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Sedentary Behaviors and Obesity in a Low-Income, Ethnic-Minority Population

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Abstract

Background—Numerous studies have documented adverse health effects from prolonged sitting and TV viewing. These sedentary pastimes are linked to increased risk for obesity and other cardiometabolic risk factors. No studies, however, have examined these associations specifically in low-income, minority communities in the US.

Methods—This cross-sectional, community-based study was conducted in South Dallas, TX. Multivariable ordered logistic regression models were used to examine the association between sedentary behaviors (self-report) and measures of objectively assessed obesity (BMI, waist circumference).

Results—Among a low-income, ethnic-minority population, there were independent and significant associations between higher levels of sitting time, computer use, and transit time with elevated BMI ($P < .05$). Elevated waist circumference was also linked to increased sitting time, computer use, and transit time, yet without statistical significance.

Conclusions—Increased time spent in passive-leisure activities is a risk marker for obesity in this population.

Keywords

African Americans; sitting; BMI; waist circumference; urban population

Since 2000, there has been a marked increase in studies examining the association between sedentary behaviors (eg, sitting time, TV viewing, video gaming) and the risk for morbidity and mortality.[1,2] Data from the National Health and Nutrition Examination Survey indicate that US adults spend over half of their waking time (7.7 hours per day) in sedentary behaviors (sitting, reclining, lying down, time in transit) at home and on the job.[3] These behaviors (measured objectively and by self-report) have been linked in observational studies to an increased risk of obesity, glucose and lipid metabolism disorders, diabetes, and cancer incidence and mortality, even after adjusting for the protective effects of moderate-to-vigorous intensity physical activity.[4–7] The association between sedentary behaviors and morbidity, however, has not been examined specifically in disadvantaged minority communities in the US, which experience significantly higher rates of obesity and other chronic diseases than otherwise not disadvantage groups.[8] In the current study, we examine the association between a number of sedentary behaviors (ie, sitting time, computer utilization, transit time) and obesity measures among members of a low-income, predominantly African American community, in Dallas, TX.

Methods

Study Design and Participants

The Fair Park Study aims to examine the effects of publicly driven investment on social, economic and health indicators in a low-income (median= $19,939) neighborhood (Fair Park) in the southern sector of Dallas, TX. The study, described elaborately elsewhere,[9] includes several waves of data collection. We analyzed data from the second wave, which included detailed questions pertaining to social-economic variables, health status, and lifestyle behaviors, as well as an objective assessment of height, weight and waist circumference. Of the 496 participants who completed this assessment wave in 2009, 452 completed both the self-report questionnaire and the objective assessment of anthropometric measures. For the present report, we performed cross-sectional analysis of this sample to assess the association between participants' sedentary behaviors and obesity. The study was approved by the institutional review boards of the University of Texas at Dallas, University of Texas Southwestern Medical Center, and University of Texas Health Science Center at Houston.

Measures

Sedentary Behaviors—Sitting time was assessed with a question from the International Physical Activity Questionnaire (IPAQ), asking about average sitting time per day (including TV viewing) during the last 7 days.[10] Transit time was calculated from 2 questions from the transportation physical activity module of the IPAQ: 1) number of days per week traveling in a motor vehicle; and 2) time spent traveling during those days. We calculated the average time spent in a motor vehicle per day (hours/day) by multiplying the number of days by the hours in travel time during these days and then dividing by 7. In addition, participants were asked specifically about computer use on a typical day during the week and on the weekend. We calculated computer time (hours/day) with the following formula: [(weekday computer usage hours × 5) + (weekend usage hours × 2)] ÷ 7.

