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Activity Patterns and Correlates Among Youth: Differences By Weight Status

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The purposes of the study were to assess differences in physical activity levels and correlates of physical activity among overweight (‡ 85th percentile of body mass index for their sex and age) and non-overweight (< 85th percentile) youth. The sample included 509 seventh through twelfth graders. Activity was measured by a 7-day, 46-item activity checklist. Overweight girls were more sedentary than non-overweight girls ($p < .03$), and non-overweight girls engaged in more vigorous physical activity than overweight girls ($p < .03$). For boys, there were no significant differences in activity. The regression analyses for vigorous activity yielded the largest total R^2's ($R^2 = .49$ for overweight and $R^2 = .27$ for non-overweight.) The significant factor for overweight youth was greater athletic coordination ($p < .01$). For non-overweight youth, the significant factors were greater family support ($p < .05$), greater peer support ($p < .001$), fewer barriers ($p < .03$), and greater athletic coordination ($p < .01$). Correlates of physical activity vary by weight status of young people.

Overweight is a major health problem for youth and the risks of obesity are well documented (24, 25, 37, 39, 40). In a recent national study, among children 4 to 12 years old, 21.8% of Hispanics, 21.5% of African Americans, and 12.3% of non-Hispanic whites were overweight (37). Furthermore, the severity and prevalence of overweight have increased dramatically in the past 30 years (37, 39, 40). For obese youth, the physical and psychological risks include increased blood pressure, increased total cholesterol and abnormal lipoprotein ratios, hyperinsulinemia, higher incidence of type-2 diabetes, poor body image, low self-esteem, and cultural stigmatization (24, 25, 30). Additionally, obese children and adolescents are more likely to become obese adults (6, 17). The increasing rates of obesity and risks of obesity among youth are an urgent public health epidemic (37).

To address this concern, one national objective is to "increase to > 50% the proportion of overweight people aged > 12 years old who have adopted sound

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dietary practices combined with regular physical activity to attain an appropriate body weight" (7). Regular physical activity decreases blood pressure in youth with borderline hypertension (2), increases physical fitness in obese youth (18, 19), and decreases the degree of overweight among obese children (5, 10, 11, 36). To promote physical activity among overweight youth, understanding the physical activity patterns and correlates of physical activity is important.

Findings from previous studies are inconsistent regarding the relationship between weight status and physical activity levels in youth (43, 44). A comprehensive review (34) of correlates of physical activity among children and adolescents identified 31 studies in children and 21 studies in adolescents related to body mass index. The body mass index and physical activity relationship was inconsistent for children, and there was no association for adolescents. A recent study (15) found that, among middle and high school students, activity (environmental factors) and inactivity (socio-demographic factors) are associated with different correlates. It may be useful to examine a broader range of physical activity and inactivity patterns and correlates. Except for one longitudinal study (32), a broad range of activity and inactivity correlates has not been studied among non-overweight and overweight youth (3, 8) even though physical activity is recommended as an essential part of treatment and therapy for overweight and obese youth (4). Recommendations from two reviews (34, 35) of correlates and interventions in youth and the Surgeon General Report on Physical Activity and Health (41) emphasize the need for further study of subgroups of youth, most notably by weight status.

Given the inconsistent findings and limited data, more research is needed to better understand similarities and differences in activity patterns and correlates between non-overweight and overweight youth. Therefore, this study addresses three questions comparing non-overweight and overweight youth: 1) Are there differences in activity patterns? 2) Are there differences in psychosocial correlates of physical activity? 3) Are there differences in levels of the psychosocial correlates?

Methods

Subjects

The subjects were recruited from all children enrolled in physical education in the public school system in Amherst, Massachusetts and surrounding towns that fed into the Amherst Regional Junior and Senior High Schools. Current analyses only include middle and high school students.

The gender, racial/ethnic, and age composition of the sample are presented in Table 1. The final sample was 509. There were a greater number of girls (55%) than boys (45%), more non-Hispanic whites (78%) than other ethnic groups (22%), and more middle school students (59%) than high school students (41%). A significantly greater proportion of boys were overweight than girls ($p < .009$) and more ethnic minority youth were overweight compared to non-Hispanic whites ($p < .007$).

