Journal of Affective Disorders 200 (2016) 172–177

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Persistent leisure-time physical activity in adulthood and use of antidepressants: A follow-up study among twins

K. Waller [a,*], J. Kaprio [b,c,d], T. Korhonen [b,e], A. Tuulio-Henriksson [f,g], U.M. Kujala [a]

[a] Department of Health Sciences, University of Jyväskylä, Finland
[b] Department of Public Health, University of Helsinki, Finland
[c] Mental Health Unit, Department of Health, National Institute for Health and Welfare, Finland
[d] Institute for Molecular Medicine FIMM, University of Helsinki, Finland
[e] Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland
[f] Department of Behavioral Sciences, University of Helsinki, Finland
[g] The Social Insurance Institution, Kela, Helsinki, Finland

ARTICLE INFO

Article history:
Received 9 February 2016
Received in revised form
14 April 2016
Accepted 16 April 2016
Available online 21 April 2016

Keywords:
Physical activity
Inactivity
Depression
Antidepressants
Twins
Genetic
Follow-up

ABSTRACT

Background: To study whether persistent leisure-time physical activity (PA) during adulthood predicts use of antidepressants later in life.
Methods: The Finnish Twin Cohort comprises same-sex twin pairs born before 1958, of whom 11 325 individuals answered PA questions in 1975, 1981 and 1990 at a mean age of 44 years (range 33–60). PA volume over 15-years was used as the predictor of subsequent use of antidepressants. Antidepressant use (measured as number of purchases) for 1995–2004 were collected from the Finnish Social Insurance Institution (KELA) prescription register. Conditional logistic regression was conducted to calculate odds ratios (OR) with 95% confidence intervals (CI) for the use of antidepressants in pairs discordant for PA (642, including 164 monozygotic (MZ) pairs).
Results: Altogether 229 persons had used at least one prescribed antidepressant during the study period. Active co-twins had a lower risk (unadjusted OR 0.80, 95%CI 0.67–0.95) for using any amount of antidepressants than their inactive co-twins; trends being similar for DZ (0.80, 0.67–0.97) and MZ pairs (0.78, 0.51–1.17). The lowest odds ratio (0.51, 0.26–0.98) was seen among MZ pairs after adjusting for BMI, smoking and binge drinking. The point estimates were similar but non-significant for long-term antidepressant use (4+purchases equivalent to 12 months use).
Limitations: Self-reported physical activity and low number of discordant MZ pairs.
Discussion: Use of antidepressants was less common among physically active co-twins even when shared childhood experiences and genetic background were controlled for. Physical activity in midlife may therefore be important in preventing mild depression later in life.

1. Introduction

Depression is a major cause of sickness leaves and early retirement; it also reduces quality of life and causes high economic costs. In Finland, mood affective disorders were a leading reason for a disability pension in 2013, accounting for 18.9% of all disability pensions awards and for 23.1% among women (Finnish Centre for Pensions and The Social Insurance Institution of Finland, 2014). Depression is characterized in the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-V) as the presence of sad, empty, or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function (American Psychiatric Association, 2013). According to WHO (2012) recommendations, the treatment options for moderate to severe depression consist of basic psychosocial support which is combined with either antidepressant medication or psychotherapy (WHO, 2012). A recent systematic review on the effect of different treatments for depression concluded that antidepressants or psychotherapy alone are not significantly different from alternative therapies, such as exercise, or active intervention controls (Khan et al., 2012).

Epidemiological studies have shown that physical activity is associated with reduced risk for depressive symptoms and anxiety (Strohle, 2009). Several meta-analyses have been conducted on

* Correspondence to: Department of Health Sciences, University of Jyväskylä, P.O. Box 35 (LL227), 40014 Jyväskylä, Finland.
E-mail address: katja.waller@jyu.fi (K. Waller).

http://dx.doi.org/10.1016/j.jad.2016.04.036
0165-0327/

whether, in randomized controlled trials, physical activity reduces depression (Josefsson et al., 2014; Krogh et al., 2011; Lawlor and Hopker, 2001). The most recent meta-analysis confirms the findings of earlier studies that physical activity has a moderate or large effect on depression and could be recommended as a treatment for depressive subjects (Josefsson et al., 2014). In a study of the relationship between baseline physical activity and future psychotropic medication use (Lahti et al., 2013), physical activity was found to predict decreased risk for using psychotropic medications, the most active participants having the smallest hazard ratios. However, in that study physical activity was measured only once and therefore it does not indicate a long-term physical activity habit. Moreover, in addition to antidepressant medications, the study combined sedatives and sleep medications (N05B and N05C) in the psychotropic medication analysis.

Heritability for participation in physical activity is relatively high (Bouchard et al., 1992; Kujala et al., 2002) while for depression it is low to moderate (Burton et al., 2015; Kendler et al., 2006; Takkinen et al., 2004). Therefore, an association between physical activity and depression may be mediated in part by genetic factors common to both. Genetic and biological factors may also account for interindividual differences in response to therapy, such as exercise, among depressed patients. Twin data offer a unique opportunity for studying the nature of the association between physical activity and depression. By studying outcomes in twin pairs discordant for exposure to physical activity, the possible confounding role of genetic and shared early childhood experiences can be taken into account (Boomsma et al., 2002). Twin pairs nearly always share the same childhood family environment. Dizygotic (DZ) pairs share, on average, half of their segregating genes (like siblings), while monozygotic (MZ) pairs are genetically identical at the sequence level.

