

Differences in Leisure-Time Physical Activity Levels Between Blacks and Whites in Population-Based Samples: The Minnesota Heart Survey

Aaron R. Folsom,^{1,2} Timothy C. Cook,^{1,3} J. Michael Sprafka,¹
Gregory L. Burke,⁴ Stephan W. Norsted,⁵ and David R. Jacobs, Jr.¹

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Energy expenditure in leisure-time physical activity (LTPA) was measured using the Minnesota LTPA Questionnaire in 35- to 74-year-old black and white residents of Minneapolis-St. Paul, Minnesota. Estimates of the geometric mean LTPA energy expenditure were 129 and 204 kcal per day for black and white men ($p < .05$) and 91 and 123 kcal per day for black and white women ($p < .05$). The percentage of individuals expending 2000 kcal or more per week in LTPA was significantly lower in black men than white men (25 vs. 35%; $p = .01$) but was not different in black versus white women (18 vs. 17%). Although black men and women reported greater occupational physical activity than their white counterparts, LTPA and job activity were unrelated in all race and sex groups. In both races, LTPA energy expenditure declined with age. LTPA increased with level of formal education, and the largest LTPA difference between blacks and whites was observed in those who had a high-school diploma or less. Blacks had lower participation rates

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¹Division of Epidemiology, School of Public Health, University of Minnesota, 515 Delaware Street S.E., 1-210 Moos Tower, Minneapolis, Minnesota 55455.

²To whom correspondence should be addressed.

³Present address: American Medical Systems, 11001 Bren Road East, Minnetonka, Minnesota 55343.

⁴Department of Public Health Sciences, Bowman-Gray School of Medicine, 300 South Hawthorne Road, Winston-Salem, North Carolina 27103.

⁵Cardiac Pacemakers, Inc., 4100 Hamline Avenue North, Arden Hills, Minnesota 55112.

than whites in most of the individually assessed physical activities. Additional research is needed on the determinants and promoters of LTPA in population subgroups.

KEY WORDS: exertion; health surveys; leisure; race.

INTRODUCTION

The association between increased physical activity and reduced risk of cardiovascular disease is well established (Blackburn, 1983; Powell *et al.*, 1987). Factors related to greater physical activity among adults are younger age, higher levels of socioeconomic status or education, and male sex (National Center for Health Statistics, 1978; Dishman *et al.*, 1985; Folsom *et al.*, 1985; Sallis *et al.*, 1985; Stephens *et al.*, 1985). However, few studies (National Center for Health Statistics, 1978; Caspersen *et al.*, 1986; Schoenborn, 1986; White *et al.*, 1987) have investigated racial differences in physical activity. Several of those which have were not population-based or did not simultaneously adjust for the confounding effects of age and education.

Previously, the Minnesota Heart Survey reported the association between LTPA and cardiovascular disease risk factors in a 1980–1982 sample of Twin Cities adult residents, predominantly whites (Folsom *et al.*, 1985). The Minnesota Heart Survey subsequently sampled blacks residing in Minneapolis in 1985 for comparison with whites in 1985–1986. This report describes the LTPA differences between blacks and whites in these population-based samples.

METHOD

Subjects. The Minnesota Heart Survey measures trends in cardiovascular disease mortality, morbidity, and risk factors in Minnesota populations. The Twin Cities risk factor survey in 1985–1986 employed a two-stage cluster sample of households in the seven-county metropolitan area (Sprafka *et al.*, 1988). First, 704 clusters of approximately 1000 households were defined using updated census information, and 40 clusters were selected randomly. Second, clusters were remapped, and households were selected randomly. Household residents ages 25 to 74 years were identified, and one was randomly selected for participation.

The general survey of the Twin Cities metropolitan area was predominantly white (> 95%). Therefore, in 1985 blacks in five census tracts of Minneapolis containing high proportions of black residents were sampled. These five census tracts represented 12% of the total black population in the seven-county area. Household address data for these tracts were obtained

from census maps, three commercial residential directories, and supplemental listings by survey personnel. All black residents ages 35 to 74 years were identified and recruited.

