Published in final edited form as:

J Phys Act Health. 2009 January ; 6(1): 105–111.

Past-Year Sports Participation, Current Physical Activity, and Fitness in Urban Adolescent Girls

Jennie A. Phillips and Deborah Rohm Young

Dept of Kinesiology, University of Maryland, College Park, MD 20742

Abstract

Background—This study examined associations between sports participation, physical activity, fitness level, and body mass index in ninth-grade girls.

Methods—Data were analyzed for 221 participants who completed sports participation and physical activity recall questionnaires, an aerobic step test, and height and weight measurement.

Results—On average, participants had low physical activity levels, and many were overweight or obese (47%). About half participated in at least one organized sport in the previous year. Sports participants had higher current estimated energy expenditure compared with non-sports participants ($P = .0007$). Those who participated on at least two teams were more likely to complete the three-stage step test without reaching their target heart rate than those who did not participate on any teams ($P < .03$). Past sports participation was positively associated with current physical activity and fitness levels.

Conclusion—Urban adolescent girls who participate in sports have increased energy expenditure and higher fitness levels, indicating sports as a potential strategy to improve physical activity and health in this population.

Keywords

African American; females; energy expenditure; high school

Physical activity and its associated fitness benefits are important components of a healthy lifestyle. However, the US population of all ages does not achieve the recommended levels of physical activity.^{1,2} Although children are the most physically active age group, adolescence is a time in which physical activity declines.^{2,3} The decline is greater in girls than boys² and greater in black than white girls.⁴ According to the 2003 Youth Risk Behavior Survey (YRBS), 37.5% of white high school girls had an insufficient amount of physical activity, defined as doing less than 3 bouts per week of at least 20 minutes of vigorous physical activity and less than 5 bouts per week of at least 30 minutes of moderate physical activity.² The prevalence of insufficient activity was even higher for black females (50.4%).² Overweight adolescent girls might be at a higher risk for physical inactivity, which might increase their risk for further weight gain and negative health consequences.³

Sports participation is a common form of activity in children and adolescents; 30 million American children and adolescents currently participate in organized sports.⁵ As indicated by the percentage of YRBS respondents reporting sports participation, approximately 10

million high school students are involved in organized sports.⁶ The YRBS reports that 55.9% of white high school girls and only 39.6% of black girls played on at least 1 sports team in the past 12 months.² Unfortunately, participation in sports also declines during adolescence. Dropout is noticeable by age 10 and reaches its peak at ages 14 to 15.⁷ The number of high school girls participating in sports declines throughout grades 9 through 12; the 2003 report showed that past-year sports participation dropped from 55.2% in 9th grade to 45.7% in 12th grade.² The dropout rate of girls in sports is higher than boys.⁷ Decrease in interest, coaching factors, and time factors were cited as reasons for discontinued sport participation by a large group of 7th and 8th graders.⁸

Cardiorespiratory fitness levels are also lower than desirable in adolescent girls. Data from the National Health and Nutrition Examination Survey (NHANES) categorized 34.4% of adolescent girls as having low fitness.⁹ McMurray et al¹⁰ reported mean fitness levels in 11- to 14-year-old girls to be between 33.0 and 36.5 ml · kg⁻¹ · min⁻¹. These values are considered poor to fair for adolescent girls.¹¹ Another study reported similar values for white high school girls but significantly lower mean fitness levels for black girls (29.6 ml · kg⁻¹ · min⁻¹). With declining levels of physical activity, declining participation in sports programs, and low fitness, adolescent girls are at risk for facing future physical inactivity-related health consequences.

The relationships among organized sports participation, physical activity, and fitness have not been extensively researched in high school age girls,^{12,13} particularly with a physical activity measure capable of estimating total energy expenditure. Sports participation might be an important avenue for maintaining physical activity, fitness, and healthy weight in adolescent girls. Therefore, the purpose of this study was to explore the associations between sports participation, physical activity, and fitness level in a sample of urban, ninth-grade girls. It was hypothesized that sports participation would be related to current energy expenditure, fitness level, and body mass index (BMI), such that those who participated in sports would be more physically active, more likely to be fit, and have lower BMI.

Methods

Participants

This study analyzed baseline data collected for Project Heart, an intervention trial in a Baltimore City, MD, high school. The intervention was designed to increase physical activity levels and fitness in adolescent girls.

