Research Centre in physical Activity, Health and Leisure (CIAFEL)

Physical Activity and Quality of Life of Outpatients with Schizophrenia

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RESUMO

Os indivíduos com esquizofrenia apresentam altas taxas de mortalidade e de co-morbidades. Estes fatores favorecem não só a redução na sua capacidade para executarem atividades da vida diária como também a diminuição da sua qualidade de vida. A investigação tem evidenciado melhorias físicas e psicológicas decorrentes da prática de atividade física nesta população. Porém, estudos acerca dos benefícios da participação regular em programas de atividade física em indivíduos portugueses com esquizofrenia são ainda escassos. Concomitantemente, a ausência de instrumentos válidos e fiáveis para avaliar a atividade física na realidade Portuguesa é uma realidade. Deste modo, o objetivo principal desta dissertação foi desenvolver ferramentas e estratégias relacionadas com a atividade física, visando a melhoria da qualidade de vida de pacientes portugueses com esquizofrenia residentes na comunidade. Os objetivos específicos da presente dissertação foram: i) avaliar as diferenças dos níveis de qualidade de vida e de atividade física entre indivíduos com esquizofrenia e saudáveis; ii) explorar a fiabilidade e validade do 6MWT em indivíduos com esquizofrenia; iii) determinar qual o tipo de atividade física preferida para estes indivíduos; iv) avaliar os efeitos de um programa de atividade física de 16 semanas na aptidão física e qualidade de vida de pacientes com esquizofrenia e, ainda; v) analisar a fiabilidade e validade do IPAQ-SF para indivíduos com esquizofrenia na realidade portuguesa. Para alcançar os objetivos específicos foi selecionada uma amostra de indivíduos com esquizofrenia, adultos e residentes na comunidade. A amostra de indivíduos saudáveis foi pareada com idade, índice de massa corporal e sexo. No que se refere aos principais resultados da dissertação foi possível verificar que: i) o nível de atividade física e a qualidade de vida dos indivíduos com esquizofrenia eram inferiores aos dos indivíduos saudáveis; ii) o

6MWT é um instrumento válido e fiável que permite avaliar a capacidade funcional em indivíduos com esquizofrenia; iii) os programas de atividade física especificamente desenhados para indivíduos com esquizofrenia devem oferecer uma prática combinada, designadamente de jogos desportivos em pequenos grupos e caminhada; iv) um programa de atividade física de 16 semanas, baseado em jogos desportivos, influencia positivamente a qualidade de vida e os níveis de atividade física de indivíduos com esquizofrenia; v) o IPAQ-SF é um questionário válido e fiável para avaliar o nível de atividade física em indivíduos com esquizofrenia. Em nosso entender esta dissertação apresenta estudos importantes no âmbito da esquizofrenia, da atividade física e da qualidade de vida desta população, adicionando conhecimento que pode constituir-se como relevante para a prossecução de estudos na área da saúde mental.

Palavras-chave: esquizofrenia, pacientes residentes na comunidade, qualidade de vida, nível de atividade física, validação, programa de atividade física.

ABSTRACT

Individuals with schizophrenia display high rates of mortality and comorbidities. The disease can lead to a reduction in the ability to perform daily activities, as well as in the decrease of life quality. Research regarding schizophrenia emphasizes the physical and psychological improvements arising from the practice of physical activity in this population. However, there are a scarce number of studies about the benefits of regular participation in physical activity programs for Portuguese individuals with schizophrenia. Additionally, it can be verified the deficiency of valid and reliable instruments to measure physical activity in the Portuguese reality. Accordingly, the main objective of this thesis was to develop strategies and tools related to physical activity, in order to improve the quality of life from outpatients with schizophrenia. The specific objectives of this thesis were: i) to evaluate the differences in the levels of life quality and physical activity among individuals with schizophrenia and healthy controls; ii) explore the reliability and validity of the 6MWT in patients with schizophrenia; iii) determine which is the type of preferred physical activity for people with schizophrenia; iv) evaluate the effects of a 16-week physical activity program on physical fitness and quality of life of patients with schizophrenia; v) analyze the reliability and validity of IPAQ-SF for individuals with schizophrenia in the Portuguese reality. To achieve the specific goals, sampling was performed with adult outpatients with schizophrenia. The sample from healthy individuals was paired with age, body mass index and gender. Regarding to the thesis main results was verified that: i) the level of physical activity and quality of life of individuals with schizophrenia are lower than those of healthy controls; ii) the 6MWT is a valid and reliable tool for assessing functional capacity in individuals with schizophrenia; iii) physical activity programs specifically designed for individuals with schizophrenia should offer a combined practice of

small-sided games and walking; iv) a 16-week of physical activity program based on sports games, positively influences the quality of life and physical activity levels of individuals with schizophrenia; v) the IPAQ-SF is a valid and reliable questionnaire to assess the level of physical activity in individuals with schizophrenia. This thesis presents knowhow which is essential for schizophrenia, physical activity and quality of life, which adds knowledge into mental health.

Keywords: schizophrenia, outpatients, quality of life, physical activity levels, validation. physical activity program.

LIST OF ABREVIATIONS

6MWT: six-minute walk test

ANARP: Associação Nova Aurora de Reabilitação Psicossocial

ANOVA: analysis of variance

ATS: American Thoracic Society

BMD: bone mineral density

BMI: body mass index

CEFADE: Comitê de ética da Faculdade de Desporto

CG: control group

DALYs: disability-adjusted life years

DXA: Dual energy x-ray absorptiometry

DSM: Diagnostic and Statistical Manual of Mental Disorders

EG: experimental group

HR: heart rate

ICC: Intraclass Correlation Coefficient

IPAQ-SF: International Physical Activity Questionnaire – Short form

LIGPA: light physical activity

MET: metabolic equivalent

mmHg: millimeters of mercury

MODPA: moderate physical activity

MVPA: moderate to vigorous physical activity

PA: physical activity

QOL: quality of life

respiratory exchange ratio: RER

SEDPA: sedentary physical activity

VIGPA: vigorous physical activity

VO_2max: maximal oxygen consumption

WHO: World Health Organization

WHOQOL-Bref: World Health Organization Quality of Life

GENERAL INTRODUCTION

Schizophrenia is one of the most debilitating psychiatric disorders (Rossler et al., 2005) that usually begins in early adulthood and lasts indefinitely (Seeman, 2009) It is characterized by a group of symptoms that include distortions of thinking and perception cognitive and, psychomotor abnormalities, avolition and apathy, as well as emotional and communication and emotional difficulties (Carpenter & Tandon, 2013; Tandon et al., 2009).

Individuals with schizophrenia have high rates of mortality and comorbidities. This situation is aggravated by the presence of diabetes mellitus, hypertension, respiratory diseases, coronary heart disease and obesity (Blouin, 2009; De Hert et al., 2010; Ösby et al., 2000; Weinmann et al., 2009). There is scientific evidence that antipsychotic medications can produce side effects such as, overweight and obesity (Drake et al., 2003; Ösby et al., 2000; Roick et al., 2007). Additionally, these individuals usually have smoking habits (Kalman et al., 2005), inadequate diets (Stokes & Peet, 2004) and insufficient levels of daily physical activity (PA) for maintenance of general health (Beebe & Harris, 2012; Faulkner et al., 2006). These factors lead to a reduction in the ability to perform activities of daily living, which can promote financial difficulties, social discrimination, as well as the reduction in their quality of life (QOL) (Chan & Yu, 2004; Strassnig et al., 2003).

Different national and international groups have developed strategies to monitor and manage of the increased risk for physical comorbidity in severe mental illness. For example, the ROAMER (roadmap for mental health research

in Europe) project, funded under the EC's Seventh Framework Program (FP7), aims to develop comprehensive and integrated mental health research roadmap, sensitive to potential shifts in future needs related to demographic changes. ROAMER is aligned with the policies of the Horizon 2020 program, and addresses a pragmatic and integrated approach to develop of a pan-European strategy to match mental health services to needs (Haro et al., 2013). In Portugal, the Portuguese Mental Health Plan 2007-2016 (Ministério da Saúde, 2008), promotes equitable access to quality mental health care to all people with mental illness. It purpose reducing the impact of mental illness; contributing to the promotion of mental health; and, integrating mental health care into in primary care and general hospitals and long-term care, in order to facilitate access and to reduce institutionalization.

In this context, a multi-modal treatment approach includes medication and psychosocial interventions (i.e., cognitive behavioural therapy, social skills training, family psycho-education, assertive community treatment and supported employment) are recommended. The goals are to reduce the mortality and morbidity by decreasing the frequency and severity of episodes of psychotic exacerbation and to improve functional capacity and QOL of the patients (Seeman, 2009; Tandon et al., 2010; Van Os & Kapur, 2009).

In the last years, the inclusion of PA is strongly recommended as an adjunct treatment in psychiatric rehabilitation (Beebe et al., 2005; Faulkner & Biddle, 1999; Richardson et al., 2005; Vancampfort et al., 2011). Regular PA promotes reduction of weight, body mass index (BMI), waist circumference, and cholesterol (Attux et al., 2011; Gomes et al., 2014; Poulin et al., 2007; Van

Citters et al., 2010; Vittaca et al., 2013). In addition, its benefits on psychosocial domains of health and well-being (e.g., mood elevating effects, reduced anxiety, improved concentration, increased self-esteem) are recognized (Faulkner & Biddle, 1999; Fogarty & Happell, 2005; Holley et al., 2011; Soundy et al., 2012).

Therefore, there is a wide range of PA programs offer to individuals with schizophrenia. Usually, the focus is on walking exercises (Beebe et al., 2005; McDevitt, 2005; Vreeland et al., 2003), general aerobic exercises (i.e., dance, cycling, aerobic training, abdominal, seated arm ergometer, step-machine and mini-trampoline) (Fogarty et al., 2004; Marzolini et al., 2009; Pajonk et al., 2010; Pelletier et al., 2005) and yoga (Behere et al., 2011; Duraiswamy et al., 2007).

Although the relevance of structured PA programs for individuals with schizophrenia is reported in the literature, there are still several research gaps that need to be clarified when analyzing the Portuguese reality. Specifically, there is lack of scientific evidence on the benefits of regular participation in PA programs for Portuguese individuals with schizophrenia, and there is a lack of valid and reliable instrument to assess PA in Portuguese individuals with schizophrenia. Therefore, the main purpose of this thesis was to develop strategies and tools related with PA in order to improve the QOL of outpatients with schizophrenia in the Portuguese reality.

Outline of the doctoral thesis

This doctoral thesis was designed to be a group of manuscripts that were written to stand-alone. Therefore, the reader may find some repetition in the manuscripts, mainly in the description of the “Materials and Methods" sections.

This fact results from sharing the sample and instruments among the manuscripts. All manuscripts were connected in what concerns the thesis rationale and their logical sequence. Therefore, the thesis was organized into 6 chapters, each of them with specific goals, as follows.

Chapter 1 comprised the **Background** of the doctoral thesis.

The goal of the background was developed focusing on the main clinical features of schizophrenia, the screening and monitoring practices of modifiable risk factors, on the treatment and on the rationale PA assessment in the specific population.

Chapter 2 comprised one manuscript entitled **Quality of Life and Physical Activity Levels in Outpatients with Schizophrenia**.

With the use of accelerometers to assess the PA levels and a questionnaire to assess the QOL, the aim of this manuscript was to examine the differences in QOL and PA levels between outpatients with schizophrenia and healthy controls matched for age, gender, BMI, hip and waist circumferences. Additionally, the associations between PA levels, QOL, anthropometric and behavioural measures among outpatients with schizophrenia were analyzed.

The following research questions were raised:

a) Are there any differences between PA levels and QOL from outpatients with schizophrenia and healthy controls?

b) Which are the associations between PA levels, QOL, anthropometric and behavioural measures among outpatients with schizophrenia?

This manuscript can provide added value because previous research in this field only used subjective measures (i.e., questionnaires) to assess the PA levels of the participants (Pesek et al., 2011; Strassnig et al., 2012; Vancampfort et al., 2011). In addition, to our knowledge, there is no research that compares QOL and objective measures of PA for individuals with schizophrenia and general population in the Portuguese reality.

Chapter 3 comprised one manuscript entitled **Reliability and Validity of 6MWT for Outpatients with Schizophrenia: A Preliminary Study**.

This manuscript aimed to explore the test–retest reliability and validity of the Six-Minute Walk Test (6MWT) in individuals with schizophrenia. In addition, we assessed predictors' parameters of the variability of the distance walked in 6MWT.

The following research questions were raised:

a) Is the 6MWT reliable for outpatient with schizophrenia in the Portuguese reality?

b) Is the 6MWT valid for outpatients with schizophrenia?

This manuscript can provide added value in this field because there is only one previous study exploring the reliability of 6MWT for individuals with schizophrenia (Vancampfort et al., 2010) which focused only in inpatients from a single mental health centre. To our knowledge, the association between the 6MWT and maximal exercise tests (i.e., validation procedures) was never explored.

Chapter 4 comprised two manuscripts that aimed to contribute to the development of PA programs specifically designed to the needs of individuals of schizophrenia.

The first manuscript entitled **A Contribution to Designing Effective and Enjoyable Physical Activity Programs for People with Schizophrenia**, aimed to determine which type of PA (i.e., walking, dancing and small-sided games) is the most enjoyable and effective for people with schizophrenia.

The following research questions were raised:

a) From walking, dancing or small-sided games, which PA activity is more enjoyable for a group of outpatients with schizophrenia?

b) From walking, dancing or small-sided games, in which PA activity a group of outpatients with schizophrenia achieve more minutes of moderate to vigorous PA?

This manuscript can provide added value because there a lack of consensus regarding the type of PA activity that better suites the patient´s preference (Vancampfort et al., 2012; Vancampfort et al., 2011). Moreover, most of the PA programs for patients with schizophrenia are based on walking and gym activities, privileging aerobic exercises (Beebe et al., 2005; Fogarty et al., 2004; Marzolini et al., 2009; McDevitt, 2005).

Therefore, the first step when designing an intervention program is to determine whether interventions will be feasible in terms of their acceptability (Beebe & Smith, 2010), since motivational strategies can help trouble-shooting the adherence to PA programs (Archie et al., 2003; Vancampfort et al., 2012).

Regarding the effectiveness of PA programs, five days per week of 30 minutes moderate to vigorous intensity PA daily, are recommended for adults (American College of Sports Medicine, 2000). Therefore, the participation in PA programs help individuals with schizophrenia to achieve these recommendations (Vancampfort et al., 2011).

The second manuscript entitled **Effects of a Group Physical Activity Program on Physical Fitness and Quality of Life in Individuals with Schizophrenia** aimed to evaluate the effects of a 16-week group PA program on physical fitness and QOL in outpatients with schizophrenia. Specifically, the focus was on the anthropometric characteristics, the body composition, the functional exercise capacity, the PA levels, and the quality of life of the participants.

The following research questions were raised:

a) After a 16-week group physical activity program, individuals with schizophrenia reduce their BMI, fat mass, waist and hip circumferences?

b) After a 16-week group physical activity program, individuals with schizophrenia increase their bone mineral density and lean mass?

c) After a 16-week group physical activity program, individuals with schizophrenia improve their functional exercise capacity and PA levels?

d) After a 16-week group physical activity program, individuals with schizophrenia improve their quality of life?

This manuscript can provide added value to the research because most of the studies only focus on PA and physical parameters (Beebe et al., 2005;

Dodd et al., 2011). However, it is known that psychosocial factors are an important to the recovery of these individuals (Harris & Boyce, 2013). We also consider as the added value of this manuscript the type of activities offered to patients, since could not identify any study offering similar activities. Moreover, our study was the first one to use accelerometers (to assess the PA levels) and dual-energy X-ray absorptiometry (to assess the body composition) in PA programs for individuals with schizophrenia. Finally, during the PA program, motivation and adherence strategies were developed to improve the satisfaction of the individuals, and consequently, their levels of attendance (Vancampfort et al., 2011).

Chapter 5 comprised one manuscript entitled **Reliability and Validity of IPAQ-SF for Individuals with Schizophrenia in the Portuguese Reality**.

This manuscript aimed to analyze the reliability and validity of the Short-Form International Physical Activity Questionnaire (IPAQ-SF) for outpatients with schizophrenia in Portuguese reality.

The following research questions were raised:

a) Is the IPAQ-SF reliable for outpatients with schizophrenia in the Portuguese reality?

b) Is the IPAQ-SF valid for outpatient with schizophrenia in the Portuguese reality?

This manuscript can provide added value because information about validation of IPAQ-SF in Portuguese individuals with schizophrenia is non-existent, which limits both clinicians and researchers aiming promote the

participation of their patients in PA program. Moreover, to our knowledge, only one a study (Faulkner et al., 2006) performed preliminary validation of the IPAQ-SF for this population.

Chapter 6 comprised the **Final Conclusions** of the doctoral thesis. This chapter summarizes the main conclusions and contributions of this thesis, according to the findings supported by the manuscripts. In addition, reflections about the limitations of the thesis and future perspectives of the research in this field were discussed.

