Does strenuous leisure time physical activity prevent severe back disorders leading to hospitalization?

Sanna Kääriä · Juhani Kirjonen · Risto Telama ·
Leena Kaila-Kangas · Päivi Leino-Arjas

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Abstract

Study design Prospective cohort study.

Objective To study the associations between strenuous leisure time physical activity (LTPA) and subsequent hospitalization due to back disorders.

Summary of background data Socioeconomic and lifestyle factors are associated with back-related hospitalization, but the significance of strenuous LTPA in the working population is unclear.

Methods The cohort ($n = 902$) was drawn from among employees in the metal industry ($n = 2,653$). Data were collected by a questionnaire and a structured interview on LTPA. Activity regarding strenuous (>500 kcal/h) LTPA was categorized as none, some, and high. Information from national registers on hospitalizations and deaths during 28 years of follow-up was linked to the data. Cox proportional hazards regression was used.

Results Subjects with a high level of strenuous LTPA had a decreased risk of hospitalization due to back disorders (hazard ratio 0.40; 95 % CI 0.21–0.79) compared with persons with no strenuous activity, after adjustment for age and gender. The association persisted (0.48; 0.24–0.96) when further adjusted for occupational class, self-reported back diseases, smoking, and body mass index at baseline.

Conclusion Strenuous LTPA decreased the risk of inpatient hospital care for back disorders among industrial employees.

Keywords Back disorders · Hospitalization · Leisure time physical activity · Prospective study

Introduction

Based on randomized controlled trials, exercise treatment has a slight beneficial effect on chronic and subacute non-specific low back pain (LBP) [1]. Results from studies on the relationship between leisure time physical activity (LTPA) and low back disorders in non-patient populations are conflicting, as is the interpretation of the results. A review of studies from the period 1966–1998 found no evidence for an effect of sport activities or total LTPA [2] and the literature between 1999 and 2009 showed inconsistent results [3], while a review of reviews on primary prevention of low back pain (LBP) by exercise found four reviews with strong, three with moderate, and two with conflicting evidence for its effectiveness [4].

There are methodological challenges in assessing LTPA. It is recommended that the assessment should be based on the intensity (energy expenditure), frequency, and duration of activity. The operationalization of LTPA varied considerably between studies and was usually not very specific [2, 3]. The definitions of low back disorders have also varied. Most studies relied on self-reported LBP, but also compensation for back problems, seeking care for LBP, as well as sickness absence and disability pension due to back disorders were used as outcome measures [2–4].

While LBP is experienced by the majority of people during their lifetime and about a third of the adult

S. Kääriä · L. Kaila-Kangas · P. Leino-Arjas
Finnish Institute of Occupational Health, Helsinki, Finland

S. Kääriä (✉)
Tietäjäkatu 28, FI-53100 Lappeenranta, Finland
e-mail: sanna.kaaria@multicom.fi

J. Kirjonen · R. Telama
University of Jyväskylä, Jyväskylä, Finland

population report it during the past month, hospitalization for back disorders is a rare event and may be seen as an indicator of a severe disorder. According to the few previous studies among samples of the normal population, blue-collar occupations, overweight, and smoking increase the risk of back-related hospitalisations, whereas the total volume of LTPA does not [5–7]. In these studies, the intensity of activity was not considered.

We examined the significance of strenuous LTPA in predicting hospitalization due to back disorders in a representative sample of white-collar and blue-collar employees of an industrial enterprise.

Materials and methods

The study sample was drawn from the employees of the Valmet metal industry factories in Jyväskylä, Finland, restricted to those employed for ≥ 15 months in 1973 ($n = 2,653$). A systematic sample of 902 subjects was drawn in strata by sex, age [born in 1925 or earlier ($n = 250$), born in 1926–1945 ($n = 353$), and born in 1946 or later ($n = 299$)], and occupational class (managers, office staff, skilled workers, semiskilled workers) [6]. Of the participants, 68 % were men.

To ensure adequate variation in LTPA, the respondents were before sampling arranged in an ascending order within the strata according to their crude LTPA score based on a preliminary questionnaire with an 81 % response rate. Persons who refused to participate (17 %) were replaced by the next person within the stratum. The data were gathered by questionnaire and interviews. The study was approved by the Ethics Committee for Occupational Health and Safety of the Hospital District of Helsinki and Uusimaa.

Data on causes and dates of hospital admissions from the Finnish Hospital Discharge Register, which covers every hospital in the country, concerning the period between the 1st of January in 1973 and 30th of December in 2000 were linked with the data using unique personal identification codes. The median follow-up time was 27.6 years (minimum 0.1, maximum 27.8 years). Primary diagnoses were coded according to the 8th–10th revisions of the ICD. There were 75 subjects with at least one *back-related hospitalization* in the sample.

Interviewers (students of sport science) trained for the purpose assessed LTPA using a 51-item check-list, which included both leisure time and household activities typical for urban Finnish adults [8]. During a 20 min interview the examinees were asked about the type, frequency, duration, and intensity of each LTPA in which the subjects had participated during the past year. The time spent in each activity was estimated taking also seasonal variation, sick leaves, and other deviations from routine into account. For

each activity, the level of intensity (high = getting severely out of breath and perspiring, moderate = to some extent getting out of breath and perspiring, low = neither) was inquired and the average energy consumption coded based on the literature; both were considered in the scoring. A threshold value for strenuousness was specified at >500 kcal/h of energy consumption. An index of *strenuous LTPA* was constructed as $\sum$ (time $\times$ energy consumption) and classified in three categories (none, some and high).

