Physical Activity and Sedentary Behaviors in Adolescents

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ABSTRACT

Background *and* ***Purpose****: The main goal of this study was to address two questions: How is physical activity affected by sedentary behavior (computer, television, and commuting), and how are physical activity characteristics (intensity, frequency, type) different based on adolescents reports of physical activity?* ***Methods:*** *The sample comprised 230 girls and 220 boys 14.6 years of age. Physical activity (PA) was assessed by questionnaire. Based on previously published standards, participants were grouped into the nonactive group, which included both sedentary and low active youth, and the active group, which included the moderately and vigorously active youth. Another questionnaire about leisure activities was applied to define the nature of PA. Sedentary behaviors, such as television viewing and computer use (weekday and weekend), and commuting to and from school (passive vs. active) were analyzed.* ***Results:*** *Significantly more girls ($p \leq .000$) belonged to the inactive group (71.7%) than boys. The active participants reported being significantly more engaged in moderate intensity (49.1%; $p < .000$), moderate frequency (55.6%; $p < .001$), and team activities (62.0%; $p < .005$) than inactive participants. In addition, active participants reported significantly more participation in organized sports (21.6% vs. 5.2%) and in both activities (organized and individual activities; 45.5% vs. 3.9%) than nonactive counterparts. Our data show that active versus inactive groups did not differ on television watching on weekdays or on commuting. However, active participants were less likely to watch television on the weekends than inactive participants. Logistic regression showed that computer use during weekdays was a predictor of PA. An increase in computer use time (from 1 hr to 2–3 hr/day) was associated a higher PA.* ***Conclusions:*** *Sedentary behaviors such as television viewing or computer use might have different value in relation to PA for youth.*

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INTRODUCTION

To promote physical activity (PA) among youth more effectively, it is necessary to understand factors that may influence their participation. Overall, the daily activity undertaken by young people occurs both in organized (sport clubs or formal exercise programs) and nonorganized (walking or other PA not guided by trainers) settings (1,2). Besides participation in organized or nonorganized PA, active transportation has been suggested as potential source of PA for youth (3). Therefore, health professionals have started to promote walking to and from school as an effective and attractive means of increasing levels of PA (3). However, the time spent in inactive pursuits may be just as important as time spent in PA (4). Therefore, it is commonly accepted that media-based sedentary behaviors, such as television viewing, video game playing, and leisure-time computer use, compete for the time that would be spent in PA (5).

The main goal of this study was to address two questions: How is PA affected by sedentary behavior (computer, television, and commuting), and how are PA characteristics (e.g., intensity, frequency) different based on level of PA?

METHODS

Sample

Three public secondary schools participated in this study. The potential sample included 500 students from the 7th to 12th grades. The questionnaires were distributed and filled out during physical education classes. A response rate of 94% ($n = 470$) was obtained. Questionnaires were deleted from the analysis if they contained a majority of missing information ($n = 20$). After deletions, 450 adolescents' responses (230 girls, 220 boys) entered the analysis. The average age was 14.6 years (range = 12–18 years). Informed written consent was obtained from the participants and their parents or guardians before the participants entered into the study.

Assessment of physical activity. PA was assessed by a questionnaire (6). A significant and negative correlation was found between the index of physical activity and heart rate at rest, serum insulin and skin fold measurements, and assumed as indication of validation of the activity measure (7). The test–retest reliability of the PA questionnaire was previously carried out within 1-week interval, across 150 participants (1). Using intraclass correlation coefficients, the reliability was high (0.92–0.96). To verify the inter-item consistency, the Cronbach α test was applied to the dimensions of the questionnaire of physical activity. The score obtained ($\alpha = .87$) was high, which indicated a good internal consistency (1).

The questionnaire had five questions with four choices (4-point scale). Overall a maximum of 20 points can be reached. A PA index was obtained, which divided the sample into different activity groups, according to the total sum. Because health-related PA guidelines for youth stressed the engagement into moderate to vigorous PA for statistical analysis, the participants were grouped into two categories: (a) the nonactive group (NPA),

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which comprised sedentary and low active youth, and (b) the active group (APA), which comprised the moderately and vigorously active youth on the basis of their reported physical activity.

Nature of physical activity. A questionnaire focused on discretionary nonorganized physical activities during leisure time (8) was applied and allowed to define three categories: the organized physical activity (activities guided by trainer), the nonorganized physical activity (nonguided), and the choice of both (organized and nonorganized). Using intraclass correlation coefficients, the reliability (within 1-week interval) was high (0.91 and 0.92).

