Exercise Effects on Body Composition in Male and Female Prepubescent Children

by

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A Senior Honors Project Presented to the
Honors College
East Carolina University
In Partial Fulfillment of the
Requirements for
Graduation with Honors
by
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Greenville, NC
May 2014

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Abstract

The difference between the male and female body with respect to body composition post puberty is widely known and mostly understood. However, the difference between male and female prepubescent children regarding lean mass and fat mass, and changes in these measures with exercise training have not been extensively studied. A study was conducted at East Carolina University investigating the effects of a 16-week physical activity program on African American and Caucasian prepubescent children. The purpose of the present analysis was to use data from the larger study to examine the difference in body composition in male (M) and female (F) prepubescent children. Twenty four female and twenty two male, prepubescent children participated in the exercise group of the study with eleven females and ten males in the control group. Body composition was measured using dual energy X-ray absorptiometry (DXA). Measures were taken before and after a 16-week mentor based physical activity program with an intensity goal of heart rate >140 beats/min for one hour, 3 days per week. The lean mass increased 5.81± 0.95% in female and 4.33 ± 0.92% in male exercise groups, respectively. The control groups increased lean mass by 4.41 ± 0.83% in females and 4.34 ± 1.03% in males. This indicates that female prepubescent children had a greater increase in total lean body mass with exercise. The fat mass increased by 0.67± 1.51% in females and 3.48 ± 2.58% in male exercise groups, respectively. Fat mass increased in the control groups by 14.39 ± 3.86% in females and 7.07 ± 3.62% in males.
Introduction

A large scale study was conducted at East Carolina University studying the effects of a 16 week mentor based physical activity program on African American and Caucasian prepubescent children. The study examined the differences in African American and Caucasian prepubescent children regarding lean body mass, fat body mass, BMI, aerobic capacity, and bone mineral density and the differences in their response to the program. The purpose of the present study was to take the data from the previous study and examine the differences in total lean body mass in male and female prepubescent children before and after the 16 week program in both the exercise and control groups. It was hypothesized that there would not be a significant difference between the male and female children due to their prepubescent status, but there would be an increase in lean mass and decrease in fat mass in the exercise groups that would not be evident in the control groups over the 16 weeks.

Materials and Methods

Participants included prepubescent children age 8-11yr who were recruited from Pitt County and randomly assigned to exercise or control groups. Participants who engaged in purposeful exercise training (>30 min/day >3 days per week) and those with clinical conditions that would limit or prevent exercise were excluded. Participants gave assent and parental guardians gave consent to participate. Fat and lean mass were determined using dual-energy x-ray absorptiometry (DXA; GE Lunar Prodigy Advance, Madison, WI). Measures were taken in female and male control groups after 16 weeks of no purposeful exercise training, and in female
and male exercise groups before and after a 16-week mentor based physical activity program with an intensity goal of heart rate >140 beats/min for one hour, 3 days per week.

Results

Within the exercise group the average changes in total fat mass were 0.67% and 3.48% in females and males, respectively (P= 0.35). The average changes in total lean mass were 5.81% and 4.33% for females and males, respectively (P=0.23). Within the control group the changes in fat mass were 14.39% and 7.07% in females and males, respectively (P=0.19). The changes in lean mass were 4.41% and 4.34%, in females and males, respectively (P=0.96). The increase in fat mass in females was less in the exercise than control group (P=0.0004). Tables 1 and 2 along with Figures 1 and 2 display these results along with standard error and standard deviation.

<table>
<thead>
<tr>
<th></th>
<th>Female Exercise</th>
<th>Female Control</th>
<th>Male Exercise</th>
<th>Male Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.67</td>
<td>14.39</td>
<td>3.48</td>
<td>7.07</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>7.38</td>
<td>12.71</td>
<td>12.08</td>
<td>11.45</td>
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<tr>
<td>Standard Error</td>
<td>1.51</td>
<td>3.86</td>
<td>2.58</td>
<td>3.62</td>
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</tbody>
</table>
Figure 1. The change in total fat mass of female and male exercise and control groups (n=24, 11, 22, 10, respectively) over 16 weeks of exercise or no exercise participation. Data are presented as mean ± SEM. * indicates significantly different than female exercise and female control.

Table 2. Change in Total Lean Mass (%)

<table>
<thead>
<tr>
<th></th>
<th>Female Exercise</th>
<th>Female Control</th>
<th>Male Exercise</th>
<th>Male Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.81</td>
<td>4.41</td>
<td>4.33</td>
<td>4.34</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>4.63</td>
<td>2.76</td>
<td>4.33</td>
<td>3.26</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.95</td>
<td>0.83</td>
<td>0.92</td>
<td>1.03</td>
</tr>
</tbody>
</table>
Figure 2. The change in total lean mass of female and male exercise and control groups (n=24, 11, 22, 10, respectively) over 16 weeks of exercise or no exercise participation. Data are presented as mean ± SEM.

Conclusion

There was a greater increase in fat mass in females in the control group than in the exercise group (P=0.0004). The female exercise group increased by an average 0.67 ± 1.51% and the female control group increased by an average of 14.39 ± 3.86%. There may have been some variability on the developmental stages in the females that would have affected the fat and lean mass percentages. There are several variables that occur outside of the designated time of the study (3 hour per week for exercise group) that play a role in the fat and lean mass of the subjects such as diet and other activities they may or may not participate in. However, it can be concluded that for females, exercise did have a significant effect on decreasing the percent fat mass compared to those who did not exercise in the program.
References
Hickner, R., Dubose, K., Brophy, P., Schmitt, B., Mazzawi, J., Cox, J., Cooper, E., & Tanner, C. (2013). *Effects of a 16-week physical activity program on body composition and aerobic capacity are greater in african american than caucasian prepubescent children.* Informally published manuscript, Human Performance Laboratory, Departments of Kinesiology1, Physiology2, Center for Health Disparities Research3, East Carolina Diabetes and Obesity Institute4, East Carolina University, East Carolina University, Greenville, NC, .