
by

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Presentation Outline

- Problems with youth obesity and fitness
- Importance of resistance training
- Manual Resistance Training
Youth obesity and fitness

- Currently 30.4% of U.S. adolescents are overweight (7)
- Children have low levels of physical fitness;
  - El Paso children with about 55% physical fitness test passing rates (6)
- Schools are the most ideal settings for youth health promotion programs (13,18)
- PE classes must be:
  - enjoyable to all children
  - vigorous enough
Obese children have low strength to body-weight ratio and low level of cardio fitness.

In PE class obese children:
- experience difficulty performing activities
- fatigue rapidly

PE often further discourages them from engaging in physical activity. (15)
Resistance training for youth

- Previously, youth resistance training was considered ineffective and unsafe \(^{(10,11)}\)
- Today, well-designed youth resistance training is recognized as:
  - safe
  - effective
  - beneficial method of conditioning
Resistance training for youth

- Recent research has emphasized the importance of resistance training for youth fitness and injury prevention (8,9,10,14,15,16,18,19).

- Youth resistance training supported by:
  - American Academy of Pediatrics (2)
  - American College of Sports Medicine (3)
  - National Strength and Conditioning Association (10)
Benefits of youth resistance training

- Various physiological benefits
  - muscle function, cardiovascular fitness, body composition, bones, posture, insulin sensitivity, type 2 diabetes, blood lipid profiles, HDL cholesterol, blood pressure
- Improved performance, reduced injury risk
- Better self-satisfaction and self-esteem
- Enjoyment and enhanced positive attitude towards exercising (8,9,10,13,15,16,18)
Resistance training for obesity

- Overweight children perform poorly and fatigue quickly in aerobic type exercises.

- Resistance training is enjoyable because:
  - it is less aerobically taxing
  - overweight children can experience success (8,9)

- Absolute strength of overweight children is usually greater than normal-weight peers (8)

- Through better performance in resistance training overweight children can earn respect and enhance self-confidence (9)
Advantages of higher-intensity activities

- High-intensity training improves fitness better than low-intensity exercise \(^{(14,15)}\)

- Children with improved fitness can:
  - sustain exercises longer
  - perform greater intensity exercises
  - expend more overall energy

- Great motivational effects
  - large strength gains in short-term
  - immediate gratification and incentive for becoming more active \((5)\)
Resistance training in PE

- Traditional resistance training (weight training) uses a variety of equipment
  - free-weights
  - exercise machines
  - various accessories
- Weight training is expensive
- Due to equipment and budget requirements, often excluded from PE (17)
Manual Resistance Training

- MRT is an applicable alternative \(^{(17)}\)
- Requires minimal portable and inexpensive equipment
  - PVC pipes, straps, chains
  - step-boxes, chairs, tables, mats
- Resistance is provided by one or more partners
- Resisting partner applies accommodating resistance throughout full range of motion \(^{(1)}\)
Manual Resistance Training

- Almost all weight training exercises can be simulated with MRT exercises
- MRT requires minimal set-up
- Provides high-intensity training in short time
- Adjustable training stimuli components
  - exercise selection and order, number of exercises, sets, repetitions, rest intervals, and resistance
Illustration of MRT

- Video of identical WRT and MRT exercises
- Observe equipment needs of the two forms
Pilot Study #1 on MRT

- Pilot study conducted at UTEP
- 84 college students (46 male, 38 female)
- Two groups:
  - Weight Resistance Training
  - Manual Resistance Training
- Training program
  - 14 week training
  - 3 sessions/week, 1 hour/session
  - Identical exercises, tri-set format, hypertrophy zone (8-12RM)
Pilot Study #1 on MRT

- Pre- and post-test design
- Measurements:
  - 1 RM bench press and squat
  - Bench press and squat muscle endurance
  - VO2max
  - Body composition
Results of Pilot Study #1

- Males and females in both WRT and MRT groups showed significant increase in
  - 1 RM bench press and 1 RM squat
  - Bench press and squat muscle endurance
- MRT participants showed significant changes that were comparable to WRT participants in muscular strength and endurance tests
- Females in MRT group showed significant changes in body composition
## Muscular Strength Results

<table>
<thead>
<tr>
<th>Test</th>
<th>Gender</th>
<th>Group</th>
<th>N</th>
<th>Pre-training test</th>
<th>Post-training test</th>
<th>Change</th>
<th>(α)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean ± (SD)</td>
<td>Mean ± (SD)</td>
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</tr>
<tr>
<td>1RM BP (kg)</td>
<td>Male</td>
<td>WRT</td>
<td>18</td>
<td>93.2 ± 15.0</td>
<td>98.8 ± 14.3</td>
<td>5.95%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>28</td>
<td>88.9 ± 24.2</td>
<td>93.1 ± 19.4</td>
<td>4.65%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>WRT</td>
<td>13</td>
<td>31.4 ± 5.3</td>
<td>39.4 ± 5.1</td>
<td>25.5%</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>25</td>
<td>30.9 ± 6.6</td>
<td>35.9 ± 7.4</td>
<td>16.1%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1RM Squat (kg)</td>
<td>Male</td>
<td>WRT</td>
<td>18</td>
<td>104.5 ± 26.3</td>
<td>133.4 ± 21.8</td>
<td>27.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>26</td>
<td>104.1 ± 29.7</td>
<td>125.5 ± 28.3</td>
<td>20.6%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>WRT</td>
<td>13</td>
<td>48.7 ± 16.4</td>
<td>72.2 ± 11.0</td>
<td>48.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>22</td>
<td>44.3 ± 16.2</td>
<td>63.8 ± 18.5</td>
<td>44.0%</td>
<td>&lt;0.001</td>
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</tbody>
</table>
## Muscular Endurance