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CHAPTER 1

Background

1 Schizophrenia

Schizophrenia is a disabling chronic psychiatric mental disorder (Awad & Voruganti, 2008; Rossler et al., 2005).It is both complex and multifactorial (Pishva, 2014; The European Network of Schizophrenia Networks for the Study of Gene-Environment Interactions(EU-GEI), 2008). Individuals with schizophrenia may present wide range of symptoms, including distortions of thinking and perception, cognitive, psychomotor abnormalities, avolition and apathy, communications and emotional difficulties (Carpenter & Tandon, 2013; Tandon et al., 2009). It accounts for 1.1% of the total disability-adjusted life years (DALYs). Schizophrenia is listed as the fifth leading cause of loss of DALYs worldwide in patients with 15-44 years (World Health Organization, 2008).

1.1 Symptoms

Individuals with schizophrenia generally present positive and negative symptoms, cognitive impairments, in mood symptoms and psychomotor symptoms (Tandon et al., 2008a). The positive symptoms include delusions, hallucinations and other distortions of reality (Keshavan et al., 2008). The illusions and delusions are common and influenced by the patient´s life experience and socio-cultural condition (Tandon et al., 2013). Bizarre content and mood incongruence are two other symptoms that may suggest schizophrenia. The negative symptoms include phenomena such as poverty in the speech, avolition and diminished emotional expression (Cosgrove &

Suppes, 2013) as well as, difficulties in personal relationships (PogueGeile & Harrow, 1984) and usually involve a blunting or loss of affective and cognitive functions (Tandon et al., 2013).

Individuals with schizophrenia may present different degree of cognitive impairments (Keefe, 2008; Tandon et al., 2008b), that may affect the memory, attention, working memory, problem solving, processing speed, and social cognition (Bowie et al., 2008; Nuechterlein et al., 2004). Mood symptoms are characterized by depression and mania that occur in different stages of the disease. Mood symptoms have to be present along of the duration of the psychotic illness in order to be diagnosed the schizophrenia (Carpenter & Tandon, 2013).

Psychomotor symptoms are also common in schizophrenia. While the increased psychomotor difficulty is related with negative symptoms, the excessive motor activity itself seemingly without purpose is more often associated with positive symptoms (Lehoux et al., 2003). Disturbances of psychomotor activity can range from complex motion patterns such as catatonic states (Carpenter & Tandon, 2013; Ungvari et al., 2009), to simple isolated movements in posture, mannerisms and stereotypes (Morrens et al., 2006).

1.2 Prevalence and incidence

The prevalence and incidence rates are 0,30-0,66% and 10,2–22,0 cases per year for each 100.000 inhabitants, respectively (McGrath et al., 2008). It is believed that the incidence of schizophrenia is identical for both men and women, but the disease is most easily identified in men by the gravity

in which it appears (Aleman et al., 2003). In Portugal, the prevalence of schizophrenia is estimated between 0.5% and 1% of the population and it is one of the most incapacity disease for productive activities (Direção-Geral da Saúde, 2013).

The mental illness is among the 20 leading causes of disability (World Health Organization, 2008) . Specifically, schizophrenia accounts for 1.1% of the total DALYs (disability-adjusted life years) and 2.8% for men and 2.6% for women of YLDs (years lived with disability) according to the Global Burden of Disease Study (World Health Organization, 2008). In Portugal, according to *Rede de Referenciação de Psiquiatria e Saúde Mental* (Direção-Geral da Saúde et al., 2004) (Direção-Geral da Saúde, 2004) schizophrenia was the main cause for care (36,5%) at mental health care institutions.

1.3 Lifestyle

Most part of the individuals with schizophrenia has smoking addiction and abuses of alcohol (Kalman et al., 2005; McCreadie, 2002). Usually, these individuals smoke 3-4 times more than the average of the population (Lasser et al., 2000). As these individuals are more likely to be physically inactive (Bobes et al., 2010), greater neuro-cognitive deficits and social, juridical and medical problems (Bahorik et al., 2014; Drake & Mueser, 2002) may occur.

Poor diet is also a common habit in this population. This characteristic partly explains the higher incidence of metabolic abnormalities (Dipasquale et al., 2013; Stokes & Peet, 2004), and these nutritional factors seem to have a key role in the development of diabetes, osteoporosis and aggravation of

schizophrenia (Kishimoto et al., 2012; Peet, 2004) . This population consumes diets higher in fat, and lower in content of fiber-rich food than a general population (Brown et al., 1999) as well as, consume fewer serving of fruits and vegetables (McCreadie, 2003).

Individuals with schizophrenia are more sedentary than the general population (Beebe & Harris, 2013; Janney et al., 2013; Vancampfort et al., 2010). A sedentary lifestyle is a major contributor to disability and death, and includes diabetes mellitus, cancers, cardiovascular and obstructive pulmonary disease. The recommendation of weekly accomplishment of moderate to vigorous PA is achieved only by a small number of individuals (Beebe & Harris, 2012; Faulkner et al., 2006; Lindamer et al., 2008). It is worth to note that there is an association between sedentary behavior (i.e., time spent laying or sitting) and the increased incidence of metabolic syndrome (Ford et al., 2005), as well as neuro-cognitive deficits (Leutwyler et al., 2014).

1.4 Schizophrenia related diseases

Individuals with schizophrenia may be at increased risk to develop obesity, cardiovascular disease, diabetes and metabolic syndrome. Antipsychotic medications, particularly second-generation antipsychotics (SGAs), have metabolic consequences that contribute to obesity (Foussias & Remington, 2010; Gurpegui et al., 2012). In addition, poor diet can cause obesity (Peet, 2004). Individuals with obesity have higher concentrations of visceral adipose tissue and are more prone to insulin resistance that

predisposes to diabetes, hypertension and dyslipidemia (Dixon et al., 2000; Friedman et al., 2010).

Cardiovascular disease is in fact the leading cause of death among individuals with schizophrenia (Brown et al., 2010). Important causal cardiovascular risk factors in schizophrenia are related to lifestyle, including poor diet, lack of PA, smoking, and alcohol abuse (Ringen et al., 2014).

Individuals with schizophrenia are at a greater risk of type II diabetes, with prevalence rates reaching more than two times those of the general population (Chen et al., 2014; El-Mallakh, 2007; Heiskanen et al., 2003).

Individuals with schizophrenia are more likely to develop metabolic syndrome (De Hert et al., 2009; Heiskanen et al., 2003). The metabolic syndrome refers to a complex of interrelated modifiable risk factors for cardiovascular diseases and diabetes. Metabolic syndrome is a cluster of risk factors comprising obesity (central and abdominal), dyslipidaemias, glucose intolerance, insulin resistance, hypertension, and is highly predictive of type 2 diabetes mellitus and cardiovascular disease (Grundy et al., 2004). Correll et al. (2006) stated that, in patients with schizophrenia the presence of metabolic syndrome has been associated with a twofold increase in predicted 10-year cardiovascular disease risk.

The schizophrenia related diseases and the unhealthy lifestyle promote premature death. In this context, individuals with schizophrenia are likely to die on average 12-15 years earlier than the general population (Saha et al., 2007).

2 Treatments

2.1 Medication

The schizophrenia treatment is accomplished through the use of antipsychotic medication. The first-generation antipsychotics medications (e.g., chlorpromazine, fluphenazine, haloperidol) were discovered in the 1950s. Although, they are effective in the treatment of psychotic symptoms, their side effects include movement disorders, inability to remain motionless and muscle spasms (Warikoo et al., 2014).

In the past 15 years, second-generation antipsychotics medications (e.g., olanzapine, quetiapine, risperidone, ziprasidone) were introduced with the advantage of lower probability for the side effects of first-generation medications (Voruganti et al., 2008) . However, they may lead to changes in visceral fat distribution via its effects on appetite and energy regulation neuropeptides, and to chronic low-grade inflammation in adipose tissue, which causes insulin resistance. Second-generation antipsychotics have been associated with higher levels of free-fatty acids which also exacerbate skeletal muscle insulin resistance through decreased muscle glycogen synthesis and glucose oxidation (Tsuchiyama et al., 2004).

2.2 Psychosocial approaches

The use of antipsychotic drugs *per si* is not sufficient to increase quality of life (QOL) of the individuals with schizophrenia. Psychosocial interventions as an adjunct to medications or usual psychiatric care, can reduce psychotic symptoms and relapse, improving patients' long-term outcomes such as,

recovery, remission, and illness progression (Berry & Barrowclough, 2009; Chien et al., 2013; Patterson & Leeuwenkamp, 2008) .

The purpose of psychosocial approaches is to help patients to develop cognitive-behavioral training of social capacities, family and community relationship, and, to focus on individuals needs (Van Os & Kapur, 2009), promoting their autonomy and improving their QOL (Bobes, 2001; Bobes et al., 2007; Chien et al., 2013; Masthoff et al., 2006) . Therapies for individuals with schizophrenia focus on the patient, as well as on family caregivers (Fallahi Khoshknab et al., 2014; Hou et al., 2008) and include cognitive therapy (cognitive behavioral and cognitive remediation therapy), psychoeducation, family intervention, social skills training, and assertive community treatment (Seeman, 2009).

3 Outpatients

The transformation of the mental healthcare system during the last decades has without doubt significantly, if not radically, changed the care course for individuals with mental illness in countries that conducted psychiatric reforms (Salize et al., 2008). There are many reasons for this transformation, such as the introduction of more efficient therapeutic medication that reduced relapsing rates; the decrease of health and medical costs, and the de-institutionalization, that includes progressive ‘de-stigmatization` of psychiatric patients, for which society recognizes the status of normal citizens (Leguay & Boyer, 2012). The downsizing of the number of psychiatric beds or the closure of large psychiatric hospitals is a reality (Salize et al., 2008).

Clinical mental health teams now are responsible for psychiatric care both at outpatient and inpatient levels (Leguay & Boyer, 2012). The care of outpatients includes strategies to prevent relapse, and new therapeutic methods (Leguay & Boyer, 2012). In this context, research started to focus in the development of strategies to improve QOL and social integration, to decrease rehospitalization and readmission of outpatients (Salize et al., 2008).

4 Quality of life and Schizophrenia

The general concept of QOL was initially considered a useful adjunct to traditional concepts of health and functional status. An ideal health assessment, therefore, would include a measure of the person's physical health, a measure of physical, social and psychological functioning, and a measure of QOL (WHOQOL Group, 1998),

In schizophrenia, QOL may represent the functional effect itself and its treatment as perceived by the patient (Awad & Voruganti, 2012). The psychopathology has substantial impact on QOL, well-being and social and occupational function (Siegel et al., 2006; Tyson et al., 2008) and thus creates a considerable socio-economic burden (Abouzaid et al., 2014). In schizophrenia, QOL is associated with emotional distress (Ritsner, 2014), depressive and negative symptoms (Fitzgerald et al., 2001), low self-esteem and self-efficacy, as well as, lack of emotional and social support (Ritsner, 2014). Financial problems, as well as social stigmatization and discrimination are associated with low QOL (Allison et al., 2003; Awad & Voruganti, 2012; Strassnig et al., 2003). In addition, hypertension, obesity and metabolic syndrome (Allison et al.,

2003; Kolotkin et al., 2008), pharmacotherapy, depression, pain (Almeida et al., 2013; de Araujo et al., 2014), disease duration and psychopathology severity (Chang et al., 2013; Zahid et al., 2010) are related with low QOL.

The general concept of QOL was initially considered as a useful adjunct of traditional concepts of health and functional status (WHOQOL Group, 1998), and as an important outcome measure. The QOL several domain related to health, such as life physical, social, psychological and spiritual (THE WHOQOL GROUP, 1998). As a broad, general concept, QOL has always included several domains related to health, but the concept also originally included many other non-health-related issues such as work, family, prosperity, and environment (Awad & Voruganti, 2012).

5. Physical activity and Schizophrenia

The physical activity (PA) is defined as any bodily movement produced by skeletal muscles resulting in energy expenditure. Exercise is a subset of PA that is planned, structured, and repetitive bodily movement performed to improve or maintain one or more components of physical fitness (Caspersen et al., 1985).

Regarding PA in individuals with schizophrenia, Lindamer et al. (2008) found that 30% of patients in study were regularly active as opposed to 62% of a non-psychiatric comparison group. Nowadays, studies stated that PA is important to individuals with schizophrenia (Faulkner & Biddle, 1999; Vancampfort et al., 2012). Regular PA improves cardio-vascular integrity, increases oxygen transportation, decreases blood pressure, cholesterol and

triglycerides, and consequently, improves QOL (Beebe et al., 2005; Marzolini et al., 2009; Strassnig et al., 2012).

Healthier lifestyles, which include adequate PA have been associated with longer survival and postponed and compressed years of disability (Lee et al., 2013; Reiser & Schlenk, 2009). The International Organization of Physical Therapy in Mental Health (IOPTMH) suggests applying the U.S. Department of Health and Human Services guidelines for PA to patients with schizophrenia (U.S. Department of Health and Human Services, 2008). The above mentioned guidelines are summarized below:

A. Some PA is better than none, and those patients who participate in any amount of PA gain some health benefits;

B. For substantial health benefits, patients with schizophrenia should do at least 150 minutes a week of moderate-intensity, or 75 minutes of moderate-to vigorous-intensity aerobic activity;

C. Aerobic activity should be performed in episodes of at least 10 minutes. Spreading PA across at least 3 days a week may help to reduce the risk of injury and avoid excessive fatigue;

D. For additional and more extensive health benefits, patients with schizophrenia should increase their aerobic PA beyond this amount, up to 300 minutes a week of moderate intensity, or 150 minutes a week of vigorous intensity aerobic PA, or an equivalent combination of moderate-and vigorous-intensity activity.

PA is important for individuals with schizophrenia, since they show high levels of physical inactivity and, the inactivity is one of the important modifiable

cardiovascular risk factors and strongly associated with mortality (Kilbourne et al., 2009). Despite this, these individuals have poor access and quality of PA and physical health care services (Kilbourne et al., 2009; Mitchell et al., 2009).

5. 1 Adherence to the PA programs

The adherence of individuals with schizophrenia to PA programs is a challenge for the professional of mental health. The most common barriers of adherence of PA programs are motor side effects of antipsychotic medication, high levels of perceived stress, low self-efficacy and self-esteem, negative expectations about PA, lack of body perception, lack of enjoyment and autonomy for the patient during PA, low accessibility to PA services and high financial costs (Carless, 2007; McDevitt et al., 2006; Rastad et al., 2014; Vancampfort et al., 2011).

In the literature, some strategies are reported to overcome the above mentioned barriers. That can influence satisfaction in PA programs (Vancampfort et al., 2009). To provide adequate trained support, make telephone calls to participants who missed PA sessions, establish a trusting relationship between participants and the professor of PA, as well share personal experiences about PA are some of the most important strategies that can be applied in individuals with schizophrenia (Beebe & Harris, 2013; Beebe & Smith, 2010; Bernard & Ninot, 2012; Tetlie et al., 2009).

6 Assessment

6.1 Quality of life assessment

There has been significant interest in QOL assessment in mental health. QOL measurements are considered an important way of evaluating the treatments and care provided to patients with schizophrenia (Hofer et al., 2004). In clinical management, QOL measures may provide information about the needs and gaps, which promote adequate therapies (Awad & Voruganti, 2012).

QOL questionnaires have become increasingly used as outcome measures for schizophrenia. There are a wide variety of QOL assessment tools (Awad & Voruganti, 2012), some of which are patient-rated, whilst others are observer-rated (i.e., where the observer is often a clinician or trained researcher) (Kusel et al., 2007).

The SF-36 Health Survey (Ware & Sherbourne, 1992), the WHOQOL-Bref (WHOQOL Group, 1998), the Lehman Quality of Life Short Form TL30S (Lehman, 1996) and the self-report questionnaire Client's Assessment of Strengths, Interests, and Goals (CASIG) (Lecomte et al., 2004; Wallace et al., 2001) are the most commomnly used questionnaires to assess the QOL in individuals with schizophrenia.

In this doctoral thesis, we have chosen to apply the Portuguese version of the WHOQOL-Bref (Vaz-Serra et al., 2006), which was considered a valid and reliable instrument, with a range of moderate to high values of retest reliability ($r > 0.65$) and a Cronbach's alpha internal consistency of $\alpha = 0.92$. This instrument is a 26-item questionnaire composed of four domains: i) physical (e.g., energy and fatigue; mobility; pain and discomfort); ii) psychological (e.g.,

positive and negative feelings; thinking, learning, memory and concentration); iii) social (e.g., personal relationships; social support); and iv) environment (e.g., freedom, physical safety and security; health and social care; leisure activities; transport) and two questions related to the person's general perception of his/her quality of life and health (WHOQOL Group, 1996).

6.2 Physical activity assessment

PA assessment is important to determine the PA level and to ensure the efficacy of the PA program. There are numerous tests for measuring PA ranging from simple questionnaires to more sophisticated laboratory tests. The literature reported three types of PA evaluation: a) criterion methods; b) objective methods, and c) subjective methods (Vanheesa et al., 2005).

Criterion methods include doubly labelled water, and indirect and direct calorimetry. Although it is most reliable and valid method for PA analyses, it is also considered an invasive procedure that is not easy to apply in large samples or in clinical environment (Vanheesa et al., 2005). Objective methods, like pedometers and accelerometers, are becoming increasingly prominent in research as tools to measure relationships between PA and physical health (Friedewald, 1985). Despite that, they are expensive and more technically demanding than subjective measures (Parker et al., 2008). Subjective methods (i.e., questionnaires) are cheapest and easy to apply in clinical environments (Vanheesa et al., 2005). Nevertheless, subjective methods can underestimate time spent in moderate intensity activities (Ainsworth et al., 2000; Strath et al., 2004). Questionnaires (D. Vancampfort et al., 2012), accelerometers (Gomes et

al., 2014) and pedometers (Beebe & Harris, 2012) are used to assess the PA levels in individuals with schizophrenia.

