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Lower cardiorespiratory fitness is associated with more time spent sedentary in first episode psychosis: A pilot study

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ABSTRACT

Patients with a psychotic disorder show lower cardiorespiratory fitness and higher mortality rates compared to healthy individuals. The aim of this cross-sectional study was to explore whether in patients with first-episode psychosis a low cardiorespiratory fitness is associated with decreased physical activity and increased sedentary levels. Twenty-nine outpatients (21 men; 22.8 ± 5.1 years) performed a maximal exercise test to assess their maximum oxygen uptake (VO_2max), wore a Senswear armband for five consecutive days and were assessed with the Positive and Negative Syndrome Scale. Twenty-four patients (82.8%) scored below the normative cardiorespiratory values. The percent-predicted VO_2max ranged from 47% to 109%. In a backward regression analysis, less time spent sedentary (min/day) was the only independent predictor of a higher VO_2max. The model explained 28.0% of the variance in the VO_2max-score. The current study indicates that future research should explore whether reducing sedentary behaviour (e.g. time spent napping or prolonged sitting during waking hours) might improve cardio-respiratory fitness levels. Interventions targeting recreational screen time (watching television, computer use, playing video games, etc.) or replacing passive to more active video games should be investigated.

1. Introduction

People with schizophrenia have an approximately 10–20 years reduced life expectancy compared to the general population (Laursen, 2011; Walker et al., 2015). There is an established body of evidence demonstrating that the majority of this reduced life expectancy is due to preventable illnesses such as cardiovascular diseases and diabetes mellitus (Olfson et al., 2015; Vancampfort et al., 2013). There are many factors that contribute to this premature mortality and increased morbidity. First of all, psychotropic medications contribute significantly to the decline of the cardio-metabolic health (Correll et al., 2015), which deteriorates quickly after medication initiation (Correll et al., 2014; Foley and Morley, 2011; Galling et al., 2016). Second, lifestyle factors such as smoking (Grossman et al., 2017), lack of physical activity (Nyboe et al., 2016; Stubbs et al., 2016a, 2016b), and unhealthy eating habits (Teasdale et al., 2016) are important risk factors and should be targets of multidisciplinary treatment from the early stages of disease onwards (Carney et al., 2016; Yung and Firth, 2017).

In the general population, cardiorespiratory fitness (the ability of the circulatory and respiratory systems to supply oxygen to working muscles during sustained physical activity) is a strong and independent predictor for cardiovascular diseases [relative risk (RR)=1.56; 95% confidence interval (CI)=1.39–1.75; $p < 0.001$] and all-cause mortality (RR=1.70; 95%CI=1.51–1.92; $P < 0.001$) (Kodama et al., 2009). Cardiorespiratory fitness testing might therefore have important clinical implications and can be used to help guide the prescription of physical activity programs (Firth et al., 2016; Rosenbaum et al., 2015a, 2015b; Vancampfort et al., 2017). People with schizophrenia are known to have a reduced cardiorespiratory fitness (Vancampfort et al., 2015a). Previous research using submaximal fitness tests showed that, compared with age- and gender matched healthy controls (Nyboe et al., 2015) or normative data (Rosenbaum et al., 2016), individuals in the first episode of psychosis (FEP) already have worse cardiorespiratory fitness. Although submaximal fitness tests (e.g. tests were the maximal cardiorespiratory fitness is estimated based on heart rate during submaximal exercise) are safe, relatively easy to administer and

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inexpensive, they only evaluate the global and integrated responses of the cardiorespiratory, peripheral circulation and neuromuscular systems involved during submaximal exercise or functional activities (Vanhees et al., 2005). Submaximal fitness tests do not provide more specific diagnostic and prognostic information about the function of each of the different systems involved in exercise or about the mechanism of exercise limitation as is possible with maximal cardiopulmonary exercise testing (Vanhees et al., 2005). Although a maximal cardiorespiratory fitness testing is more costly, needs highly specialized equipment, requires technical expertise to supervise and interpret the test and is more demanding for the patients, the maximal oxygen uptake (VO_2max) assessed with a maximal incremental exercise test is the gold-standard to assess cardiorespiratory fitness (Vanhees et al., 2005).

Also assessing physical activity and sedentary levels in people with psychosis is a challenge and valid methods are warranted in order to be able to accurately assess the extent to which physical activity and sedentary levels are associated with cardiorespiratory fitness levels (Carney et al., 2015; Vancampfort et al., 2016a). Objective methods for measuring physical activity such as accelerometers are considered to offer the more precise estimates of physical activity than self-reported levels as they remove many of the issues of recall and response bias (Rosenbaum et al., 2015a).

To date, it is unknown whether cardiorespiratory fitness (as assessed with the gold-standard measures) is associated with objectively measured physical activity and sedentary levels in people with FEP. Such information would be of clinical relevance as it will assist researchers and clinicians in identifying potential risk factors for lower cardiorespiratory fitness levels in this population and consequently targets for treatment. Therefore, the aim of the current study was to explore associations between cardiorespiratory fitness, physical activity and sedentary levels in people with FEP using objective measures. In order to assess whether the cardiorespiratory fitness test performance could have been influenced by psychiatric symptoms we explored also associations between the obtained cardiorespiratory fitness levels and positive and negative symptoms.