Survey Examination. In both samples, a two-step survey process was followed. A 25-min home interview measured sociodemographic characteristics, medical history, health behaviors, and knowledge. It included a few brief questions about regular vigorous exercise at work and leisure. Upon completion of the home interview each subject was invited to a clinic where technicians measured physiologic and anthropometric variables. Height and weight were measured with subjects in stocking feet and light clothing. Height was measured to the nearest centimeter using a secured metal rule. Weight was measured to the nearest half-pound using a calibrated balance beam scale. Body mass index [weight (kg)/height (m)²] was calculated.

During the clinic visit, the Minnesota LTPA questionnaire (Taylor *et al.*, 1978; Leon *et al.*, 1987) was interviewer-administered to a 50% systematic sample of participants. The LTPA questionnaire ascertained (1) the specific leisure-time physical activities that participants did in the past year, (2) the average number of times the activity was done per month, and (3) the time spent per occasion. By assigning intensity codes for various activities, an activity metabolic index was derived which approximates kilocalories (kcal) per day in leisure-time energy expenditure (Taylor *et al.*, 1978). Kilocalorie estimates were obtained for total activity, as well as light (2.0 to 4.0 kcal/min), moderate (4.5 to 5.5 kcal/min), and heavy (6.0 or more kcal/min) intensity categories. In whites, the LTPA questionnaire has been indirectly validated against caloric intake and duration of treadmill exercise (Taylor *et al.*, 1978; Leon *et al.*, 1981) and its reliability is good (Folsom *et al.*, 1986). The questionnaire has not been validated in a black population.

Participation rates for the general Twin Cities survey were 90% for the home interview and 68% for the home interview plus clinic visit. In the survey of blacks, the respective response rates were 75 and 65%.

Statistical Analysis. Over a dozen cardiovascular risk factor levels were compared between the systematic 50% of participants who received the LTPA and the 50% who did not. Only three sex-race-specific differences were found for which $p < .05$. Among black women, those who received the LTPA questionnaire had lower BMI (1.0 kg/m²; $p = .04$) than those not receiving it. Among black men, those who received the LTPA questionnaire had higher total and HDL cholesterol levels (9 mg/dl, $p = .02$, and 3 mg/dl, $p = .04$, respectively). Twenty-two participants were excluded from LTPA analyses because they reported either zero LTPA or greater than 180 min of LTPA per day. These participants primarily did not comply with the interview or apparently included occupational activity as LTPA.

Energy expenditure was log transformed (log kcal/day) to normalize the distribution. Geometric means were computed by taking the antilog. Using

BMDP software (Dixon, 1985) paired *t* tests were used to compare sex-specific means of log kilocalories of LTPA between races. The log LTPA score was age-adjusted by analysis of covariance. We next compared sex- and education-specific mean log LTPA between blacks and whites adjusted for age and body mass index (BMI). Finally, we compared participation in 13 physical activity categories between blacks and whites, adjusting for age and education. All reported *p* values are two-tailed.

RESULTS

For both races, leisure-time energy expenditure was higher in men than women and declined with age (Table I). In all age groups white men had higher mean leisure-time energy expenditure than black men. The age-adjusted mean values were significantly different ($p < .05$) between black and white men. White women had higher age-specific mean energy expenditure than black women, except in the 55 to 64-year age group, and the age-adjusted values were significantly different. Adjusted for age, 35% of white men and 25% of black men expended 2000 kcal or more per week in LTPA ($p = .01$). Black and white women were similar in the proportion achieving this level (18 vs. 17%, $p = .6$).