6.3 Functional exercise capacity assessment

Functionality and inability are designed with the dynamic interaction between the states of health (diseases, nuisances, lesions, and so on) and the contextual factors (environmental and personal) (Direção-Geral da Saúde, 2003). Most studies regarding PA and schizophrenia used sub maximal tests (Beebe et al., 2005; Dodd et al., 2011; Marzolini et al., 2009) to evaluate the effects of the functional exercise capacity. In sedentary patients who usually develop symptoms below their theoretical maximal exercise capacity, the sub maximal tests and questionnaires could be particularly relevant.

In this doctoral thesis, the Six-minute walk test (6MWT) (American Thoracic Society, 2002) was used to assess the functional exercise capacity. 6MWT evaluates global and integrated responses of all the systems involved during exercise, including the pulmonary and cardiovascular systems, peripheral circulation, neuromuscular units, and muscle metabolism (American Thoracic Society, 2002; Enright, 2003).

6.4 Bone and body composition assessment

Individuals with schizophrenia show high prevalence of osteoporosis and bone fractures when compared with general population (Howard et al., 2007; Renn et al., 2009). Some specific factors that contribute to the reduction of bone mineral density (BMD) in this population are: i) antipsychotic medication and

consequent hyperprolactinemia; ii) smoking; iii) poor diet; iv) alcohol abuse; v) lack of PA; and vi) lack of vitamin D due to decreased sunlight exposure (Abraham et al., 2003; Hummer et al., 2005; Kanis et al., 2008).

It is well established that body weight is related to BMD (Reid, 2010) and that changes are predictors of bone alterations (Shapses & Riedt, 2006).In addition, body weight is composed by fat mass and lean mass. Evidence suggests that PA has a long-term anti-inflammatory effect which reduces in visceral fat mass (Petersen & Pedersen, 2005). Moreover, regular PA has been associated with increased BMD, by promoting osteoblast activity in favor to bone formation (Kohrt et al., 2004). In this doctoral thesis, BMD, fat mass and lean mass were assessed through of dual-energy x-ray absorptiometry (DXA) scanning. This technique differentiates body weight into lean and fat soft tissues and bone, based on their differential attenuation of the two-level x-ray energy.

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Chapter 2

Quality of life and physical activity levels in outpatients with schizophrenia

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ABSTRACT:

Background: It is known that the individuals with schizophrenia have poor quality of life (QOL) and lower physical activity (PA) levels compared with general population. However, PA levels are usually assessed though subjective measures which limit the generalization of the findings. **Objective:** With the use of accelerometers to assess the PA levels and a questionnaire to assess the QOL, the aim of this study was to examine the differences in QOL and PA levels between outpatients with schizophrenia and healthy controls matched for age, gender, body mass index, hip and waist circumference. Additionally, the associations between PA levels, quality of life, anthropometric and behavioural measures among outpatients with schizophrenia were analyzed. **Methods:** Thirty outpatients with schizophrenia (M = 41.16 yrs., SD = 6.89 yrs) and 30 individuals without mental illness (M = 38.56 yrs., SD = 8.7 yrs) were included in the study. The QOL and PA levels were assessed by World Health Organization Quality of Life Scale- Bref (WHOQOL-Bref) and by GTX3 triaxial accelerometer, respectively. **Results:** Outpatients with schizophrenia had lower QOL and vigorous PA compared to healthy controls ($p < 0.05$). The group with schizophrenia showed a significant association between higher weight and lower scores in the mental domain of the WHOQOL-Bref. A higher BMI was also significantly associated with lower scores in the physical domain of the WHOQOL-Bref. Individuals with schizophrenia with smoking behavior were associated with lower levels of moderate to vigorous PA. **Conclusions:** The present study helps to understand the lifespan of the population with schizophrenia. New psychosocial approaches need to focus on PA, weight and smoking management helping this population to improve QOL.

Keywords: quality of life, physical activity, outpatients, schizophrenia

INTRODUCTION

Schizophrenia is characterized by a diverse set of signs and symptoms, such as, delusions and hallucinations (Keshavan et al., 2008), impairments in cognitive function (Tandon et al., 2009) and in affective experience, as well as a loss of motivation and initiative (Stahl & Buckley, 2007). These characteristics can contribute to a poor long-term outcome for this population (Eack & Newhill, 2007; Picardi et al., 2006; Rossler et al., 2005). Additionally, the antipsychotic medication used to reduce the symptoms of this disease may produce side effects, including decrease bone mineral density, as well as, increased body mass, diabetes mellitus, hypertension and metabolic syndrome (Blouin, 2009; Crews & Howes, 2012; De Hert et al., 2009).

Over time individuals with schizophrenia may suffer a decrease of functionality in life with negative effects on the ability to conduct activities of daily living (Awad & Voruganti, 2012; Pazvantoglu et al., 2014; Zou et al., 2014). For example, Vancampfort et al., (Vancampfort, Probst, Sweers, et al.) stated that individuals with schizophrenia experience physical limitations when performing a walking during the test. In addition, Kurtz & Tolman (2011) referred the neurocognitive function limitations related with deficits on attention, working memory, speed of processing, verbal learning, reasoning and problem-solving. Moreover, this population often experiences financial problems (Shibre et al., 2003) and a poor social network (Sibitz et al., 2011). Stigma, discrimination, and the inability to maintain social relations also impair a proper social functioning (Lysaker & Davis, 2004; Lysaker et al., 2010). This scenario makes it difficult to

self-manage the illness (Allison et al., 2003; Zou et al., 2014) and may lead to a poor quality of life (QOL) in individuals with schizophrenia.

QOL is a subjective experience and presents a multidimensional nature (i.e., physical, psychological, social, and environmental) (Awad & Voruganti, 2012; WHOQOL Group, 1995). In psychiatric research, QOL has become an important outcome measure for medical care and interventions (Masthoff et al., 2006) whose goal is to enhance the patients' autonomy (Bobes, 2001; Bobes et al., 2007; Chien et al., 2013). QOL has a significant negative relationship with negative symptoms and general psychopathology (i.e. anxiety, depression), while positive symptoms have been found to have mixed relationships (Lambert & Naber, 2004). There are many factors associated with low QOL among individuals with schizophrenia such as demographic (e.g., ethnicity, gender, educational levels) (Pinikahana et al., 2002); clinical variables (e.g., hypertension, Obesity, Metabolic Syndrome) (Allison et al., 2003; Kolotkin et al., 2008); pharmacotherapy, insight, depression, pain (Almeida et al., 2013; de Araujo et al., 2014); duration of untreated illness, and severity of psychopathology (Chang et al., 2013; Zahid et al., 2010).

Literature also reports that physical activity (PA) is an important tool to improve the QOL in individuals with schizophrenia (Duraiswamy et al., 2007; Martín-Sierra et al., 2011; Vancampfort, Probst, Scheewe, et al., 2011). A regular practice of PA helps to reduce weight, to control the lipids profile, to improve functional exercise capacity and PA levels (Beebe et al., 2005; Dodd et al., 2011; Vittaca et al., 2013), to reduce the symptoms of the disease and to

increase the social skills in this population (Chamove, 1986; Faulkner & Sparkes, 1999; Gomes et al., 2014; Leutwyler et al., 2014).

Some studies have determined the relationships between PA levels and QOL in individuals with schizophrenia (McLeod et al., 2009; Pesek et al., 2011; Strassnig et al., 2012; Vancampfort, Probst, Scheewe, et al., 2011; Vancampfort, Probst, Sweers, et al., 2011). However, a limitation common to all the previous mentioned studies is the use of subjective measures (i.e., questionnaires) to assess the PA levels of the participants. This is why several authors advocate the use of objective measures that do not rely on information provided by the patient, but instead measure and record the consequences of performing PA in real time (Trost et al., 2005; Ward et al., 2005). Martín-Sierra et al. (2011) have investigated the relationships between QOL and functional exercise capacity but no focus was given to the PA levels of the participants.

Therefore, to our knowledge, there is no research that compares QOL and objective measures of PA levels for individuals with schizophrenia and general population.

Therefore, with the use of accelerometers to assess the PA levels and a questionnaire to assess the QOL, the aim of this study was to examine the differences in QOL and PA levels between outpatients with schizophrenia and healthy controls matched for age, gender, body mass index, hip and waist circumference. Additionally, the associations between PA levels, quality of life, anthropometric and behavioural measures among outpatients with schizophrenia were analyzed.

METHODS

Participants

Outpatients with schizophrenia and individuals without mental illness were enrolled in the study. All participants of the study met the following criteria: were more than 18 years old, without substance dependence and had ability to provide informed consent. The individuals with schizophrenia were recruited from three different psychiatric rehabilitation units. Psychiatric diagnosis based on DSM-IV (American Psychiatric Association, 2000) criteria was established by experienced psychiatrists responsible for the patients' treatment. Age, gender, body mass index (BMI), waist and hip circumferences matched control subjects who were employees and students of University. The study procedure was approved by the Faculty Ethics Committee. All participants gave their informed consent.

Instruments

Anthropometric measures

Height and weight were measured with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (HoltainLtd., Crymmych, UK) and recorded in centimeters to the nearest millimeter. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between weight and squared height ($kg.m^2$).

Waist circumference was measured at the level of the navel and hip circumference was measured at the largest circumference of the hips.

Behavioural Measures

Smoking addictions (to smoke regularly for more than 15 years), number of cigarettes per day, and frequency of PA at least three times per week in the last month prior to the study were register by the researches.

World Health Organization Quality of Life Scale- Bref (WHOQOL-Bref)

This scale is composed by 26 items divided into four broad domains: physical health, psychological health, social relations and environment and two questions relating to the person's general perception of his/her quality of life. In this study the Portuguese version of the WHOQOL-Bref (Vaz-Serra et al., 2006; WHOQOL Group, 1998) was used. For individuals with mental illness, the Portuguese version of WHOQOL-Brief was considered a valid and reliable instrument, with a range of moderate to high values of retest reliability ($r > 0.65$) and a Cronbach's alpha internal consistency of $\alpha = 0.92$ (Vaz-Serra et al., 2006).

Accelerometer

The GTX3 triaxial accelerometer (Actigraph, Florida) was used to objectively measure daily PA. Individuals were instructed to wear an accelerometer over 7 consecutive days, placed on the right hip using an adjustable belt. Exceptions included time spent sleeping and showering. Individuals were instructed to maintain their usual routine of activities.

This instrument has been proved to be valid for quantifying activity levels in laboratory and field settings (Harris et al., 2009; Nichols et al., 2000; Trost et al., 2005). Accelerometer data was recorded in 5-second sampling periods (epochs) and then aggregated in 60-second epochs for analysis. The standard software ActiLife version 6.9 (Actigraph, Florida) was used to reduce the raw activity data from the accelerometers into daily PA. Time periods with at least 10 consecutive minutes of zero activity recorded were excluded from analysis assuming that the monitor was not worn. A minimum recording of 8-hours/day was the criteria to accept daily PA data as valid. Individual's data were only accepted for analysis if at least five days were successfully assessed. The main outcomes of reduced data were: total physical activity [total PA (counts/min/day)], time in sedentary physical activity [SEDPA (min/day)], light physical activity [LIGPA (min/day)], moderate physical activity [MODPA (min/day)], vigorous physical activity [VIGPA (min/day)] and moderate to vigorous physical activity [MVPA (min/day)]. To determine the time spent in PA of different intensities, the following counts intervals (counts/min) were considered: 0-99 for SEDPA, 100-2019 for LIGPA, 2020-5998 for MODPA and ≥ 5999 for VIGPA (Troiano et al., 2008).

Medication use

Current antipsychotic medication use was recorded for each patient and converted into a daily equivalent dosage of chlorpromazine (Gardner, 2010).

Statistical analysis

Data were tested for normality using the Shapiro-Wilk test. To assess the differences between the overall schizophrenia group and matched healthy control subjects an Independent student t test or Mann-Whitney test was used when appropriate. Relationships between variables were calculated using the Spearman correlation coefficient. All analyses were computed with SPSS (Version 20.0) with the significance level set at 0.05.

RESULTS

A total of 32 outpatients with schizophrenia (males = 23, females = 9) and 32 individuals without mental illness (males = 22, females = 10) were enrolled in the study. Subject characteristics are shown in Table 1. There were no significant differences for gender distribution and age, weight, BMI, waist and hip circumferences and waist-rip ratio. Only 25% of the individuals with schizophrenia and 50% of the healthy controls perform regularly PA (i.e., at least 3 times per week) (American College of Sports Medicine, 2006). Approximately, 53% of the patients with schizophrenia smoked compared to 15% of the healthy controls. Smokers with schizophrenia (n = 19) smoked more cigarettes than the healthy control (11.3 ± 9.8 versus 1.94 ± 4.83). Mean daily equivalent dosage of chlorpromazine was 464.3 ± 351.5 mg/day.

Table 1. Characteristics of study participants

Variables	**Schizophrenia** (n = 32)	**Healthy controls** (n = 32)
Age (years)	41.16 ± 6.89	38.56 ± 8.70
Weight (Kg)	85.91 ± 15.10	78.96 ± 14.17
BMI (Kg/m^2)	29.61 ± 4.68	27.66 ± 3.61
Waist circumference (cm)	104.70 ± 12.99	99.29 ± 8.85
Hip circumference (cm)	107.89 ± 14.83	102.68 ± 13.47
Waist-rip ratio (cm)	0.98 ± 0.13	0.96 ± 0.10

Data expressed as mean ± standard deviation, BMI = body mass index. No significant differences between both groups.

QOL and PA levels of both schizophrenia and healthy control individuals are presented in Table 2. The QOL assessed in all domains of WHOQOL-Bref in the individuals with schizophrenia was significant lower ($p < 0.05$) compared to healthy controls. Individuals with schizophrenia showed only a significant difference for vigorous PA with greater values for the healthy controls ($p < 0.05$).

Table 2. Quality of life and PA levels of study participants

Variables	Schizophrenia	Healthy controls	*p*
Physical domain	59.59 ± 13.44	79.46 ± 13.59	< 0.001
Mental domain	62.41 ± 17.37	81.11 ± 11.88	< 0.001
Social domain	54.03 ± 21.15	83.85 ± 14.81	< 0.001
Environmental domain	59.96 ± 12.46	74.12 ± 13.64	< 0.001
Counts per minute during wear time	344.25 ±108.78	372.32 ± 109.25	0.60
Sedentary PA (min/day)	438.88 ± 48.30	442.92 ± 44.09	0.44
Light PA (min/day)	224.69 ± 68.19	225.81 ± 51.71	0.94
Moderate PA (min/day)	34.58 ± 15.77	36.30 ± 17.39	0.98
Vigorous PA (min/day)	0.23 ± 0.41	2.03 ± 4.63	0.04*
MVPA (min/day)	34.82 ± 15.92	38.33 ± 18.25	0.73

Data expressed as mean ± standard deviation, BMI = body mass index, PA = physical activity, MVPA = moderate to vigorous physical activity

Associations between QOL, PA levels, anthropometrics and behavioural measures in outpatients with schizophrenia

The weight was negatively associated with mental domain (r = -.375; *p* = 0. 034). BMI was negatively associated with physical domain (r = -.367; *p* = 0. 039). Light PA was negatively associated with physical (r = -.436; *p* = 0. 013) and mental (r = -.472; *p* = 0. 006) domains.

In this study, 19 individuals with schizophrenia are smokers. The number of cigarettes smoked per day was negatively associated with counts per minute during wear time (r = -.574; *p* = 0. 010) and moderate PA (r = -.526; *p* = 0. 021), MVPA (r = -.512; *p* = 0. 025).

DISCUSSION

The main aim of this study was to examine the differences in QOL and PA levels between outpatients with schizophrenia and healthy controls matched for age, gender, body mass index, hip and waist circumference. Our general findings demonstrated that outpatients with schizophrenia have lower QOL and PA levels compared to healthy controls.

Considering the assessment of the QOL, we found that individuals with schizophrenia presented, on average, lowest scores in the physical (25.0%), mental (23.0%), social (35.6%), and environment (19.1%) domains than healthy controls. Therefore, our findings are in line with previous research that stated that individuals with schizophrenia experience poor quality of life (Allison et al., 2003; Hsiao et al., 2012; Lasebikan & Lasebikan, 2014; Pinikahana et al., 2002).

Regarding the PA levels, we found that individuals with schizophrenia presented, in general, counts per minute during wear time (7.53%), sedentary (0.9%), light (0.5%), moderate (4.7%), vigorous (88.7%) and MVPA levels (9.1%) lowest compared to healthy controls. However, with the exception of vigorous PA, no significant differences were found between both groups. Although our findings are in line with the research of Lindamer et al. (2008) and McLeod et al. (2009), other studies had found significant lower levels of PA in individuals with schizophrenia compared to healthy controls (Faulkner et al., 2006; Roick et al., 2007; Vancampfort, Probst, Sweers, et al., 2011).