2. Methods

2.1. Participants and procedure

Over a one-year period, consecutive outpatients with a diagnosis of FEP (American Psychiatric Association, 2013) of the UPC KU Leuven campus Kortenberg in Belgium were invited to participate. Patients had to be psychiatrically stable on current antipsychotic regimen for at least 4 weeks. Somatic exclusion criteria included evidence of severe cardiovascular, neuromuscular and endocrine disorders which according to the American College of Sports Medicine (2009) might prevent safe participation in the study. All patients were assessed with the Positive and Negative Syndrome Scale (PANSS), performed a cardiorespiratory fitness test and wore a Senswear armband for six consecutive days following the cardiorespiratory fitness test day. The study was approved by the Scientific and Ethical Committee of the UPC KU Leuven, campus Kortenberg, Belgium and conducted in accordance with the principles of the Declaration of Helsinki. All participants gave their written informed consent. Patients did not receive any compensation for study participation.

2.2. Cardiorespiratory fitness test

Cardiorespiratory fitness tests were performed according to Internationally accepted standards (Gibbons et al., 2002) on a cycle ergometer (Siemens-Elema 380B; Ergometrics 800S, Ergometrics, Bitz, Germany) in an air-conditioned laboratory where the room temperature was regulated at 18–22 °C. Participants were asked to cycle at a constant rate of 60 revolutions per minute. The initial workload of 20 W was increased by 20 W every minute. Blood pressure was measured at rest before the test, with the patient sitting on the bicycle, and every 2 min during the test. Heart rate and a 12-lead electrocardiogram (Max Personal Exercise Testing®, Marquette, WI, USA) were registered continuously. In- and expired gasses were analysed breath-by-breath by means of the Oxycon Pro (Jaeger, Mijnhardt, The Netherlands). The gas analysers and the flow meter were calibrated before each test according to the manufacturer's instructions. VO_2max values were defined as the 30 s average at the highest workload achieved. In order to define a maximal effect we followed the criteria described by the European Association for Cardiovascular Prevention and Rehabilitation (Mezzani et al., 2009). A maximal effort was assumed if the cardiorespiratory fitness test was terminated by the patient due to exhaustion, dyspnea, pain or tiredness in the legs and if (1) a peak respiratory exchange ratio (RER) ≥1.10 and/or (2) a rating of perceived exertion ≥16 on the Borg Scale (Borg, 1998). Percent-predicted VO_2max taking into account age, gender and body weight was calculated according to normative values (Wasserman et al., 2005).

2.3. The Borg scale

The Borg Scale (Borg, 1998) is a 15-point linear Likert scale and measures subjective, ie, perceived exertion/exercise intensity (including heart rate, respiration effort, soreness and fatigue). Exertion is rated on a scale of 6–20; between 7 and 8 is 'very light' exertion. Eleven is a light level of exertion. Fifteen would be consistent with a level of heavy resistance. A level of 20 cannot be sustained.

2.4. Physical activity and sedentary behaviour: Sensewear Armband (SWA)

All participants wore a SWA for six consecutive days, except when showering, bathing or swimming. The SWA was worn over the right arm triceps muscle and assessed minute to minute movement through multiple sensors, namely a two-axis accelerometer and sensors measuring heat flux, galvanic skin and near body-temperature. Data were combined with gender, age, body weight and height, to estimate active energy expenditure using algorithms developed by the manufacturer (SenseWear Professional software, version 7.0). Data obtained during 5 subsequent days (including 3 weekdays and 2 weekend days) were used. Physical activity levels were expressed in metabolic equivalents (MET; in kcal/hour/kg), an indicator of daily energy expenditure. The unit MET is used to estimate the amount of oxygen used by the body during physical activity. We calculated the mean daily active energy expenditure (AEE; in kcals: ≥3MET) as a measure for physical activity behaviour and time spent in sedentary activities (≤3MET) during waking hours as a measure of sedentary behaviour. Data were accepted when the average on-body measuring time was at least 1368 min per day (95% of a 24-h bout).

2.5. Positive and Negative Syndrome Scale (PANSS)

In this study we used the positive (7 items) and negative (7 items) subscales of the PANSS (Kay et al., 1987). Each item is scored on a Likert type severity scale ranging from 1 (absent) to 7 (extreme). The subscale scores range from 7 to 49.

2.6. Anthropometric assessments

Anthropometric measurements included body weight and height. Body weight was measured in light clothing to the nearest 0.1 kg using a SECA beam balance scale, and height to the nearest 0.1 cm using a wall-mounted stadiometer. Waist circumference (WC) was measured to nearest 1 cm at the level of the umbilicus and at the end of expiration with the participant upright and his/her hands by the side.