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Amount of Time Spent in Sedentary Behaviors in the United States, 2003–2004

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Abstract

Sedentary behaviors are linked to adverse health outcomes, but the total amount of time spent in these behaviors in the United States has not been objectively quantified. The authors evaluated participants from the 2003–2004 National Health and Nutrition Examination Survey aged ≥6 years who wore an activity monitor for up to 7 days. Among 6,329 participants with at least one 10-hour day of monitor wear, the average monitor-wearing time was 13.9 hours/day (standard deviation, 1.9). Overall, participants spent 54.9% of their monitored time, or 7.7 hours/day, in sedentary behaviors. The most sedentary groups in the United States were older adolescents and adults aged ≥60 years, and they spent about 60% of their waking time in sedentary pursuits. Females were more sedentary than males before age 30 years, but this pattern was reversed after age 60 years. Mexican-American adults were significantly less sedentary than other US adults, and White and Black females were similarly sedentary after age 12 years. These data provide the first objective measure of the amount of time spent in sedentary behavior in the US population and indicate that Americans spend the majority of their time in behaviors that expend very little energy.

Keywords

energy metabolism; monitoring; ambulatory; motor activity; obesity; population surveillance

The amount of time spent in sedentary behaviors has been independently associated with lower levels of physical-activity energy expenditure (1, 2), increased risk of weight gain (2, 3), and increased risk of metabolic syndrome, diabetes, and heart disease (3–5). In light of

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these links to adverse health outcomes and the continued increase in the prevalence of overweight and obesity in the United States (6), sedentary behaviors have emerged as an important target of health promotion and obesity and disease prevention efforts (7–9), complementing efforts to increase levels of moderate-to-vigorous physical activity (10–12). Sedentary behaviors have been defined as a range of human endeavors that result in an energy expenditure of no more than 1.5 times' resting energy expenditure (8). These behaviors are typically associated with time spent sitting, reclining, or lying down during waking hours (7, 8).

Current estimates of amounts of time spent in sedentary behaviors in the United States have been derived from self-reports of a limited number of discretionary behaviors thought to be indicative of a more sedentary lifestyle (e.g., television viewing, video game-playing, and computer use). However, assessment of these behaviors provides only a partial picture of overall levels of sedentary behavior in a typical waking day. For example, the American Time Use Survey, a population-based survey of adolescents and adults aged 15 years, indicated that respondents reported an average of 2.6 hours/ day of television viewing and less than 0.5 hours/day of computer use at home (13), which represents only a modest proportion of the average 15.4-hour waking day in this sample. Similarly, 80 percent of adults in the United States reported only three or fewer hours of television viewing or non-work-related computer use per day (4). The average amount of time spent in overall sedentary behaviors during waking hours in the United States is unknown and may be substantially underestimated by surveillance systems that have been used to assess only a limited number of discretionary behaviors.

Incorporation of an objective measurement of physical activity in the National Health and Nutrition Examination Survey (NHANES) enabled the direct measurement of time spent in sedentary behaviors in a representative sample of youth and adults in the United States. Accordingly, the purpose of this investigation was to describe, for the first time, the amount of time spent in overall sedentary behaviors in the United States, by gender, age, and racial/ ethnic group.

MATERIALS AND METHODS

Study population and design

NHANES 2003–2004 included a representative sample of the US civilian, noninstitutionalized population, selected with a complex multistage probability design. Participants aged ≥6 years who were seen in NHANES mobile examination centers were asked to wear an Actigraph accelerometer (model 7164; Actigraph, LLC, Fort Walton Beach, Florida) for 7 consecutive days.