Ninth-grade girls were recruited from physical education (PE) classes at a public, all-girl, city-wide, high school. Recruitment took place in the fall of 3 consecutive school years (2000–2002). Students who were enrolled in and able to participate in PE classes were eligible for the project. Of the entering ninth-grade class, approximately two-thirds were eligible based on their PE schedule. Students were excluded from enrolling in the study if they were pregnant or breast feeding, planning to move out of the area in the next year, or had a sister already participating in the study. A parental written informed consent statement was obtained, along with child assent. The protocol of the study was approved by the institutional review boards of Johns Hopkins University and the University of Maryland.

Measures

Baseline measurements were completed in the first 4 to 5 weeks of each school year, before randomization for the intervention portion of the study. The girls completed measurements during PE class time, lunch, before school, or after school in a classroom dedicated for study purposes. Measurements for each student were completed in 3 to 5 sessions. The measures used in this analysis included BMI (kg/m^2), cardiorespiratory fitness, physical activity level in terms of estimated energy expenditure, and previous-year sports participation.

Anthropometry—Trained technicians measured height and weight. Height was measured with a wall-mounted stadiometer to the nearest 0.1 cm without shoes. Weight was measured with a calibrated physician's scale to the nearest 0.1 kg in light indoor clothing without shoes. BMI was calculated by the equation $(\text{mass in kg})/(\text{height in m})^2$.

Physical Fitness—Cardiorespiratory fitness was assessed with a submaximal 3-stage step test.¹⁴ The protocol was designed for participants to exercise successively at 50%, 59%, and 70% of estimated maximal heart rate reserve by stepping up and down on 3 steps with heights calculated to meet the required energy expenditure. Participants stepped up and down the steps at progressive heights until the test was completed or until the participant reached the target heart rate (70% of estimated heart rate reserve).

Participants' exercise heart rate was monitored throughout each 3-minute stage and recorded at 2:30, 2:45, and 3:00. If a student's average heart rate during the stage did not exceed her target heart rate, she proceeded to the next highest step and repeated the procedure (Stage 2). If the Stage 2 heart rate was below the target heart rate, then she proceeded to Stage 3. Students who made it to Stage 3 completed all 3 minutes of the stage unless they stated that they were unable to continue. The girls were classified by the stage they completed: completed Stage 1, completed Stage 2, completed Stage 3 and reached their target heart rate, and completed Stage 3 without reaching their target heart rate. The average Stage 1 heart rates of these 4 groups were all significantly different and lower for each progressing level ($P < .0001$), indicating reasonable differentiation of fitness. Test–retest reliability showed no significant difference in heart rate at any stage.¹⁵

Physical Activity—Current physical activity was estimated with an interview-administered 7-day physical activity recall (7DPAR).^{16,17} Girls were asked about their before, during, and after school weekday physical activities and their morning, afternoon, and evening activities on the weekend for each day of the past 7 days. Sleep time was also recorded. To ascertain usual physical activity, the survey was not administered following a school break nor when a girl had reported being sick in the previous week. The amount of time reported in moderate, hard, and very hard physical activity was multiplied by the appropriate intensity code (4, 6, and 10 metabolic equivalents [METs], respectively). Light activity was recorded as the time not sleeping and not in any of the above categories. Light activity and sleep were also multiplied by intensity codes (1.5 and 1.0 METs, respectively), and total estimated daily energy expenditure was calculated in kilocalories per kilogram per day ($\text{kcal} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$). Data were reported as the average daily energy expenditure for the 7 days recorded for each participant. The instrument is reliable in older adolescents and has

been validated in many samples. The correlation of reported very hard activities with heart rate monitoring data was .45 among 8th-grade students and .72 among 11th-grade students.¹⁸

Sports Participation—Two questions from the YRBS¹⁹ were used to determine past-year sports participation:

1. During the past 12 months, on how many sports teams run by your school did you play? (Do not include PE classes.)
2. During the past 12 months, on how many sports teams run by organizations outside of your school did you play?