Instruments and Measures

Questionnaires. Two questionnaires were used: a parent-proxy survey and a self-report survey for the older children. The questionnaires were designed to investigate

Table 1 Gender, Ethnic, and Age Composition of Sample

	Percent		Percent
Males	45.4	Females	54.6
White	77.6	Non-White	22.4
Younger	58.7	Older	41.3
Overweight	19.3	Non-overweight	80.7

Variable		N	Percent ‡ 85th percentile	Chi-square p-value
Gender				
	Males	231	24.2	.009
	Females	278	15.1	
Ethnic background				
	White	395	16.7	.007
	Other	114	28.1	
Age Group				
	Grade 7–9	299	19.7	.744
	Grade 10-12	210	18.6	

$n = 509$.

correlates of activity, the child's activity level, and the parent's activity. Each questionnaire took approximately 45 minutes to complete.

To estimate the child's activity during the previous seven days, 46 activities including sedentary behaviors were listed plus three spaces for "other" activities. Respondents indicated whether the activity was performed and if so, on how many days and how many minutes per session. Additional questions asked about sports team participation and any activity classes or lessons that were attended.

Correlates of Physical Activity

Questions about correlates of activity assessed the child's environment, attitudes, household, peer, and parental influences on physical activity behavior. For example, questions included ratings of athletic coordination, health benefits of physical activity, enjoyment of physical activity, choices of recreational time, safety and convenience of recreational areas, transportation to activity, encouragement from adults and peers, and parental participation in physical activity. These variables are described in Tables 2 and 3.

Some items and scales were taken from other studies (33, 38) but many items were developed for this study to expand the range of potential correlates. In a substudy, 105 parents of children aged 6 to 15 years (mean age =11.1, $SD = 2.8$)

Table 2 Description of Adult Report Variables

Variable name	# Items [Range]	Description, sample items	Cronbach Alpha coefficient	ICC*
Environmental variables				
Neighborhood safety	1 [1,5]	Safe to play outdoors without adult supervision, 1 = strongly disagree, 5 = strongly agree	N/A	.75
Access to facilities	1 [1,5]	Access to playgrounds, parks or gyms, 1 = strongly disagree, 5 = strongly agree	N/A	.69
Park distance	1 [0,20]	Distance in miles from home to park	N/A	.42
Park safety	1 [1,5]	Safety of park, 1 = very unsafe, 5 = very safe	N/A	.62

*Test-Retest Reliability, Intraclass Correlation.

and 66 sixth through eighth graders completed the same survey twice, an average time of 16 days apart. We computed an intra-class correlation to assess test-retest reliability. The correlations ranged from .42 (park distance) to .90 (barriers) (Tables 2 and 3).

For the correlates scales, principal component factor analysis with varimax rotation was used to check for unidimensionality. Summing the scores of items for the same construct created scale scores. Cronbach's alpha coefficients were computed to assess internal consistency of each scale. The Cronbach's alpha coefficients ranged from .65 (peer influences) to .92 (benefits) (Tables 2 and 3). All scales with more than three questions exceeded the criterion of > .70 (26) for internal consistency. The variable names, range of items, description of sample items and Cronbach's alpha coefficients are presented in Table 2 (adult questionnaire) and Table 3 (student questionnaire).

Assessment of Physical Activity

For a total of 46 activities and three write-in activities, the student and adult were asked to complete how many days and for how many minutes the student had performed the activity during the past 7 days. Physical activity minutes as reported were corrected for gross errors by re-scoring outlier values to the 90^{th} or 99^{th} percentile values of the distribution. MET values were obtained for each activity using the Physical Activity Compendium (1) and the value was multiplied by the hours and days per week that the activity was performed. Means per day in kcal/kg/day for total activity, sedentary and moderate, and vigorous and very vigorous activity were calculated.

