Psychosocial Correlates of Physical Activity in Healthy Children

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Background: Understanding the determinants of physical activity in children is critical for the treatment and prevention of childhood obesity. Social-cognitive theory has been used to understand behavioral patterns in children.

Objectives: To explore the relationship between health beliefs, self-efficacy, social support, and sedentary activities and physical activity levels in children and to examine the relationship between physical activity and children’s self-esteem.

Methods: Ninety-two children aged 10 to 16 years completed the study. Physical activity was monitored for 1 week with a motion detector (Actitrac; IM Systems, Baltimore, Md). Moderate-level activity and high-level activity were defined based on the results of treadmill testing. Health beliefs, self-efficacy, social influences, and time spent in sedentary behaviors were determined through questionnaires. Self-esteem was measured using the Piers-Harris Children’s Self-Concept Scale. Chronic anxiety was measured with the Revised Children’s Manifest Anxiety Scale.

Results: There was a significant decline in physical activity levels between ages 10 and 16 years, particularly in girls. Preteen girls spent approximately 35% more time in low- and high-level activity than did teenage girls (P<.001). Overall, children spent 75.5% of the day inactive, with a mean ± SD of 5.2 ± 1.8 hours watching television, sitting at the computer, and doing homework. In contrast, only 1.4% of the day (12.6 ± 12.2 minutes) was spent in vigorous activity. Time spent in sedentary behaviors was inversely correlated with the amount of moderate-level activity (P<.001) but not high-level activity. In contrast, time spent in high-level activity correlated with self-efficacy scores (P<.001) and social influences scores (P<.005). High-level physical activity was also associated with improved self-esteem (P<.05). Higher health beliefs scores were not correlated with physical activity levels.

Conclusions: Children and adolescents are largely sedentary. Correlates of high- and low-level physical activity are different. Time spent on sedentary activities is inversely correlated with moderate-level activity, while self-efficacy and social influences are positively correlated with more intense physical activity. In addition, increased high-level physical activity is an important component in the development of self-esteem in children.


Previous research has demonstrated that most children are largely sedentary. Using data from the Muscatine Study, Janz et al found that pubertal and postpubertal children spend only 8 to 10 minutes per day in aerobic activity. Livingstone and colleagues also showed that girls aged 7 to 15 years spend, on average, 8 to 10 minutes per day in vigorous physical activity, while boys of the same age spend approximately 30 minutes per day in vigorous activity.

Determinants of levels of childhood physical activity are complex. Social-cognitive theory involves analyzing the effects of parental and peer influences, child beliefs, and personality on the adoption of a particular behavior, in this case physical activity. It is now widely accepted that family, peers, and school affect physical activity levels in children. Access to physical activities, such as the location of parks and schools, and opportunities to participate in games or sports are also factors affecting sports involvement. Similarly, parents who play with their children regularly and provide transportation to activities have more-active children. Personality characteristics, such as achievement, motivation, self-confidence, independence, and one’s perceived ability to be active (ie, self-efficacy), are also associated with physical activity levels. It has also been suggested that physical activity, particularly sports participa-
SUBJECTS AND METHODS

SUBJECTS

Ninety-five of 96 consecutive healthy children between the ages of 10 and 16 years were recruited for the study between March 23 and June 12, 2000. Children were recruited from suburban and urban families through the pediatrics clinics at University of Medicine & Dentistry of New Jersey, New Brunswick, and 2 worksites, representing mixed ethnicities and socioeconomic status. Approximately 16 (17%) children were Hispanic or African American, 19 (20%) were from single-parent families, and 20 (21%) had parents who were professionals. Complete data were available on 92 children (44 boys and 48 girls). Informed consent was obtained at the time of recruitment, and each family received a stipend after completion of the study. Approval for the study was obtained from the institutional review board of Robert Wood Johnson Medical School, University of Medicine & Dentistry of New Jersey.