Specifically, in our study, we believe that there are three main reasons to justify these differences. First, all individuals with schizophrenia lived successfully in the community and were included in psychosocial rehabilitation units. The goal of these units is to help patients to overcome the psychosocial integration difficulties through the participation in daily activities (Gisbert, 2002). Patients are encouraged to deal with different roles and demands represented by living, working and mixing in different community environments in the most independent way (Cnaan et al., 1988; Li et al., 2014) . These are important strategies to enhance work function and the performance in daily living in individuals with schizophrenia (Harvey & Strassnig, 2012; Strassnig et al., 2011). Therefore, we believe that the participation in psychosocial rehabilitation programs may had a positive influence in the PA levels of the group with schizophrenia. Second, we are aware that due to the financial constraints that the country is facing, individuals with lower socioeconomic status have lost social benefits. Possibly, the lack of support in transportation costs may influence the routines and habits of our sample of outpatients who possible were forced to use walking as a primary form of transport. Third, we cannot neglect a selection bias of healthier control volunteers in our study. Healthy controls were University students and employees convenient selected and they cannot be representative for the national population (Silva et al., 2011).

The present study also investigated the association between QOL, PA levels, anthropometric measures, and behavioural characteristics among outpatients with schizophrenia. We found that, between individuals with schizophrenia and smokers, present lower counts per minute during wear time,

moderate and MVPA were associated with increased number of cigarettes smoked per day. Bobes et al., (2010) also argued that individuals with schizophrenia who smoke are less likely to do regular exercise and to have other unhealthy life habits.

We also found significant correlations between QOL, weight and BMI of the participants. Individuals with schizophrenia with more weight were significantly associated with lower scores in mental domain of the QOL and those with higher BMI were significantly associated with lower scores in physical domain. Similarly, Strassing et al., (2003) reported that the excess body weight strongly influenced poor QOL. Therefore, to provide mixed PA and weight-management programs are an important strategy to improve the QOL of this population (Allison et al., 2009; Faulkner et al., 2007; Vancampfort et al., 2012; Wildgust & Beary, 2010). Light PA was also a factor for the low scores of physical and mental domains of QOL. Our findings suggest that a potential way to improve QOL might be targeted reduction of inactivity with regular PA (Strassnig et al., 2011). Likewise, Pesek et al.(2011) found that higher scores on PA were associated with higher QOL in the physical domain.

CONCLUSION

The findings of the present study help to understand the lifestyle of the population with schizophrenia, as well as, to support the design of effective approaches to improve the QOL. New psychosocial approaches need to focus on PA, weight and smoking management, as well as to help this population to better perceive these benefits in daily lives, in order to improve QOL.

However, these findings need to be interpreted with caution due to some methodological limitations. This is a cross-sectional study in volunteers, and hence may underestimate the results of PA, specifically in the healthy control group. In addition, there was a gender imbalance with a smaller proportion of female participants. Also, we did not formally assess symptoms of psychopathology of the participants with schizophrenia. Possibly, negative and depressive symptoms may have interfered in the data. However, it is important to mention that all individuals with schizophrenia lived successfully in the community before participating in this study. Lastly, further studies need to replicate the present findings in a larger sample and in different multicenter studies.

Competing interests

The author declares that there is no conflict of interest.

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Chapter 3

Reliability and validity of 6MWT for outpatients with schizophrenia: a preliminary study

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ABSTRACT

Background: Although the 6MWT has been widely used in patients with schizophrenia, there is a lack of scientific evidence about its reliability and validity in this population. **Objective:** Therefore, the goal of this study was to explore the test–retest reliability and validity of the 6MWT in individuals with schizophrenia. In addition, we assessed predictors' parameters of the variability of the distance walked in 6MWT. **Methods**: Fifty one outpatients with schizophrenia participated in the study. To test reliability (n = 51), participants performed the 6MWT twice within 3 days interval. To test validity (n = 13), peak oxygen uptake (VO_{2peak}) was measured on a treadmill. For the predictor parameter of walked distance (n = 51), medications use, smoking behavior, body and bone composition (dual-energy X-ray absorptiometry) were analyzed. **Results**: No significant differences between the means of the two 6MWTs were found. The intraclass correlation coefficient was 0.94 indicating good reliability. 6MWT correlated significantly with VO_{2peak} (r = .67; p = 0.01) indicating validity. Height, total percent body fat mass, total mass and smoking behavior per week were associated with the 6MWT. **Conclusions**: 6MWT is reliable and valid for the evaluation of functional exercise capacity in individuals with schizophrenia. The 6MWT can be recommended for use in clinical practice in the studied population.

Keywords: schizophrenia, outpatients, validation, 6MWT

INTRODUCTION

Schizophrenia is a leading cause of disability worldwide (World Health Organization, 2008), which affects about 24 million people (World Health Organization, 2012). The antipsychotic medication is important to control the symptoms of the disease (Tandon et al., 2010). However, the use of this medication has been associated with metabolic disturbances (Blouin, 2009; Newcomer, 2004). Individuals with schizophrenia have a higher prevalence of diabetes mellitus (Wani et al., 2015), vascular disease, kidney disease, respiratory disease, metabolic disease and overweight (De Hert et al., 2009; Leucht et al., 2007; Sánchez-Mora et al., 2007).

Additionally, individuals with schizophrenia usually have unhealthy lifestyle with an inadequate diet (Stokes & Peet, 2004); substance abuse (Kalman et al., 2005; Winklbaur et al., 2006) and insufficient levels of daily physical activity (PA) for the general health maintenance (Beebe & Harris, 2013; Faulkner et al., 2006). It has also been documented that individuals with schizophrenia have suboptimal levels of cardiovascular fitness (Saha et al., 2007; Vancampfort, Probst, et al., 2011). Previous studies (Vancampfort, Probst, et al., 2011; Vancampfort, Sweers, et al., 2011) reported association between low functional exercise capacity and low level of perceived sports competence, perceived physical fitness, and PA participation in individuals with schizophrenia.

Despite the importance of PA in the prevention and reduction of schizophrenia related disorders (e.g., metabolic syndrome, cardiovascular disease, obesity) (Beebe et al., 2005; Faulkner & Biddle, 1999; Fogarty et al.,

2004; Gomes et al., 2014; Marzolini et al., 2009; Richardson et al., 2005; Vittaca et al., 2013) and in the reduction of the specific symptoms (e.g.: negative and positive) of the disease (Bernard & Ninot, 2012; Vancampfort et al., 2012), few studies analyzed the validity and reliability of the instruments that assess the effects of regular PA in individuals of schizophrenia (Vancampfort et al., 2014; Vancampfort et al., 2010).

In this context, the best measure used to assess the benefits of regular PA is the maximal oxygen consumption (VO_{2max}) determined by ergospirometry. This method measures cardiovascular fitness (VO_2 max/peak) and is conducted in a laboratory using respired gas analysis (American Thoracic Society & American College of Chest Physicians, 2003; Mezzani et al., 2009). Nonetheless, ergospirometry is expensive and not always available in clinical practice (Elmahgoub et al., 2012). Moreover, adults with schizophrenia generally exhibit lower cardiopulmonary fitness (i.e., higher respiratory quotient on submaximal workloads and lower calculated VO_{2max}) than the general population (Nilsson et al., 2012). Therefore, it is difficult to motivate individuals with severe schizophrenia to consistently undertake exhausting exercise (Dodd et al., 2011).

The 6-minute walking test (6MWT) is considered an adequate submaximal test for individuals with schizophrenia (Beebe et al., 2005; Vancampfort et al., 2010). It is a self-paced test, it is better tolerated and more reflective of daily activities than other maximal exercise tests (Solway et al., 2001). From a clinical perspective, The 6MWT has the advantages of been practical and safe; and

requires no special equipment or advanced training, and unlike maximal cardiopulmonary exercise testing, it can be performed by patients with severe impairments (American Thoracic Society, 2002; Enright, 2003). This is why the 6MWT is commonly used to measure the functional exercise capacity in individuals with different diseases (i.e., cardiovascular diseases, chronic obstructive pulmonary disease, traumatic brain injury) (Campo et al., 2006; Langenfeld et al., 1990; Mossberg & Fortini, 2012; Roberts et al., 2006).

Although 6MWT has been widely used in individuals with schizophrenia (Beebe et al., 2005; Gomes et al., 2014; Marzolini et al., 2009; Vittaca et al., 2013), to our knowledge only one study evaluated the reliability of the 6MWT in this population (Vancampfort et al., 2010). The authors found high values of retest reliability with Intraclass Correlation Coefficient (ICC) between the two 6MWT distances of 0.96 (CI 95% of 0.94–0.98). However, the generalization of this result is limited due to some methodological issues namely: i) focus only in inpatients; ii) focus only in one mental health center; and, iii) lack of information about the amount of the participants´ daily exercise (Vancampfort et al., 2010). Lastly, the association between the 6MWT and maximal exercise tests was not explored in individuals with schizophrenia, which limits the validity of the test.

Therefore, the goal of this study was to explore the test–retest reliability and validity of the 6MWT in outpatients with schizophrenia. In addition, we assessed predictors' parameters of the distance walked in the 6MWT.

METHODS

Participants

Over a five-month period, outpatients with a DSM-IV diagnosis of schizophrenia and stable on antipsychotic medication, (i.e., using the same dosage for at least four weeks prior to inclusion) were recruited from three different psychiatric rehabilitation units to participate in the study. Patients were excluded if they had co-morbid substance abuse and evidence of cardiovascular, neuromuscular and endocrine disorders. This study was carried out following the Declaration of Helsinki guidelines for human research. The Faculty Ethics Committee approved this study. All participants gave their informed consent.

Medication use

Antipsychotic medication was recorded for each patient and converted into a daily equivalent dosage of chlorpromazine according to Gardner et al. (2010).

Body and bone composition

Height and weight were measured before testing, with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (Holtain Ltd., Crymmych, UK) and recorded in centimeters to the nearest millimeter. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between

weight and squared height (kg.m-2). Waist circumference was measured at the level of the navel and hip circumference was measured at the largest circumference of the hips.

Bone mineral density, lean mass (Kg), fat mass (Kg), total percent body fat mass and fat mass (kg/m^2) were assessed trough dual-energy X-ray scan (Explorer QDR 4500, Hologic, Bedford, MA) with whole body protocol. Participants were placed in a supine position with their arms in extension near the trunk and lower limbs in extension, with a slight abduction of the feet. Participants removed clothes and all metallic objects (earrings, watches, etc.) and used on a gown.

6MWT

The 6-minute walk test (6MWT) was performed in an indoor corridor with a minimum of external stimuli. Two cones, 25 m apart, indicated the length of the walkway. Participants were instructed to walk back and forth around the cones during six minutes, without running or jogging. The protocol states that the testing should be interrupted in case threatening symptoms appear. Walks were timed with a stopwatch for six minutes and measured to the nearest foot. Standardized encouragements were provided at recommended intervals (American Thoracic Society, 2002). Heart Rate (HR) was registered with a Polar watch (Polar Electro Oy, Kempele, Finland), blood pressure was registered with Omron M6 (HEM-7001-E) and the participants were asked to rate perceived

exertion on the Borg Scale (Borg, 1982). For reproducibility, the 6MWT was repeated within three days interval (test-retest).

Estimation of VO_{2max}

Participants were invited to perform a treadmill test to estimate VO_{2max}. The incremental treadmill protocol (Balke & Ware, 1959) was modified. After measuring resting expired gases for 2 min, participants were gradually brought to the selected running speed for the first minute of the test, which was then maintained throughout the duration of the test. The first 4 min of the protocol were performed at 0% grade; thereafter, the treadmill grade was increased by 1%/2min until volitional fatigue. The primary goal of the test was to encourage the participants to give a maximal effort. The protocol has constant speed with changes in inclination during the test. Directly measured VO_{2max} was considered when a plateau in the VO_2 curve was detected. The VO_{2peak} was taken and defined as the highest oxygen uptake achieved during the test at exhaustion. The exhaustion was considered when: i) reaching 85% to 90% of age-predicted maximum heart rate (HR); ii) a plateau in VO_2 with an increase in workload (i.e.: stabilization, or an increase of less than 2.1 ml. kg-1.min-1 for consumption oxygen, with the load increment); iii) a respiratory exchange ratio equal to or greater than 1.10; iv) participants showed symptoms of discomfort and/or signs of high sweating, facial flushing, or if they requested to stop. No manual assistance was provided during any of the testing procedures. A similar test was performed by individuals with schizophrenia (Heggelund et al., 2011).

The measurements of pulmonary gas exchange and heart rate were measured by the computerized metabolic measurement system (Oxycon-Pro®) and the Polar watch (Polar Electro Oy, Kempele, Finland), respectively.

Statistical analysis

Descriptive statistics are presented as mean ± standard deviation (SD). Since betablocking agents could affect the HR response, participants (n=5) with this medication were excluded from the HR analyses. The ICC was calculated to objectively assess reliability between two 6MWT and its associated 95% CI to assess reliability. Paired t-test was performed to evaluate the statistically significant improvement in the mean 6MWT between two trials. Independent t test was calculated to evaluate differences between individuals who participated in the reliability test and individuals who participated in the validity test. Validity was evaluated by calculating Pearson's r correlation between the 6MWT and the VO_{2peak}. Forward stepwise linear regression was used to exam the characteristics (demographical, medication, bone and body composition) that might interfere in the validity coefficient of 6MWT (the correlation between 6MWT and VO_{2peak}). All statistical analyses were completed with SPSS 22.0 (SPSS Inc., Chicago, United States), with a significance level of 0.05.

RESULTS

Participants

A total of 51 outpatients with schizophrenia were enrolled in the study. All participants performed the test-retest for reliability analyses of 6MWT. Sex distribution of the final sample was 39 men (39.2 ± 6.9 years; BMI= 28.5 ± 4.4; waist circumference = 104.7 ± 7.7; hip circumference = 101.8 ± 13.1; hip to ratio = 0.97 ± 0.07) and 12 women (42.2 ± 7.3 years; BMI = 30.9 ± 5.7; waist circumference = 109.6 ± 22.6; hip circumference = 101.2 ± 15.1; hip to ratio = 0.95 ± 0.21).

All individuals were Portuguese natives and all were treated with antipsychotic medication at the moment of the assessments. Participants used the monotherapy antipsychotic medication (n = 33) and combination of antipsychotics medication (n = 18). Mean daily equivalent dosage of chlorpromazine was 478.9 ± 340.1 mg/day. 20 participants had obesity (WHO, 1995) and 36 were smokers. Table 1 summarizes the data regarding the characteristics of the participants of test-retest.

6MWT scores and reliability

All participants were able to walk for 6 minutes without stopping prematurely. The mean 6MWT score (N = 51) on the first test was 547.22 ± 70.87 m and on the retest was 556.25 ± 75.05 m. Analyses of reliability of the 6MWT showed an ICC = 0.94 (95% IC = 0.90-0.97). Walking distance assessed on the retest was 9.03 ± 4.18 m higher than test (p = 0.55).

Predictors' parameters

Table 1. Characteristics of study participants (n = 51)

Characteristics	Mean ± SD	Correlation with 6MWT*	*p*
Age (years)	39.9 ± 7.10	-.20	NS
Body and bone characteristics			
Weight (Kg)	82.89 ± 14.43	-.09	NS
Height	1.69 ± 0.75	.30	0.03
BMI (Kg/m^2)	29.06 ± 4.77	-.25	NS
Waist Circumference (cm)	105.88 ± 12.70	-.19	NS
Hip Circumference (cm)	101.68 ± 13.46	-.22	NS
Hip to ratio (cm)	0.96 ± 0.11	-.05	NS
BMD (g/cm^2)	1.09 ± 0.23	.12	NS
Lean mass (Kg)	27.93 ± 10.46	.24	NS
Fat mass (Kg)	50.69 ± 7.46	-.31	NS
Total fat (%)	33.64 ± 8.56	-.42	0.002
Fat mass (kg/m^2)	9.85 ± 3.81	-.35	0.010
Smoking (cigarettes/day)	13.75 ± 9.97	-.34	0.013
Systolic BP pre* (mm Hg)	129.95 ± 15.41	.08	NS
Systolic BP post* (mm Hg)	129.15 ± 17.61	.09	NS
Diastolic BP pre* (mm Hg)	91.32 ±11.87	.01	NS
Diastolic BP post* (mm Hg)	91.43 ± 13.00	.08	NS
HR pre* (beats/min)	92.91 ± 40.58	-.04	NS
HR post* (beats/min)	94.73 ± 53.93	.00	NS

Data are presented as mean ± standard deviation. *Mean of two 6MWT. BMI = body mass index; BMD = bone mineral density; 6MWT = six minute walk distance; PA = physical activity; NS = not significant.

Table 1 showed that height; total percent body fat mass and total fat mass were significantly associated with distance walked on the 6MWT. In the same way, smoking behavior was significantly associated to the 6MWT. Higher total minutes of PA per week was significantly associated with a higher 6MWT score.

Validity

The participants who accepted to perform the treadmill maximal test (n = 13) were men. There were no significant differences on age and anthropometrics measures (i.e.; BMI, BMD, lean mass, fat mass, hip and waist circumferences and rip to ratio) between this group and the group that performed test-retest reliability ($p > 0.05$). Descriptive statistics of the 6MWT of the patients enrolled in the treadmill maximal test are shown in table 2.

Table 2. Clinical characteristics of the participants, 6MWT and physiological variables measured during peak treadmill test (n = 13).