Table 3 Description of Student Reported Variables

Variable	Number of items	Description	Range	Cronbach Alpha Coefficient	ICC*
Barriers	23	How often factors prevent you from getting exercise, 0 = Never, 4 = Very often	0–4	.88	.90
Benefits	13	Rated agreement with possible consequences of exercise (e.g., feel less depressed or bored, improve self-esteem, etc.), 1 = Strongly disagree, 5 = Strongly agree	1–5	.92	.65
Self-efficacy	5	Rating of how sure subject is that he or she can exercise in certain circumstances, 1 = I'm sure I can't, 5 = I'm sure I can	1–5	.85	.89
Family influences	19	Frequency with which family encouraged, exercised with, provided transportation or watched you play sports, do family members enjoy physical activity, 0 = None, 4 = Daily (Q8 -Q12)	0–5	.81	.88
Peer influences	3	Frequency friends are active, encourage you to be active, are active with you, 0=None, 4=Daily	0–5	.65	.86
Activity choices	1	Usual activities during leisure time from sedentary to very active choices, 1 = TV, reading listening to music, 5 = bicycling, dancing, outdoor, games	1–5	N/A	.81
Athletic coordination	1	Rate of athletic coordination compared to others of same age and sex, 1 = much less, 5 = much more	1–5	N/A	.80
Enjoy physical activity	1	Rating of how much enjoy PA, 1 = unenjoyable, 5 = very enjoyable	1–5	N/A	.80
Enjoy PE	1	Rating of how much enjoy PE, 1 = unenjoyable, 5 = very enjoyable	1–5	N/A	.83
Diet to lose weight	1	During the past 30 days, 0 = no, 1 = yes	0–1	N/A	.74
Exercise to lose weight	1	During the past 30 days, 0 = no, 1 = yes	0–1	N/A	.60
Leadership	1	Frequency child encourages friends to be physically active, 0 = non, 4 = daily	0–4	N/A	.62

* Test-Retest Reliability, Intraclass Correlation.

Measure of Overweight

Body mass index (BMI) is calculated by dividing student reported weight in kilograms by the square of height in meters. Weight or BMI alone is not regarded as a complete measure of obesity for growing children. Given these limitations and consistent with previous literature (23, 40), we used the 85th percentile of BMI from national standards as the cutoff for our measure of overweight.

Procedures

Prior to in-school visits by the research team, permission was obtained from the superintendent of schools, school principals, athletic directors, school committees, and physical education teachers. All questionnaire data were collected in November and December 1996. CSA monitor data were collected in November 1996 and in March 1997. This data collection procedure was used because cold weather during the winter months in Massachusetts could adversely limit the activity levels of the children.

Children were then given a packet of materials that included, one "free incentive" worth $1.00, informed consent document, and the parent questionnaire. Children were instructed to take the packet home and obtain consent from their parents. Another free incentive (video rental) was provided upon return of the parent questionnaire and informed consent.

Older children (grades 7–12) who returned the informed consent and parent questionnaire were given a student survey. All children who returned a parent questionnaire were included in the possible pool of subjects to wear the CSA monitor. Only one child per household was allowed into the monitoring portion of the study.

The goal for the monitoring portion of the study was to obtain 100 (50 male) subjects per age group, in this case grades 7-9 and 10-12. Subject selection was accomplished by using random number tables. Children in grades 7 to 12 received their monitors at the beginning of their PE class. Monitors were distributed equally across age groups during any given week to decrease confounding affects of changes in weather. The children who successfully completed 7 days of monitoring received monetary compensation ($20.00) and an entry in a raffle for sporting event tickets.

Analysis

The agreement between classification of < 85th percentile and ‡ 85th percentile comparing parent and student reports of height and weight was 0.93 ($p < .001$) (correlation coefficient) and 0.79 (Kappa). A Kappa of >.75 denotes excellent agreement (31). In this study, we used only student reports and not parent reports.

The physical activity variables were log transformed because these variables were positively skewed. Age was the covariate in the analysis of covariance. T-tests were calculated for each correlate comparing overweight (‡85th percentile) and non-overweight (< 85th percentile) youth. Chi-square statistic was performed for weight practices such as dieting to lose weight in the past 30 days.

For each dependent variable, separate regressions by overweight and non-overweight were computed. The analyses were multiple hierarchical regressions; the initial analysis entered the demographic variables and determined the variance accounted for by this block of variables. The demographic block was entered first

to determine how much of the variance modifiable variables explained after adjusting for demographic variables. The second analysis included the demographic variables and additional variables that were significantly correlated with the dependent variable in preliminary zero-order correlations. Partial R^2 indicates the variance accounted for by individual variables.