MEASUREMENT OF SOCIAL AND COGNITIVE FACTORS

Each child was asked to complete the children's physical activity questionnaire developed by Saunders et al. This questionnaire consists of 3 scales to measure psychosocial correlates of exercise in children as young as 10 years: the Self-Efficacy, Social Influences, and Health Beliefs scales (Table 1). Parents completed questionnaires concerning the amount of time each child spent on sedentary activities.

MEASUREMENT OF PHYSICAL ACTIVITY

Levels of habitual physical activity were assessed with a biaxial accelerometer (Actitrac; IM Systems, Baltimore, Md). The detector is approximately half the size of a beeper and is worn on the child's waist. Previous pilot testing had established a high correlation ($r^2>0.96$) between activity readings using this detector and those from other larger triaxial motion detectors. Children were instructed to wear the monitor during waking hours for 1 week. Acceleration was sampled 40 times a second and integrated over 30-second intervals. Habitual physical activity levels were categorized by units of acceleration based on treadmill testing during previous pilot data collection (Table 2). Similar cutoffs for physical activity levels have been previously reported. Because children spent minimal time in vigorous activity, high activity and vigorous activity times were grouped together. Individual activity levels and self-efficacy were further categorized as high or low based on the 25th and 75th percentiles of the entire cohort, respectively.

MEASUREMENT OF SELF-ESTEEM AND ANXIETY

The Piers-Harris Children's Self-Concept Scale and the Revised Children's Manifest Anxiety Scale were used to assess self-esteem and anxiety. The Piers-Harris Children's Self-Concept Scale is an 80-item standardized self-report inventory designed to assess children's feelings about themselves. The Revised Children's Manifest Anxiety Scale measures chronic (as opposed to acute situational) anxiety. Total anxiety scores measured by the Revised Children's Manifest Anxiety Scale were correlated with anxiety subscores measured in the Piers-Harris inventory ($r=0.82$, $P<.001$), suggesting a high level of consistency with the questionnaires.

DATA ANALYSIS

Data were analyzed using commercially available software (SPSS version 8.0; SPSS Inc, Chicago, Ill). Differences in continuous variables were assessed using the independent $t$ test or 1-way analysis of variance. Differences in proportions were compared by means of $\chi^2$ tests. Multivariate regression analysis was used to assess the effect of social and cognitive variables and sedentary behavior on physical activity levels after controlling for age and sex. Logistic regression analysis was used to determine the relationship between high and low levels of physical activity and high and low levels of sedentary behavior and self-efficacy. A small number of outliers greater than 3 SDs from the predicted models were excluded.

RESULTS

Children spent a mean±SD of 24.5%±6% of waking hours in moderate- or high-level physical activity (Table 3). Sixteen percent of their time was spent in moderate-level activity (ie, walking or playing), with vigorous activity constituting only 1.4% of waking time (mean±SD, 12.6±12.2 min/d). Children spent 10.4±0.8 hours per day relatively motionless. Overall, these children spent 5.2±1.8 hours per day doing homework, sitting at the computer, or watching television, while the remaining 4.5±0.7 hours per day of sedentary time primarily were at school.

Physical activity levels were related to age and sex. Before age 13 years, similar levels of physical activity were present in girls and boys ($P=.43$); however, after age 13, boys were significantly more active than were girls (total...
activity time: 23.5%±4.7% vs 19.0%±3.8%; P<.05). Moderate- and high-level activity decreased significantly between ages 10 and 16 years for both sexes (Table 4). Among girls, overall time spent at all physical activity levels was 35% higher in preteens compared with that in teenage girls (P<.001).

Correlates of moderate- and high-level activity were different (Table 4). Time spent on sedentary activities was inversely correlated with moderate activity. Children who spent the least time participating in sedentary behaviors were significantly more likely to have high levels of moderate activity compared with children who spent the most time in sedentary behaviors (odds ratio, 9.14; 95% confidence interval, 1.53-55.00). In particular, television time (β=−.29, P<.01) and computer time (β=−.29, P<.01) were inversely correlated with moderate activity. Health beliefs, self-efficacy, and social influences scores were not significantly correlated with moderate activity. Multivariate regression analysis demonstrated that only age and sedentary behavior time independently correlated with moderate activity levels (r²=0.35, P<.001), with approximately 10% of the variance in moderate activity explained by sedentary behavior time.