The Actigraph is a small (2.0 × 1.6 × 0.6 inches (5.1 × 4.1 × 1.5 cm)), light (1.5 ounces (0.4 kg)) instrument that records integrated acceleration information as an activity count, which provides an objective estimate of the intensity of bodily movement. The device was programmed to record in 1-minute epochs. Participants were instructed to wear the monitor on their right hip attached by an elastic belt during all waking hours; however, because the monitors were not waterproof, participants were asked to take them off while bathing or swimming. After the monitors had been worn, they were returned by mail to the NHANES contractor, where data were downloaded and the instruments were checked for calibration. Units that did not meet the manufacturer's specifications for calibration (± 5 percent) were recalibrated or repaired prior to reuse.

The high sensitivity of the Actigraph results in wide variability of activity count values over a range of human ambulatory movements (e.g., walking at 2–3 miles/hour (3.2–4.8 km/

hour), about 1,000–3,000 counts/minute; running at 6–7 miles/hour (9.6–11.2 km/hour), about 10,000 counts/minute) (14). Activity counts recorded while sitting and working at a desk are very low (≤50 counts/minute), and counts recorded while driving an automobile are typically below 100 counts/minute (unpublished observations). The sensitivity and well-described measurement properties of this device facilitated the development of an automated approach to objective estimation of monitor wear by scanning of the minute-by-minute data. Nonwear time was defined as intervals of at least 60 consecutive minutes of zero counts, with allowance for up to 2 consecutive minutes of observations of 1–100 counts/minute. Periods of nonwear were defined as ending when count levels exceeded 100 counts/minute or when 3 consecutive minutes of observation were between 1 and 100 counts/ minute. Monitor-wearing time was estimated by subtracting nonwearing time from the total observation time for the day. We estimated time spent in sedentary behaviors as the amount of time accumulated below 100 counts/minute during periods when the monitor was worn, expressed as a proportion of monitor-wearing time (percent) and as total duration (hours/day). This threshold was identified in a calibration study carried out among adolescent girls (15) and was used to identify an independent association between sedentary behavior and 2-hour postload glucose measures in adults (16).

In a small validation study in adults (n 19; 53 percent female; mean age = 40.1 years (standard deviation (SD), 10.0); body mass index (weight (kg)/height $(m)^2$) 27.2 (SD, 4.4)), we tested the 100-counts/minute Actigraph threshold against data from the Intelligent Device for Energy Expenditure and Activity (IDEEA) monitor, which is a near-gold-standard measure of amounts of time spent sitting, reclining, and lying down. Compared with direct observation, the IDEEA monitor has been shown to correctly identify these body positions with greater than 98 percent accuracy (17). In 2 days of observation in the validation study, average wear time for both devices was 13.20 hours/day (SD, 2.15), and participants spent approximately 65 percent of their time in sedentary behaviors. The Actigraph (<100 counts/minute) and the IDEEA recorded similar amounts of time spent in sedentary behaviors (8.63 hours/day (SD, 1.90) and 8.53 hours/day (SD, 1.86), respectively ($p = 0.82$)), and correlations between the measures were moderately high ($r = 0.59$, $p < 0.01$; unpublished observations). These findings suggest that the 100 counts/minute Actigraph threshold provides a useful measure of time spent in sedentary behaviors among adults.

There were 7,176 persons who participated in the Actigraph component of NHANES. Initial evaluation and cleaning of these data resulted in exclusion of the records of participants whose monitors were not in calibration upon return (n = 346). In addition, implausible minute-by-minute values that were consistent with monitor malfunction (e.g., 32,767 counts/minute) were replaced by imputed values that were the averages of the counts recorded in the minute immediately before and the minute immediately after the implausible value(s). After exclusion of participants with no recorded monitor-wearing time, 6,830 persons remained. We then excluded records with fewer than 10 hours/day of monitor wear, leaving 6,329 persons with at least one day of observation available for analyses.

