Aerobic Fitness Status and Out-of-School Lifestyle of Rural Children in America and Russia

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Background: This study compares the aerobic fitness status of a sample of rural American and Russian children, and examines these findings in light of their out of school physical activity participation. Methods: Ten and eleven year old (N = 415) children from both countries completed a 15 m Progressive Aerobic Cardiovascular Endurance Run (PACER) fitness test, and following the test, the children scoring beyond the upper limit of the healthy fitness zone were interviewed with regard to their out-of-school participation in physical activity. Results: The Russian students achieved significantly higher scores than American students (P < .001), and males scored higher than females for both countries (P < .001). After examining the profiles of the students 3 apparent themes begin to emerge: Russian students walk to and from school; the students in both settings who achieve a superior fitness level participate in after school physical activity; after school activities for the American students appear to be more recreational orientated than the Russian students, who participate in structured training in sports clubs. Conclusions: For the students in this study, it appears that participating in after school activity may have contributed to achieving high levels of aerobic fitness.

Keywords: PACER test, aerobic fitness, Russia

Throughout its history, physical education in American schools has seen periods where fitness was the primary goal. In between these times, the focus has been less on the organic component of the subject and more on the development of motor skills. In Russian schools, there has also been a history of a focus on physical development in physical education, with stated objectives including a focus on physical training and drill activities.

Recent events in both countries have resulted in a change of emphasis. In America, there has been a growing concern for the state of affairs of children’s physical health. Numerous documents and reports have been published suggesting American children are a nation at risk, particularly with reports of raising levels of childhood obesity and other hypokinetic ailments. In Russia, the breakup of the Soviet Union has resulted in a focus by health professionals and researchers on the consumption of alcohol and tobacco products. Nonetheless, studies focusing on the activity levels of Russian youth show that while they do obtain sufficient amounts of any level of physical activity per week, efforts may be needed to promote more regular moderate to vigorous physical activity. From the perspective of physical education, the Russian president has recently called for new approaches to physical education in Russia to be developed in which “a focus on a healthy lifestyle and interest in sports should be taught from childhood.”

Another recent phenomenon in American schools has been the advent of criterion-based fitness testing. This testing focuses on comparisons against health standards rather than against age-related norms. The FITNESSGRAM for example, provides tests of cardiovascular endurance, muscular strength, and endurance, as well as flexibility and body composition. In Russia, however, norm-referenced tests are still in operation, with students’ performance on these tests counting directly toward their grades. While Russian students complete motor performance tests of speed, power, and agility, their fitness batteries do include health-related activities similar to those of FITNESSGRAM such as a distance run, and tests of push-ups and sit-ups.

Given some of the structural and philosophical differences between the physical education systems of the United States and Russia, the purpose of this study was 2-fold. The first objective was to determine similarities and differences between a cohort of American and Russian children with regard to their levels of cardiovascular fitness. The second objective was grounded on a comprehensive review of worldwide children’s aerobic test performance that demonstrated a wide variation in fitness levels between countries with Baltic and Scandinavian countries having more fit children and Mediterranean and developed Pacific Rim countries having the least fit children. While there is not enough published evidence on what fit children do to become or stay fit in those countries, some authors suggested that in the case of the Northern European
(Baltic and Scandinavian) and, to a lesser extent, the Central European states excellent levels of children’s fitness may be due to their long tradition of institutionalized and organized participation in physical activity. Therefore, one of our goals for the study was to investigate the physical activity patterns of those children who achieve the highest fitness levels. In this way, we may learn more about the social conditions of both countries that promote physical activity engagement by young children.

Method

Participants

A total of 415 students from the United States and Russia participated in this study. The children from both countries were in the 4th or 5th grades (ages 10 or 11). One hundred and fifty students from 7 elementary schools in the rural southeast were the American participants in this study, while the Russian cohort of 265 came from 5 different schools in the Central Chernozem region of the Russian Federation. Institutional approval of the protocol was achieved and participants provided assent following parental informed consent.

Data Collection Procedures

The aerobic fitness status of each student was measured using the Progressive Aerobic Cardiovascular Endurance Run (PACER) fitness test. The PACER was administered according to the procedures outlined in the FITNESSGRAM Test Administration Manual. That is, the students were instructed to run across a 15m distance and touch the opposite marked end with their foot by the time the “beep” sounded on an audio compact disc. Keeping time to the audio beep, students ran back and forth between the marked 15m distances for as many laps as possible. The test was completed for each student when they either voluntarily stopped, or could not maintain the required speed for 2 laps.

Four certified Physical Best specialists administered all tests. These specialists had practical experience in school administering the PACER test before these data were collected. The same protocol was used across all sites. The test was explained, and the students listened to the first level of the test from the CD-Rom while one of the test administrators demonstrated that it was not necessary to run as fast as possible at the beginning.