Adjusted for age, 32% of black men and 23% of white men reported regular vigorous occupational physical activity ($p = .02$). Twenty-one percent of black women and 17% of white women reported vigorous job activity ($p = .17$). Although more blacks than whites reported regular vigorous exercise at work, job activity was not correlated with LTPA ($r < .08$) and did not explain racial differences in LTPA.

Table I. Kilocalories of Energy Expended per Day in Leisure-Time Physical Activity (LTPA) by Age, Race, and Sex in Minneapolis-St. Paul, MN, 1985-1986: The Minnesota Heart Survey

Age	Race ^a	N	Men		Women		
			log kcal/day (95% CI)	Geometric mean	N	log kcal/day (95% CI)	Geometric mean
35-44	B	83	2.24 (2.13-2.34)	174	108	1.96 (1.86-2.06)	91
	W	143	2.36 (2.31-2.41)	229	163	2.13 (2.07-2.19)*	135
45-54	B	53	2.03 (1.90-2.16)	107	71	2.02 (1.89-2.14)	105
	W	106	2.35 (2.29-2.41)*	224	108	2.16 (2.08-2.24)	145
55-64	B	44	2.06 (1.90-2.21)	115	61	1.94 (1.81-2.07)	87
	W	75	2.23 (2.14-2.33)	170	81	1.93 (1.83-2.03)	85
65-74	B	37	1.97 (1.79-2.15)	93	37	1.85 (1.65-2.05)	71
	W	33	2.22 (2.09-2.35)	166	56	2.04 (1.92-2.16)	110
Age- adjusted	B	217	2.11 (2.06-2.17)	129	277	1.96 (1.90-2.01)	91
	W	357	2.31 (2.27-2.36)*	204	408	2.09 (2.04-2.13)*	123

^aB, black, W, white.

* $p < .05$ for sex-specific difference in means between blacks and whites.

Table II. Kilocalories of Energy Expended per Day in Total and Heavy Intensity Leisure-Time Physical Activity (LTPA) by Education Level, Race, and Sex in Minneapolis-St. Paul, MN, 1985-1986: The Minnesota Heart Survey

Education	Race ^b	N	Total LTPA ^a		Heavy LTPA ^a	
			log kcal/day (95% CI)	Geometric mean	log kcal/day (95% CI)	Geometric mean
Men						
≤ High school	B	110	1.99 (1.90-2.08)	98	1.23 (1.12-1.35)	17
	W	121	2.26 (2.17-2.34)*	182	1.58 (1.48-1.67)*	38
Some college	B	67	2.23 (2.13-2.32)	170	1.50 (1.37-1.64)	32
	W	106	2.32 (2.24-2.39)	209	1.62 (1.51-1.73)	42
College graduate	B	40	2.23 (2.13-2.33)	170	1.68 (1.52-1.83)	48
	W	130	2.36 (2.31-2.42)	229	1.94 (1.86-2.03)*	87
Women						
≤ High school	B	155	1.89 (1.81-1.97)	78	0.85 (0.74-0.96)	7
	W	182	2.04 (1.97-2.12)*	110	1.11 (1.01-1.21)*	13
Some college	B	78	2.05 (1.95-2.15)	112	1.22 (1.07-1.36)	17
	W	135	2.07 (1.99-2.14)	117	1.34 (1.23-1.45)	22
College graduate	B	43	2.11 (1.99-2.24)	129	1.49 (1.30-1.67)	31
	W	91	2.16 (2.08-2.25)	145	1.48 (1.35-1.61)	30

^aAdjusted for age and body mass index.

^bB, black; W, white.

* $p < .05$ for sex-specific difference in means between blacks and whites.

Leisure-time energy expenditure increased with level of formal education, and formal education was greater in whites than blacks. Table II therefore presents sex-, education-, and race-stratified mean kilocalories of log LTPA. The largest racial differences in LTPA were observed in the group who had a high school diploma or less. In this stratum, heavy LTPA and total LTPA were significantly higher in whites than blacks for both sexes. The LTPA differences were not statistically significant in other education strata, except for heavy LTPA in male college graduates.