Statistical analyses

All analyses were conducted with SAS 9.0 (SAS Institute, Inc., Cary, North Carolina) and SUDAAN 9.0 (Research Triangle Institute, Research Triangle Park, North Carolina) to account for the multistage probability design used in NHANES. Descriptive analyses were initially conducted to identify possible outliers and to describe the distributions of our primary data. These analyses revealed significant differences ($p < 0.01$) in monitor-wearing time by age, gender, and racial/ethnic group. Since wear time was positively associated with sedentary time, we controlled for wear time in our analysis to enhance our ability to describe differences between groups. Men, middle-aged adults, and African Americans tended to wear the monitor for longer periods of time. Thus, we used analysis of variance to estimate

amounts of time spent in sedentary behaviors (hours/ day) after adjustment for average monitor-wearing time. Standard errors derived from SUDAAN were calculated via Taylor series linearization. Tests for linear trend were conducted by constructing a continuous variable that contained the median value in each category of the variable and fitting the resulting variable in the regression model as a continuous variable. Pairwise statistical comparisons of the conditional marginal means were employed to test the hypothesis that groups were not different from one another (18).

RESULTS

Among the 6,329 participants with at least one 10-hour day of monitor wear, the average number of days of observation was 5.0 (SD, 1.9). The average monitor-wearing time was 13.9 hours/day (SD, 1.9), and 79.2 percent of participants provided 3 or more days of observation. Table 1 presents the frequency distribution of the population sample by gender, age, and racial/ethnic group. Overall, children and adults in the United States spent 54.9 percent of their waking time, or 7.7 hours/day, in sedentary behaviors (figure 1 and table 2).

Differences by age and gender

Across the age range of the study population, there were two striking peaks in the amount of time spent in sedentary behavior. Children aged 6–11 years were the least sedentary group in the United States (males: 41.4 percent, 6.0 hours/ day; females: 43.4 percent, 6.1 hours/day), but by age 16–19 years, time spent in sedentary pursuits had increased by about 2.0 hours/ day (males: 55.8 percent, 7.9 hours/day; females: 59.0 percent, 8.1 hours/day). Young adults (ages 20–29 years) were less sedentary than older adolescents, but sedentary time increased by about 2 hours/day between the ages of 30 and 39 years (men: 50.8 percent, 7.2 hours/day; women: 53 percent, 7.3 hours/day) and the ages of 70 and 85 years (table 2). Adults aged 70–85 years were the most sedentary group in the population (men: 67.8 percent, 9.5 hours/ day; women: 66.3 percent, 9.1 hours/day). Tests for linear trend by age were significant ($p < 0.001$) overall (table 2) and when evaluated separately in youth and adulthood (data not shown).

There was also an interaction between age and gender (figure 1 and table 2). Females were more sedentary than males throughout youth and early adulthood, but this pattern was reversed after age 60 years, when the level of sedentary behavior in men surpassed that of women (p for interaction < 0.01). However, the interaction between age and gender in adulthood was significant in Whites ($p < 0.01$) but not in Blacks or Mexican Americans.

Differences by race/ethnicity

In youths (ages 6–19 years), there were few significant differences by race/ethnicity, except that Black girls aged 6–11 years were less sedentary than either Whites or Mexican Americans (table 3). In addition, when males and females were examined together, Mexican-American adolescents were less sedentary than Whites. In adulthood (ages 20–85 years), Mexican Americans were less sedentary than Whites and Blacks, both before and after age 60 years. Differences between White and Black adults were few, except that White men aged 40–59 years were more sedentary than Black men of the same age. White and Black females were similarly sedentary after age 12 years. Mexican-American men aged 20–39 years were the least sedentary group of adults (about 6 hours/day). In general, there were consistent positive associations between age and time spent in sedentary behaviors in all racial/ethnic groups.