The number of laps completed was recorded for data analysis and to determine the age- and sex-related criterion-referenced standards. These standards, established by The Cooper Institute, represent levels of fitness that offer protection against the diseases that result from sedentary living. Consequently, the lap count for each child was compared with the healthy-fitness standard to determine if that child achieved, or failed to achieve, the criterion score for his or her age. While there has been no reported research on the validity of the US-derived FITNESSGRAM standards for Russian children, these same standards were applied to provide at least some consistent comparison.

Following the completion of the PACER tests, students who exceeded the upper end of the healthy fitness zone were interviewed with regard to their after-school physical activity participation. The interviews took place in either a quiet area of the gym or in the physical education teacher’s office. Students were interviewed individually, with the researcher asking the following 3 questions: (i) How do you get to and from school each day? (ii) What do you do when you get home from school—play games or sports, watch television, play on the computer? Where do you do this? and (iii) Are you a member of a sport club, or do you play on a team in a sports league? None of the students had difficulty responding to the questions, and very few prompts were necessary.

Data Analysis

A 2 (country) × 2 (sex) × 2 (age) analysis of variance (ANOVA) evaluated differences in the number of laps achieved by the listed conditions. In addition, a chi-square test of independence was calculated to determine if a relationship exists between Country and meeting the healthy fitness standards as designated by FITNESSGRAM, (dichotomized as either Yes or No). Further, logistical regression was used to predict the odds ratio that students would reach the healthy fitness zone, using sex and country of origin as the independent variables. Alpha level was set at .05 for all analyses and SPSS version 15 was used.

A researcher whose native language was Russian performed the analysis of the qualitative data on the original text (in Russian) and the resulting themes were later translated into English for the purposes of reporting. This method was used to reduce the possibility of inconsistencies and alternate meanings that may arise from translation.

Results

Accumulated Laps

The means and standard deviations of the students’ accumulated laps on the PACER test are presented in Table 1. The results indicated (a) a statistically significant main effect for country $F (1, 414) = 38.05, P < .001, \eta^2 = .085$, with Russian students completing more laps (mean $= 70.39, SD = 29.12$) than American students, (mean $= 51.19, SD = 29.34$); (b) a statistically significant main effect for sex $F (1, 414) = 13.67, P < .001, \eta^2 = .033$, with males completing more laps (mean $= 69.22, SD = 33.43$) than females (mean $= 55.92, SD = 24.56$); and (c) a statistically significant interaction effect for Country by Sex, $F (1, 414) = 17.55, P < .001, \eta^2 = .041$. Follow-up independent samples $t$ tests reported that Russian males scored statistically significantly more laps (mean $= 80.53, SD = 31.45$) than Russian females (mean $= 58.33, SD = 20.42$). However, there were no significant differences between American males (mean $= 51.33, SD = 28.38$) and American females (mean $= 50.97, SD = 31.02$).
Achievement of Health Standards

The percentage of students’ who achieved the healthy fitness standards as designated by FITNESSGRAM is presented in Table 2. The chi-square tested showed the association between the 2 variables was significant, $\chi^2 (1, n = 415) = 39.30, P < .001, C = .308$. Overall, 97.4% of the Russian students achieved their respective age-and sex-related cut-offs, while 78.7% of the Americans reached the relevant healthy standard. Using separate models for age and sex, odds ratio suggests that the Russian children are 9.4 times more likely to surpass the healthy standard than American children. In particular, Russian girls were 23.5 times more likely while Russian boys were 6.9 times more likely to exceed the FITNESSGRAM cut-off than their American counterparts.

Achievement of Superior Fitness Levels

In terms of achieving scores that exceeded the upper limits of the healthy standard, Russian students overall were 2.3 times more likely to achieve high scores than the American children. However, within these data, there was no significant difference in the extent to which girls exceeded the healthy standard, while for boys, the Russian students were 3.3 times more likely to exhibit superior fitness levels than American boys.

Profiles of Russian Children

When analyzing the interviews with the Russian children, there appeared a number of consistencies with their after school activity levels. All of the Russian children walked to and from school. Not a single one rode in a car or bus (note, they attend school on Saturday as well). All but 1 Russian student owned a bicycle and rode it daily after school and on weekends. All of the students spent significant time outdoors after school in active play. For boys, soccer was the most popular activity, but many, including girls, played chasing and tag games. There was no mention by any of the children of play on computers or watching television. It must be noted here, that not many, if any, own computers, and Russian TV is limited. During interviews, over 80% of students mentioned they were engaged in some formal out of school sport club specialist training, and many of these are particularly aerobic in nature. The common activities include cross-country skiing and orienteering, with another group highly engaged in combatives, particularly judo and wrestling.