Characteristics	**Mean ± SD**
Age	37.92 ± 7.32
Body and bone characteristics	
Weight (Kg)	84.82 ± 9.81
Height (m)	1,70 ± 0.6
BMI (Kg/m^2)	29.22 ± 3.86
Waist Circumference (cm)	105.18 ± 5.56
Hip Circumference (cm)	103.58 ± 9.69
Hip to ratio (cm)	0.98 ± 0.6
BMD (g/cm^2)	1.09 ± 0.11
Lean mass (Kg)	26.53 ± 5.69
Fat mass(Kg)	53.80 ± 5.54
Total fat (%)	9.18 ± 2.26
Fat mass (kg/m^2)	31.80 ± 4.73
Treadmill test	
6MWT (m)	564.73 ± 70.27
HR (beats/min)	157.08 ± 14.85
VO_{2peak} (ml/kg/min)	28.97 ± 4.91
V_E (l/min)	91.77 ± 16.49
RER	1.09 ± 0.06

Data are presented as mean ± standard deviation. BMI = body mass index; BMD = bone mineral density; VO_{2peak} = peak oxygen uptake; HR = heart rate; V_E = total pulmonary ventilation; RER = respiratory exchange ratio.

A significant correlation was found between walking distance (6MWT) and VO_{2peak} was significant (r = .67; 95% CI = .19-.89 p = 0.01; n = 13). The forward stepwise linear regression showed that 6MWT and VO_{2peak} were related when the analyses was adjusted to height (R = .814; 95% CI = -76.51- -4.71; p = 0.03; n = 13).

DISCUSSION

This study was the first one to investigate the reliability and validity of the 6MWT in outpatients with schizophrenia. Preliminary findings demonstrated that the 6MWT is both reproducible and reliable, indicating that it can be used to quantify the functional exercise capacity in this population. We found adequate values of ICC (0.94) similarly to Vancampfort et al. (2010) and no significant differences were found in the 6MWT test-retest. The mean distance on the 6MWT of our sample was lower (test = 547.2; retest = 556.2) when compared to the outcome of the participants (test = 564.0; retest = 572.1) of Vancampfort et al. (2010).

On the basis of our results, we can conclude that the 6MWT is a valid tool to assess functional exercise capacity in outpatients with schizophrenia, as there was a significant correlation between 6MWT and VO_{2peak}. These results are in line with findings in populations with other diseases (i.e., Down Syndrome, Ischaemic Heart Disease and Traumatic Brain Injury) (Mossberg & Fortini, 2012; Roberts et al., 2006; Vis et al., 2009). In addition, the analyses adjusted for height, through linear regression analyses, showed an increase of correlation coefficient. Futures studies that aim to develop a prediction equation to estimate VO_{2peak} through of 6MWT in individuals with schizophrenia should considerate the height as an important variable.

In the second part of the study, associations of predictor's parameters with the 6MWY in this population were examined (n = 51). We found a negative association between total percent body fat mass and 6MWT. Chen et al. (2014) found a similar correlation in heart transplant recipients.

Smoking addiction was also associated to a worse functional exercise capacity which is in accordance with Vancampfort et al. (2010). Individuals with schizophrenia who smoke are known to exercise less, to have other unhealthy life habits and consequently are more likely to suffer a cardiovascular event (Bobes et al., 2010) .

CONCLUSIONS

The 6MWT shows acceptable validity and reliability for assessing functional exercise capacity in outpatients with schizophrenia. This clinical tool is well-suited to assess functional exercise capacity in clinical trials and psychiatric care.

However, this study has also some limitations. In our study, although the sample size has been pre-specified for reliability, the same analysis cannot be used for validity. The small sample size for validity analyses makes the development of a statistically sound multiple regression model difficult. In addition, the extrapyramidal side-effects were not assessed. More research is needed to understand the influence of antipsychotics on one's functional exercise capacity. Therefore, futures studies should develop comparative analyses between individuals with schizophrenia and a health control group. Further research should also investigate the 6MWT in different ranges of age and different anthropometric categories (weight, BMI, circumference) to develop an equation to predict the walked distance of the 6MWT in individuals with schizophrenia.

Competing interests

The author declares that there is no conflict of interest.

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Chapter 4

A contribution to designing effective and enjoyable physical activity programs for people with schizophrenia

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ABSTRACT

Background: Schizophrenia is one of the most debilitating diseases among psychiatric disorders. Additionally, this people present high mortality rates and sedentary lifestyles. Physical activity is an important factor for reducing morbidity and mortality among people with schizophrenia. However, develop motivational strategies to increase the participation of people with schizophrenia in physical activity are necessary. **Objective:** The goal of this pilot study was to determine which type of physical activity is the most enjoyable and effective for people with schizophrenia. **Methods:** Nine outpatients with schizophrenia/ schizoaffective disorder (men = 5 and women = 4; M = 37.0 yrs., SD= 7.10 yrs.). Different types of physical activity sessions (walking, dancing and small-sided games) were performed. Physical activity levels, heart rate and type of PA preferred were assessed. **Results:** The walking sessions were the most effective (72% of the estimated HRmax). Most of the participants (n=7) chose the small-sided games session as the most enjoyable. **Conclusion:** Physical activity programs specifically designed for people with schizophrenia should offer both small-sided games and walking. An increase of the sessions' duration (i.e., to over 60 minutes) can also be suggested in order to increase the time spent in vigorous physical activity.

Keywords: Schizophrenia, outpatients, physical activity, enjoyment

INTRODUCTION

People with schizophrenia present high mortality rates and sedentary lifestyles (Roick et al., 2007), as well as comorbidities such as Diabetes Mellitus, Hypertension, respiratory diseases and Obesity (Correll et al., 2006). Additionally, there is scientific evidence that the second-generation of antipsychotic drugs produce side effects, including increased body mass and hyperlipidemia (Ösby et al., 2000). These factors reflect a decrease in the quality of life of people with schizophrenia (Allison et al., 2003).

Physical activity (PA) is an important factor for reducing morbidity and mortality among people with schizophrenia (Allison et al., 2003; Beebe et al., 2005). It helps to control lipid profile (Marzolini et al., 2009) and reduce body mass (Beebe et al., 2005). Furthermore, some studies have stated that PA improves cognitive function (Pajonk et al., 2010), self-esteem (Vancampfort, De Hert, et al., 2011), as well as improving positive (e.g., hallucinations or delusions) and negative symptoms (e.g., apathy, lack of ability to engage in and keep up planned activities) of the disease (Bernard & Ninot, 2012). These factors have a positive impact on the overall quality of life of this population (Faulkner & Sparkes, 1999).

The literature highlights the importance of PA programs in people with schizophrenia (De Hert et al., 2011) and different methodological approaches have been developed in order to design the most suitable PA intervention plan (Faulkner & Biddle, 1999). Some authors have developed PA programs focused on walking exercises (Beebe et al.,

2005; McDevitt, 2005), yoga (Behere et al., 2011; Duraiswamy et al., 2007) and general aerobic exercises (i.e., dance, cycling, aerobic training, abdominal, seated arm ergometer, step-machine, and mini-trampoline) (Acil et al., 2008; Daumit et al., 2011; Dodd et al., 2011; Fogarty et al., 2004; Marzolini et al., 2009; Pelletier et al., 2005).

Any assessment of PA should ideally measure all of the four dimensions of PA (frequency, duration, intensity and type of activity) (Armstrong & Welsman, 2006). A detailed analysis of two dimensions (frequency and intensity) of PA programs designed for people with schizophrenia also shows different methodological decisions. The frequency of the programs ranged between 2-5 days per week (Acil et al., 2008; Duraiswamy et al., 2007; Pajonk et al., 2010) whereas the intensity of the exercises range between 60% - 80% of the heart rate reserve (Marzolini et al., 2009) and 65–75% of the maximum heart rate (Dodd et al., 2011). Due to this heterogeneous context it is difficult to identify an optimal PA dose or intervention strategy for people with schizophrenia (Vancampfort et al., 2009). The recommendation for the public in general is of 30 minutes a day of moderate-intensity aerobic (endurance) PA for five days/week or vigorous-intensity aerobic PA for at least 20 min for three days/week to improve health (American College of Sports Medicine, 2006).

Regarding attendance in PA programs studies have reported an average of 13% to 35% dropout (McDevitt, 2005; Menza et al., 2004; Poulin et al., 2007; Skrinar et al., 2005). Specifically, in the study of Archie et al.,(Archie et al., 2003) a dropout rate of 90% was reached after a 6-month period of free access to a public fitness facility. The lack of PA programs and facilities, the lack of

ongoing support and transportation, the costs of the programs and the perceived negative outcomes of the general population participants are some of the barriers to the practice of PA that has been pointed out in literature (Wilcox et al., 2006). For people with mental illness in particular, the lack of intrinsic motivation and enjoyment seems to be related to the high dropout rates in PA program (Centorrino et al., 2006; Choi & Medalia, 2010; Hodgson et al., 2011). The side effects of the medication, the mental illness itself, the social stigma together with the lack of motivational leadership by mental service professionals are some of the barriers that justify the lack of motivation in PA programs (McDevitt et al., 2006; Mitchell et al., 2009).

Faulkner and Biddle (1999) stated that the lack of adherence to PA programs occurs in any population and that effective strategies to increase the participation of people with schizophrenia in PA are necessary. For example, the professional support throughout the programs and the implementation of motivational strategies can help trouble-shoot the adherence to the PA program (Archie et al., 2003; Beebe & Smith, 2010; Bernard & Ninot, 2012).

Thus, the first step when designing intervention programs it to determine whether PA interventions are feasible in terms of their acceptability (Beebe & Smith, 2010). Similarly, Vancampfort et al.,(2009) stated that further studies should assess what types of exercises or techniques would best fit with the patient's preference and which are the most enjoyable for the patients. Therefore, the goal of this pilot study was

to determine which type of PA (i.e., walking, dancing and small-sided games) is more enjoyable and effective (i.e., minimal target heart rate and PA levels) for people with schizophrenia.

MATERIALS AND METHODS

Participants

Individuals with diagnosis of chronic schizophrenia/ schizoaffective disorder (DSM-IV) were recruited from a rehabilitation unit within a psychiatric community service. All participants were selected according to the following inclusion criteria: i) to be 18 years old or above; ii) outpatients; iii) to have had a antipsychotic treatment in the previous 2 years; iv) to have a medical certificate stating that the participant could safely take part in PA, and that they had no other known medical conditions (i.e., proliferative diabetic retinopathy, musculo-skeletal, severe chronic obstructive pulmonary disease, and peripheral vascular disease) that could likely put them at risk. An informed consent was signed by all the participants. This study was carried out following the Declaration of Helsinki guidelines for human research. The Faculty Ethics Committee (CEFADE 24.2013) approved this study.

Experimental protocol

The participants were exposed to three types of PA sessions, namely: i) walking, ii) dancing and, iii) small-sided games. The PA sessions took place in the sports facilities of a Sport Faculty for one week. The sessions occurred with

one day interval and the duration of each session was of approximately 60 minutes.

Regarding the type of exercises suggested the walking session consisted in: stretching, walking and breathing exercises. The dance session consisted of: stretching exercises, choreographed dance, free dance, and breathing exercises. Finally, the small-sided games session consisted of: stretching exercises, small-sided games (2_v2, 3_v3, 4_v4) of handball and soccer as well as basic skills (shooting, passing, dribbling), abdominal exercises, jogging and, breathing exercises.

Measurements

Anthropometric measurements

Height and weight were measured before testing, with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (Holtain Ltd., Crymmych, UK) and recorded in centimeters to the nearest millimeter. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between weight and squared height (kg.m-2). Waist circumference was measured at the level of the umbilicus and hip circumference was measured at the largest circumference of the hips.

Physical activity levels

Participants wore the Actigraph GTX3 accelerometer (Manufacturing Technology, Fort Walton Beach, FL) to measure PA

levels during the three PA sessions. All participants agreed to wear the device over their right hip by using an adjustable nylon belt. Verbal instructions for caring for and placing the monitor were given to participants.

The mentioned device has been proved to be valid for quantifying activity levels in laboratory and field settings (Harris et al., 2009; Trost et al., 2005). Accelerometer data was recorded in 5-seconds sampling periods (epochs). The standard software ActiLife version 6.0 (Actigraph, Florida) was used to reduce the raw activity data from the accelerometers into daily PA. Wear time validation was carried out according to definitions from Troiano et al.,(2008) and time period records of at least 60 consecutive minutes of zero counts were excluded from analysis and regarded as non-wear. To determine the time spent of PA different intensities, the following counts intervals (counts/min) were considered: 0-99 for sedentary physical activity (SEDPA), 100-2019 for light physical activity (LIGPA), 2020-5998 for moderate physical activity (MODPA) and ≥ 5999 for vigorous physical activity (VIGPA).

Heart rate

To assess the heart rate response during the PA sessions, the participants used heart rate monitors (Polar TEAM Pro, Polar Electro Inc., Port Washington, NY). The intensity of the sessions was described as a percentage of the estimated maximal heart rate, calculated as 220-age(Fox et al., 1971).

Logbook

The training logbook was used by the researchers to record any behavioral problems observed (e.g., refusing to participate in the activities, showing agitation during the session), as well as the comments of the patients throughout the sessions.

Type of PA preferred by the participants

At the end of the three sessions the participants were asked which one they had enjoyed the most. The question was: “From the three physical activity sessions that you performed, which one did you enjoy the most?”

Medication use

Current antipsychotic medication use was recorded for each patient and converted into a daily equivalent dosage of chlorpromazine (Gardner et al., 2010).

Statistical analysis

Descriptive statistics are presented as Mean (M) ± standard deviation (SD). Differences between the sessions (i.e., walking, dancing and small-sided games) were assessed using the Kruskal-Wallis Test. All analyses were computed with SPSS (Version 20.0) with the significance level set at 0.05.

RESULTS

Characteristics of the participants

Nine outpatients (men = 5 and women = 4; M = 37.0 yrs., SD= 7.10 yrs.) participates of this study. Seven participants used typical antipsychotics and two participants used atypical antipsychotics. These participants also used antianxiety (n = 7), antidepressants (n = 8) and antiepileptic medication (n = 2). Mean daily equivalent dosage of chlorpromazine was 606.3 ± 388.5 mg/day. The participants' characteristics are presented in Table 1.

Table1. Weight, BMI and waist and hip circumference of the participants (n=9)

Caracteristics	**Mean ± SD**	**Range**
Weight (Kg)	77.18 ± 12.49	65.00 – 99.30
Male	76.68 ± 8.26	65.00 – 92.20
Female	77.82 ± 16.27	65.00 – 99.30
BMI (Kg/m^2)	27. 49 ± 5.05	21.00 – 37.00
Male	25.91 ± 3.91	21.00 – 30.00
Female	29.48 ± 6.18	22.00 – 37.00
Waist circumference (cm)	96.41 ±13.80	72.00 – 117.00
Male	93.80 ± 15.10	72.00 – 106.00
Female	99.87 ± 13.35	87.00 – 117.00
Hip circumference (cm)	105.91 ± 11.50	95.00 – 131.00
Male	101.00 ± 5.24	95.00 – 107.00
Female	112.05 ± 15.03	98.00 - 131.00

BMI = body mass index

PA Levels

The average PA levels of the participants are presented in Table 2. Across the three sessions of PA, the average of minutes of moderate to vigorous physical activity (MVPA) was significantly different between the dancing and walking sessions ($p < 0.001$) and between small-sided games and the walking session ($p < 0.001$). No difference was found between the average of MVPA for dancing and the small-sided games session ($p = 0.104$).

Table 2. Means (M), standard deviations (SD), Kruskal-Wallis values and *p* values regarding the level of physical activity of the participants during the sessions

	Dancing (1)	**Walking (2)**	**Small-sided games (3)**	
	M ± SD	**M ± SD**	**M ± SD**	**Kruskal-Wallis**
Sed. (min/session)	1.00±1.22	0,78±1.09	8.89±3.72	x^2KW(2) = 13.212; $p < 0.001$ 1<3; 2 < 3
Light (min/session)	39.55±14.52	1.88±1.05	26.55±6.97	x^2KW(2) = 19.490; $p = 0.001$ 1 > 2; 2 < 3; 1>3
Mod. (min/session)	13.11±10.53	37.11±15.49	16.89±3.65	x^2KW(2) = 11.171 ; $p < 0.001$ 1 < 2; 2 > 3
Vig. (min/session)	2.33±4.63	17.00±15.38	5.66±4.74	x^2KW(2) = 8.708 ; $p = 0.004$ 1 < 2; 2 > 3
MVPA (min/session)	15.44±14.57	54.11±1.45	22.55±4.95	x^2KW(2) = 18.627; $p < 0.001$ 1 < 2; 2 > 3

Sed.= sedentary, Mod.=moderate, Vig.=vigorous, MVPA= moderate to vigorous physical activity

Heart rate

The average of the heart rate response of the participants during the three types of sessions ranged from 50% to 80% of their estimated maximum heart rate (HRmax). The average HR responses of the participants recorded in dancing sessions was approximately of 60% of the estimated HRmax (60 ± 6,30%), 72% of the estimated HRmax in the walking session (72 ± 6,67%) and 65% of the estimated HRmax in the small-sided games session (65 ± 8,45%).

Session preferred by the participants

After the three PA sessions, the participants were invited to choose which session had been the most enjoyable. Seven participants chose the small-sided games session and two participants chose the dancing session. None of the participant chose the walking session as being their favorite.