The reliability of the LTPA assessment was analysed by comparing the estimates of time spent in LTPA as based on the interview and on a diary of time usage with an accuracy of 15 min for 2 weekdays and one Saturday and Sunday. The two methods gave highly similar results [8]. All subjects at baseline underwent the assessment of LTPA.

The subjects who responded affirmatively to the question: “Do you have at present any long-term disease/impairment?” were asked to write down the disease(s). Those who reported a disease of the cervical, thoracic, or lumbar spine were classified as having a chronic back disorder. The subjects were also asked whether they had ever had sciatica diagnosed by a physician. The two variables were combined to indicate *chronic back disorder* (yes/no) at baseline.

Body mass index (BMI, kg/m^2) was based on measured weight and self-reported height and put in two classes: ≤ 24.9 and ≥ 25.0 . *Smoking* was assessed by the question: “Do you smoke regularly at present? (no/yes)”. One subject had missing information on smoking status.

Statistical analysis

Cox proportional hazards model with censoring for death ($n = 232$) was used to analyse associations between strenuous leisure time physical activity and the first hospitalization for back disorder during the period of 1973–2000. The hazard rate ratios were adjusted first for age and gender and in successive modelling also for occupational class, chronic back disorder, and BMI and smoking. Analyses were made using R statistical software version 2.11.0.

Results

Of the sample, 26 % had a high activity level of strenuous LTPA, 27 % had a low level, and 47 % had no strenuous LTPA at baseline. During the follow-up, 75 subjects (8 %) were hospitalized due to back disorders. The first hospital admissions by the index of strenuous LTPA were dispersed in time as shown in Fig. 1.

Fig. 1 Hospital admissions with back-related diagnoses in 1973–2000 by the levels of strenuous leisure time physical activity at baseline. Survival function

Compared to those without strenuous LTPA, participants with a high activity level had a reduced risk of inpatient hospital care for back disorders, after adjustment for age and gender (HR 0.40, 95 % CI 0.21–0.79). The risk attenuated somewhat but remained statistically significant when all potential confounders (occupational class, chronic back diseases, BMI and smoking) were adjusted for (Table 1). In the ‘some’ category of strenuous LTPA, the risk was intermediate in size.

Discussion

This study found that strenuous LTPA was inversely associated with the risk of subsequent hospitalization due to back disorders among a cohort of industrial employees. Controlling for self-reported chronic back diseases at baseline did not alter this finding. The modifying effects of the other studied covariates, occupational class, smoking and BMI, were minor.

There is a lack of previous prospective studies concerning the relationship between strenuous LTPA and hospitalization due to back disorders. Among Finns aged 20–59 years and among Danish men aged 40–59 years at entry, no association between the total volume of LTPA and hospitalization due to lumbar disc disease was found [5, 7]. In addition, the total volume of LTPA did not predict hospitalization due to back disorders in the current study cohort [6]. A recent cross-sectional study among police employees [9] found differences between the associations of the volume and intensity of physical activity with LBP. Persons with high metabolic equivalent hours of high intensity physical activity had a lower risk (albeit statistically non-significantly) for functionally limiting LBP compared to those with some metabolic equivalent hours, although the overall volume of activity increased the risk. More work is needed to understand why strenuous LTPA may be important for the health of the back.

It might be argued that persons with strenuous LTPA in our study differed in some important individual-level or socioeconomic factors from those with no strenuous LTPA [10]. We could control for the most relevant measured potential confounders but, e.g. a possible heritable component may affect the relationship. Good physical fitness is a likely prerequisite for highly strenuous LTPA. Genetic factors might influence both fitness and back disorders. We had access to information on muscle strength measurements for the majority of the sample. As a proxy for constitutional factors we included knee extension and grip strength among the covariates, but this did not abolish the inverse association between strenuous LTPA and back-related hospitalizations.

There are certain strengths in our study such as a representative sample of employee groups in an industrial corporation, a design that ensured a large variation in LTPA and was prospective, a register-based outcome measure of severe back-related disorders, and the possibility to take into account possible confounding factors at baseline. LTPA during the past 12 months was assessed using a structured and detailed interview by persons trained

Table 1 Strenuous physical activity as a predictor of hospitalization due to back disorders

<i>n</i> (hospitalized cases)		Adjusted for age, gender		Adjusted for the aforementioned and occupational class		Adjusted for the aforementioned and self-reported chronic back diseases		Adjusted for the aforementioned and BMI and smoking	
		HR	95 % CI	HR	95 % CI	HR	95 % CI	HR	95 % CI
Strenuous physical activity									
None	421 (44)	1.00		1.00		1.00		1.00	
Some	242 (20)	0.76	0.44–1.29	0.87	0.51–1.50	0.79	0.46–1.38	0.83	0.48–1.45
High	239 (11)	0.40	0.21–0.79	0.45	0.23–0.89	0.46	0.23–0.90	0.48	0.24–0.96

Cox regression analysis; hazard ratios (HR) and 95 % confidence intervals (CI)

for the purpose. It was, however, an indirect measurement based on self-report and thus subject to recall bias. Strenuous LTPA tracked rather well in follow-ups of the sample [8]. Regardless of the rather small study sample a clear inverse association between strenuous LTPA and back-related hospitalizations.

In conclusion, our results showed that strenuous LTPA decreased the risk of severe back disorders leading to hospital care among employees. The finding underlines the importance of assessing the intensity levels of physical activity in future studies in this field. More information from large population samples on the effect of well-characterized LTPA on specific outcome measures of LBP is needed.

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Conflict of interest The authors declare that they have no conflict of interest.

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