Obesity Measures—Weight was measured using a calibrated digital scale (Detecto Platform Balance Scales), and height was measured with a stadiometer (Seca Portable Stadiometer). BMI was calculated using the standard formula (kg/m2), and was categorized as follows: Underweight: BMI < 18.5; Normal: BMI 18.5–24.9; Overweight: BMI 25–29.9; Obesity (Class I): BMI 30–34.9; Obesity (Class II): BMI 35–39.9; and Extreme Obesity (Class III): BMI ≥ 40.[11] For statistical analysis, the underweight and normal weight categories were grouped together due to the small number of participants in the underweight category (n = 19; 4%); and to enable determining a detrimental transition to the overweight and obesity categories in multivariable analysis (please see statistical analysis). Waist circumference was measured at the umbilicus level with a tape measure (Seca 72″ Tape) at the end of a normal expiration.[12] We categorized waist size normal, increased, and substantially increased with different cut points for men (< 94, ≥ 94 to 101.9, ≥ 102 cm) and women (< 80, ≥ 80 to 87.9, ≥ 88 cm), based on the World Health Organization cutoff points for metabolic complications.[11]

Covariates—The statistical analysis adjusted for gender, age, race/ethnicity, marital status, health status, presence of children in the household < 18 (yes/no), transportation physical activity (MET-minutes/week via IPAQ), and health insurance coverage (yes/no). Although we measured both general physical activity and transportation physical activity, we adjusted only for 1 (transportation physical activity) because both variables were significantly correlated ($r = .47$; $P < .001$). Adjusting for either measure of physical activity did not change results materially.

Statistical Analysis

Statistical analysis was conducted using STATA 11 (STATA, College Station, TX). Ordered logistic regression models were computed to analyze the relation between sedentary behaviors (sitting time, transit time, and computer utilization) and obesity measures (waist circumference or BMI), while controlling for the covariates described above. Ordered logistic regression was used due to the natural order of the dependent variables (BMI and waist circumference) (ie, higher categories indicate increased overweight/obesity). Sitting time was entered into the model as a categorical variable according to quartile cut points, whereas with computer utilization and transit time, the median cut point was used due to the large number of 0 hours (42% and 17% responses, respectively) found in both variables. Each model included only 1 measure of sedentary behavior and the covariates. Multivariable regression results are reported as adjusted odds ratios (OR) and 95% confidence intervals (CI) for moving to higher BMI and waist circumference categories versus remaining in the same category.[13]

Results

Participants were primarily African American (94%) and Hispanic (4%) men and women, with a mean age of 44 years (range 18–92 years). As depicted in Table 1, most were women (61%), unmarried (78%), unemployed (57%), and without health insurance (57%); yet most (70%) reported their health to be either good, very good, or excellent. More than half (62%) of the participants reported exceeding the 2008 Physical Activity Guidelines for Americans (ie, > 1000 METs per week); please see Table 1. In addition, on average, participants spent close to 5 hours a day sitting, 2.3 hours on the computer, and 2.5 hours in a motor vehicle. The majority was overweight or obese (71%), and 56% had a substantially increased waist circumference (ie, ≥ 102 cm in men, and ≥ 88 cm in women).

The adjusted odds for obesity associated with each type of sedentary behavior are presented in Table 2. More time spent sitting was independently and significantly associated with a higher BMI category. Specifically, the odds for higher BMI increased when independently comparing the 2nd (2.3–4.0 hours), 3rd (4.0–6.5 hours), and 4th quartiles (> 6.5 hours) to the 1st quartile (ORs =1.9, 2.1, 2.0; P-values = 0.02, 0.01, 0.01; respectively). The odds for higher waist circumference increased when comparing the 2nd, 3rd, and 4th quartile to the 1st (ORs= 1.7, 1.3, and 1.7; respectively), yet without statistical significance. In addition, computer use of ≥ 1.3 h/d was significantly associated with higher BMI (OR= 1.6; P= 0.03), but not significantly with waist circumference. Spending 1 or more hours per day in a motor vehicle was significantly associated only with a higher BMI (OR =1.7; $P = 0.01$).

