MAYO CLINIC

ORIGINAL ARTICLE

The Importance of Vigorous-Intensity Leisure-Time Physical Activity in Reducing Cardiovascular Disease Mortality Risk in the Obese

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Abstract

Objective: To investigate the role of vigorous-intensity leisure-time physical activity in reducing cardiovascular disease (CVD) mortality risk in the obese.

Participants and Methods: Trained interviewers assessed physical activity and body mass index (BMI; calculated as the weight in kilograms divided by the height in meters squared) in 59,005 adult participants (mean ± SD age, 57±12 years; 46.5% male) in 2 household-based surveillance studies: Health Survey for England and Scottish Health Survey. Mortality was ascertained from death certificates. Data were collected from January 1, 1994, through March 31, 2011. Cox proportional hazards models were adjusted for age, sex, smoking habit, total physical activity, long-standing illness, prevalent CVD, and occupation.

Results: There were 2302 CVD deaths during 532,251 person-years of follow-up (mean ± SD, 9±4 years). A total of 15,002 (25%) participants were categorized as obese (BMI ≥30). Leisure-time physical activity was inversely associated and BMI was positively associated with CVD mortality. Compared with those who reported meeting physical activity guidelines including some vigorous-intensity physical activity and who had a normal BMI (18.5-24.9) (reference group), the CVD mortality hazard ratio was not significantly different in the obese who also reported meeting physical activity guidelines including some vigorous-intensity physical activities (1.25; 95% CI, 0.50-3.12). Compared with the reference group, the CVD mortality hazard ratio was more than 2-fold in the obese who reported meeting physical activity guidelines, including only moderate-intensity physical activities (2.52; 95% CI, 1.15-2.53).

Conclusion: This large, statistically powerful study suggests that vigorous-intensity leisure-time physical activity is important in reducing CVD mortality risk in the obese.

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Cardiovascular disease (CVD) mortality risk is greater in overweight adults and greater still in obese adults than in normal-weight adults.[1] The American College of Sports Medicine and the American Heart Association recommend physical activity in the primary prevention of morbidity and mortality in the general population[2]; nonetheless, the relationship between physical activity and CVD mortality in the obese is unclear. The inverse association between physical activity and CVD mortality risk in the general population is independent of body mass index (BMI)[3]; however, few studies have been large enough to investigate the association between physical activity and CVD mortality risk in the obese per se.[4] Compared with being inactive, any participation in vigorous-intensity physical activity is associated with lower CVD mortality risk in the general population.[3] Therefore, the objective of the present study was to investigate the role of vigorous-intensity physical activity in reducing CVD mortality risk in the obese using a pooled analysis of 11 population-based cohorts.

METHODS

Participants

The methods used in the Health Survey for England (HSE) and the Scottish Health Survey (SHS) are consistent and are described in detail elsewhere.[5,6] Briefly, the HSE and SHS

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are household-based surveillance surveys in which households are selected using a multistage, stratified probability design to be representative of the target populations of each country. Stratification is based on geographic areas, not individual characteristics: postcode (zip code) sectors are selected at the first stage, and household addresses are selected at the second stage. Participants in the present study were from surveys conducted in 1994 (HSE only), 1995 (SHS only), 1997 (HSE only), 1998 (HSE and SHS), 1999 (HSE only), 2003 (HSE and SHS), 2004 (HSE only), 2006 (HSE only), and 2008 (HSE only). Participants 40 years or older were included in the present study because it was deemed likely that congenital abnormalities would be responsible for cardiac events in young individuals and lifestyle would be responsible for such events in middle-aged and older adults.[7] Data were collected from January 1, 1994, to March 31, 2011. Local research ethics committees approved each survey, and participants gave written informed consent.

Physical Activity

Trained interviewers asked about physical activity. Physical activity was assessed using an established questionnaire that is described elsewhere.[8] Briefly, the interviewer used the questionnaire to inquire about the following aspects of the respondent's physical activity in the 4 weeks before the interview: frequency and duration of participation in domestic physical activity (light and heavy housework, gardening, and do-it-yourself); frequency, duration, and pace of walking (slow, average, brisk, or fast); and frequency, duration, and perceived intensity of participation in sports and exercise using a prompt card showing 10 main groupings, including cycling, swimming, jogging/running, football, rugby, tennis, and squash (6 open entries could also be recorded). The validity[9] and reliability[10] of the physical activity questionnaire are described elsewhere. A compendium was used to identify physical activity intensities according to metabolic equivalents (METs), where 1 MET represents resting energy expenditure.[11] Light-intensity activities were of 1.5 to 2.9 METs, moderate-intensity activities were of 3.0 to 5.9 METs, and vigorous-intensity activities were of 6.0 METs or greater. A MET-hour was computed by multiplying the MET score of an activity by the time (in hours). Total physical activity was computed by summing the MET-hours of all light-, moderate-, and vigorous-intensity activities. Only leisure-time physical activities were included in the present analysis, not occupational and routine domestic activities.

Obesity

Trained interviewers measured weight and height,[6] and BMI was calculated as the weight in kilograms divided by the height in meters squared. Overweight was defined as a BMI of 25 to less than 30 and obese as a BMI of 30 or greater.[12] Trained and qualified nurses measured waist circumference at the midpoint of the iliac crest and costal margin (lower rib). Obesity was defined as a waist circumference greater than 102 cm in men and greater than 88 cm in women.[13]

Covariates

The trained interviewers also asked about age, sex, smoking habit, long-standing illness, CVD, occupation, and ethnicity. Socioeconomic status was determined from participants' occupations using the 4-group version of the Registrar General's classification: professional and managerial occupations, skilled nonmanual occupations, skilled manual occupations, and routine and manual occupations.

Mortality Follow-up

The British National Health Service Central Registry flagged participants. Data for survivors were censored to the end of 2009 (SHS) or the first quarter of 2011 (HSE). Diagnoses for the primary cause of death were based on the *International Classification of Diseases, Ninth* (codes 390-459) and *Tenth* (codes I01-I99) *Revisions*.

Statistical Analyses

Cox proportional hazards models were used to estimate the associations between physical activity, obesity, and CVD mortality risk. In keeping with prevailing guidelines,[2] exposure to physical activity was defined as at least 150 minutes per week of moderate-intensity physical activity, at least 75 min/wk of vigorous-intensity activity, or equivalent combinations. We further distinguished between