DISCUSSION

To our knowledge, this is the first quantification of the amount of time spent in overall sedentary behaviors in a large representative population sample in the United States. Time spent in these behaviors reflects the accumulated amount of time spent sitting, reclining, or lying down at home, at work, at school, in transit, and during leisure time. These US children and adults spent approximately 55 percent of their waking hours, or 7.7 hours/day, in behaviors that result in only very low levels of energy expenditure. Older adolescents (ages 16–19 years) and older adults (ages 60–85 years) spent nearly 60 percent of their time, or more than 8 hours/day, in sedentary behaviors. In contrast, children aged 6–11 years spent only 6 hours/day in these behaviors. Mexican-American adults were the least sedentary group of adults, while Black and White adults tended to be similarly sedentary. Given the amount of time spent in these behaviors on a daily basis, particularly for older adolescents and adults, reducing the amount of time spent being sedentary represents an important opportunity for increasing the level of physical activity in the population.

Our study differs significantly from other population-based estimates of sedentary behaviors, in terms of both methodology and critical findings, and thus provides unique insight into the current level of sedentary behavior in the United States. In contrast to previous estimates of sedentary behavior derived from self-reports of a limited number of behaviors (i.e., television viewing and computer use), we directly quantified the total amount of time spent at very low activity levels over an average of 13.9 hours/day. Given our method of estimating time spent in sedentary behavior, it is not surprising that our results showed that children and adults are twice as sedentary as indicated by previous estimates derived only from assessment of media-related discretionary behaviors (13, 19). These results highlight the idea that media use accounts for only about half of the overall time spent in sedentary behavior in the US population.

The second important finding from our study is that previously quantified differences in television viewing and computer use that have been described by age, gender, and ethnicity may not translate to differences in levels of overall sedentary behavior. For example, prevalence estimates of sedentary behavior, defined as spending 3 or more hours per day watching television or using a computer, from the Youth Risk Behavior Surveillance System in 2005 indicated that males were more sedentary than females, Blacks were more sedentary than Hispanics or Whites, and time spent in these behaviors decreased between grades 9 and 11 (20). Our study revealed a markedly different picture among youth. We found that girls were more sedentary than boys, Blacks were similar to both Whites and Mexican Americans, and the level of overall sedentary behavior increased substantially during adolescence. Perhaps the most striking variation in our results from previous studies was seen among Black and White children. Previous reports have found that approximately 40 percent of Black children reported watching 4 or more hours of television per day, while only about 20 percent of White children reported this much television viewing (21, 22). We found no evidence that this difference in television viewing translated into differences in objectively determined levels of overall sedentary behavior between White and Black children.

Close evaluation of time spent in sedentary behaviors across the wide age range in these data revealed two dramatic peaks that merit comment. Over the approximate decade from ages 6–11 years to ages 16–19 years, there was about a 2-hour/day increase in sedentary behavior, and this was approximately the same magnitude of increase as that observed across the four decades from young adulthood (ages 20–39 years) to older age (ages 70–85 years). Previous studies have also reported that the rate of decline in physical activity levels is greater in adolescence than in adulthood (23). Studies using objective measures of

sedentary behavior to describe age effects in youth have reported results that are similar to ours (24, 25). For example, Treuth et al. (24) described nearly a 2-hour/day increase in time spent in sedentary behaviors when comparing elementary, middle, and high school students (proportion of monitored time in sedentary behavior: 46.7 percent, 51.4 percent, and 56.0 percent, respectively), and this increase was predominantly due to a reduction in time spent in light-intensity activities (i.e., 100–899 counts/minute by Actigraph). Pate et al. (26) recently reported that sixth-grade girls (ages 11–12 years) spent 55.6 percent of their time, or 7.7 hours/day, in sedentary behaviors, which is virtually identical to results from the present study. Fewer studies have estimated the amount of time adults spend in sedentary behaviors, but results from the American Time Use Survey indicate that a large proportion of the average 15.4-hour waking day is spent in activities that expend very little energy (13). In concordance with our study, Healy et al. (16) employed the Actigraph and reported that Australian adults (average age 53.3 years) spent 57 percent of their monitored time in activities below 100 counts/minute. The reduction in time spent being sedentary between adolescence (ages 16–19 years) and early adulthood (ages 20–39 years) may reflect entrance into the workforce and domestic responsibilities related to raising families (13). The increase in time spent in sedentary behaviors after age 60 years, particularly among men, may reflect an increase in leisure time following retirement and/or the development of comorbid health conditions that may increasingly limit activity in later life. Troiano et al. (27) reported a reduction in overall activity levels with increasing age among men in this NHANES sample, which suggests that the increase in time spent in sedentary behavior we observed may not be offset by increases in leisuretime physical activity as reported by previous investigators (28, 29).