Results

Overweight and Activity Questionnaire

The activity levels (kilocalories per day for total, sedentary, moderate, vigorous, teams and classes) were compared between overweight and non-overweight youth. In fourteen comparisons there were only three significant differences. The overweight youth were more sedentary than the non-overweight youth, overweight girls were more sedentary than non-overweight girls, and overweight girls engaged in less vigorous physical activity than non-overweight girls (Table 4).

Comparing Activity Correlates Between Overweight and Non-overweight Youth

In boys, the overweight participants did not differ from the non-overweight participants in fourteen comparisons of correlates. In girls, six of the fourteen comparisons were significant. Parents or guardians perceived overweight girls to be significantly less safe in the park than non-overweight girls. Overweight girls perceived greater barriers ($p < .01$), less peer support ($p < .04$), fewer activity choices ($p < .03$), less athletic coordination ($p < .01$), and less enjoyment of physical activity ($p < .01$) than non-overweight girls.

Overweight boys ($p < .004$) and overweight girls ($p < .002$) were significantly more likely to have dieted to lose weight in the past 30 days than their non-overweight counterparts. Similarly, overweight boys ($p < .001$) and overweight girls ($p < .002$) were significantly more likely to exercise to lose weight than non-overweight youth.

Activity Variables and Correlates in Overweight and Non-overweight Youth

Ten regressions were computed to assess the relationships among activity correlates and youth-reported total, sedentary, moderate-intensity, and vigorous-intensity activity as well as number of classes and team sports for overweight and non-overweight youth. For total activity (Table 5), the demographic (age, gender, and ethnic background) block was not significant for non-overweight youth. For overweight youth, the demographic block was significant ($p < .0001$, total $R^2 = 22$). Ethnic background was the only significant variable; overweight ethnic minority youth were more active than overweight non-Hispanic white youth. For overweight youth, none of the other correlates were significant. For non-overweight youth, family support, peer support, and activity choices were significant variables (overall model, $p < .001$, total $R^2 = 0.28$).

The regression analyses for sedentary behaviors (Table 6) identified few significant variables. The only significant variable was age ($p < .001$) for the non-overweight youth. Older youth reported fewer sedentary pursuits than younger

Table 4 Self-Reported Physical Activity (kcal · kg^{-1} · day^{-1}) Adjusted by Weight Status and Age

Variables	<85th percentile N	Mean	SD	Median	‡85th percentile N	Mean	SD	Median	p*-value
				Males					
kcal · kg^{-1} · day^{-1}									
Total	175	20.2	12.9	16.2	56	24.2	18.4	16.9	.26
Sedentary	174	3.5	2.5	2.9	56	4.1	3.8	2.9	.33
Moderate	173	6.7	5.3	5.1	55	7.2	7.9	4.9	.81
Vigorous	168	9.8	9.3	6.6	54	12.9	13.5	8.5	.23
Teams & classes	174	3.8	2.8	4	56	4.4	3.1	3.5	.33
				Females					
kcal · kg^{-1} · day^{-1}									
Total	236	17.9	11.5	14.9	42	15.9	9.1	14.5	.23
Sedentary	234	3.7	2.2	3.2	41	4.7	3.6	3.6	.03
Moderate	230	5.1	4.7	3.3	41	4.6	3.6	3.6	.90
Vigorous	227	9.1	8.8	6.2	41	6.8	7.9	4.7	.03
Teams & Classes	236	3.3	2.8	3	42	3.9	3.9	3	.73

Log transformed for ANCOVA.

