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Original Article

Leisure-time physical activity and risk of disability incidence: A 12-year prospective cohort study among young elderly of the same age at baseline

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A R T I C L E I N F O

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A B S T R A C T

Background: To clarify the role of physical activity in preventing disability in Japan, we investigated the association between amount of leisure-time physical activity and incidence of disability among the young elderly.

Methods: In the New Integrated Suburban Seniority Investigation (NISSIN) project conducted from 1996 to 2013, we followed 2888 community-dwelling adults aged 64–65 years with no history of cerebrovascular disease for a median follow-up of 11.6 years. Disabilities were defined as follows based on the classifications of the Japanese long-term care insurance system: 1) support or care levels (support levels 1–2 or care levels 1–5); 2) care levels 2–5; 3) support or care levels with dementia; and 4) care levels 2–5 or death. In addition, we also assessed 5) all-cause mortality.

Results: After controlling for sociodemographic, lifestyle, and medical factors, male participants reporting an activity level of 18.1 metabolic equivalent (MET)-hours/week (the median among those with activities) or more had 52% less risk of being classified as support or care levels with dementia compared with the no activity group (hazard ratio 0.48; 95% confidence interval, 0.25–0.94). No significant association was found among women between amount of leisure-time physical activity and incidence of disability.

Conclusion: We identified an inverse dose–response relationship between the amount of leisure-time physical activity and the risk of disability with dementia in men. Therefore, a higher level of physical activity should be recommended to young elderly men to prevent disability with dementia.

Introduction

In developed and developing countries alike, increases in longevity are accompanied by increases in the number of individuals with disability.[1] Worldwide, from 1990 to 2013, estimated years lived with disability (YLDs) increased 42.3%, from 537.6 million to 764.8 million.[1] On the other hand, in Japan, the national long-term care insurance (LTCI) system operated by local governments covers 90% of the health care costs for middle-aged and elderly individuals with disability. When the LTCI system was launched in fiscal year (FY) 2000, the number of beneficiaries was 2.56 million. By 2012, this number had more than doubled, reaching 5.61 million from among the total population of 127 million.[2] Because disability limits social participation, lowers quality of life, and makes it difficult to live independently in the community,[3–5] health care providers should aim to prevent the incidence of disability in elderly people.

Many studies have reported that regular physical activity (total physical activity, including activities of daily life [e.g., working and housekeeping], leisure-time physical activities, and walking)

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reduced the risk of disability in the elderly.[6–42] In addition, some reviews and guidelines have suggested the appropriate activity level for the elderly population.[40,42,43] For example, a Japanese guideline recommended performing at least 10 metabolic equivalent (MET)-hours/week in physical activity at any intensity for adults aged 65 years or older.[43] However, a number of issues remain unclear. First, few studies have measured the intensity and duration of physical activity quantitatively.[7,14,17,18,32] Therefore, the current guidelines for physical activity require validation.[40] Second, common physical activities vary among populations.[44] Therefore, even if the frequency and duration of physical activity are similar, the amount may be different. However, in Japan, many studies have only examined the association between general measures of physical activity (e.g., walking time or frequency and total exercise frequency) and incidence of disability.[9,24,27,34,37] Third, age is one of the most important risk factors for the incidence of disability.[45] Previous studies have mainly applied multivariate analysis to adjust for the effect of age,[6–10,12,14,15,17,18,20–22,24–27,29–32,34–39] but it may be difficult to fully control for confounding by age.[46]

Therefore, in this study, we attempted to quantitatively assess leisure-time physical activity (sports and recreational activities) and follow-up long-term disability onset prospectively among the elderly of about the same age in a Japanese cohort.

Methods

Study design and participants

This study was conducted as part of the New Integrated Suburban Seniority Investigation (NISSIN) project, a prospective cohort study targeting adults who were approaching 65 years old at baseline (the young elderly). The methods of that project and the characteristics of the participants have been described elsewhere.[47] The participants were community-dwelling elderly in a suburban area (Nisshin city). All participants were invited to undergo a medical checkup and asked to complete a questionnaire on socio-demographic, lifestyle, comorbidity, and psychological factors.

