Available online at www.sciencedirect.com

ScienceDirect

Comprehensive Psychiatry 74 (2017) 144–150

COMPREHENSIVE PSYCHIATRY

www.elsevier.com/locate/comppsych

Physical activity ameliorates the association between sedentary behavior and cardiometabolic risk among inpatients with schizophrenia: A comparison versus controls using accelerometry

Brendon Stubbs[a,b], Li-Jung Chen[c,d,*], Ming-Shun Chung[e], Po-Wen Ku[d,f,**]

[a]Physiotherapy Department, South London and Maudsley NHS Foundation Trust, Denmark Hill, London SE5 8AZ, United Kingdom
[b]Health Service and Population Research Department, Institute of Psychiatry, Psychology and Neuroscience, King's College London, De Crespigny Park, London, Box SE5 8AF, United Kingdom
[c]Department of Exercise Health Science, National Taiwan University of Sport, 271, Lixing Road, Taichung City 404, Taiwan
[d]Department of Epidemiology and Public Health, University College London, 1-19 Torrington Place, London, WC1E 6BT, UK
[e]Jianan Psychiatric Center, Ministry of Health and Welfare, 80, Lane 870, Zhongshan Road, Tainan 717, Taiwan
[f]Graduate Institute of Sports and Health, National Changhua University of Education, 1, Jin-De Road, Changhua 500, Taiwan

Abstract

Objective: A lack of clarity exists regarding the relationship between objectively measured physical activity (PA) and sedentary behavior (SB) and cardiometabolic outcomes in people with schizophrenia. We conducted a large study investigating the independent relationships of PA and SB among inpatients with schizophrenia versus healthy controls (HCs).

Methods: A cross sectional study including 199 inpatients with schizophrenia (mean age 44.0 years, mean illness duration 23.8 years) versus 60 age/sex/body mass index matched HCs. Participants wore accelerometers for 7 days to capture SB and daily steps. Cardiometabolic outcomes included blood pressure, fasting blood glucose (FBG), triglycerides, high-density lipoprotein cholesterol (HDL-C) and waist circumference (WC). Multivariate regression analyses adjusting for multiple confounders were undertaken.

Results: Compared to HCs, patients engaged in more sedentary behavior and less daily steps versus HCs ($p < 0.001$). Patients with higher levels of SB ($n = 89$) had increased fasting glucose compared to patients with low levels of SB (105.2 vs. 96.3 mg/dl, $p < 0.05$). In the multivariate analysis, sedentary behavior was associated with higher FBG ($\beta = .146$, $p = .041$) but this was ameliorated when daily steps were inserted in to the model ($\beta = .141$, $p = .059$). In the final model, higher daily steps were associated with more favorable HDL-C ($\beta = -.226$, $p = .004$), independent of SB and other confounders.

Conclusions: Our data suggest that higher than while sedentary behavior is related to worse fasting glucose, this relationship is attenuated when PA is taken into account. Physical activity is also associated with favorable HDL-C. Interventions targeting replacing sedentary behavior with PA may improve metabolic risk.

1. Introduction

There is now irrefutable evidence that people with schizophrenia have a greatly reduced life expectancy [1]. The greatest contributors to this premature mortality are physical health conditions and in particular cardiometabolic and cardiovascular disease [2]. People with schizophrenia have greatly increased levels of metabolic syndrome [3] while approximately 12% have type 2 diabetes [4,5]. The heightened cardiometabolic risk is evident in the earlier stages of illness, including those who are antipsychotic naïve [4] and is elevated in youth who have recently been exposed to antipsychotic medication [6]. While genetic factors may also contribute to the

Statement: This work is not currently under review elsewhere and has not been previously published.

* Correspondence to: L.-J. Chen, Department of Exercise Health Science, National Taiwan University of Sport, 271, Lixing Road, Taichung City 404, Taiwan. Tel.: +886 4 22213135x1307.

** Correspondence to: P.-W. Ku, National Changhua University of Education, Taiwan, No. 1, Jinde Rd., Changhua City 500, Taiwan. Tel.: +886 4 7232105x1991.

E-mail addresses: brendon.stubbs@kcl.ac.uk (B. Stubbs), ljchen@ntupes.edu.tw (L.-J. Chen), mschung3@gmail.com (M.-S. Chung), powen.ku@gmail.com (P.-W. Ku).

http://dx.doi.org/10.1016/j.comppsych.2017.01.010
0010-440X/

heightened cardiometabolic risk, there is an increasing realization that lifestyle factors may have a key role in cardiometabolic risk in people with schizophrenia [7].