Table 5 Multiple Regressions To Explain Total Reported Physical Activity By Weight Group

<85th Percentile BMI, N=389			‡85th Percentile BMI, *N* = 88		
Total R^2 = .016 *F* = 2.02, 3 df, *p* = .1111			Total R^2 = .217 *F* = 7.76, 3 df, *p* = .0001		
Variables	Partial R^2	*p*-value	Variables	Partial R^2	*p*-value
Age	.0034	.08	Age	.0217	.37
Sex	.0121	.10	Sex	.0070	.08
Race	.0002	.42	Race	.1184	.001
Total R^2 = .276 Adj. R^2 = .251 *F* = 10.86, 13 df, *p* = .001			Total R^2 = .32 Adj. R^2 = .241 *F* = 4.07, 9 df, *p* = .0003		
Variables	Partial R^2	*p*-value	Variables	Partial R^2	*p*-value
Family support	.1816	<.001	Family support	.0181	.45
Peer support	.0424	.01	Peer support	.0000	.96
Activity choices	.0224	.02	Activity choices	.0776	.12
Benefits	.0084	.08			
Self efficacy	.0035	.30			
Barrier	.0020	.32			
Enjoy PA	.0001	.81	Enjoy PA	.0001	.92
Athletic coordination	.0001	.85	Athletic coordination	.0065	.42
Leadership	.0000	.91	Leadership	.0002	.89
Enjoy PE	.0000	.98			

Note. Dependent variables were log transformed.

adolescents. For moderate-intensity activity, several significant variables were found, and the regressions accounted for 11% (non-overweight) and 21% (overweight) of the variances (total R^2). Among overweight youth, dieting to lose weight ($p < .01$) was a significant variable. For non-overweight youth, family support ($p < .01$) and exercising to lose weight ($p < .04$) were significant variables. Also, boys were more active than girls ($p < .001$).

For vigorous-intensity activity regression analyses, overweight ethnic minority youth were more active than overweight non-Hispanic white youth ($p < .001$, total $R^2 = 0.26$). Among non-overweight youth, family support ($p < .05$), peer support ($p < .001$), fewer barriers ($p < .03$) and athletic coordination ($p < .01$) were significant; the overall model was significant ($p < .0001$, total $R^2 = 0.27$). In overweight youth, athletic coordination ($p < .01$) was significant; the overall model

Table 6 Multiple Regressions to Explain Reported Sedentary Behavior by Weight Group

<85th Percentile BMI			‡85th Percentile BMI		
Total R^2 = .049 F = 6.45, 3 df, p = .0003			Total R^2 = .093 F = 2.83, 3 df, p = .04321		
Variables	Partial R^2	p-value	Variables	Partial R^2	p-value
Age	.0388	.001	Age	.0254	.20
Sex	.0050	.29	Sex	.0309	.50
Race	.0048	.21	Race	.0366	.08
Total R^2 = .070 Adj. R^2 = .055 F = 4.73, 6 df, p = .0001			Total R^2 = .236 Adj. R^2 = .157 F = 3.01, 8 df, p = .0054		
Variables	Partial R^2	p-value	Variables	Partial R^2	p-value
			Activity Choices	.0292	.17
Self-efficacy	.0037	.26			
Barriers	.0178	.08	Barriers	.1032	.09
			Enjoy PA	.0024	.62
Athletic coordination	.0001	.81	Athletic coordination	.0001	.93
			Safety of park	.0080	.34

was significant ($p < .0001$, total $R^2 = 0.49$). In the number of classes and team sports analyses, none of the variables was significant among overweight youth. In non-overweight youth, younger age ($p < .05$), greater family support ($p < .01$), fewer barriers ($p < .05$), greater athletic coordination ($p < .02$), and more likely to exercise to lose weight ($p < .02$) were significant variables; the overall model was significant ($p < .0001$; total R^2=0.22).

Discussion

Psychosocial variables may explain activity differences or suggest different approaches to interventions for non-overweight and overweight youth. In this study, overweight girls spent more time in sedentary behaviors than non-overweight girls. Non-overweight girls engaged in more vigorous physical activity than overweight girls. Overweight girls perceived greater barriers, less peer support, less athletic coordination, fewer activity choices, and less enjoyment of physical activity than non-overweight girls. These results indicate that interventions for overweight girls may need to target these variables. The differences among several psychosocial

variables may make it difficult for overweight girls to be physically active, even though they are not consistently shown to be less active than non-overweight girls. In this study, there were no significant differences among psychosocial variables between overweight and non-overweight boys. These results are consistent with the absence of physical activity differences in boys in this sample.