From 1996 to 2005, 3073 individuals participated in the baseline survey, which was conducted each year in June. We excluded three and one persons who had relocated or had received an LTCI certification before the checkup, respectively. We also excluded 140 persons who had a history of cerebrovascular disease before the checkup and 41 individuals who had relocated or died before the start of the LTCI system (April 1, 2000). Ultimately, 2888 participants were included in the present analysis.

Informed consent and approval of the study protocol

Informed consent was obtained from all participants before conducting the medical checkups. For the questionnaire-based study, oral consent was obtained using an opt-out approach until 2001, and written consent was obtained using an opt-in approach thereafter. The study protocol was approved by the ethics committees of the Nagoya University Graduate School of Medicine, the National Center for Geriatrics and Gerontology of Japan, the Aichi Medical University School of Medicine, and the Hokkaido University Graduate School of Medicine.

Exposure assessment

At baseline, participants reported the type, frequency, and duration per episode of their leisure-time physical activity in the previous year. Activity types listed in the questionnaire and their assigned intensity (METs) are as follows: running or jogging: 7.0; swimming: 5.8; calisthenics: 3.8; baseball or softball: 5.0; tennis: 7.3; golf: 4.8; gateball (Japanese croquet): 3.3; and mountain climbing or hiking: 6.5.[48] For the response of “other types” of activity (non-pre-coded activity), we applied a weighted-average intensity of 3.9 METs based on the data provided in a free comment field because only partial information regarding non-pre-coded activity types (25%) was available. Although the participants who responded “other types” of activity provided the type of activity, only a data file was kept for most of the participants (75%), and the type of “other” activity was not included in this file. Therefore, we calculated the weighted-average intensity for participants whose questionnaires were kept and applied that value to all the participants. We then calculated the amount of activity (MET-hours/week) by multiplying intensity, duration, and frequency. In accordance with existing guideline for physical activity,[42] we only counted sessions lasting 10 min or longer.

Covariates

The following demographic variables were considered: year of participation in the study (continuous variable); currently working (yes or no); marital status (married or other [single, divorced, or widowed]); and educational attainment (junior college and higher or high school and lower). Lifestyle variables were: smoking status (never, former, or current); alcohol consumption (men: none, ≤23 g/day, or >23 g/day; women: none or current drinkers); body mass index (BMI; <18.5, 18.5–24.9, or ≥25.0 kg/m^2); social activity score[49] (in tertiles; men: ≤25, 26–28, or 29–54 points; women: ≤27, 28–31, or 32–54 points; items on work, sports, and recreational activities were excluded in this study because they were considered as exposure or other covariates); and total walking time per day, including work and housekeeping (<30 min, 30 min – 1 h, 1–2 h, or ≥2 h).

We included hypertension, dyslipidemia, diabetes mellitus, and neuralgia and/or low back pain as comorbidity variables in the analysis. Hypertension was defined as systolic blood pressure ≥140 mm Hg, diastolic blood pressure ≥90 mm Hg, and/or self-reported medication for hypertension. Dyslipidemia was defined as serum low-density lipoprotein (LDL) cholesterol ≥140 mg/dL (estimated using the Friedewald equation if triglycerides <400 mg/dL) or LDL cholesterol ≥170 mg/dL (estimated as total cholesterol minus high-density lipoprotein [HDL] cholesterol if triglycerides ≥400 mg/dL), HDL cholesterol <40 mg/dL, triglycerides ≥150 mg/dL, and/or self-reported medication for hyperlipidemia. Diabetes mellitus was defined as blood hemoglobin A1c ≥ 6.1% (based on the former method of the Japan Diabetes Society, equivalent to ≥6.5% in the National Glycohemoglobin Standardization Program [NGSP]),[50] fasting plasma glucose ≥126 mg/dL, and/or self-reported medication for diabetes mellitus. All participants underwent health checkups and provided blood samples the morning after an overnight fast. History of neuralgia and/or low back pain was reported as none, cured, under treatment, or leaving; the last two categories were combined because of the small number of subjects in each category. We used the short version of the Geriatric Depression Scale (GDS) as a screening test for depression and regarded six points or higher as probable depression.[51]

Follow-up and outcomes

We followed-up the participants prospectively for qualification as an LTCI recipient or death from baseline through the end of December 2013. Participants' LTCI certifications were surveyed by the local government of Nisshin city. We identified all-cause mortality using the resident registry.

In Japan, all individuals aged 65 years or older, or those aged 40–64 years who suffer from age-related diseases are eligible for