DISCUSSION

The lack of scientific consensus about the optimal PA dose or intervention strategies for people with schizophrenia (Archie et al., 2003; Vancampfort et al., 2009) makes it necessary to carry out research in this field. Therefore, the goal of this pilot study was to determine which type of PA (i.e., walking, dancing and small-sided games) is the most enjoyable and effective (i.e., minimal target heart rate and PA levels) for people with schizophrenia.

For adults, it is recommended to perform PA in 55%/65%-90% of HRmax to promote health benefits of enhancing muscular fitness (i.e., the functional parameters of muscle strength, endurance, and power) (American College of

Sports Medicine, 2006; U.S. Department of Health and Human Services, 2008). Thus, the average of heart rate responses recorded in the three sessions was in accordance with the recommendations. The average of estimated HRmax in the walking session was higher than that of dancing and small-sided games sessions.

Regarding the PA levels for adults, moderate-intensity aerobic activity for a minimum of 30 minutes per day (at least 5 days per week) or vigorous-intensity of aerobic activity for a minimum of 20 minutes per day (at least 3 days per week) is recommended to improve and maintain health (Haskell et al., 2007). In this study, more than 30 minutes sessions of MVPA were achieved only in the walking session. Possibly, these differences occur because the walking exercises were performed continuously. In this context, it is important to emphasize that several studies have successfully developed PA programs with more than 60 minutes of the exercises per sessions (Marzolini et al., 2009; Pelletier et al., 2005). Consequently, further studies implementing small-sided games and dancing exercises should increase the duration of the PA sessions in order to increase the participants' opportunities to achieve more MVPA during the sessions.

The analysis of the enjoyment in the PA sessions showed that most of the participants (n = 7) considered the small-sided games session the most enjoyable. The participants reported that these activities were a good opportunity to learn new movements in a dynamic way. Moreover, the participants highlighted the importance of being engaged in a team sport to have the opportunity to play with their friends. Acknowledging that patients with

schizophrenia commonly experience difficulties in volition, mutual communication and everyday social interactions(Waters et al., 2011), this type of activity can help develop social skills needed in situations on the daily living.

None of the participants choose the walking session as their favorite. The participants reported that walking was a monotonous activity (i.e., to perform the same exercise for a long time) which they can easily do by themselves (e.g., during the summer) without supervision. Finally, the dancing session was considered a fun and innovative activity. For most of the participants (n = 6) it was the first time they had experienced this specific activity. However, participants also mentioned that the basic steps were too complex for them. Bonsaksen et al.,(2011) argued the importance of implementing a diversity of activities according to personal preferences to achieve a higher level of participation among individuals with severe mental illness. Moreover, different studies analyzing the relationship between adherence and enjoyment in PA program with general population found a significant correlation between sport identity and commitment, enjoyment and time spent in PA (Curry & Weaner, 1987), and motivation and regular participation in PA (Kilpatrick et al., 2002).

Overall, the present study shows that the small-sided games were enjoyable although the walking was the most effective. Therefore, we can suggest that PA programs specifically designed for people with schizophrenia should offer activities based on team sport and small-sided games mixed with walking. An increase of the sessions' duration can also be suggested (i.e., over 60 minutes) to increase the time spent in vigorous PA. These findings may help researchers and practitioners to design successful PA intervention programs

that may contribute towards reducing the risk of health problems common among people with schizophrenia.

PERSPECTIVE

Taking into consideration that people with schizophrenia reveal lack of motivation to engage in PA programs (Vancampfort, Probst, et al., 2011), it is crucial to understand which type of physical activity will increase the enjoyment in this specific group. It is believed that the findings of the present study can have a positive impact in the adherence of people with schizophrenia to PA programs. According to our data, it is possible to suggest that further research should propose PA programs based on small-sided games mixed with walking exercises and increase the duration of the sessions in order to offer an enjoyable and effective practice. Consequently, these findings will help researchers and practitioners to design successful PA intervention programs that may contribute to reduce risk of health problems common in people with schizophrenia.

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Conflict of interest

The author declares that there is no conflict of interest.

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Effects of a group physical activity program on physical fitness and quality of life in individuals with schizophrenia

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ABSTRACT

Purpose: The purpose of this study was to evaluate the effects of a 16-week group physical activity (PA) program on physical fitness and quality of life in outpatients with schizophrenia.
Methods: Nineteen outpatients with schizophrenia were divided into experimental (EG) ($n = 8$; mean age 39 ± 7 years) and control (CG) ($n = 11$; mean age 40 ± 6 years) groups. The EG underwent twice a week sessions of a group PA program for a period of 16-week. The participants completed a battery of tests at baseline and after 16-week, which included the assessment of body composition (dual-energy X-ray absorptiometry), functional exercise capacity (6MWT), physical activity levels (accelerometers), quality of life (WHOQOL-Brief), and anthropometric measures. During the program different strategies were implemented to ensure the participants' adherence.
Results: The attendance to the program was 79.7%. In the EG a significant decrease was observed in hip circumference ($p = 0.02$); a significant increase occurred in moderate to vigorous physical activity ($p = 0.05$) and in the environment domain (WHOQOL-Brief) ($p = 0.02$). The improvement in environment domain scores was also associated with a decrease in sedentary behavior ($r = -0.82$, $p = 0.01$) in the EG.
Conclusions: The strategies used during the program promoted a high rate of attendance. PA may have a positive impact on the participants' ability to perform activities of daily living. This study showed that a group PA program can be successfully implemented for outpatients with schizophrenia and can influence their quality of life and PA levels.

1. Introduction

People with schizophrenia experience greater health problems than the general population (Hennekens, Hennekens, Hollar, & Casey, 2005; Roick et al., 2007). This condition is associated with a sedentary lifestyle, with a poor diet intake, and with the use of alcoholic beverages and smoking addiction which is on average, 3 to 4 times higher when compared to the general population (Faulkner & Biddle, 1999; Janney et al., 2013; Strassnig, Brar, & Ganguli, 2005; Van Os & Kapur, 2009). Furthermore, the majority of this population uses antipsychotic drugs that may produce weight gain (Gothelf et al., 2002; Henderson et al., 2006). Individuals with schizophrenia have an increased risk of developing hypertension, coronary heart disease, type 2 diabetes and osteoporosis (von Hausswolff-Juhlin, Bjartveit, Lindström, & Jones, 2009; Howard, Kirkwood, & Leese, 2007; Renn et al., 2009).

Therefore, individuals with schizophrenia are more likely to experience an impaired quality of life (Allison, Mackell, & McDonnell, 2003; Faulkner, Cohn, Remington, & Irving, 2007; Sugawara et al., 2013) and a reduced average life expectancy (Allebeck, 1989; Brown, 1997; Ösby, Correia, Brandt, Ekbom, & Sparén, 2000). Worldwide, schizophrenia is ranked as the fifth cause of disability-adjusted life years (DALYs) for people between the ages of 15 and 44 (WHO, 2008).

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In the last decade, a body of research has been examining the effects of physical activity (PA) for people with schizophrenia (Bradshaw, Lovell, Bee, & Campbell, 2010; Fogarty & Happell, 2005; Knöchel et al., 2012). The regular practice of PA promotes benefits, such as the reduction of weight, body mass index (BMI), waist circumference, cholesterol, triglycerides, negative symptoms, as well as increasing mental health, cognitive functioning, physical and social functioning (Acil, Dogan, & Dogan, 2008; Attux et al., 2011; Duraiswamy, Thirthalli, Nagendra, & Gangadhar, 2007; Methapatara & Srisurapanont, 2011; Pelletier, Nguyen, Bradley, Johnsen, & McKay, 2005; Poulin et al., 2007; Prouteau et al., 2005; Van Citters et al., 2010).

In order to promote an active lifestyle for individuals with schizophrenia, different PA programs have been developed. Attux et al. (2011), Bradshaw et al. (2010), Goldberg et al. (2013), Methapatara and Srisurapanont (2011) and Poulin et al. (2007) promoted counseling programs focusing on nutrition, healthy lifestyle and PA. Besides this, other authors promoted intervention programs, mainly based on walking and gym activities (e.g., stationary bicycle, indoor rowing, treadmill, and resistance exercises) (Beebe et al., 2005; Chen et al., 2009; Daumit et al., 2011; Dodd, Duffy, Stewart, Impey, & Taylor, 2011; Marzolini, Jensen, & Melville, 2009; McDevitt, 2005; Vittaca, Paneroni, Comini, & Bianchi, 2013).

Despite the growing research, several important issues about PA for individuals with schizophrenia need further enlightenment. One important issue is the lack of agreement on which kind of PA recommendations and interventions are suitable for this population (Gorczynski & Faulkner, 2010; Vancampfort, Knapen, et al., 2010). Similarly, Dubbert, White, Grothe, O'Jile, and Kirchner (2006) and Lindamer et al. (2008) argued that an accurate measurement of PA is fundamental to achieve the effectiveness of the programs.

Another important issue is the lack of research regarding the importance of PA programs in the quality of life for individuals with schizophrenia. Although it is widely recognized that PA contributes to a healthy lifestyle and better quality of life (Chaoyang, Ford, Mokdad, Jiles, & Giles, 2007; Fleury et al., 2013; Vancampfort, Probst, Scheewe, et al., 2011) there are a lack few studies have focused on the impact of PA programs in the quality of life of individuals with schizophrenia (Chen et al., 2009; Daumit et al., 2011; Vittaca et al., 2013).

Specifically regarding mental illness, the motivation and adherence strategies used in PA programs are another important issue to ensure the effectiveness of programs. Such strategies are quite valuable since they can influence the satisfaction of the individuals in the programs (Vancampfort, Probst, Sweers, et al., 2011), and consequently, their levels of attendance.

In this context, the purpose of this study was to evaluate the effects of a 16-week group PA program on physical fitness and quality of life of outpatients with schizophrenia. Specifically, the focus was on the anthropometric characteristics, the body composition, the functional exercise capacity, the PA levels, and the quality of life of the participants. In this study outpatients with schizophrenia enrolled in a 16-week program were compared to patients with the same diagnosis with no adjuvant program.

2. Methods

2.1. Participants

Nineteen outpatients with a psychiatric diagnosis of schizophrenia (DSM-IV) were recruited from two different psychiatric rehabilitation units to participate in the PA program. The group of participants who accepted the invitation participated in the EG and those who refused to participate in the PA program participated in the CG. The diagnosis had been made by well experienced (>10 years clinical experience with these groups) psychiatrists. Apart from this condition, one or more cardiovascular risk factors had to be present (Grundy, Pasternak, Greenland, Smith, & Fuster, 1999), namely physical inactivity (not engaged in regular [>3 days/week] PA in the 16 weeks prior to the beginning of this study), smoking addictions (smoking regularly [>10 cigarettes/week] for more than 15 years) and family history of cardiovascular disease (if first-degree relatives have had strokes or if both parents have suffered from heart disease before the age of 55). Exclusion criteria included uncontrolled hypertension (defined as a systolic blood pressure >160 mmHg or diastolic blood pressure >110 mmHg); severe chronic obstructive pulmonary disease; peripheral vascular disease; and musculo-skeletal limitations that would have been aggravated by regular PA (Marzolini et al., 2009).

This study was carried out following the Declaration of Helsinki guidelines for human research. The Faculty Ethics Committee (CEFADE 24.2013) approved this study. After a detailed explanation of the study's goals, benefits and risks all the participants gave written informed consent.

2.2. Study design

This study was a quasi-experimental design.

2.3. Produces

The PA program was implemented for 16 weeks at the facilities of a Faculty of Sport. The sessions took place at either indoor or outdoor facilities according to weather conditions or organization needs (i.e., the places were used according to the sports equipment needed for each specific activity and also according to the availability of the Faculty). The participants used public transportation to get to the sports facilities without receiving any financial support to commute. The program occurred twice a week and each session was 55–60 min in duration. The participants were also encouraged to perform a third unsupervised session with similar activities. Regarding the intensity of the activities, the initial prescription was, on average, 65%–75% of heart rate reserve measured by a portable heart rate monitor (Polar TEAM^2 Pro – Polar®) worn by the participants throughout the sessions. The prescription progressed after 8 weeks, on average, to 75%–85% of heart rate reserve and remained at this intensity until the end of the program. To obtain subjective information about the perceived exertion of the participants, the VAS Scale was used at the end of each session according to the scale low – high (Question: How was the intensity of the session for you?).

The program comprised a small group approach mixing different types of PA at aerobic level. The activities were based on small-sided games (2_v2, 3_v3, 4_v4) of volleyball, handball, basketball, soccer and walking/jogging. Basic sports competencies/skills such as shooting, passing, and dribbling were also the focus of the program.

During the program the research team implemented different strategies to ensure the participants' adherence. Therefore, the following recommendations from literature (Beebe & Harris, 2013; Beebe & Smith, 2010; Bernard & Ninot, 2012; Dodd et al., 2011; Tetlie, Heimsnes, & Almvik, 2009; Vancampfort et al., 2009; Warren et al., 2011) were applied: i) to organize the exercises with small groups of participants ($n = 2$–4); ii) to provide adequate trained support (i.e., supervised by a qualified adapted physical education teacher with 5 years of experience in the field); iii) to continuously encourage and give positive feedback throughout the sessions; iv) to make telephone calls to participants who missed PA

sessions, and v) to establish a trusting relationship between participants and the research team through discussions focused on PA and health lifestyles, or sharing personal experiences. Individuals of the control group continued with no adjuvant program.

2.4. Outcome measures

The participants were tested at baseline (Time 1) and at the end of the program (Time 2). The following variables were assessed at both times: anthropometric characteristics (i.e., height, weight, body mass index, waist circumference, hip circumference and waist to hip ratio), body composition, functional exercise capacity, PA levels, and quality of life. The PA levels were also assessed at mid-term (i.e., 8 weeks of program) in a random group of participants (EG = 5; CG = 7).

2.4.1. Adherence

A training logbook was used by the research team to record participants' attendance at each PA session. The logbook was also used to register any behavioral problems that might have occurred (e.g., refusing to participate in the activities, to show agitation during the session or tests), as well as the comments of the patients during the PA sessions. Participants were to be excluded if they missed more than 50% of the PA sessions.

2.4.2. Anthropometrics characteristics and body composition

Height and weight were measured before testing, with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (Holtain Ltd., Crymmych, UK) and recorded in centimeters to the nearest millimeter. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between weight and squared height ($kg\ m^{-2}$).

Bone mineral density, total lean mass and fat free mass were assessed through dual-energy X-ray scan (Explorer QDR 4500, Hologic, Bedford, MA) with whole body protocol. Participants were placed in a supine position with their arms in extension near the trunk and lower limbs in extension, with a slight abduction of the feet. Participants removed clothes and all metallic objects (earrings, watches, etc.) and wore a gown.

Waist circumference was measured at the level of the navel and hip circumference was measured at the largest circumference of the hips.

2.4.3. Functional exercise capacity

To evaluate the functional exercise capacity the 6-minute walk test (6MWT) was used. This test assimilates responses of the pulmonary and cardiovascular systems. The changes of functional exercise capacity are measured according to the number of meters walked (American Thoracic Society, 2002). Participants were asked to walk in an indoor corridor at their own preferred pace for 6 min. Walks were timed with a stopwatch for 6 min and measured to the nearest foot.

Analyses of reproducibility of the 6MWT for individuals with schizophrenia showed that the intraclass correlation coefficient was 0.96 with a 95% confidence interval of 0.94–0.98 (Vancampfort, Probst, et al., 2010). This test has been used in research when examining the effects of PA programs on individuals with schizophrenia (Beebe et al., 2005; Marzolini et al., 2009; Vittaca et al., 2013).

2.4.4. Objectively measured physical activity

The GTX3 triaxial accelerometer (Actigraph, Florida) was used to objectively measure daily PA. Participants were instructed to wear an accelerometer for 7 consecutive days, placed on the right hip using an adjustable belt. Exceptions included time spent sleeping and showering. Participants were instructed to maintain their usual routine of activities.

This instrument has been proved to be valid for quantifying activity levels in laboratory and field settings (Harris et al., 2009; Nichols, Morgan, Chabot, Sallis, & Calfas, 2000; Trost, McIver, & Pate, 2005). Accelerometer data was recorded in 5-s sampling periods (epochs) and then aggregated in 60-s epochs for analysis. The standard software ActiLife version 6.9 (Actigraph, Florida) was used to reduce the raw activity data from the accelerometers into daily PA. Time periods with at least 10 consecutive minutes of zero counts recorded were excluded from analysis assuming that the monitor was not worn. A minimum recording of 8-h/day was the criteria to accept daily PA data as valid. Individual's data were only accepted for analysis if at least five days were successfully assessed. The main outcomes of reduced data were: total physical activity [total PA (counts/min/day)], time in sedentary physical activity [SEDPA (min/day)], light physical activity [LIGPA (min/day)], moderate physical activity [MODPA (min/day)], vigorous physical activity [VIGPA (min/day)] and moderate to vigorous physical activity [MVPA (min/day)]. To determine the time spent in PA of different intensities, the following counts intervals (counts/min) were considered: 0–99 for SEDPA, 100–2019 for LIGPA, 2020–5998 for MODPA and ≥5999 for VIGPA (Troiano et al., 2008).