In the general population, there is an established evidence base that physical activity offers a protective effect against the development of an adverse metabolic profile [8,9]. Of concern, a recent meta-analysis established that people with schizophrenia engaged in low levels of physical activity and approximately half do not meet the recommended weekly guidelines [10]. To date, a small number of studies [11,12] have suggested that lower levels of activity are associated with a worse metabolic profile. While helpful, almost all of these studies have relied on small sample sizes ($n < 75$) and relied upon self-report physical activity measures which are known to have questionable accuracy and psychometric properties [13].

There is also a growing evidence base in the general population that sedentary behavior, independent from physical activity, is associated with an increased risk of diabetes, cardiovascular disease and mortality [14]. Sedentary behavior is defined as any waking activity characterized by an energy expenditure ≤1.5 metabolic equivalents including tasks such as sitting or reclining posture [15]. A recent meta-analysis demonstrated that people with schizophrenia spend approximately 12.5 h a day being sedentary which is among the highest in any population in the world [16]. Two studies have suggested that self-report sitting behavior is associated with adverse metabolic profile [17,18]. While helpful in furthering our understanding the potential deleterious relationship of sedentary behavior on people with schizophrenia, the reliance upon self-report sedentary behavior introduces a bias, and the question of whether physical activity and sedentary behavior have independent influences on metabolic profiles remains unanswered.

Given the aforementioned, the current study had the following aims: (1) to compare objectively measured sedentary behavior and physical activity among inpatients with schizophrenia versus controls, and (2) to investigate the potential independent relationships between sedentary behavior and physical activity with cardiometabolic outcomes among inpatients with schizophrenia.

2. Methods

The current study adopted a cross sectional design and took place in Taiwan [19].

2.1. Participants

Participants who were residing across six long stay psychiatric wards at Jianan Mental Hospital, were invited to take part in the current study. Specific inclusion criteria were (1) diagnosis of schizophrenia (according to DSM IV [20] made by an independent psychiatrist), and (2) individuals who were stable and on the same antipsychotic medicine regime for at least three months. Exclusion criteria included patients who were unable to communicate, were immobile, or had any major neurological disorder (e.g., stroke).

A healthy control group was recruited from the staff of two hospitals and universities. The control group was matched with patients according to age, sex and body mass index (BMI). Specific inclusion criteria were (a) no present or past history of any mental illness, and (b) not taking any psychotropic medication. A total of 60 participants were selected to ensure comparable gender balance, age and BMI ranges to the schizophrenia group.

The study was approved by the Institutional Review Board of Jianan Mental Hospital. All participants provided informed written consent.

2.2. Measures

2.2.1. Outcome variable: cardiometabolic risk factors

The parameters of cardiometabolic risk factors collected included waist circumference (WC), systolic/diastolic blood pressure (SBP/DBP), serum triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), and fasting glucose (FBG). WC, SBP, and DBP were measured by the hospital nurses. Data on TG, HDL-C, and FBG were obtained through venous blood samples, which were taken in the morning before breakfast and examined in the hospital.

2.2.2. Independent variable: sedentary behavior and steps per day

Sedentary behavior and steps per day were captured using the ActiGraph (wActiSleep, Pensacola, FL, USA), a tri-axial accelerometer. The ActiGraph has been validated previously among people with schizophrenia [21–24]. Accelerometers are the optimal free living measure in people with schizophrenia, since self-report measures such as the IPAQ [25] lack accuracy [13]. Research assistants provided the standardized instructions for wearing the accelerometers. Specifically, participants were told to wear the accelerometer on the wrist of the non-dominant hand for 7 consecutive days and to remove it during bathing or water activities. The accelerometers were initialized, downloaded and analyzed with ActiLife software version 6 (ActiGraph LLC). Sedentary behavior was defined according to the cut-off point outlined by Freedson et al. [26] as activities≦100 counts per minute (cpm), representing a threshold corresponding with sitting, reclining, or lying down. The steps per day were also calculated by the software and were used to present physical activity among participants. Sedentary time and steps were categorized into two levels: 'Low and High' in a binary split about the mean in order to demonstrate differences in key variables between these groups among inpatients with schizophrenia.

2.2.3. Covariates

Details of participants sociodemographic information were collected including data on age (≦40 or >40), sex, smoking habits, alcohol consumption, and education. Participants smoking and alcohol status were subsequently categorized based on self-report as 'Yes (current/former smoker or drinker)' and 'No' (never).