Increased levels of high activity were primarily associated with increased self-efficacy and social influences scores. Time spent on sedentary activities was not correlated with high activity. Similarly, higher health beliefs scores were not correlated with high activity levels. In contrast, all 3 measures of self-efficacy were signifi-
Self-efficacy

Table 4. Correlates of Physical Activity in Children Aged 10 to 16 Years

<table>
<thead>
<tr>
<th>Health Beliefs</th>
<th>Sedentary Behaviors</th>
<th>Physical Outcomes</th>
<th>Social Outcomes</th>
<th>Support Seeking</th>
<th>Perceived Barriers</th>
<th>Perceived Alternatives</th>
<th>Social Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.01</td>
<td>-0.03</td>
<td>0.14</td>
<td>-0.04</td>
<td>0.22</td>
<td>-0.12</td>
<td>0.05</td>
</tr>
<tr>
<td>Physical activity (28-94 mG)†</td>
<td>-0.50</td>
<td>-0.36</td>
<td>0.14</td>
<td>-0.03</td>
<td>0.12</td>
<td>-0.09</td>
<td>0.12</td>
</tr>
<tr>
<td>P</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>0.18</td>
<td>0.18</td>
<td>0.25</td>
<td>0.38</td>
<td>0.26</td>
</tr>
<tr>
<td>High activity (&gt;94 mG)†</td>
<td>-0.45</td>
<td>-0.11</td>
<td>0.03</td>
<td>0.07</td>
<td>0.28</td>
<td>0.32</td>
<td>0.34</td>
</tr>
<tr>
<td>P</td>
<td>&lt;.001</td>
<td>0.32</td>
<td>0.73</td>
<td>0.48</td>
<td>&lt;.01</td>
<td>0.002</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Table 5. Physical Activity and Self-Esteem*

<table>
<thead>
<tr>
<th></th>
<th>≤25th Percentile</th>
<th>≥75th Percentile</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate-Level Activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety†</td>
<td>11.6 (5.4)</td>
<td>10.6 (6.9)</td>
<td>.60</td>
</tr>
<tr>
<td>Anxiety</td>
<td>51.1 (12.5)</td>
<td>51.8 (11.1)</td>
<td>.85</td>
</tr>
<tr>
<td>Behavior</td>
<td>51.8 (11.7)</td>
<td>55.1 (8.0)</td>
<td>.26</td>
</tr>
<tr>
<td>Happiness</td>
<td>49.6 (12.4)</td>
<td>53.5 (9.1)</td>
<td>.22</td>
</tr>
<tr>
<td>Intellectual</td>
<td>52.2 (8.7)</td>
<td>55.3 (9.0)</td>
<td>.23</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>54.4 (11.6)</td>
<td>56.8 (10.1)</td>
<td>.71</td>
</tr>
<tr>
<td>Popularity</td>
<td>50.8 (11.1)</td>
<td>52.8 (8.5)</td>
<td>.55</td>
</tr>
<tr>
<td>Total</td>
<td>53.9 (11.3)</td>
<td>57.8 (19.0)</td>
<td>.21</td>
</tr>
<tr>
<td>Response bias</td>
<td>39.0 (7.6)</td>
<td>38.5 (4.8)</td>
<td>.77</td>
</tr>
</tbody>
</table>

|                      | High-Level Activity |                |       |
| Anxiety†             | 11.3 (6.2)        | 9.4 (4.6)       | .31   |
| Anxiety              | 50.4 (11.3)       | 53.6 (12.1)     | .31   |
| Behavior             | 49.4 (10.1)       | 55.4 (9.3)      | <.05  |
| Happiness            | 48.6 (10.6)       | 54.9 (9.9)      | <.05  |
| Intellectual         | 51.3 (9.2)        | 58.0 (8.8)      | <.05  |
| Physical appearance  | 52.5 (10.8)       | 57.5 (10.7)     | .12   |
| Popularity           | 49.1 (10.1)       | 54.8 (9.0)      | <.05  |
| Total                | 53.0 (10.7)       | 59.0 (10.1)     | <.05  |
| Response bias        | 38.6 (7.9)        | 38.0 (4.1)      | .69   |

*scores based on the Revised Children’s Manifest Anxiety Scale (higher scores indicate higher levels of anxiety).