Consistent with our results, another study (27) reported that, among eighth and tenth graders, fundamental movement skills significantly predicted the amount of time spent in organized physical activity (a positive relationship); the prediction was stronger for girls compared to boys. In a review (29), recommendations to increase activity participation among obese girls included the following: introduce the girls gradually to enjoyable forms of exercise and build confidence in their physical abilities with the goal of improving their sense of self-mastery. The current findings that overweight girls perceived less enjoyment of physical activity and less athletic coordination provide empirical support for these recommendations.

Gender similarities and differences were found in this study. Both overweight boys and overweight girls were significantly more likely to have dieted to lose weight in the past 30 days and to exercise to lose weight than their non-overweight counterparts. However, non-overweight and overweight girls differed in physical activity levels and correlates of physical activity, whereas, non-overweight and overweight boys did not differ in physical activity levels and correlates. This gender difference may be explained by several reasons. Boys are more active than girls; therefore, weight status may not be as relevant a factor for the activity levels of boys. On the other hand, because of social desirability, there may be more error in the assessment of activity and correlates for boys, which would obscure differences by weight status. Another possibility is that gender-specific correlates or a broader range of correlates are needed to identify differences among correlates by weight status for boys. Also, perhaps, a different measure of overweight and obesity or a larger sample of overweight youth would yield different results. Nevertheless, more research is needed to further explore gender similarities and differences as well as to identify appropriate correlates and intervention needs by weight status among boys.

The limitations of this study include the reliance on self-report questionnaires, the small amount of variance accounted for, and potential selection bias. Several of the variables were one-item questions and the validity of the self-report measures requires further documentation. The internal consistency and test-retest reliability, however, of most of the questionnaire variables were good. Several reasons may explain why the amount of variance accounted for is low. One explanation is error in measuring physical activity and psychosocial correlates. More precise measures would be expected to reveal greater associations. In particular, it may be important to collect objective measures of environmental variables. Another explanation is that the psychosocial correlates and demographic characteristics represent only a subset of variables and should not be expected to account for total variance. A recent review (34) identified a broad range of correlates. The challenge is to identify critical modifiable variables and improve precision of measures to better explain differences in activity among subgroups of youth. The smaller sample of overweight youth helps explain the small number of significant variables in the regressions.

Generalizing our results to obese youth merits appropriate caution because overweight was defined by body mass index and not body fat measures. Furthermore, we do not know to what extent the study sample is representative, so caution

is needed in generalizing these results to youth in general as well as to overweight youth. The findings that overweight ethnic minority youth were more active than overweight non-Hispanic white youth, and that older youth engaged in fewer sedentary pursuits than younger youth, are novel results that warrant further investigation.

Childhood and adolescence obesity have increased dramatically in the past 30 years (16,37,42). Increased adiposity negatively affects fitness. Low fitness levels and obesity can affect the willingness of adolescents, particularly girls, to be active. Results from this study indicate that physical activity interventions targeting overweight youth should consider improving athletic coordination, providing a range of activity choices, reducing barriers to activity, establishing peer support, and creating opportunities and environments to enhance enjoyment of activity. Effective physical activity interventions in all youth can help us achieve the goal of a more physically active and healthier society.

