that emphasizes resistance training. This population can experience strength gains similar to their nondisabled peers when given a supervised program of resistance training (4, 14). Certainly those subjects in the present study who also had physical limitations such as cerebral palsy or spinal myelodysplasia realized strength gains that had direct benefits on their activities of daily living. Individuals with disabilities must not be excluded from such programs of physical fitness; all persons, regardless of their limitations, have a right to a lifestyle of health and physical fitness (8). Arguably, these individuals benefit from and need such programs as much as if not more than their nondisabled peers.

References


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