Time spent in pursuits that require only low levels of energy expenditure have been linked to increased risk of weight gain (2, 30), an adverse metabolic profile (4, 16, 31, 32), and type 2 diabetes (3). Westerterp (1) has described the importance of lower-intensity (e.g., light-to-moderate) activity on physical activity energy expenditure levels, and Levine et al. (2) suggested that an additional 2 hours/day spent sitting conserved approximately 350 kcal/day in a small sample of obese adults, relative to lean adults. In the context of the current study, where we observed two age-related increases in sedentary behaviors of approximately 2 hours/day in adolescence and adulthood, we estimate that approximately 2 metabolic equivalent (MET)-hours/day (or 2 kcal/kg/day) of energy would be conserved by shifting 2 hours/day from light-intensity behaviors (2.5 METs) to sedentary behaviors (1.5 METs). For a person with a resting energy expenditure of 67 kcal/hour, this would equate to 134 kcal/day. This amount of energy is slightly greater than that associated with 30 minutes/day of brisk walking (0.5 hours/ day × 3.5 METs = 1.75 MET-hours/day, or 117 kcal/day) and is similar to the level of energy imbalance that has been associated with the current obesity epidemic (33). Hence, even modest reductions in time spent in sedentary behaviors have the potential to increase energy expenditure and alter energy balance, if the increase in expenditure is not offset by a compensatory increase in energy intake.

Strengths of this study include the use of a large representative sample of children and adults in the United States, oversampling of Blacks and Mexican Americans to improve precision of the estimates in these groups, and the use of an objective measurement of overall sedentary behaviors. We supported our accelerometer cutpoint selection with a validation study in adults using a near-gold standard. This same cutpoint was identified in a calibration study among adolescent girls (15). An additional strength of our study was that the majority of participants were quite compliant with the measurement procedures. While the minimum number of days of observation required to be included in our analyses was only 1, nearly 80 percent of the sample wore the device for at least 10 hours/day on 3 or more days. There has been some debate regarding the minimal number of days of observation required to achieve useful estimates from accelerometers in field-based studies (34, 35) and issues associated

with missing data (36). Our decision to use data for persons with at least one day of observation differs from decisions made by other investigators, but our results are virtually identical to those of Healy et al. (16), who required at least 5 days of observation, including one weekend day, and those of Pate et al. (26), who employed a minimum of 6 days of measured and imputed observation. This suggests that our methods provide useful estimates of the population mean for amount of time spent in sedentary behavior.

Limitations of our study should also be considered. The amount of monitor-wearing time in our study (13.9 hours/ day) was approximately 1.5 hours/day less than the average waking time reported in other national surveys (13). Thus, our estimates of time spent in sedentary behaviors are likely to have underestimated the actual amount of time spent in these behaviors. If we normalized the population average for the proportion of monitored time spent being sedentary (54.9 percent) to a 15.4-hour waking day, our estimate of time spent in sedentary behavior would increase from 7.7 hours/day to 8.5 hours/day. In addition, the assessment of sedentary behaviors by accelerometer is relatively new, and our estimates of time spent in these behaviors will have been sensitive to the cutpoints employed. That said, it is unlikely that cutpoint selection would have affected our results with respect to age, gender, and race/ethnicity. Future studies that use more direct estimates of body position (e.g., see the paper by Grant et al. (37)) are needed to confirm the present results. Additionally, our results provide estimates of the average amount of time spent per day in sedentary behaviors and reflect the influence of both weekend days and weekdays; patterns of behavior may vary on these days. Finally, our cross-sectional study design limits causal inferences, particularly for the age differences reported, and our results are generalizable only to the noninstitutionalized population of the United States. Results from this report should be interpreted accordingly.