References

1. Ainsworth, B.A., W.L. Haskell, A.S. Leon, D.R. Jacobs Jr., H.J. Montoye, J.F. Sallis, and R.S. Paffenbarger Jr. Compendium of physical activities: Classification of energy costs of human physical activities. *Med. Sci. Sports Exerc*. 25(1):71-80, 1993.
2. Alpert, B.S., and J.H. Wilmore. Physical activity and blood pressure in adolescents. *Pediatr. Exerc. Sci.* 6:361-380, 1994.
3. Anderson, R.E., C.J. Crespo, S.J. Bartlett, L.J. Cheskin, and M. Pratt. Relationship of physical activity and television watching with body weight and level of fatness among children. *JAMA* 279:938-942, 1998.
4. Bar-or, O., J. Joreyt, C. Bouchard, K. Brownell, W. Dietz, E. Ravussin, A. Salbe, S. Schwenger, S. St. Jeor, and B. Torun. Physical activity, genetic and nutritional considerations in weight management. *Med. Sci. Sports Exerc*. 30:2-10, 1998.
5. Brownell, K.D., and F.S. Faye. A school based behavior modification, nutrition education, and physical activity program for obese children. *Am. J. Clin. Nutr*. 35:277-283, 1982.
6. Casey, V.A., J.T. Dwyer, K.A. Coleman, and I. Valadian. Body mass index from childhood to middle age: A 50-year follow-up. *Amer. J. of Clin. Nutr.* 56:14-18, 1992.
7. Centers for Disease Control and Prevention. Guidelines for school and community programs to promote lifelong physical activity among young people. *Morb. and Mortal. Wkly. Rep*. 46:5, 1997.
8. Durant, R.H., W.O. Thompson, M. Johnson, and T. Baranowski. The relationship among television watching, physical activity, and body composition of 5- or 6-year-old children. *Pediatr. Exerc. Sci*. 8:15-26, 1996.
9. Epstein, L.H., and G.S. Goldfield. Physical activity in the treatment of childhood overweight and obesity: Current evidence and research issues. *Med. Sci. Sports Exerc*. 31(11): S553-S559, 1999.
10. Epstein, L.H., A.M. Valoski, L.S. Vara, J. McCurley, L. Wisniewski, M.A. Kalarchian, K.R. Klein, and L.R. Shrager. Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. *Health Psychol.* 14(2):109-115, 1995.
11. Epstein, L.H., A. Valoski, R.R. Wing, and J. McCurley. Ten-year follow-up of behavioral, family-based treatment for obese children. *JAMA* 264(19):2519-2523, 1990.
12. Epstein, L.H., R.R. Wing, R. Koeske, and A. Valoski. A comparison of lifestyle exercise, aerobic exercise, and calisthenics on weight loss in obese children. *Behv. Therapy*. 16:345-356, 1985.

13. Felton, G.M, and M.A. Parsons. Factors influencing physical activity in average weight and overweight young women. *J. of Com. Hlth. Nurs*. 11:109-119, 1994.
14. Goran, M.I., K.D. Reynolds, and C.H. Lindquist. Role of physical activity in the prevention of obesity in children. *Int. J. Obesity*. 23(3):S18-S33, 1999.
15. Gordon-Larsen, P., R.G. McMurray, and B.M. Popkin. Determinants of adolescent physical activity and inactivity patterns. *Pediatr.* 105(6):1-8, 2000.
16. Gortmaker, S.L., W.H. Dietz, A.M. Sobol, and M.S. Wehler. Increasing pediatric obesity in the United States. *Amer. J. of Diseases of Child.* 141: 535-540, 1987.
17. Guo, S.S., A.F. Roche, W.C. Chumlea, J.D. Gardner, and R.M. Siervogel. The predictive value of childhood body mass index values for overweight at age 35 years. *Amer. J. of Clin. Nutr.* 59:810-819, 1994.
18. Gutin, B., N. Cucuzzo, S. Islam, C. Smith, and M.E. Stachura. Physical training, lifestyle education, and coronary risk factors in obese girls. *Med. Sci. Sports Exerc*. 26(1):19-23, 1996.
19. Ignico, A.A., and A.D. Mahon. The effects of a physical fitness program on low-fit children. *Res Q. Exerc. Sport.* 66(1):85-90, 1995.
20. Klesges, R.C., L.M. Klesges, and L.H. Eck. A longitudinal analysis of accelerated weight gain in preschool children. *Pediatrics* 95:126-130, 1995.
21. Melanson, E.L., and P.S. Freedson. Validity of the computer science and applications, Inc. (CSA) activity monitor. *Med. Sci. Sports Exerc*. 27(6): 934-940, 1995.
22. Moore, L.L., S. Nguygen, K.J. Rothman, L.A. Cupples, and R.C. Ellison. Preschool physical activity level and change in body fatness in young children: The Framingham Children's Study. *Am. J. Epidemiol*. 142:982-988, 1995.
23. Must, A., G.E. Dallal, and W.H. Dietz. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht^2) and triceps skinfold thickness. *Am. J. Clin. Nutr*. 53:838-846, 1991.
24. Nieto, F.J., M. Szklo, and G.W. Comstock. Childhood weight and growth rate as predictors of adult mortality. *Am. J. Epidemiol.* 136:201-213, 1992.
25. NIH strategy development workshop for public education on weight and obesity, sponsored by the *National Heart, Lung, and Blood Institute* in 1992, p 51.
26. Nunnally, J.C., and I.H. Bernstein. *Psychometric Theory* (3rd ed.). New York: McGraw-Hill, 1994.
27. Okely, A.D., M.L. Booth, and J.W. Patterson. Relationship of physical activity to fundamental movement skills among adolescents. *Med. Sci. Sport Exer*. 33(11):1899-1904, 2001.
28. Pate, R.R., B.J. Long, and G. Heath. Descriptive epidemiology of physical activity in adolescents *Ped. Exerc. Sci.* 6:434-447, 1994.
29. Rhea, D.J. Physical activity and body image of female adolescents. *JOPERD* 69(5):27-31, 1998.
30. Rosenbloom, A.L., J.R. Joe, R.S. Young, and W.E. Winter. Emerging epidemic of type-2 diabetes in youth. *Diabetes Care* 22:345-354, 1999.
31. Rosner, B. *Fundamentals of Biostatistics (*4th ed.). Belmont, CA: Duxburg Press, 1994.
32. Sallis, J.F., J.E. Alcaraz, T.L. McKenzie, and M.F. Hovell. Predictors of change in children's physical activity over 20 months, variations by gender and level of adiposity. *Amer. J. Prev. Med.* 16(3):222-229, 1999.
33. Sallis, J.F., and M.F. Hovell. Determinants of exercise behavior. *Exerc. Sports Sci. Rev.* 18:307-330, 1990.
34. Sallis, J.F., J.J. Prochaska, and W.C. Taylor. A review of correlates of physical activity of children and adolescents. *Med. Sci. Sports Exerc.* 32:963-975, 2000.