LTPA was more diverse in whites than blacks (Table III). That is, participation by whites in most physical activities was greater than or equal to that for blacks. Among participants, however, blacks and whites tended to be similar in the average minutes of each activity performed per day (data not shown).

The age-adjusted mean BMI was not significantly different between black and white men (26.9 and 27.5 kg/m²; $p = .08$). However, black women had a higher mean BMI than white women for every 10-year increment but ages 55-64 years. The age-adjusted mean BMI was 28.6 kg/m² in black women and 26.3 kg/m² in white women ($p < .001$).

Finally, to verify that the results were not the product of nonresponse bias, we compared several characteristics of participants who completed the

Table III. Percentage Participation in 13 Categories of Leisure-Time Physical Activity by Sex and Race in Minneapolis-St. Paul, MN, 1985-1986: The Minnesota Heart Survey

Activity	Men		Women	
	Blacks (%)	Whites (%)	Blacks (%)	Whites (%)
Walking, cycling	83	89*	87	95*
Hiking, stair climbing	59	76*	65	75*
Dancing, moderate conditioning exercises	78	69*	78	80
Heavy conditioning exercises, jogging	43	37	42	42
Light- or moderate-intensity water activities (e.g., boating)	12	33*	5	21*
Heavy-intensity water activities (e.g., swimming)	28	61*	13	44*
Heavy-intensity winter activities (e.g., skiing)	19	40*	15	30*
Light- or moderate-intensity sports (e.g., bowling, golf)	58	69*	39	52*
Heavy-intensity sports (e.g., tennis, basketball)	53	48	24	29
Light- or moderate-intensity lawn and garden work	90	94	79	88*
Heavy-intensity lawn and garden work	79	88*	63	73*
Light- or moderate-intensity fishing or hunting	39	26*	24	14*
Heavy-intensity fishing or hunting large game	9	25*	2	2

^aAdjusted for age and education.

^b $p < .05$ for sex-specific difference between blacks and whites.

clinic visit to those who completed the home interview. The average age and education level did not differ ($p > .05$) between clinic attenders and those interviewed in the home. The proportion who reported engaging in regular leisure time exercise was also similar between those who attended the clinic and those who completed the home interview: 46 and 45%, respectively, for blacks and 49 and 49% for whites. Also not different between the two respondent groups was the proportion who reported vigorous exercise at work: 28 versus 29%, respectively, for blacks and 20 versus 20% for whites.

DISCUSSION

There is considerable epidemiologic evidence to indicate that leisure-time physical activity is associated with reduced cardiovascular disease in white populations (Blackburn, 1983; Powell *et al.*, 1987). This association is not established in blacks. The Evans County Study, one of the few cohort studies in blacks, did not have sufficient sedentary blacks to test this hypothesis (Cassel *et al.*, 1971). Furthermore, we know of only three descriptive population-based studies on the physical activity habits of blacks (National Center for Health Statistics, 1978; Caspersen *et al.*, 1986; Schoenborn, 1986; White *et al.*, 1987).

In the 1975 National Health Interview Survey (National Center for Health Statistics, 1978) a higher percentage of U.S. white adults participated in leisure-time physical activity (49%) than did "all other" races (43%). Age-specific participation rates were also lower in "all others" than whites, but for that analysis the study lumped men and women together. Whites were also found to participate more frequently in LTPA than blacks in the 1985 National Health Interview Survey (Caspersen *et al.*, 1986). A second analysis of the 1985 NHIS (Schoenborn, 1986) was stratified by sex and race: black men were more sedentary than white men (52.7 vs. 48.9%) and were slightly less likely to be categorized as moderately active (13.6 vs. 16.8%) or very active (33.8 vs. 34.2%). Black women were more sedentary than white women (66.8 vs. 60.9%) and were less likely to be moderately active (14.1 vs. 16.7%) or very active (19.2 vs. 22.4%). Whether the racial differences in physical activity were related to education or age were not explored. The 1981-1983 Behavioral Risk Factor Survey of over half of U.S. states assessed adult caloric expenditure in active sports (White *et al.*, 1987). The percentages reporting no energy expenditure in active sports was 35.5% for whites and 40.8% for other races, adjusted for age, sex, and education. Most of this racial difference was attributable to women.