The variability and reliability of the accelerometers used in our study were initially determined in accordance with previous guidelines from literature (Powell, Jones, & Rowlands, 2003; Prince et al., 2008). Five accelerometers were tested and all were identified as having acceptable coefficients of variation. The intra-accelerometer variability tested at 4 km/h for all five accelerometers used in the study was 1.93%. The intra-accelerometer variability for vector magnitude showed that all accelerometers were sensitive enough to measure the different types of activities tested (walking on a treadmill at 2, 4, and 6 km/h; sitting still; and transport in a subway) (Soundy, Roskell, Stubbs, & Vancampfort, 2014; Soundy, Taylor, Faulkner, & Rowlands, 2007).

2.4.5. Quality of life

Quality of life was assessed using the Portuguese version of the WHOQOL-Bref (Vaz-Serra et al., 2006). This instrument is a 26-item questionnaire composed of four domains: i) physical (e.g., energy and fatigue; mobility; pain and discomfort); ii) psychological (e.g., positive and negative feelings; thinking, learning, memory and concentration); iii) social (e.g., personal relationships; social support); and iv) environment (e.g., freedom, physical safety and security; health and social care; leisure activities; transport) and two questions related to the person's general perception of his/her quality of life and health.

The Portuguese version of WHOQOL-Bref was considered a valid and reliable instrument, with a range of moderate to high values of retest reliability ($r > 0.65$) and a Cronbach's alpha internal consistency of $\alpha = 0.92$ (Vaz-Serra et al., 2006).

2.4.6. Medication use

Current antipsychotic medication use was recorded for each participant at baseline and after the 16 weeks of intervention and converted into a daily equivalent dosage of olanzapine according to Gardner, Murphy, O'Donnell, Centorrino, and Baldessarini (2010).

2.5. Statistical analysis

Differences between groups at baseline were assessed using the independent-samples Student's T tests for continuous variables and Fisher's exact test for categorical variables. The Student's T test

for paired samples and Wilcoxon Test were used to determine changes within the groups from baseline to post program. Correlations were analyzed using Pearson's correlation coefficient. In addition, the effect size was reported using Cohen's *d* (d). A repeated-measures ANOVA, with Bonferroni adjustment, was used to compare the changes in the outcomes between treatments over time (treatment × time) as appropriate. All analyses were computed with SPSS (Version 20.0) with the significance level set at 0.05.

3. Results

3.1. Characteristics of the participants

At the beginning of this study, 25 potential participants (EG = 12; CG = 13) were recruited. During the program, six participants were excluded due to, hospitalization (EG = 2; CG = 1), starting work (EG = 2) or refusing re-tests after 16 weeks (CG = 1). At the end of the study, 19 participants (sixteen males and three females) completed the program (EG = 8; CG = 11). With the exception of light physical activity in the EG ($p = 0.002$), no significant differences in the baseline characteristics between groups were found.

Concerning the educational level of the sample, all participants had completed high school (CG = 8; EG = 5) or middle school (CG = 3; EG = 3). Most of the participants (CG = 8; EG = 4) were current tobacco smokers.

The dosages of antipsychotic medication were analyzed at baseline and after the 16 weeks of intervention. During the program, only 2 participants (CG) modified their dosage of antipsychotic medication. Based on the clinical dosing equivalencies for olanzapine (Gardner et al., 2010), there were no significant differences regarding dosage of medication between groups at baseline ($p = 0.51$) and after the 16 weeks ($p = 0.51$).

3.2. Adherence and subjective experiences

The percentage of attendance to the program was 79.7% (range 53–100%) of all sessions. Content analysis of the logbook (Patton, 2002) showed that all the participants of the EG reported positive feedback regarding the motivational and adherence strategies (i.e., small groups intervention; encouragement; frequent telephone calls) applied by the research team. The participants stated that the last mentioned strategies increased their self-confidence to perform PA and promoted empathy and a trust relationship between participants and the research team. Furthermore, participants reported enjoyment and satisfaction with the activities. One of the reasons pointed out was the fact that the mixed PA reminded them of positive experiences from their childhood and adolescence. Finally, the participants valued the sports facilities used during the program, considering them to be a pleasant and suitable environment to perform PA.

3.3. Anthropometric characteristics and bone composition

There were no significant differences in the anthropometric measures between baseline and the end of the program except a decrease in hip circumference ($p = 0.02$) in the EG. In the CG a significant increase in lean mass ($p = 0.03$) and decrease in waist circumference ($p = 0.04$) was observed (Table 1).

An individual analysis of the data revealed that 37.5% of EG had reduced their BMI; 25% of participants improved their BMD; 50% of participants improved lean mass; 75% of participants reduced waist circumference; and 62.5% of participants reduced waist to hip ratio.

3.4. Functional exercise capacity

There were no significant differences from baseline to 16 weeks in the walking distance performed by EG ($p = 0.18$) and CG

Table 1
Anthropometric characteristics, body composition, functional exercise capacity, and PA levels at Time 1 (baseline) and Time 2 (16 weeks) between individuals with schizophrenia in an experimental and control condition.

	Experimental group N = 08		Effect size	Control group N = 11		*P*
	Time 1	Time 2		Time 1	Time 2	
Age (yrs)	39 ± 7			40 ± 6		–
Anthropometric characteristics						
Weight (Kg)	83.6 ± 10.9	83.3 ± 12.4	0.02	78.9 ± 11.5	79.8 ± 12.6	0.401
BMI (m/Kg2)	29.0 ± 3.4	29.0 ± 4.2	0.01	27.5 ± 3.3	27.8 ± 3.6	0.519
Waist circumference (cm)	103.2 ± 9.4	102.1 ± 9.4	0.02	98.3 ± 12.1	95.4 ± 13.6*	0.359
Hip circumference (cm)	106.6 ± 6.9	104.8 ± 6.8*	0.26	102.5 ± 7,0	100.3 ± 7.6	0.800
Waist to hip ratio	0.96 ± 0.1	0.97 ± 0.1	0.01	0.95 ± 0.06	0.94 ± 0.1	0.420
Bone density						
BMD (g/cm^2)	1.12 ± 0.11	1.11 ± 0.12	0.08	1.13 ± 0.09	1.14 ± 0.10	0.668
Total fat (%)	31.90 ± 8.01	31.41 ± 7.82	0.06	30.73 ± 7.53	30.17 ± 6.94	0.917
Fat mass (kg/m^2)	9.56 ± 1.94	9.36 ± 2.01	0.10	8.36 ± 2.72	8.32 ± 2.64	0.625
Fat Mass (kg)	26.52 ± 7.55	25.97 ± 7.59	0.07	23.92 ± 7.28	25.09 ± 7.00	0.388
Lean Mass (kg)	53.18 ± 6.74	53.35 ± 7.83	0.02	50.81 ± 7.76	51.74 ± 8.04*	0.287
Exercise capacity						
6MWT (m)	581.8 ± 80.8	615.1 ± 112.7	0.33	527.0 ± 57.8	549.9 ± 62.2	0.691
PA levels[a]						
Sedentary (min/day)	455.1 ± 112.9	450.5 ± 92.5	0.04	451.8 ± 108.1	453.2 ± 113.5	0.858
Light (min/day)	284.8 ± 58.7	260.5 ± 63.3	0.40	191.0 ± 44.8	181.1 ± 42.8	0.519
Moderate (min/day)	53.5 ± 24.0	59.2 ± 20.6	0.25	36.8 ± 23.0	35.0 ± 26.1	0.063
Vigorous (min/day)	0.6 ± 0.8	1.8 ± 2.0	0.79	0.5 ± 0.8	0.5 ± 0,7	0.162
MVPA (min/day)	54.1 ± 24.1	61.1 ± 20.1	0.31	37.7 ± 23.7	35.6 ± 26.1	0.048**

Data are presented as mean ± standard deviation. BMI = body mass index; BMD = bone mineral density; 6MWT = 6-minute walk test.
P for treatment × time interaction with repeated-measures ANOVA.
*Significant intragroup difference $p \leq 0.05$.
**Significant difference in the pairwise comparison time 2 with Bonferroni adjustment $p \leq 0.05$.
[a] $n = 9$ for the CG.

($p = 0.21$) (Table 1). An individual analysis based on Vancampfort, Probst, et al. (2010) criterion showed that 75% of the participants of the EG improved their walked distance by a minimum of 50.2 m for women and 56.2 m for men. This criterion is considered to be the minimal distance necessary to promote functional exercise capacity improvement (Vancampfort, Probst, et al., 2010).

3.5. Physical activity levels

MVPA increased in the EG (7.0 ± 4.0 min/day) and remained unchanged in the CG (−2.1 ± 2.4 min/day) (treatment × time interaction: $n_p^2 = 0.24$). This improvement in MVPA was confirmed by the significant mean difference between groups at time 2 assessment ($p = 0.04$) (Table 1). The PA levels assessed at mid-term of the program showed a significant higher level of MVPA of the EG (47.6 ± 9.9 min/day) when compared to the CG (26.8 ± 18.7 min/day) ($p = 0.05$). An individual analysis of the data showed that 62.5% of the participants of the EG had decreased sedentary time since baseline.

3.6. Quality of life

There was a significant improvement from baseline to 16 weeks in the environment domain for the EG ($p = 0.02$), effect size of 0.53, with no significant improvement for the CG ($p = 0.9$). A significant treatment × time interaction was observed in the physical domain ($n_p^2 = 0.22$) (Table 2), but no difference was found between groups at time 2 ($p > 0.05$). An individual analysis also showed that 50% of EG participants increased on the social measures of the quality of life scale.

The correlation analysis revealed a strong significant, negative correlation between improvement in environment domain scores and sedentary time ($r = -0.82$, $p = 0.01$) in participants of the EG. No correlation between reductions in sedentary time and physical ($r = 0.04$, $p = 0.92$), mental ($r = 0.48$, $p = 0.23$) and social ($r = -0.09$, $p = 0.83$) domains were found in the EG.

4. Discussion

The purpose of this study was to evaluate the effects of a 16-week group physical activity (PA) program in the anthropometric characteristics, bone density, functional exercise capacity, PA levels, and quality of life of individuals with schizophrenia. The program yielded significant improvements in MVPA, in the hip circumference and in the environment domain of quality of life, with attendance averaging 79.65%. Among the participants of the EG, improvement in the environment domain was associated with reductions in sedentary time.

Literature has stated the importance of regular practice of PA for the general health of individuals with schizophrenia (Zschucke, Gaudlitz, & Ströhle, 2013). Therefore, participants had to attend the majority of the PA sessions in order to benefit their general health. In our study the attendance to the program was similar to other studies which developed structured PA programs for individuals with schizophrenia (Beebe et al., 2005; Dodd et al., 2011; Marzolini et al., 2009; McDevitt, 2005; Vittaca et al., 2013). However in the last mentioned studies, the PA programs took place at a local community center or, the participants arrived at the facilities where the PA took place in transportation provided by the researchers. The participants of our study arrived at the sports facilities using their own means. Although the lack of available transportation to the facilities where the PA programs occur can be seen as a barrier to regular PA (Wilcox et al., 2006), this situation was not observed in our study, possibly due to the distance from the rehabilitation unit to the sports facilities (i.e., 10–15 min by bus) and the good public transportation network in the region.

The high rate of adherence achieved in our study can also be related to the trust building relationship between participants and the research team which promoted the participants' motivation and commitment throughout the program. We believe that the adherence and motivational strategies implemented helped with the evolution of a trusting relationship with participants and, consequently, strengthened their positive capacity (Tetlie et al., 2009). Additionally, the staff from the psychiatric services, from where the participants were recruited, reinforced the importance of the program as a positive and beneficial activity. In accordance, Ussher, Stanbury, Cheeseman, and Faulkner (2007) argued that individuals with mental illness were more likely to adhere to PA programs if they were encouraged to participate by people around them.

Another issue that can be related with the successful adherence rates found in this study is the type of activities (i.e., small-sided games) proposed during the program. Participants associated the activities performed to good PA experiences experienced in their childhood/teenage years. This is why PA programs specifically designed for individuals with schizophrenia need to take into account the preferences for PA reported by this population in order to be successful (McDevitt, Snyder, Miller, & Wilbur, 2006; Soundy, Kingstone, & Coffee, 2012; Ussher et al., 2007; Vancampfort et al., 2009).

Despite several studies having reported favorable changes in weight, BMI (Dodd et al., 2011) and fat percentage (Beebe et al., 2005) in individuals with schizophrenia participating in PA programs, in the present study a significant improvement was only found in hip circumference in the EG. In the CG there was a significant increase in lean mass and decrease in waist circumference. It is possible to argue that the lack of information about eating

Table 2
Quality of life measured by WHOQOL-Bref at Time 1 (baseline) and Time 2 (16 weeks) between individuals with schizophrenia in an experimental and control condition.

	Experimental group N = 08		Effect size	Control group N = 11		*P*
	Time 1	Time 2		Time 1	Time 2	
Quality of life						
Physical domain	58.03 ± 8.90	68.04 ± 15.99	0.77	66.22 ± 12.61	62.65 ± 16.70	0.041
Mental domain	51.21 ± 13.46	51.03 ± 9.80	0.01	63.63 ± 14.32	59.93 ± 16.41	0.405
Social domain	35.4 ± 26.26	38.53 ± 23.54	0.12	58.70 ± 21.92	53.78 ± 21.18	0.112
Environment domain	61.32 ± 11.92	67.96 ± 13.23*	0.53	60.50 ± 11.29	60.96 ± 10.90	0.106

Data are presented as mean ± standard deviation.
P for treatment × time interaction with repeated-measures ANOVA.
*Significant intragroup difference $p \leq 0.05$.

habits of both groups during the 16 weeks program can be a limitation for the discussion of these findings (Lee et al., 2010; Marzolini et al., 2009).

The functional exercise capacity in the EG did not reach significant improvement. The lack of statistical significance may be explained by the small sample size and, consequently, inadequate statistical power. This problem was also reported in similar studies which measured 6MWT outcome in outpatients with schizophrenia participating in a PA program (Beebe et al., 2005; Dodd et al., 2011; Marzolini et al., 2009). However, it is important to mention that 75% of the EG increased walking distance and reached the minimal detectable changes needed to improve functional status (Vancampfort, Probst, et al., 2010). Despite the lack of significant differences most of the participants in the EG had improved their functional exercise capacity by the end of the program.

A strength of the study was the use of an objective measure of PA. Notably, the PA program yielded significant improvements in MVPA. This is an important finding because an improvement in the PA levels is directly associated with a decrease on health risk due to reduced body weight, to improve glucose regulation and triglycerides (Centorrino et al., 2006; Chen et al., 2009; Sanz, Gautier, & Hanaire, 2010). Therefore, the enhancement of PA can have a positive effect in the reduction of metabolic syndrome common in people with schizophrenia. Additionally, EG achieved more than 30 min of MVPA per day at the baseline and after 16 weeks which is in accordance with the recommendations of the American College of Sports Medicine (2006). Given the quasi-experimental design, a potential bias is the self-selecting nature of the sample in that more active participants volunteered to participate in the experimental condition.

In recent years, there has been an increasing interest in sedentary behavior and its relation to health in general (Beets et al., 2013; Crespo, Sallis, Conway, Saelens, & Frank, 2011; Greef et al., 2011; Janney et al., 2013; van der Berg et al., 2014). Moreover, sedentary behavior may influence markers associated with inflammation, irrespective of MVPA, glycemia and adiposity (Healy, Matthews, Dunstan, Winkler, & Owen, 2011; Henson et al., 2013). Although it bears no statistical significance, in our study the EG demonstrated an average of 4.6 min per day decrease in sedentary behavior while the CG presented a mean increase of 1.40 min per day. It is evident that more research is needed to understand the changes in sedentary behavior in individuals with schizophrenia engaged in PA programs.

An important goal in the treatment of schizophrenia is to improve quality of life in areas such as living situation, finances, work and school, daily activities and functioning, family and social relations, legal issues, and services and continuity of care (Drake, Green, Mueser, & Goldman, 2003; Lehman, 1988). There is also a relationship between PA and quality of life in individuals with mental illness (Sugawara et al., 2013; von Hausswolff-Juhlin et al., 2009). In our study a moderate to high effect size was found in the environment and physical domain, respectively. The physical domain of WHOQOL-Bref presents some facets such as: i) ability to perform activities of daily living, ii) energy and fatigue, iii) pain and discomfort, iv) work capacity. In this context, it is possible to argue that individuals who are engaged in PA programs and increase their PA levels, are more suitable to change their perception about some facets of the physical domain.

The environment domain of WHOQOL-Bref is composed of some facets that may be related to PA settings, such as: i) participation in and opportunities for recreation/leisure activities; ii) freedom, physical safety and security; iii) health and social care: accessibility and quality. Different authors have argued about the importance of implementing environmental strategies (e.g., the creation of programs in community centers or other public spaces for PA, PA at affordable costs, available transportation to PA facilities) in order to create a viable and positive approach to PA (Crespo et al., 2011; Wilcox et al., 2006). Specifically in the mental health population, Barton, Griffin, and Pretty (2012) stressed the key role that the type of environment where the PA takes place plays in the success of an PA based therapeutic intervention.

Moreover, a negative and strong correlation between the environment domain and sedentary time was also observed. In our study, we think that the environment where the program took place (i.e., facilities of a Faculty of Sport) may have had a positive influence in the adherence to the program and PA behavior of the participants. The participants were integrated in an inclusive and sports-based setting that they felt a part of. The participants reported they felt comfortable and accepted by the surrounding community and expressed happiness because they were not stigmatized and discriminated against. This is an important point because lower subjective quality of life is related to higher levels of stigma (Switaj, Wciórka, Smolarska-Switaj, & Grygiel, 2009). Literature has shown that individuals with schizophrenia often suffer stigmatization experiences (e.g., have been treated as less competent, have witnessed others saying offensive things about mental illness) by society (Angermeyer & Matschinger, 2005; Crisp, Gelder, Goddard, & Meltzer, 2005; Pescosolido et al., 2010).