Answer options for both questions were *None, 1 team, 2 teams, or 3 or more teams*. For this analysis, an answer of at least 1 team for either question was considered participation. Students were categorized into 3 sports participation groups: (1) no sports participation (none), (2) participation on 1 team, (3) participation on 2 or more teams. A single item from another instrument, the Multidimensional Body-Self Relations Questionnaire (MBSRQ),²⁰ was used in the study sample to check validity of the YRBS questions. The MBSRQ question asked if participants played a sport regularly throughout the year. The responses from this question were significantly associated with sports participation categories in a chi-square analysis ($\chi^2 = 72.1$, $P < .0001$).

Data Analysis

Data were analyzed using the SAS Version 9.1 statistical software package (SAS Institute, Cary, NC). Means of continuous variables and distributions of categorical variables were used to describe the sample. Analysis of variance (ANOVA) was used to assess between-group differences in energy expenditure and BMI. Chi-square tests were conducted to determine differences in the fitness distribution by sports participation groups.

Results

Two hundred twenty-one students, 50% of the eligible sample, agreed to participate in the study. Participants and nonparticipants were similar and representative of the school population in terms of race, socioeconomic status, and home neighborhood. The participants were from all neighborhoods of Baltimore City, MD. Most of the girls (75%) were 14 years old at recruitment, and 83% of participants classified themselves as African American. Participant characteristics are presented in Table 1. The mean BMI of the sample was $25.1 \pm 6.8 \text{ kg/m}^2$. Using international BMI cut points for 14-year-old girls,²¹ 47.3% of this sample was overweight or obese. Over half the sample (52.3%) reported no organized sport participation in the past 12 months. Sport participation did not differ by mother's education level ($\chi^2 = 3.3$, $P = .5$). Participants had a low level of physical activity; the mean daily energy expenditure was $35.1 \pm 3.5 \text{ kcal} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$. (An energy expenditure less than $35 \text{ kcal} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ is considered low activity.²²) More than half of the girls (57.9%) were able to complete all 3 stages of the step test, and approximately 14% completed just Stage 1 (Table 2).

Table 3 displays the means of BMI and estimated energy expenditure by sports participation group. BMI did not differ across sports participation groups ($F = 0.06$, $P = .94$). However, sports participation was associated with estimated energy expenditure ($F = 7.49$, $P = .0007$). Those who participated on one or more sports teams in the previous year had significantly higher current estimated energy expenditure than those who did not participate on any teams.

Table 2 displays the fitness category distribution by level of sports participation. Those who participated on 1 sports team in the previous year did not differ in fitness compared with those who did not participate on any teams ($\chi^2 = 0.99$, $P = .80$) or those who participated on at least 2 teams ($\chi^2 = 3.7$, $P = .30$). However, a significant difference was found between those who did not participate in any sports and those who participated in at least 2 sports ($\chi^2 = 8.98$, $P < .03$). Of participants in at least 2 sports, 46% completed the step test without reaching their target heart rate, compared with 24% of nonparticipants. Conversely, only 11% of the girls who participated in at least 2 sports ended the step test at Stage 1.

Discussion

Similar to nationwide data for ninth-grade girls, almost half of this sample of girls participated in at least 1 team sport in the past year.² This is a promising finding in that the sample was predominantly African American and many were overweight or obese, characteristics that are usually associated with lower participation. Other studies have reported a negative relationship between sports participation and overweight status. In a sample of Hispanic American 10- to 18-year-olds, those who participated on at least 1 sports team were significantly less likely to be overweight than those who did not participate on any teams.²³ Tremblay and Willms also reported a negative association between participation in organized or unorganized sports and obesity in Canadian children.²⁴ Overweight or obesity status did not appear to negatively impact sports participation in our sample, suggesting that weight status might not be a barrier in a predominantly African American population.

Although it seems intuitive that sports participants would be more physically active than their nonparticipating peers, relatively few studies have examined the differences in energy expenditure, especially in high school girls. Studies with broad, subjective physical activity measures have found that participants are more likely to exhibit beneficial physical activity patterns; however, none of these studies have examined the impact on total energy expenditure.^{6,25–28} Wickel and Eisenmann recently published the first study with an objective measure and found that sports participation can be a significant contributor to overall physical activity in a sample of 6- to 12-year-old boys.²⁹ Because it is known that physical activity generally decreases in adolescence, it is imperative to know what might help maintain or even increase activity. Sports participation might provide an important opportunity to improve the physical activity levels and health status of high school girls. We found that sports participants were more active than nonparticipants, suggesting that the organized and scheduled nature of sports might provide a critical opportunity for increased physical activity.