These Minnesota Heart Survey data are consistent with previous reports and demonstrate higher levels of LTPA in whites than blacks, independent of age, education level, and BMI. Whites had higher rates of participation than blacks in most individual LTPA categories (Table III). Blacks, as a group, reported greater occupational exercise, but this did not account for their lower LTPA because occupational exercise and LTPA were not correlated.

LTPA declined with age for both blacks and whites. We are unaware of any published data which have demonstrated a decline in LTPA with age in black populations, although this is well established in predominantly white populations (National Center for Health Statistics, 1978; Dishman *et al.*, 1985; Folsom *et al.*, 1985; Sallis *et al.*, 1985; Stephens *et al.*, 1985). The decline in physical activity in white populations has been attributed to age-related changes in social expectations, health, and physiology (Shephard and Sidney, 1978).

Education level was associated positively with LTPA in both blacks and whites. Stratifying our data by education level diminished the racial differences in LTPA, but they remained sizable for the lowest-educated stratum. Education level or other socioeconomic indicators have been positively associated with caloric expenditure during leisure time in other, predominantly white populations (National Center for Health Statistics, 1978; Dishman *et al.*, 1985; Folsom *et al.*, 1985; Sallis *et al.*, 1985; Stephens *et al.*, 1985). Compared to those with less formal education, individuals with greater educa-

tion may have more leisure time to exercise or more health knowledge and thus value the benefits (or the image) that exercise provides (Blair *et al.*, 1985). Some physical activities are expensive and require equipment (e.g., skiing) or require facilities (e.g., swimming) and therefore may be less accessible to some individuals.

In this population, BMI was significantly higher and LTPA was significantly lower in black women than white women. One may speculate that the higher prevalence of obesity in black women is related in part to their low physical activity levels. There was no difference in BMI between black and white men despite different levels of LTPA.

We have attempted to rectify some of the problems of previous studies but our findings must also be interpreted with a few caveats. While the validity and reliability of the Minnesota LTPA questionnaire were established for predominantly white populations (Taylor *et al.*, 1978; Folsom *et al.*, 1986), no such data are available for black populations. Blacks may engage in specific physical activities not covered by the questionnaire; however, the instrument accounts for this by allowing such activities to be added to the list. The black survey was performed in only a small area of the Twin Cities, as opposed to the seven counties covered by the general Twin Cities survey. Factors related to geography besides race (e.g., availability of facilities) may influence amount of LTPA. Finally, clinic response rates were similar between the two samples (68% for whites vs. 65% for blacks), and clinic attenders seemed similar in physical activity, age, and education to those who completed the home interview. Nonresponse bias therefore seems an unlikely explanation for the results.

Low leisure time activity likely contributes to the prevalence of obesity in black women and may increase blacks' risks of cardiovascular disease. Additional studies are needed on the determinants of LTPA in population subgroups. Given that there are racial and educational differences in patterns of LTPA, those interested in promoting exercise may well want to target strategies to specific groups at high risk, such as less-educated and minority populations.