Television Watching and Computer Use

Participants were asked how many hours they usually watched television and used the computer in the day preceding the examination (weekday) and during the weekends. Respondents were grouped as watching television and using computer on average less than 1 hr per day, between 2 and 3 hr per day and more than 4 hr per day, according a protocol used previously (9).

Commuting to and From School

Commuting was obtained with a self-administered questionnaire. Participants were asked if they walked, bicycled, went by car, or went by bus to and from school, and the duration (in minutes) of the trip. Based on their answers, the respondents were categorized as using active (e.g., walking, bicycling) or passive (e.g., bus, riding in a private vehicle) commuting (3).

Statistical Procedure

For all analysis, respondents were assigned to two groups (active vs. nonactive) based on their self-reported level of PA. Descriptive statistics included the number and percentages in the APA and NPA groups. Bivariate associations between variables were done using Spearman correlation. The independent association of predictors with PA as dependent variable was examined using logistic regression analysis. The variables entered in the final model were selected for variables associating at a $p \leq .05$ in the correlation. The analysis was developed using the SPSS 11.0 program. The level of significance was set at $p \leq .05$.

RESULTS

Table 1 showed that significantly more girls ($p \leq .000$) were classified as NPA (71.7%) than boys. Boys were more frequently classified as APA (61.7%, $p \leq .000$) than girls. The APA group reported being significantly more likely to engage in moderate intensity (49.1%, $p < .000$), moderate frequency (55.6%, $p < .001$), and team activities (62.0%, $p < .005$), whereas NPA youth reported being significantly more likely to engage in low intensity (97.1%, $p < .000$), low frequency (91.9%, $p < .000$), and individual activities (87.5%, $p < .005$). In addition, APA reported significantly more participation in organized (21.6% vs. 5.2%) and in both activities (organized and individual activities; 45.5% vs. 3.9%) than nonactive counterparts.

Table 2 shows that there was no significant differences (APA vs. NPA) in television watching on weekdays across the

TABLE 1
Characteristics of Physical Activity According to the Activity Groups

Characteristics	*Active*[a]	*Nonactive*[b]	
Boys	61.7	38.3	$\chi^2 = 67.65$
Girls	28.3	71.7	$p = .000$
Activity (%)			
Frequency			
Low	9.4	91.9	$\chi^2 = 3509$
Moderate	55.6	8.1	$p = .000$
High	35.0	0	
Intensity			
Low	35.7	97.1	$\chi^2 = 9151$
Moderate	49.1	2.9	$p = .000$
High	15.2	0	
Nature			
Organized	21.6	5.2	$\chi^2 = 9361.5$
Nonorganized	32.9	91.8	$p = .000$
Both	45.5	3.9	
Formal			
Individual	38.0	87.5	$\chi^2 = 345.5$
Team	62.0	12.5	$p = .005$
Nonformal			
Individual	67.0	70.7	$\chi^2 = 8864$
Team	33.0	29.3	$p = .534$

[a]$n = 277$. [b]$n = 173$.

TABLE 2
Differences in Sedentary Behaviors According to Physical Activity Groups

Behavior	*Active*[a] *(%)*	*Nonactive*[b] *(%)*	
TV watching (weekdays)			
≤ 1 hr	24.5	17.3	$\chi^2 = 23355.5$
2–3 hr	53.4	64.7	$p = .612$
≥ 4 hr	22.0	17.9	
TV watching (weekend)			
≤ 1 hr	9.7	7.5	$\chi^2 = 217000.5$
2–3 hr	34.3	27.2	$p = .05$
≥ 4 hr	56.0	65.3	
Computer use (weekdays)			
≤ 1 hr	72.2	86.1	$\chi^2 = 20569$
2–3 hr	23.8	12.7	$p = .00$
≥ 4 hr	4.0	1.2	
Computer use (weekend)			
≤ 1 hr	53.8	64.2	$\chi^2 = 21412.5$
2–3 hr	34.3	27.2	$p = .03$
≥ 4 hr	11.9	8.7	
Commuting			
Active	23.5	22.5	$\chi^2 = 23739.5$
Passive	76.5	77.5	$p = .822$

[a]$n = 277$. [b]$n = 173$.

two groups. However the NPA group spent significantly more time (> 4 hr/day) watching television during the weekends (p = .05) than the APA group. It is interesting to see that APA spent more time using computers than the NPA group during the weekdays (p = .00) and weekends (p = .03). No significant differences were found regarding commuting.