In our study, sports participants' daily energy expenditure was almost 2 kcal/kg higher than that of those who did not participate. With an average weight of 67.1 kg for the sports participants, this translates to a daily energy expenditure of 121 kcal more than nonparticipants. This is a significant amount of physical activity in terms of health and disease prevention, including obesity. Evidence of this protective factor is particularly important given that adolescence is a time when sports participation is declining while BMI and other risk factors are increasing.

High school sports participation might have a protective effect on weight in the adult years. In a study of African American and Caucasian women, Alfano and colleagues found past sports participation to be associated with current BMI.³⁰ Women with higher levels of past sports participation had lower BMI compared with women who did not participate in high school sports. A potential reason for this protective effect is that sports participation in youth might foster habits that translate into physical activity participation in adulthood.

Participation in sports early in high school appears to have a significant impact on girls' continuation in sport and physical activity. Researchers have reported positive associations between early sport participation and later physical activity.^{27,30–32} Dovey et al reported that boys and girls playing on a school sports team at age 15 were almost twice as likely to spend more than 4 hours per week in physical activity at age 18 than those who did not participate in a school sport.³² Similar odds (OR = 1.8 to 2.2) were reported for girls studied from 8th through 12th grades, showing that sports participation increased the likelihood of vigorous physical activity at later time periods.²⁷ Examination of specific activities in the same sample showed participation in early adolescence was linked to continued participation in the same activities.³³ We extend these previous findings in urban, adolescent girls; girls who participated in at least 1 sport in the previous year were currently more physically active than those who were not involved in sports.

It is also believed that benefits enjoyed and habits formed during adolescent participation in organized sports might make a person more likely to continue physical activity into adulthood. Although correlations tend to be low to moderate, several studies have shown a positive association between past sports participation and continuing physical activity such that those adolescents who participate in sports are more likely to continue to be physically active in adulthood than those who do not participate in sports.^{30,34–39} Other forms of physical activity^{40–43} and physical fitness^{42–45} track throughout adolescence and adulthood in a similar fashion. These findings emphasize the importance of early participation for girls.

There is little research about the association between sports participation and fitness in adolescents in community-based samples. In the National Children and Youth Fitness Study, the total number of organized activities was weakly but significantly correlated with mile-run performance in 11-, 12-, and 14-year-olds.⁴⁶ Beets and Pitetti examined a variety of fitness measures in relation to school sports participation.¹² Girls who participated in at least 1 school sport performed better on the aerobic shuttle run test than girls who did not participate. Significant differences were not found between groups for girls' BMI, push-ups, or sit-and-reach assessments. The factors related to change in cardiorespiratory fitness from 8th to 12th grade were examined in the LEAP sample.¹³ Sports participants (≥ 1 team) had

significantly higher weight-relative fitness, assessed with the physical work capacity–170 bike test, than nonparticipants at all 3 time periods. In the current study, students needed to participate on at least 2 sports teams before fitness benefits could be observed. More prospective studies are needed to determine if participation in organized sports can improve fitness, especially in light of the lack of association observed in weight status.

There are several limitations to this study. The questions used to determine sports participation asked only about organized sports teams. The definition of *team* is left to the participant to interpret and might not have been consistent across the sample. However, these are the questions used in the YRBS national data. These questions do not provide any data about specific sport activity or level of participation; therefore *participants* might have a wide range of involvement in organized sports activities. Others^{33,47} have now been using instruments able to discern specific physical activities to better describe the behavior of adolescent girls. In addition, the YRBS questions ask about the past 12 months and, therefore, do not provide any information about current participation. The estimates of current physical activity were obtained through self-report, possibly leading to bias because participants might not accurately remember all of their activities. However, self-report is a very common method to assess physical activity, and the instrument used was reliable and valid. In addition, physical activity data might be subject to a social desirability bias in which participants overestimate their activity level to appear more physically active. The level of physical activity in this sample is quite low and is comparable to other large samples of adolescent girls,⁴ so the likelihood of a substantial bias being introduced is low. Finally, the results from this study might not extend beyond a population of urban, predominately African American girls.