Discussion

To our knowledge, no studies to date have specifically assessed and characterized various sedentary behaviors and obesity measures among disadvantaged-minority populations in the US. Current results indicate that sitting more than 2.3 hours a day was independently and significantly associated with higher odds of obesity. Even minimal computer use (> 1.3 hours daily) was an independent and significant risk marker for obesity, as was spending an hour or more per day in a motor vehicle. A detrimental relationship between these sedentary behaviors and increased abdominal girth was also found; however, without statistical significance. This lack of statistical significance might stem from the homogeneity of the sample (70% with either increased or significantly increased waist circumference).

Thorp et al, in a large cohort of Australian adults, found higher levels of sitting time to be correlated with both higher BMI and waist girth categories in men and women.[7] However, unlike our findings, which focused solely on anthropometric measures, they found detrimental effects of prolonged sitting on other cardiometabolic risk markers (eg, blood pressure, glucose levels).[7] Hu et al, in a large cohort study of women (the Nurses' Health Study), determined that a 2 hour per day increase in sitting time and TV viewing was prospectively associated with a 5% and 23% respective increase in obesity risk.[14] As with our study, these 2 studies assessed sedentary behavior through a self-report questionnaire;[7,14] however, the study populations were markedly different (ie, primarily white, well-educated populations versus a low-income, ethnic-minority population). Healy et al assessed the relationship between sedentary behavior (measured via accelerometers) and obesity (and other cardiometabolic biomarkers) in a nationally representative (multiethnic) sample of US adults.[15] Yet, unlike our study which focused on low-income African Americans, they did not find a detrimental association between sedentary time and obesity in African Americans. Future studies are warranted to continue assessing these associations in ethnic-minority populations.

Our results should be considered in light of several limitations. The study design is cross-sectional, therefore the existence of a temporal relation cannot be determined. In addition, the relatively small sample size precludes stratifying the analysis by gender; therefore we adjusted for this variable in multivariable analysis. In addition, the study population consists of participants from a specific geographic region, and may not be representative of similar populations elsewhere, although there is no reason to think the potential physiologic mechanisms would be different between geographic regions. Furthermore, even though anthropometric measures were obtained objectively, sedentary behavior was determined via a self-report tool that has scarcely been validated among low-income African Americans. More specifically, though the IPAQ has been validated in numerous studies in the US and elsewhere (eg, Sweden, China), few have examined its validity among African Americans.[10,16,17] Wolin et al (2008) assessed the validity of the IPAQ (short) in low-income African Americans, finding fair correlations between moderate/vigorous physical activity and accelerometry.[18] However, they did not examine the validity of the IPAQ question pertaining to sitting time.

Nonetheless, our results significantly contribute to the literature by assessing sedentary behaviors and obesity specifically among an African American low-income community, which is mostly unemployed and lacks adequate health insurance. Even though participants' average sitting (5 h/d) was lower than the national average (7 h/d), obesity prevalence (45.0%) was markedly higher (35.7%).[3,8] The significant associations found between

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sedentary time and increased risk for obesity underscores the need to inform this population of the adverse effects of sitting; and potentially introduce tailored interventions aimed at decreasing sedentary behaviors.

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Table 1

Characteristics of Fair Park Participants (n=452), South Dallas, Texas

Characteristic	**n**[a1]	**(%)**[a2]
Education		
<High school graduate	97	23
≥High school graduate	317	77
Married		
No	352	78
Yes	100	22
Employed		
No	255	57
Yes	196	43
Gender		
Men	177	39
Women	275	61
Health Status		
Poor	21	5
Fair	111	25
Good	160	26
Very Good	110	24
Excellent	47	10
Health Insurance		
No	194	43
Yes	258	57
Children <18 years living at home		
No	236	52
Yes	216	48
BMI[b], kg/m^2		
Underweight	19	4
Normal weight	113	25
Overweight	113	25
Obese I	84	19
Obese II	59	13
Obese III	60	13
Elevated waist circumference[c]		
Normal	133	30
Increased	63	14
Substantially increased	252	56
General Physical Activity [d]		
Not meeting DHHS guidelines (0–499 METs)	118	30
Meeting DHHS guidelines (500–1000 METs)	28	7
Exceeding DHHS guidelines (>1000 METs)	243	62