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REFERENCES

- Blackburn, H. (1983). Physical activity and coronary heart disease: A brief update and population view (Part 1). *J. Cardiac Rehab.* 3(2): 101-111.
- Blair, S. N., Jacobs, D. R., Jr., and Powell, K. E. (1985). Relationships between exercise or physical activity and other health behaviors. *Public Health Rep.* 100(2): 172-180.
- Caspersen, C. J., Christenson, G. M., and Pollard, R. A. (1986). Status of the 1990 physical fitness and exercise objectives—evidence from NHIS 1985. *Public Health Rep.* 101(6): 587-592.
- Cassel, J., Heyden, S., Bartel, A. G., Kaplan, B. H., Tyroler, H. A., Cornoni, J. C., and Hames, C. G. (1971). Occupation and physical activity and coronary heart disease. *Arch. Intern. Med.* 128(6): 920-928.
- Dishman, R. K., Sallis, J. F., and Orenstein, D. R. (1985). The determinants of physical activity and exercise. *Public Health Rep.* 100(2): 158-171.
- Dixon, W. J. (ed.) (1985). *BMDP Statistical Software Manual*, University of California Press, Berkeley.
- Folsom, A. R., Caspersen, C. J., Taylor, H. L., Jacobs, D. R., Jr., Luepker, R. V., Gomez-Marin, O., Gillum, R. F., and Blackburn, H. (1985). Leisure time physical activity and its relationship to coronary risk factors in a population-based sample: The Minnesota Heart Survey. *Am. J. Epidemiol.* 121(4): 570-579.
- Folsom, A. R., Jacobs, D. R., Jr., Caspersen, C. J., Gomez-Marin, O., and Knudsen, J. (1986). Test-retest reliability of the Minnesota Leisure Time Physical Activity Questionnaire. *J. Chron. Dis.* 39(7): 505-511.
- Leon, A. S., Jacobs, D. R., Jr., DeBacker, G., and Taylor, H. L. (1981). Relationship of physical characteristics and life habits to treadmill exercise capacity. *Am. J. Epidemiol.* 113(6): 653-660.
- Leon, A. S., Connett, J., Jacobs, D. R., Jr., and Rauramaa, R. (1987). Leisure-time physical activity levels and risk of coronary heart disease and death: The Multiple Risk Factor Intervention Trial. *JAMA* 258(17): 2388-2395.
- National Center for Health Statistics (1978). Exercise and participation in sports among persons 20 years of age and over: United States, 1975. Advance Data, No. 19. U.S. Government Printing Office, Washington, D.C.
- Powell, K. E., Thompson, P. D., Caspersen, C. J., and Kendrick, J. S. (1987). Physical activity and the incidence of coronary heart disease. *Annu. Rev. Public Health* 8: 253-287.
- Sallis, J. F., Haskell, W. L., Wood, P. D., Fortmann, S. P., Rogers, T., Blair, S. N., and Paffenbarger, R. S., Jr. (1985). Physical activity assessment methodology in the Five-City Project. *Am. J. Epidemiol.* 121(1): 91-106.
- Schoenborn, C. A. (1986). Health habits of U.S. adults, 1985: The "Alameda 7" revisited. *Public Health Rep.* 101(6): 571-580.
- Shephard, R. J., and Sidney, K. H. (1978). Exercise and aging. *Exerc. Sport Sci. Rev.* 6: 1-57.
- Sprafka, J. M., Folsom, A. R., Burke, G. L., and Edlavitch, S. A. (1988). Prevalence of cardiovascular disease risk factors in blacks and whites: The Minnesota Heart Survey. *Am. J. Public Health* 78(12): 1546-1549.
- Stephens, T., Jacobs, D. R., Jr., and White, C. C. (1985). A descriptive epidemiology of leisure-time physical activity. *Public Health Rep.* 100(2): 147-158.
- Taylor, H. L., Jacobs, D. R., Jr., Schucker, B., Knudsen, J., Leon, A. S., and DeBacker, G. (1978). A questionnaire for the assessment of leisure time physical activities. *J. Chron. Dis.* 31(12): 741-755.
- White, C. C., Powell, K. E., Hogelin, G. C., Gentry, E. M., and Forman, M. R. (1987). The Behavioral Risk Factor Surveys. IV. The descriptive epidemiology of exercise. *Am. J. Prev. Med.* 3(6): 304-310.