Overall, children spent more than 10 hours each day sedentary. In contrast, children were involved in vigorous physical activity only 12 to 13 minutes per day. These data also demonstrate a significant decline in physical activity as children progress through adolescence. In particular, girls have a significant decrease in physical activity levels between ages 10 and 16 years. Similar decreases in physical activity between the 6th and 12th grades have been previously described in schoolchildren. Data from the Youth Risk Behavior Surveillance System also demonstrated a significant decline in physical activity among girls during high school.

In 1977, Bandura first postulated that behavioral changes were predominantly mediated by self-efficacy—the belief that one can successfully perform a desired behavior. According to Bandura, “Efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences.” Self-efficacy measures are tailored to assess specific behaviors. In this study, self-efficacy comprised a child’s belief in his or her ability to become physically active, even in the presence of barriers to physical activity or alternative activities. As such, self-efficacy was a major correlate of high-level activity in children. Reynolds and Saunders and their colleagues also demonstrated that self-efficacy was significantly correlated with self-reported levels of physical activity in adolescents. In addition, Sallis et al. have shown that self-efficacy was the strongest correlate of exercise behaviors in a community sample of adults. Therefore, programs that enhance children’s beliefs in their ability to exercise may actually increase motivation to be physically active.

In contrast, the health belief model postulates that the likelihood of adopting a particular behavior is related to an individual’s perception that the behavior will either improve or damage his or her health. In this study, health beliefs about the benefits of physical activity were not related to actual activity levels. O’Connell and colleagues also demonstrated that the health belief model...
was minimally associated with adolescents’ exercise participation. Similarly, Sallis et al. showed that health beliefs contributed only minimally to physical activity in a community sample. These results are not surprising; after all, it is well-known that adolescents frequently smoke cigarettes and consume alcohol and other drugs despite detailed knowledge of the health detriments of these behaviors. Unfortunately, parents and physicians tend to use the health belief model most frequently to get children to be active, admonishing, for example: “If you exercise, you’ll lower your cholesterol.” “The best way to lower your blood pressure is to exercise.” “If you’re more active, you’ll lose weight and have more energy.”

Sedentary time was equally divided among viewing television, sitting at the computer, and doing homework. It is no surprise that increased levels of sedentary behaviors were associated with decreased levels of physical activity; however, previous studies have tended to solely focus on television viewing as a marker for sedentary behaviors. In this study, time spent on television viewing and computer activities was equivalent, and both were inversely correlated with moderate-level physical activity but not high-level physical activity. Therefore, children who spend less time in sedentary behaviors will spend more time in moderate-level activity, such as playing, while not necessarily participating in high-level activity, such as sports. Data from the Bogalusa Heart Study indicate that increased time spent watching television, using the computer, and playing video games was not associated with decreased levels of high-level physical activity. Other data have also shown that television viewing has only a weak, if any, association with high-level activity, such as brisk walking, jogging, and running. Therefore, the findings that less sedentary children have increased moderate-level physical activity is important, because children spend a significantly greater proportion of their time in moderate-level activity compared with high-level activity, and moderate-level activity is particularly difficult to assess by questionnaire. Therefore, increased levels of moderate activity may account for the lower amounts of weight gain observed in children who limit television viewing.

In conclusion, this study demonstrates that healthy children aged 10 to 16 years rarely engage in vigorous physical activity. Computer use is a sedentary behavior that is becoming increasingly common and is associated with lower levels of physical activity. To be most effective, interventional efforts to increase physical activity should primarily target decreasing television and computer time and increasing self-efficacy. In addition, increased levels of physical activity are an important component in the development of self-esteem in children.

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