Sport activities seem to be a promising avenue to improve adolescent activity and potentially influence future physical activity and fitness. However, the majority of such research has been done with European samples, and at times, the definition of *sport* is unclear. Research regarding what specific activities adolescent girls are doing and the how they change over time is lacking. Longitudinal research, particularly in American adolescent samples, is needed to better guide future interventions.

In conclusion, past sport participation was found to be associated with current activity and fitness in this population of urban, adolescent girls. This suggests that sports participation might be an important strategy to maintain physical activity levels and benefit the fitness and health of high school girls.

Acknowledgments

This study was supported by National Heart, Lung, and Blood Institute Grant R01 HL63861. We thank Ms. Sue Shang, Ms. Jeanette Harris, and Mr. Tavon English for their assistance in data collection and data management.

References

1. Centers for Disease Control and Prevention. Prevalence of physical activity, including lifestyle activities among adults—United States, 2000–2001. *MMWR Morb Mortal Wkly Rep.* 2003; 52:764–769. [PubMed: 12917582]

2. Grunbaum JA, Kann L, Kinchen S, et al. Youth Risk Behavior Surveillance—United States, 2003. *MMWR Surveill Summ.* 2004; 53:1–96.
3. Neumark-Sztainer D, Story M, Hannan PJ, Tharp T, Rex J. Factors associated with changes in physical activity. *Arch Pediatr Adolesc Med.* 2003; 157:803–810. [PubMed: 12912787]
4. Kimm SYS, Glynn NW, Kriska AM, et al. Decline in physical activity in black girls and white girls during adolescence. *N Engl J Med.* 2002; 347:709–715. [PubMed: 12213941]
5. NATA Research and Education Foundation Web site. www.natafoundation.org/rfpepidemiological.html. Accessed June 28, 2005
6. Pate RR, Trost SG, Levin S, Dowda M. Sports participation and health-related behaviors among US youth. *Arch Pediatr Adolesc Med.* 2000; 154:904–911. [PubMed: 10980794]
7. Seefeldt VD, Ewing ME. Youth sports in America: an overview. President's Council on Physical Fitness Sports Res Digest. 1997; 2:1–11.
8. Sirard JR, Pfeiffer KA, Pate RR. Motivational factors associated with sports program participation in middle school students. *J Adolesc Health.* 2006; 38:696–703. [PubMed: 16730598]
9. Carnethon MR, Gulait M, Greenland P. Prevalence and cardiovascular disease correlates of low cardiorespiratory fitness in adolescents and adults. *JAMA.* 2005; 294:2981–2988. [PubMed: 16414945]
10. McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S, Levine A. A school-based intervention can reduce body fat and blood pressure in young adolescents. *J Adolesc Health.* 2002; 31:125–132. [PubMed: 12127382]
11. Adams, GM. Exercise physiology: laboratory manual. Madison, WI: Brown & Benchmark Publishers; 1994.
12. Beets MW, Pitetti KH. Contribution of physical education and sport to health-related fitness in high school students. *J Sch Health.* 2005; 75:25–30. [PubMed: 15776877]
13. Pfeiffer KA, Dowda M, Dishman RK, Sirard JR, Pate RR. Cardiorespiratory fitness in girls: change from middle to high school. *Med Sci Sports Exerc.* 2007; 39:2234–2241. [PubMed: 18046196]
14. Ewart CK, Loftus K, Hagberg JM. School-based exercise to lower blood pressure in high-risk African American girls: project design and baseline findings. *J Health Educ.* 1995; 26:S99–S105.
15. Young DR, Phillips JA, Yu T, Haythornthwaite JA. Effects of a life skills intervention for increasing physical activity in adolescent girls. *Arch Pediatr Adolesc Med.* 2006; 160:1255–1261. [PubMed: 17146023]
16. Blair SN, Haskell WL, Ho P, et al. Assessment of habitual physical activity by a seven-day recall in a community survey and controlled experiments. *Am J Epidemiol.* 1985; 122:794–804. [PubMed: 3876763]
17. Sallis JF, Haskell WL, Wood PD, et al. Physical activity assessment methodology in the Five-City Project. *Am J Epidemiol.* 1985; 121:91–106. [PubMed: 3964995]
18. Sallis JF, Buono MJ, Roby JJ, Micale FG, Nelson JA. Seven-day recall and other physical activity self-reports in children and adolescents. *Med Sci Sports Exerc.* 1993; 25:99–108. [PubMed: 8423762]
19. Centers for Disease Control and Prevention. National School-Based Youth Risk Behavior Survey data documentation manual. 1997. www.cdc.gov/HealthyYouth/YRBS/data/1997/yrbs1997.pdf Accessed August 1, 2005
20. Brown TA, Cash TF, Mikulka PJ. Attitudinal body image assessment: factor analysis of the body–self relations questionnaire. *J Pers Assess.* 1990; 55:135–144. [PubMed: 2231236]
21. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000; 320:1240–1243. [PubMed: 10797032]
22. Writing Group for the Activity Counseling Trial Research Group. Effects of physical activity counseling in primary care: The Activity Counseling Trial: a randomized controlled trial. *JAMA.* 2001; 286:677–687. [PubMed: 11495617]
23. Mirza NM, Kadow K, Palmer M, Solano H, Rosche C, Yanovski JA. Prevalence of overweight and obesity among inner city Hispanic-American children and adolescents. *Obes Res.* 2004; 12:1298–1310. [PubMed: 15340113]