The aim of this study was to find out whether persistent leisure-time physical activity during adulthood predicts use of antidepressants (investigated as amount of antidepressant purchases) later in life when shared childhood environment and genetic background are controlled for. In this co-twin control design study, the twin pairs had 15 years of physical activity discordance. We were interested in whether the active co-twins were less likely to use depression medications over a 10-year follow-up period. We expected persistent physical activity to reduce the use of antidepressants.

2. Methods

2.1. Study participants

The Finnish Twin Cohort is a comprehensive national sample of same-sex twin pairs born before 1958 and with both co-twins alive in 1967 (Kaprio and Koskenvuo, 2002). In 1975, a baseline questionnaire was sent to twin pairs with both members alive. At the beginning of prospective follow-up, the total number of twin pairs was 12,069. A second similar questionnaire was sent out to all surviving twin pairs in 1981 (Kaprio and Koskenvuo, 2002). A third questionnaire was sent out in 1990 to all twin individuals aged 33–60 years who had responded to at least one of the earlier questionnaires (Romanov et al., 2003). A total of 11 325 twin individuals had answered the leisure-time physical activity questions in all three questionnaires (1975, 1981 and 1990). Among them were 4 190 complete twin pairs (1 388 MZ, 2 547 DZ and the rest with unknown zygosity). Of these, 642 pairs were discordant for leisure-time physical activity according to the mean metabolic equivalent (MET) index (see below for criteria used to determine discordance in twin pairs). The final study cohort comprised 164 MZ pairs (78 male and 86 female) and 449 DZ pairs (196 male and 253 female), and the remaining 29 pairs (14 male and 15 female) were of uncertain zygosity. In 1990, the mean age of the final study cohort was 44.2 years (SD 7.7, range 33–60) with no sex differences. The study was conducted according to the Declaration of Helsinki. All the participants gave their informed consent before answering the questionnaire.

2.2. Physical activity predictor

Physical activity habits were assessed by identical questions in 1975 and 1981 and with slightly different questions in 1990. All three questionnaires enabled calculation of the MET index. On the bases of earlier studies, the physical activity questionnaire data can be considered valid (Kaprio et al., 1978, 1987; Kujala et al., 1994, 1998; Leskinen et al., 2009; Waller et al., 2008). Assessment of the MET index was based on a series of structured questions (Kaprio et al., 1978; Kujala et al., 1998) on leisure-time physical activity (monthly frequency, mean duration and mean intensity of sessions) and physical activity during the journey to and from work. The index was calculated by assigning a MET score to each activity and by calculating the product of that activity: intensity x duration x frequency (Kujala et al., 1998). The MET index was expressed as the sum-score of leisure-time physical activity (PA) MET-hours per day.

To estimate the volume of physical activity during the three baseline years, a mean activity was calculated by summing the MET index values obtained in 1975, 1981 and 1990 and dividing by three. This new mean MET value was then divided into three activity tertiles labelled low (mean MET 0–1.54 MET h/day), medium (1.54–2.92 MET h/day) and high (2.92–26.13 MET h/day). Twin pairs were classified as discordant for physical activity if one co-twin was in the low activity tertile and his/her co-twin in the high activity tertile. A total of 642 twin pairs met this discordance criterion.

2.3. Covariates and exclusions

Self-reported social class, smoking status, use of alcohol, body mass index (BMI), and health status in 1990 were used as covariates. Social class was defined by dividing the individuals into three groups by years of education and amount of physical activity at work (Romanov et al., 2003). Smoking status was coded into three categories (never smoked, former smoker and occasional smoker/current (daily) smoker) determined from responses to detailed smoking history questions (Kaprio and Koskenvuo, 1988). Alcohol use was expressed as dichotomous variable of heavy drinking occasions (i.e. consumption of at least six drinks on one occasion) at least monthly (Kaprio et al., 1987; Sipilä et al., 2015). Somatic health status was defined as having/ not having disease diagnosed by a physician, serious injury / illness or permanent work disability, according to self-report items in 1990. Those reporting not having any of the above were classified as healthy (Romanov et al., 2003).

Severity of depressive symptoms at baseline was assessed using the Beck Depression Inventory (BDI) (Beck et al., 1961). The BDI score ranges from 0 to 63, indicating normal mood (BDI 0–9), mild depression (BDI 10–18) and moderate to severe depression (BDI $\geq$ 19) (Koivumaa-Honkanen et al., 2004). To avoid the effect of depression on physical activity, persons with moderate or severe depression at baseline (n=36 individuals) were excluded from the study. Those for whom the BDI was missing were also excluded (n=48). In total, 78 pairs were excluded owing to one or both co-twins having either no BDI information or BDI $\geq$ 19.