The following profiles provide specific examples of Russian participation. The ratio of boys to girls is representative of the number exceeding the upper health fitness zone.

Slava is 10 years old and trains 4 or 5 days a week for orienteering. He trains and competes year round, in a sport that involves mainly running, but with some sessions augmented by basketball and other cross-training games. There is a forest next to the school where Slava is coached by a specialist from the sports club. Slava walks to and from school each day, which takes about 20 minutes. After school, and when he is not training, Slava likes to play with his friends in the dvor (the area bound by high-rise apartments), usually participating in football (soccer) or just riding his bicycle.

Maxim is 12 and specializes in cross-country skiing. Like Slava, his participation is year-round, with the winter months being spent in snow training (4–5

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Table 1  Means and Standard Deviations of the Students’ Laps on the PACER Test

<table>
<thead>
<tr>
<th>Country</th>
<th>Sex</th>
<th>Age</th>
<th>Mean (laps)</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>Male</td>
<td>10</td>
<td>76.20</td>
<td>30.15</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>85.23</td>
<td>32.38</td>
<td>69</td>
</tr>
<tr>
<td>Russia</td>
<td>Female</td>
<td>10</td>
<td>50.81</td>
<td>16.87</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>64.39</td>
<td>21.12</td>
<td>67</td>
</tr>
<tr>
<td>USA</td>
<td>Male</td>
<td>10</td>
<td>54.19</td>
<td>30.35</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>46.53</td>
<td>24.42</td>
<td>34</td>
</tr>
<tr>
<td>USA</td>
<td>Female</td>
<td>10</td>
<td>48.51</td>
<td>31.72</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>55.09</td>
<td>30.07</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 2  Student Achievement of the Healthy Fitness Standards

<table>
<thead>
<tr>
<th>Country</th>
<th>Sex</th>
<th>Percent achieving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>Male</td>
<td>95.8</td>
</tr>
<tr>
<td>Russia</td>
<td>Female</td>
<td>99.2</td>
</tr>
<tr>
<td>Russia</td>
<td>Total</td>
<td>97.4</td>
</tr>
<tr>
<td>USA</td>
<td>Male</td>
<td>75.3</td>
</tr>
<tr>
<td>USA</td>
<td>Female</td>
<td>81.4</td>
</tr>
<tr>
<td>USA</td>
<td>Total</td>
<td>78.7</td>
</tr>
</tbody>
</table>
times a week), while during summers, he does rollerblading and other cross-training. Maxim walks the short distance to and from school daily, and his ski training is conducted over trails in the forest next to his school that range from 3 to 8 kilometers. In his spare time, Maxim likes to play football in the dvor, but he does not own a bicycle.

Sasha is 11 years old and used to train for orienteering, but is not presently part of the specialist group. He walks to and from school each day, which takes between 10 and 15 minutes. Sasha likes to play tag games and football with his friends in the dvor after school, and spends most of his free time either playing outside or riding his bicycle.

Ivan, a 12 year old, is a wrestler, and practices at his school 5 to 6 times per week. His daily routine usually involves a 12-minute walk to and from school, completion of his homework, and then the same walk back for wrestling. He does not have a lot of spare time to play with his friends, but when he does, he enjoys riding his bicycle.

Tatiana is 12 years old and is a swimmer and dancer. She trains for both either 3 or 4 times per week. While she walks to and from school each day, Tatiana does ride the bus to the swimming pool where she trains. When she is not training, Tatiana enjoys a number of run and tag games that she plays with her friends in the dvor, her particular favorite being “Cossacks and Robbers.”

Profiles of American Children

For the American children who achieved the highest fitness scores, participation in organized activities after school was also the norm. Some of these were school-based programs situated at the student’s home school, while others participated in sports leagues offered by the city’s recreation department. The major difference between these sporting contexts and those in Russia was the nature of the instruction. Volunteers or part-time workers staffed the American programs, while the Russian sports clubs programs were administered by professional coaches for whom this was their primary employment.

Of interest though, is that all the American students took motorized transport to school, either in cars driven by parents or on school buses. Nonetheless, most of this cohort also reported riding bicycles after school and in their free time. None, however, used a bicycle as a primary form of transport.

The following profiles provide specific examples of American participation. In this case, only data from boys are included, as none of the girls exceeded the upper health fitness zone.

Bob is 10 years old and is in the 4th grade. After school each day he goes to the After-School Program at his elementary school. A few nights a week he also goes to American football practice. He enjoys playing outside with his brothers and also enjoys riding his bike. He loves to play sports! His favorite sports are baseball, basketball and football. He doesn’t take any special lessons and his parents drive him to school in the mornings (he takes the bus home). Overall he considers himself to be very active and to be healthy.