24. Tremblay MS, Willms JD. Is the Canadian childhood obesity epidemic related to physical inactivity? *Int J Obes.* 2003; 27:1100–1105.
25. Harrison PA, Narayan G. Differences in behavior, psychological factors, and environmental factors associated with participation in school sports and other activities in adolescence. *J Sch Health.* 2003; 73:113–120. [PubMed: 12677730]
26. Mota J, Esculcas C. Leisure-time physical activity behavior: structured and unstructured choices according to sex, age, and level of physical activity. *Int J Behav Med.* 2002; 9:111–121. [PubMed: 12174530]
27. Pfeiffer KA, Dowda M, Dishman RK, et al. Sport participation and physical activity in adolescent females across a four-year period. *J Adolesc Health.* 2006; 39:523–529. [PubMed: 16982387]
28. Vilhjalmsson R, Kristjansdóttir G. Gender differences in physical activity in older children and adolescents: the central role of organized sport. *Soc Sci Med.* 2003; 56:363–374. [PubMed: 12473321]
29. Wickel EE, Eisenmann JC. Contribution of youth sport to total daily physical activity among 6- to 12-year-old boys. *Med Sci Sports Exerc.* 2007; 39:1493–1500. [PubMed: 17805079]
30. Alfano CM, Kleiges RC, Murray DM, Beech BM, McClanahan BS. History of sport participation in relation to obesity and related health behaviors in women. *Prev Med.* 2002; 34:82–89. [PubMed: 11749100]
31. Aarnio M, Winter T, Peltonen J, Kujala UM, Kaprio J. Stability of leisure-time physical activity during adolescence: a longitudinal study among 16-, 17-, and 18-year-old Finnish youth. *Scand J Med Sci Sports.* 2002; 12:179–185. [PubMed: 12135451]
32. Dovey SM, Reeder AI, Chalmers DJ. Continuity and change in sporting and leisure time physical activities during adolescence. *Br J Sports Med.* 1998; 32:53–57. [PubMed: 9562165]
33. Pate RR, Dowda M, O'Neill JR, Ward DS. Change in physical activity participation among adolescent girls from 8th to 12th grade. *J Phys Act Health.* 2007; 4:3–16. [PubMed: 17489003]
34. Kuh DJL, Cooper C. Physical activity at 36 years: patterns and childhood predictors in a longitudinal study. *J Epidemiol Community Health.* 1992; 46:114–119. [PubMed: 1583424]
35. Tammelin T, Nayha S, Hills AP, Jarvelin MR. Adolescent participation in sports and adult physical activity. *Am J Prev Med.* 2003; 24:22–28. [PubMed: 12554020]
36. Tammelin T, Nayha S, Laitinen J, Rintamaki H, Jarvelin MR. Physical activity and social status in adolescence as predictors of physical activity in adulthood. *Prev Med.* 2003; 37:375–381. [PubMed: 14507496]
37. Telama R, Laakso L, Yang X. Physical activity and participation in sports of young people in Finland. *Scand J Med Sci Sports.* 1994; 4:65–74.
38. Telama RE, Leskinen RE, Yang X. Stability of habitual physical activity and sport participation: a longitudinal tracking study. *Scand J Med Sci Sports.* 1996; 6:371–378. [PubMed: 9046549]
39. Telama R, Yang X, Laakso L, Viikari J. Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *Am J Prev Med.* 1997; 13:317–323. [PubMed: 9236971]
40. Raitakari OT, Porkka KV, Taimela S, Telama R, Rasanen L, Viikari JS. Effects of persistent physical activity and inactivity on coronary risk factors in children and young adults: The Cardiovascular Risk in Young Finns Study. *Am J Epidemiol.* 1994; 140:195–205. [PubMed: 8030623]
41. Telama R, Yang X, Viikari J, Valimaki I, Wanne O, Raitakari O. Physical activity from childhood to adulthood: a 21-year tracking study. *Am J Prev Med.* 2005; 28:267–273. [PubMed: 15766614]
42. Twisk JWR, Kemper HCG, van Mechelen W. Tracking of activity and fitness and the relationship with cardiovascular disease risk factors. *Med Sci Sports Exerc.* 2000; 32:1455–1461. [PubMed: 10949012]
43. Twisk JWR, Kemper HCG, van Mechelen W, Post GB. Tracking of risk factors for coronary heart disease over a 14-year period: a comparison between lifestyle and biologic risk factors with data from the Amsterdam Growth and Health Study. *Am J Epidemiol.* 1997; 145:888–898. [PubMed: 9149660]
44. Kemper HCG, De Vente W, van Mechelen W, Twisk JWR. Adolescent motor skill and performance: is physical activity in adolescence related to adult physical fitness? *Am J Hum Biol.* 2001; 13:180–189. [PubMed: 11460862]