In conclusion, children and adults in the United States spend the majority of their waking time in sedentary behaviors. The most sedentary groups in the population are older adolescents (ages 16–19 years) and older adults (ages ≥60 years), while the least sedentary groups are children (ages 6–11 years) and Mexican-American males. Given the large amount of time spent each day in sedentary behaviors in the United States, efforts to reduce the amount of time spent in low-energy-expenditure pursuits are warranted.

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Abbreviations

IDEEA	Intelligent Device for Energy Expenditure and Activity
MET	metabolic equivalent
NHANES	National Health and Nutrition Examination Survey
SD	standard deviation

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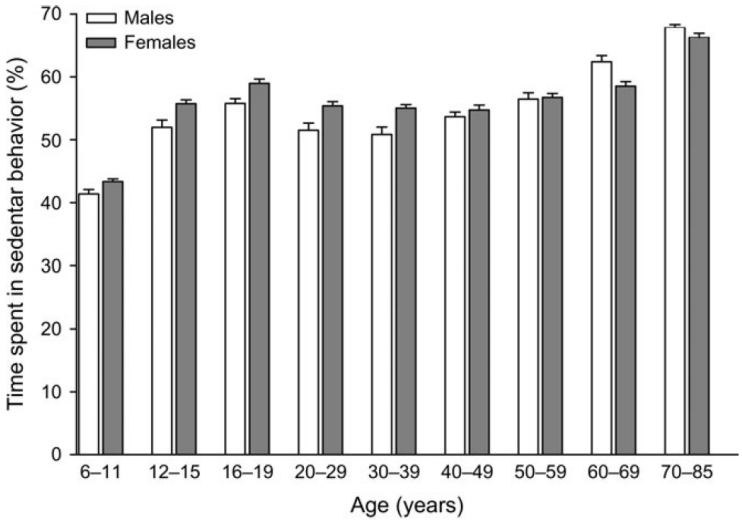

FIGURE 1.
Percentage of time spent in sedentary behaviors, by age and gender, United States, 2003–2004. Bars, standard error.

TABLE 1

Sample size for a study of the amount of time spent in sedentary behaviors, by gender, age, and racial/ethnic group, United States, 2003–2004

Gender and age group (years)	Total*	Non-Hispanic Whites	Non-Hispanic Blacks	Mexican Americans
Males				
All	3,120	1,334	828	782
6–11	386	104	138	118
12–15	466	121	180	146
16–19	429	113	162	137
20–29	300	138	69	60
30–39	282	131	61	62
40–49	309	154	72	72
50–59	238	137	50	35
60–69	299	157	51	79
70–85	411	279	45	73
Females				
All	3,209	1,413	812	796
6–11	425	117	149	138
12–15	420	105	145	151
16–19	405	126	142	113
20–29	336	169	64	73
30–39	322	174	59	69
40–49	319	144	90	64
50–59	255	150	53	34
60–69	333	159	70	87
70–85	394	269	40	67

*The total sample included persons of all racial/ethnic groups in the study; therefore, numbers for the individual racial/ethnic groups in the table do not add up to those of the total sample.