Spearman correlation provided a significant negative association (r = –.09, p = .05) between PA and television watching at weekend and a positive association with computer use in both weekdays (r = .16) and weekend (r = .10). Further, logistic regression showed computer use during weekdays was a significant predictor of PA (Exp (B) = 0.008, IC 95% = 0.007–0.814, p = .03).

DISCUSSION

Understanding the macrolevel determinants of PA and sedentary behavior in populations presents new areas of research opportunity for the exercise and sport sciences (10). Our data showed that NPA were more involved on PA characterized by low frequency and low intensity, and they were significantly more engaged in nonorganized activities, whereas the APA had an important participation in organized activities and both types of activities (organized and individual activities). These findings are consistent with a previous report showing that formal activities were more important among the more active groups for both boys and girls (1). Likewise, a decrease was shown in weekly time spend in PA, especially in nonorganized PA, but not for the time spent on organized sport activities and other "activities" (11). Furthermore, the APA reported significantly more participation in team activities (62.0%), whereas the less active youth chose the individual activities (87.5%). A previous report showed that nonorganized PA were characterized by single/dual activities of low to moderate intensity, whereas organized PA were characterized by team activities of vigorous intensity (12). In addition, organized PA tend to persist into adulthood among some European (11,13) and American (14) adolescents. An important implication from our data is that daily PA can be accrued through organized activities. In fact, some studies have shown that the decrease seen in PA levels during adolescence was due to a decrease in the number of activities in which adolescents choose to participate rather than a decrease in the time spent on each activity (14). This can be compensated by participation in organized activities, which should be encouraged at different settings and should focus on adolescents' leisure-time pursuits.

Active commuting as usual routine of everyday life has been thought to be more likely to induce habitual PA than structured types of exercise (15). However, there is little evidence in the literature to conclude whether active commuting to school is a healthful source of adolescents' PA (16). Our study did not show differences between APA and NPA groups regarding commuting (passive vs. active). In general adolescents were driven to school by car or took the bus. This choice for passive transportation might be associated to fears of traffic dangers and abduction (17). Nevertheless we need to better understand the relative importance of active commuting to and from school to overall PA in youth given new initiatives to increase national walk-to-school programs.

There is some evidence that increasing amounts of time are devoted to sedentary behaviors. Strauss et al. (18) reported that a combined sedentary behavior (television plus computer activities) might independently correlate with moderate activity levels, which seems to agree with our findings. We reported no differences between PA and the time spent watching television during weekdays, but a significant difference was found in weekends. Further our data showed that 53.4% of APA group and 64.7% of NPA spending at least 2 or 3 hr a day (weekday) watching television, whereas 56% of APA and 65.3% of NPA watched more than 4 hr during weekends. This is a timely issue, because several studies reported youth more active during weekdays compared to weekends (19). Therefore, our study highlights the weekends as a critical period of interventions targeting sedentary behavior, because reducing sedentary behaviors proved more successful than increasing PA (20). We found significant differences between groups in computer use. Surprisingly, adolescents belonging APA spent more time in computer either during weekdays or weekends. In addition, Spearman correlation provided a significant negative association between PA and television watching on the weekend and a positive association with computer use on both weekdays and the weekend. Further, logistic regression showed computer use during weekdays was a significant predictor of PA. These results suggest that an increase in computer use (from 1 to 2–3 hr) is associated with higher PA. This seems to be a contradictory outcome, but we suggest that computer use is likely related to work instead of a passive tool for this age group. In fact NPA spent much more time watching television than using computer. One possible implication from our data is that television leads to a more sustainable lack of physical activity than computer use, which might have a different value in relation to PA.

Limitations of the study should be recognized. The intent was to explore associations between sedentary behaviors and PA, but it is not possible to inferred causal relationships with such a design. Further data are need to replicate these findings in using longitudinal designs. This approach might provide additional information regarding the youth sedentary and PA behaviors relationship.

CONCLUSION

Our data show that active versus inactive groups did not differ on television watching on weekdays or on commuting; however, the groups did differed on television watching on weekends. Only computer use during weekdays was positively associated with PA. Sedentary behaviors such as television viewing or computer use might have different value in relation to PA. In addition, these data indicate that involving youth in organized sports may be a potential avenue for increasing PA in this population.

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