<table>
<thead>
<tr>
<th>Test</th>
<th>Gender</th>
<th>Group</th>
<th>N</th>
<th>Pre-training test</th>
<th>Post-training test</th>
<th>Change</th>
<th>(α)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP Reps</td>
<td>Male</td>
<td>WRT</td>
<td>18</td>
<td>13.1 ± 3.4</td>
<td>17.6 ± 3.3</td>
<td>34.3%</td>
<td>&lt;0.001</td>
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</tr>
<tr>
<td></td>
<td>Male</td>
<td>MRT</td>
<td>25</td>
<td>14.1 ± 2.4</td>
<td>17.2 ± 4.5</td>
<td>21.9%</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>WRT</td>
<td>13</td>
<td>13.9 ± 4.9</td>
<td>26.2 ± 6.9</td>
<td>88.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>MRT</td>
<td>22</td>
<td>13.8 ± 6.0</td>
<td>23.2 ± 8.6</td>
<td>67.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Squat Reps</td>
<td>Male</td>
<td>WRT</td>
<td>18</td>
<td>17.7 ± 10.8</td>
<td>34.6 ± 15.9</td>
<td>94.9%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>MRT</td>
<td>25</td>
<td>15.7 ± 6.1</td>
<td>28.3 ± 10.2</td>
<td>80.3%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>WRT</td>
<td>13</td>
<td>16.3 ± 10.7</td>
<td>45.8 ± 18.3</td>
<td>180.6%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>MRT</td>
<td>22</td>
<td>15.2 ± 12.2</td>
<td>37.1 ± 16.4</td>
<td>144.3%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
## Body Composition

<table>
<thead>
<tr>
<th>Test</th>
<th>Gender</th>
<th>Group</th>
<th>N</th>
<th>Pre-training test</th>
<th>Post-training test</th>
<th>Change</th>
<th>(α) Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Fat (%)</td>
<td>Male</td>
<td>WRT</td>
<td>17</td>
<td>21.5 ± 7.9</td>
<td>20.8 ± 7.2</td>
<td>0.66</td>
<td>0.376</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>28</td>
<td>20.7 ± 6.4</td>
<td>20.2 ± 6.4</td>
<td>0.54</td>
<td>0.216</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>WRT</td>
<td>11</td>
<td>29.8 ± 5.8</td>
<td>29.7 ± 6.5</td>
<td>0.16</td>
<td>0.848</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRT</td>
<td>23</td>
<td>29.7 ± 8.7</td>
<td>27.5 ± 8.5</td>
<td>2.25</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Pilot Study #2

- **Purpose**
  - To document the physical and physiological changes in adolescents through the application of WRT and MRT programs in physical education settings.

- **Methods**
  - **Participants:** 342 high school students in four groups (WRT group, MRT group, MRT+cardio group, control PE).
  - **Pre-, midterm-, and post-test measurements:**
    - BMI calculations, skinfold measurements.
    - Fitnessgramm: one mile run, push-ups, curl-ups, flexed arm hang, trunk lift, modified pull-ups.
  - **Training program**
    - 18 weeks, 3 sessions/week, 1:20 hour/session.
    - Identical exercises, tri-set format, hypertrophy zone.
Results of Pilot Study #2

- The Control group showed
  - no significant change in BMI and
  - significant decrement in most measures

- The MRT group showed
  - significant increase in curl-up, trunk lift, push-up, flexarm, and pull-up tests

- MRT-Cardio group showed
  - significant improvement in mile run, curl-up, trunk lift, push-up, & pull-up tests
Results of Pilot Study #2

- MRT group was significantly better than Control group in mile run, curl-up and push-up measures at midterm- and post-test.
- MRT-Cardio group was significantly better than Control group in mile run, curl-up and push-up measures at midterm- and post-test, and in trunk lift at midterm-test.
- No groups showed significant improvement in BMI or skinfold measures.
Conclusion

- MRT is appropriate for application in school-based physical education.
- MRT enhanced PE appears to be effective in improving adolescents’ muscular fitness as measured by the Fitnessgram.
- A combined MRT and cardiovascular training program effectively improves all aspects of physical fitness, but appears to be ineffective in improving adolescents’ body composition in a short period of time.
Future Plans

- More research on MRT
- Research on children and adolescents
References

References

Questions?

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