45. Matton L, Thomis M, Wihndaele K, et al. Tracking of physical fitness and physical activity from youth to adulthood in females. *Med Sci Sports Exerc.* 2006; 38:1114–1120. [PubMed: 16775554]
46. Thomas JR, Nelson JK, Church G. A developmental analysis of gender differences in health related physical fitness. *Pediatr Exerc Sci.* 1991; 3:28–42.
47. Barr-Anderson DJ, Young DR, Sallis JF, et al. Structured physical activity and psychosocial correlates in middle-school girls. *Prev Med.* 2007; 44:404–409. [PubMed: 17363050]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Participant Characteristics

Characteristic	n	%
Age (y)		
13	54	24
14	164	74
15	3	1
Race/Ethnicity		
African American	182	83
white	30	14
other	7	3
Mother's education		
high school or less	75	34
some college or more	123	56
don't know	22	10
BMI category ^a		
normal weight	116	52.7
overweight	58	26.4
obese	46	20.9
Achieved menarche	191	86.4

	Mean (SD)	Min	Max
BMI (kg/m ²)	25.1 (6.8)	14.7	46.7
Energy expenditure (kcal · kg ⁻¹ · d ⁻¹)	35.1 (3.5)	31.2	53.4

Abbreviation: BMI, body mass index.

^aDefined by Cole et al.²¹

Table 2

Step-Test Distribution by Level of Past-Year Sports Participation ^a

Sports participation level	Step-test achievement				
	Stage 1	Stage 2	Stage 3	THR	Stage 3 < THR
None	17 (15)	35 (31)	34 (30.1)		27 (23.9)
1 team	7 (14.9)	15 (31.9)	11 (23.4)		14 (29.8)
2 teams	6 (10.7)	11 (19.6)	13 (23.2)		26 (46.4) ^b
Total	30 (13.9)	61 (28.2)	58 (26.9)		67 (31)
					216

Abbreviation: THR, target heart rate.

^aData are presented as n (%).

^bSignificantly different from None, $P < .03$.

Table 3

Mean (SE) BMI and Energy Expenditure by Level of Past-Year Sports Participation

Sports participation level	BMI (kg/m ²)	Energy expenditure (kcal · kg ⁻¹ · d ⁻¹)
None (n = 115)	25.1 (0.64)	34.3 (0.32)
1 team (n = 48)	25.4 (0.99)	36.0 (0.49) ^a
2 teams (n = 57)	24.9 (0.92)	36.1 (0.45) ^a

Abbreviation: BMI, body mass index.

^aSignificantly different from None, $P < .004$.