Characteristic	n[a1]	(%)[a2]
Transportation Physical Activity [e]		
Not meeting DHHS guidelines (0–499 METs)	214	54
Meeting DHHS guidelines (500–1000 METs)	46	12
Exceeding DHHS guidelines (>1000 METs)	137	34
Time sitting, mean, SD (h/d)	4.9	5.6
Average computer usage, mean, SD (h/d)	2.3	2.9
Time in motor vehicle, mean, SD (h/d)	2.4	8.6

Abbreviations: SD, Standard Deviation; h/d, hours per day; METs, metabolic equivalent of task (1 MET = 3.5 ml O2 uptake · kg body mass-1 · min-1); DHHS guidelines, Department of Health and Human Services 2008 Physical Activity Guidelines for Americans (http://www.health.gov/paguidelines/default.aspx).

[a1] Some categories do no total 452 because of missing responses;

[a2] Some percentages do not add up to 100% due to rounding.

[b] BMI was categorized as follows Underweight: BMI < 18.5; Normal: BMI 18.5–24.9; Overweight: BMI 25–29.9; Obesity (Class I): BMI 30–34.9; Obesity (Class II): BMI 35–39.9; and Extreme Obesity (Class III): BMI ≥ 40. For statistical analysis-the underweight and normal weight categories were combined together.

[c] Waist circumference was categorized as normal, increased, and substantially increased; with different cut points for men (< 94, ≥ 94 to 101.9; ≥ 102cm) and women (< 80, ≥ 80 to 87.9, ≥ 88).

[d] General physical activity as derived from the International Physical Activity Questionnaire (IPAQ)–short form. MET categories are MET-minutes per week based on the DHHS guidelines.

[e] Transportation physical activity as derived from the IPAQ- transportation domain–long form. MET categories are MET-minutes per week based on the DHHS guidelines.

Table 2

Multivariable Logistic Regression Models[a] of the association between sedentary behaviors and Obesity Measures (BMI, Waist Circumference), South Dallas, Texas

	BMI OR (95% CI)	Waist Circumference OR (95% CI)
Time sitting (h/d)[b]		
1st Quartile, (<2.3)	1.00 (Reference)	1.00 (Reference)
2nd Quartile, (2.3, 4)	1.91* (1.14–3.23)	1.72+ (0.95 – 3.12)
3rd Quartile, (4, 6.5)	2.05* (1.18 – 3.58)	1.31 (0.70 – 2.45)
4th Quartile, (>6.5)	2.04* (1.19 – 3.50)	1.68+ (0.92 – 3.10)
Average computer usage (h/d)[c]		
Lower than Median, (<1.3)	1.00 (Reference)	1.00 (Reference)
Greater than Median, (≥1.3)	1.56* (1.04 – 2.34)	1.28 (0.80 – 2.05)
Time in motor vehicle (h/d)[d]		
Lower than Median, (<1.0)	1.00 (Reference)	1.00 (Reference)
Greater than Median, (≥1.0)	1.68* (1.16 – 2.43)	1.16 (0.76 – 1.76)

** *P* < .001,

* *P* < .05,

+ *P* < .10.

Abbreviations: OR, Odds Ratio; CI, Confidence Interval; h/d, hours per day.

[a] Multivariable models use ordinal logistic regression because dependent variables have multiple ordered categories (BMI–5; waist circumference – 3). All models adjusted for gender, age, race/ethnicity, marital status, children in the household, health status, transportation physical activity, and health insurance coverage.

Note. Of the 452 participants:

[b] 362 had complete observations for sitting time and obesity measures;

[c] 333 had complete observations for computer use and obesity measures;

[d] 381 had complete observations for time in a motor vehicle and obesity measures.