Ryan is 10 years old and is in the 5th grade. After school is over he attends the after-school program where his favorite rotation is sports. He loves to play kickball at recess and enjoys playing with his friends. Robert also enjoys playing on his soccer team 3 nights a week. Ryan is also a member of a basketball team. In the mornings Ryan takes the bus to school or he rides with his mother. He used to take swimming lessons but doesn’t anymore. Ryan rides his bike a lot and when asked, declared that he is an active and healthy person.

Paul is an 11 year-old Caucasian male. He rides the bus to and from school every day. Paul loves to go to the local aquatics center and swim after school. He is on a swim team. Paul loves to play all sports, especially soccer and basketball. He is on a soccer team with his friends. Paul likes to ride his bike when he is at home.

Chris is a 10 year-old Caucasian male. Chris rides the bus to and from school every day. His favorite sport is soccer. He plays on a soccer team for a city league with his friends. Chris loves to ride his bike. He rides his bike when he is at home and finished with his homework.

Travis is a 10 year-old Caucasian male. He rides the bus to and from school every day. He plays soccer for a city league. He likes playing soccer with his friends for fun. Travis likes riding his bike around his neighborhood. His favorite sports to play are soccer and baseball. He wants to play baseball in college when he grows up.

Discussion

The purpose of this study was to determine fitness levels of a cohort of Russian and American children and highlight the physical activity patterns of the children who achieved the superior fitness category. Overall the Russian students were more fit based on the number of accumulated PACER laps, percentage of students who achieved their age and sex cut-offs and the percentage of students who achieved superior fitness levels.

After examining the profiles of the students 3 apparent themes begin to emerge: 1) Russian students walk to and from school, 2) the students who achieve a superior fitness level participate in after school physical activities, and 3) after school activities for the American students appear to be more recreational orientated than the Russian students.
Previous studies have found that walking, biking, and other forms of active transportation provide a substantial portion of children’s physical activity. However, over the past 30 years the rates of American children who walk or bike to school have steadily declined. The National Personal Transportation Survey shows that in 1969-40.7% of American students walked or biked to school, but by 2001 the percentage decreased to 12.9%. Previous research examining Russian children’s physical activity showed that active commuting to school represents a large portion of children’s physical activity. In examining differences between Russian and American children the loss of physical activity by actively commuting to school appears to represent a critical loss of everyday physical activity and may explain the differences in fitness levels.

Proving change in environments that promote sedentary behavior is being considered as a viable means to increase children’s physical activity level. In comparing children from these 2 countries it appears that the transportation environment is related to children’s physical fitness. For American children the most frequently reported barrier to walking or biking to school is long distances to the school. Other barriers include: traffic danger, adverse weather conditions, crime danger and opposing school policy. The transportation environment for Russian students differs of that of American students. More often than not Russian children attend schools located in their neighborhoods within walking distance. In addition, many families, especially in rural areas, do not own automobiles and rely on public transportation. While Russian researchers note the decline of children’s level of physical activity in the last decade, almost 70% of today’s 11 year old Russian children (73.4% boys and 65.5% girls) report exercising at least 60 minutes per day 3 or more days of the week. A part of that exercise for Russian children is a daily walk to school. The children from both countries who achieved the highest fitness category participated in after school activities that required physical activity. Studies show that students who participate in organized sport programs and after-school activity accumulate significantly more physical activity than non participants. Furthermore, studies using objective measures of physical activity have found a moderate-to-low relationship between physical activity and aerobic fitness between boys and girls. Although a causal relationship between physical activity and physical fitness has not been established, studies consistently show that students who achieve the high fitness category accumulate significantly more physical activity throughout the day than those of lower fitness levels. For the students in this study, it appears that participating in after school activity may have contributed to achieving high aerobic fitness scores.

A majority of the literature focuses on comparing children who achieve a high fitness level to those who achieve a low fitness level or only focus on children who are inactive. While this information is valuable it does not fully explain exercise and fitness behavior of young children. This study provides key insight into why American children continually fall below fitness levels when compared with other nations and key environmental differences between the Russia and America that contribute to activity patterns.

While this study investigated aerobic fitness and out of school physical activity behaviors of children in rural settings, investigations of children living in urban settings in both countries are warranted and might provide further insight on the matters raised in this study. Further studies may consider assessing other areas of health-related fitness such as body composition, muscular strength, endurance and flexibility. However, it is still important to use the health-related criteria and emphasize fitness for health rather than set goals based on performance. Yet another area of future research lies in the investigations of children’s activity levels, especially those of Russian children as there is minimal literature on the topic.

References