TABLE 2

Amount of time* spent in sedentary behavior (mean hours/day), by gender and age, United States, 2003–2004

Age group (years)	All participants	Males	Females	*p* value†
Total	7.67 (0.04)‡	7.63 (0.04)	7.70 (0.03)	0.001
Youths				
6–11	6.07 (0.06)	6.00 (0.10)	6.14 (0.05)	0.002
12–15	7.53 (0.10)	7.37 (0.15)	7.70 (0.08)	0.003
16–19	8.03 (0.08)	7.91 (0.13)	8.13 (0.10)	0.028
Adults				
20–29	7.48 (0.11)	7.27 (0.16)	7.68 (0.09)	0.001
30–39	7.25 (0.10)	7.17 (0.17)	7.34 (0.08)	0.061
40–49	7.55 (0.08)	7.57 (0.11)	7.53 (0.11)	0.252
50–59	7.87 (0.09)	7.93 (0.14)	7.82 (0.08)	0.515
60–69	8.41 (0.09)	8.80 (0.14)	8.08 (0.10)	0.003
70–85	9.28 (0.06)	9.52 (0.06)	9.11 (0.08)	0.015
p-trend	<0.001	<0.001	<0.001	

*Estimates of amounts of time spent in sedentary behaviors are least-square means adjusted for monitor-wearing time and age, as well as for gender as appropriate.

†*t* test for the difference between males and females in each age group.

‡Numbers in parentheses, standard error.

TABLE 3

Amount of time* spent in sedentary behavior (mean hours/day), by age, gender, and racial/ethnic group, United States, 2003–2004

Gender and age group (years)	Non-Hispanic Whites	Non-Hispanic Blacks	Mexican Americans
All participants	7.74 (0.06)†	7.61 (0.05)	7.18 (0.05)‡
6–11	6.03 (0.07)	6.10 (0.10)	6.03 (0.09)
12–15	7.47 (0.13)	7.62 (0.12)	7.55 (0.07)
16–19	8.03 (0.10)	8.10 (0.10)	7.62 (0.08)§
20–39	7.42 (0.12)	7.81 (0.08)	6.47 (0.10)‡
40–59	7.79 (0.08)	7.59 (0.08)¶	7.00 (0.07)‡
≥60	8.85(0.08)	9.04 (0.11)	8.31 (0.11)‡
p-trend	<0.001	<0.001	<0.001
Males	7.73 (0.08)	7.54 (0.06)	6.89 (0.07)‡
6–11	5.90 (0.13)	6.30 (0.12)	6.08 (0.13)
12–15	7.36 (0.18)	7.44 (0.19)	7.35 (0.11)
16–19	7.91 (0.19)	8.00 (0.12)	7.42 (0.13)
20–39	7.36 (0.19)	7.81 (0.13)	5.98 (0.12)‡
40–59	7.83 (0.10)	7.57 (0.17)¶	6.82 (0.12)§
≥60	9.14 (0.11)	9.32 (0.17)	8.42 (0.20)‡
p-trend	<0.001	<0.001	0.001
Females	7.74 (0.04)	7.67 (0.06)	7.47 (0.05)‡
6–11	6.18 (0.06)	5.88 (0.14)¶,#	6.02 (0.08)
12–15	7.60 (0.12)	7.83 (0.12)	7.78 (0.09)
16–19	8.15 (0.12)	8.20 (0.10)	7.89 (0.08)
20–39	7.49 (0.09)	7.80 (0.08)	6.97 (0.13)‡
40–59	7.74 (0.11)	7.60 (0.13)	7.18 (0.10)§
≥60	8.60 (0.10)	8.83 (0.15)	8.26 (0.13)
p-trend	<0.001	<0.001	<0.001

*Estimates of amounts of time spent in sedentary behaviors (hours/day) are least-square means adjusted for monitor-wearing time, as well as for age and gender as appropriate.

†Numbers in parentheses, standard error.

‡Mexicans were significantly less sedentary than Whites and Blacks ($p < 0.05$).

§Mexicans were significantly less sedentary than Whites ($p < 0.05$).

¶Blacks were significantly less sedentary than Whites ($p < 0.05$).

#Blacks were significantly less sedentary than Mexicans ($p < 0.05$).