35. Sallis, J.F., B.G. Simons-Morton, E.J. Stone, C.B. Corbin, L.H. Epstein, N. Faucette, R.J. Iannotti, J.D. Killen, R.C. Klesges, C.K. Petray, T.W. Rowland, and W.C. Tayloir. Determinants of physical activity and interventions in youth. *Med. Sci. Sports Exerc.* 24(6):S248-S257, 1992.
36. Sasaski, J., M. Shindo, H. Tanaka, M. Ando, and K. Arakawa. A long-term aerobic exercise program decreases the obesity index and increases the high-density lipoprotein cholesterol concentration in obese children. *Int. J. Obesity.* 11:339-345, 1987.
37. Strauss, R.S., and H.A. Pollack. Epidemic increase in childhood overweight, 1986-1998. *JAMA* 286:2845-2848, 2001.
38. Taylor, W.C., W. Chan, S.S. Cummings, B.G. Simons-Morton, R.S. McPherson, H.S. Sangi-Haghpeykar, J.S. Pivarnik, W.H. Mueller, M.A. Detry, I.W. Huang, A.P. Johnson-Masotti, and H. Hsu. Healthy growth: Project description and baseline findings. *Ethnicity and Disease* (in press).
39. Troiano, R.P., and K.M. Flegal. Overweight children and adolescents: Description, epidemiology, and demographics. *Pediatrics* 101(3):497-504, 1998.
40. Troiano, R.P., K.M. Flegal, R.J. Kuczmarski, S.M. Campbell, and C.L. Johnson. Overweight prevalence and trends for children and adolescents: The National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch. Pediatr. Adolesc. Med.* 149:1085-1091, 1995.
41. U.S. Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
42. Ward, D.S., and R. Evans. Physical activity, aerobic fitness, and obesity in children. *Med. Exerc. Nutr. Health*. 4(8):3-16, 1995.
43. Ward, D.S., S.G. Trost, G. Felton, R. Saunders, M.A. Parsons, M. Dowda, and R.R. Pate. Physical activity and physical fitness in African American girls with and without obesity. *Obesity Res*. 5:572-577, 1997.
44. Wolf, A.M., S.L. Gortmaker, L. Cheung, H.M. Gray, D.B. Herzog, and G.A. Colditz. Activity, inactivity, and obesity: racial, ethnic, and age differences among school girls. *Amer. J. of Pub. Hlth*. 83:1625-1627, 1993.

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