5. Conclusion

Overall, this study showed that a small group mixed PA program can be successfully implemented for outpatients with schizophrenia. The program was associated with an improvement hip circumference, MVPA and the environment domain of quality of life. However, more research is needed to provide conclusive findings regarding the effects of PA programs on physical and mental wellbeing of outpatients with schizophrenia. Future studies should increase the sample size, randomly assign participants to conditions, increase the duration of the PA programs, and examine whether benefits are maintained over a longer period of time. Another important research topic is the low levels of participation of women in PA. Further research should try to understand which adherence strategies are more suitable to improve the motivation and adherence of women with schizophrenia to PA programs.

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Chapter 5

Reliability and validity of IPAQ-SF for individuals with schizophrenia in the Portuguese reality

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ABSTRACT

Background: Although the short version of the International Physical Activity Questionnaire (IPAQ-SF) is used worldwide to assess physical activity (PA) levels in the general population, there is a lack of validation studies in the population with schizophrenia. **Objective:** Therefore, the aim of this study was to analyze the reliability and validity of the IPAQ-SF for outpatients with schizophrenia in the Portuguese reality. **Methods:** Fifty outpatients with schizophrenia (M = 39.92 ± 7.46 years) from two different psychiatric rehabilitation units wore accelerometers for 7 consecutive days and completed the IPAQ–SF on the first and last day to recall their PA during accelerometer-wearing days. Spearman's correlation coefficients were reported based on the total reported PA (minutes) and the estimated energy expenditure. **Results:** Sperman's correlations coefficients of 0.83 for reliability and 0.33 for criterion validity for the IPAQ–SF were found. **Conclusions:** The IPAQ-SF has acceptable validity for the measurement of total PA and good reliability coefficients. Further research should replicate the present findings in large multicentre studies, across different countries, to develop comparable measures of PA in individuals with schizophrenia.

Keywords: IPAQ-SF, Accelerometers, Reliability, Validity.

INTRODUCTION

Individuals with schizophrenia have high levels of obesity (Ösby et al., 2000; Roick et al., 2007), cardiovascular and metabolic risk factors (De Hert et al., 2009; Fleischhacker et al., 2008; Hennekens et al., 2005) as well as associated premature mortality (Capasso et al., 2008; Saha et al., 2007). This is a vulnerable group for whom more frequent metabolic monitoring and medical care is advised (Seeman, 2009; Van Os & Kapur, 2009).

In recent years, physical health issues have become a major focus in both clinical care and research in different severe mental illnesses (Leucht et al., 2007; Mitchell et al., 2009). Specifically in the case of schizophrenia, interventions based on physical activity (PA) promote benefits such as, the reduction of weight, body mass index (BMI), waist circumference, cholesterol, triglycerides, negative symptoms, as well as increasing mental health, cognitive functioning, and physical and social functioning (Acil et al., 2008; Attux et al., 2011; Duraiswamy et al., 2007; Gomes et al., 2014; Methapatara & Srisurapanont, 2011; Pelletier et al., 2005; Van Citters et al., 2010).

Reliable and valid measurements of PA are essential to identify the causal relations between PA and health outcomes, to monitor the prevalence and differences in PA between different groups, to evaluate the effects of PA interventions, and to establish public health recommendations (Faulkner et al., 2006). The most common way of assessing PA has been through the use of questionnaires (Vanheesa et al., 2005). The questionnaires are the most useful tools for assessing patterns, frequency, type and the context of PA (Livingstone

et al., 2003). They are inexpensive and easy to apply in clinical situations (Vanheesa et al., 2005).

The short form of the International Physical Activity Questionnaire (IPAQ-SF) (Craig et al., 2003) has been recommended to evaluate patterns of PA that are relevant to health. The IPAQ-SF is easily accessible (http://www.ipaq.ki.se/) and available in different languages, promoting consistency in measurement within and between countries (Craig et al., 2003).

Furthermore, IPAQ-SF has been successfully applied to both healthy elements of the population (Legh-Jones & Moore, 2012; Papathanasiou et al., 2012) and to individuals with several chronic disease (e.g., musculoskeletal foot and ankle problems, diabetes mellitus, cerebral palsy, spina bifida, visually impaired, and depression) (Ranasinghe et al., 2014; Saebu & Sørensen, 2011; Shibuya et al., 2014). Specifically, when it comes to schizophrenia, several authors (Johnstone et al., 2009; Vancampfort et al., 2014; Vancampfort et al., 2012; Vancampfort et al., 2013) have used the IPAQ-SF to assess the PA levels in this population.

Although IPAQ is widely used in individuals with schizophrenia there is a lack of studies focusing on its validity and reliability as a PA assessment tool. To our knowledge, only Faulkner et al. (2006) provided a preliminary validation of the IPAQ in 35 outpatients with diagnosis of schizophrenia and found a correlation coefficient of 0.68 for reliability and 0.37 for validity based on the total minutes of PA reported. The authors also reported a non-significant correlation between the accelerometer data and the estimated energy expenditure derived from the IPAQ.

In Portugal, the IPAQ-SF has been widely used in the general population (Rute Santos et al., 2009; Santos et al., 2014; Santos et al., 2009; Santos et al., 2008; Verlaet et al., 2013). However, we did not find any study that used the IPAQ-SF in individuals with schizophrenia. Information regarding the validation of IPAQ in individuals with schizophrenia for the Portuguese reality is non-existent.

Therefore, the aim of this study was to analyze the reliability and validity of the Short-Form International Physical Activity Questionnaire (IPAQ-SF) for outpatients with schizophrenia.

METHODS

Participants

Over a five-month period, outpatients with a DSM-IV diagnosis of schizophrenia were invited to participate. In the study, we included patients with a diagnosis of schizophrenia, stable on antipsychotic medication (i.e., using the same dosage for at least four weeks prior to inclusion). Patients were excluded if they had co-morbid substance abuse and evidence of significant cardiovascular, neuromuscular and endocrine disorders which might prevent safe participation in the study. This study was carried out following the Declaration of Helsinki guidelines for human research. The Faculty Ethics Committee approved this study. All participants gave their informed consent.

Medication use

Antipsychotic medication was recorded for each patient and converted into a daily equivalent dosage of chlorpromazine according to Gardner et al. (2010).

Body and bone composition

Height and weight were measured before testing, with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (Holtain Ltd., Crymmych, UK) and recorded in centimeters to the nearest millimetre. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between weight and squared height (kg.m-2). Waist circumference was measured at the level of the navel and hip circumference was measured at the largest circumference of the hips.

Bone mineral density, percent fat mass, fat and lean mass were assessed through dual-energy X-ray scan (Explorer QDR 4500, Hologic, Bedford, MA) with whole body protocol. Participants were placed in a supine position with their arms in extension near the trunk and lower limbs in extension, with a slight abduction of the feet. Participants removed clothes and all metallic objects (earrings, watches, etc.) and wore on a gown.

PA measurement by IPAQ-SF

The Short-Form International Physical Activity Questionnaire (IPAQ-SF) consists of seven items and provides information on the time spent in PA (Craig

et al., 2003). Validity and reliability data from 12 countries (including Portugal) showed that IPAQ has comparable validity and reliability to the accelerometer and to other self-reported measures of PA (Craig et al., 2003).

Participants were asked to recall the number of days they performed each activity (frequency) and the length of time (duration) they were involved daily in each activity during the last 7 days or were asked to recall a regular 7 days of activity. Data from the questionnaire were summed within each item (i.e., vigorous intensity, moderate intensity, and walking) to estimate the total amount of time spent in PA per day. Using the official IPAQ–SF scoring protocol, total daily PA (metabolic equivalent [MET]·min/day) was estimated by summing the product of reported time by a PA category with its corresponding category MET value and was expressed as a daily average MET score. MET values for vigorous intensity activities, moderate-intensity activities, and walking are 8, 4, and 3.3, respectively (IPAQ, 2005).

PA measurement by Accelerometer

The GTX3 triaxial accelerometer (Actigraph, Florida) was used to objectively measure daily PA. Individuals were instructed to wear an accelerometer over 7 consecutive days, placed on the right hip using an adjustable belt. Individuals were instructed to maintain their usual routine of activities.

This instrument proved to be valid for quantifying activity levels in laboratory and field settings (Harris et al., 2009; Nichols, Morgan, Chabot, Sallis, & Calfas, 2000; Trost, McIver, & Pate, 2005). Accelerometer data was

recorded in 5-second sampling periods (epochs) and then aggregated in 60-second epochs for analysis. The software ActiLife version 6.9 (Actigraph, Florida) was used to turn the raw activity data from the accelerometers into daily PA. Time periods with at least 10 consecutive minutes of zero activity recorded were excluded from analysis assuming that the monitor had not been worn. A minimum recording of 8-hours/day was the criteria for accepting daily PA data as valid. Individual's data were only accepted for analysis if at least five days had been successfully assessed. The main outcomes were: total physical activity [total PA (counts/min/day)], time in sedentary physical activity [SEDPA (min/day)], light physical activity [LIGPA (min/day)], moderate physical activity [MODPA (min/day)], vigorous physical activity [VIGPA (min/day)] and moderate to vigorous physical activity [MVPA (min/day)]. To determine the time spent in PA of the different intensities, the following count intervals (counts/min) were considered: 0-99 for SEDPA, 100-2019 for LIGPA, 2020-5998 for MODPA and ≥ 5999 for VIGPA (Troiano et al., 2008).

Procedures

Prior to the beginning of the study, informed written consent was obtained from all participants. Each participant was seen on two visits, scheduled one week apart. In the first visit, demographic data, bone and body composition and IPAQ-SF were assessed. Participants were instructed to wear the accelerometers on the right hip and secured by an elastic belt for 7 consecutive days. After seven days, in the second visit, the participants delivered the accelerometer and completed the interviewed-administered IPAQ-

SF one more time. The research team administered the IPAQ–SF in a standardized manner.

Statistical analysis

Descriptive statistics are presented as mean ± standard deviation (SD), median and range, as appropriate. The intraclass correlation coefficient (ICC) was calculated to objectively assess reliability between two IPAQ-SF trials. Paired t-test were performed for evaluating the statistically significant improvement in the mean IPAQ-SF between the two trials.

The convergent validity of the IPAQ–SF was examined by correlating PA behaviors measured by the IPAQ–SF with those measured by accelerometers, and Spearman's correlation coefficients were computed. All analyses were completed with SPSS 22.0 (SPSS Inc., Chicago, United States) with a significance level of 0.05.

RESULTS

A total of 51 outpatients were surveyed during this study. However, only 50 data sets were included in the analysis, as one participant failed to wear the ActiGraph PA monitor for the entire 8-hours/day.

Participants were primarily male (76%), completed high school (48%) and were living with parents (74%). All individuals were Portuguese natives and all were being treated with antipsychotic medication at the moment of the assessments. Participants used monotherapy antipsychotic medication (n = 33) and combination of antipsychotics medication (n = 18). Mean daily equivalent

dosage of chlorpromazine was 466.5 ± 336.2 mg/day. Thirty-five were smokers (smoking regularly [>10 cigarettes/week] for more than 15 years). Table 1 shows the characteristics of the participants.

Table 1: Participants' characteristics.

Characteristics	**Mean ± SD**
Age (years)	39.92 ± 7.46
Body and bone characteristics	
Weight (Kg)	82.86 ± 14.578
Height	1.68 ± 0.07
BMI (Kg/m^2)	29.04 ± 4.81
Waist Circumference (cm)	105.7 ± 12.8
Hip Circumference (cm)	101.6 ± 13.5
Hip to ratio (cm)	0.96 ± 0.11
BMD (g/cm^2)	1.09 ± 0.22
Lean mass (Kg)	50.67 ± 7.53
Fat mass (Kg)	27.91 ± 10.56
Total fat (%)	33.61 ± 8.64
Fat mass (kg/m^2)	9.84 ± 3.85
Smoking (cigarettes/day)	9.42 ± 10.40

BMI = body mass index; BMD = bone mineral density

Reliability and validity

Descriptive statistics for the test-retest IPAQ are showed in Table 2. Total minutes of PA per week reported by participants on the retest was higher than on the test (p = 0.30). According to the accelerometer data, the participants completed an average of 286.55 (± 128.38) counts per minute and 7125.32 (± 2863.40) steps per day.

Table 2: Descriptive statistics for test-retest IPAQ responses

	Test	Median	SD	Minimum	Maximum
Test					
MET week^{-1}	830.18	662.00	814.16	0	3544
Total min of PA per week	190.92	117.50	199.40	0	840
MVPA	94.30	80.00	113.68	0	500
Walking PA	96.62	60.00	111.09	0	420
Retest					
MET week^{-1}	814.12	684.00	107.17	0	3540
Total min of PA per week	202.72	150.00	176.76	0	730
MVPA	92.70	60.00	118.94	0	600
Walking PA	106.10	60.00	115.85	0	4000

PA = physical activity, MVPA = moderate to vigorous physical activity, MET = *metabolic equivalent*.

The results of the test – retest reliability of the IPAQ–SF are shown in Table 3. The ICC values for most measured PA categories showed high reliability with ICCs ranging from .70 to .90.

Table 3: Test–Retest Reliability of the IPAQ–SF

	ICC	95%CI
MET week^{-1}	0.812**	0.67 - 0.89
Total min of PA per week	0.837**	0 .71 - 0.91
MVPA	0.706**	0.48 - 0.83
Walking PA	0.909**	0.84 - 0.94

PA = physical activity, MVPA = moderate to vigorous physical activity, MET = *metabolic equivalent*. **$p < 0.01$; *$p < 0.05$.

Regarding criterion validity, there was a fair correlation between the total minutes of PA derived from IPAQ and total counts per min derived from accelerometer (Spearman's ρ = 0.33; p < 0.05 [95% CI: 0.06–0.56]), as well as, there was a fair correlation between total minutes of PA and steps per day (Spearman's ρ = 0.32; p < 0.05 [95% CI: 0.04–0.55]).

Likewise, there was a fair correlation between MET total of PA derived from the IPAQ and Total counts min derived from accelerometer [Spearman's ρ = 0.41; p < 0.01 (95% CI: 0.15–0.62)], as well as, there was a fair correlation between MET total of PA and steps per day [Spearman's ρ = 0.39; p < 0.01 (95% CI: 0.14–0.52)].

DISCUSSION

The aim of this study was to analyze the reliability and validity of the Short-Form International Physical Activity Questionnaire (IPAQ-SF) for outpatients with schizophrenia. To our knowledge, this is the first study to validate the IPAQ–SF in individuals with schizophrenia in the Portuguese reality. We found a pooled *p* of 0.83 for reliability and 0.33 for criterion validity for the IPAQ–SF. Our findings demonstrate that the IPAQ-SF is reliable, indicating that this questionnaire can be used to assess the PA levels of individuals with schizophrenia. Similarly, Faulkner et al. (2006) reported a pooled *p* of 0.68 for reliability and 0.37 for criterion validity for the IPAQ–SF for outpatients with schizophrenia in Canada.

In terms of criterion validity, the validation scores were generally low but we found a significant correlation between indicators of PA (counts/min and

steps per day) derived from accelerometer, and the indicators of PA (total minutes of PA and MET total of PA) derived from IPAQ-SF. Despite the fact that no correlation was found between total minutes PA from accelerometer and IPAQ-SF, it seems that IPAQ-SF is honest indicator of total PA.

Our findings reported a substantial intra-individual variability within data for IPAQ and accelerometers. As suggest previously, variability might exist due to individuals PA variations across seasons of the year, differences between weekend days and daily variations in temperature and rainfall (Kolle et al., 2009; Yıldırım et al., 2014). It is also possible that the lack of accurate information about the intensity of activities, such as carrying heavy loads, stationary cycling, or resistance exercise (Hagströmer et al., 2014) provided by the accelerometers had an influence on our findings.

On the other hand, the estimation of the total minutes of PA reported by the participants in the IPAQ-SF can reflect a need for reporting social accepted behaviors rather than actual practices. It is also possible that some participants had experienced difficulties when recalling and estimating the intensity of the activities. This because individuals with schizophrenia have impaired working memory and executive functioning (Lindamer et al., 2008). To recall past PA is a complex cognitive task, and recall biases can occur (Roman-Vinãs et al., 2010).

Overall, the Portuguese version of the IPAQ-SF for individuals with schizophrenia is a valid and reliable instrument which is in accordance with the findings of Faulkner et al. (2006) for the Canadian population. Although some considerations can be made about IPAQ validity, the practicality, applicability,

and nonreactiveness features of this instrument makes it feasible to be used in clinical practice.

However, research exploring the reliability and validity of the IPAQ in the population with schizophrenia is still needed. Further research should replicate the present findings in large multicentre studies, across different countries, to develop comparable measures of PA, similarly across the general population.

Competing interests

The author declares that there is no conflict of interest.

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Chapter 6

Final Conclusions

Patients with schizophrenia are prone to develop metabolic abnormalities caused by side effects of antipsychotic medication and unhealthy lifestyle. In this context, it is known that individuals with schizophrenia have poor quality of life (QOL), which leads to different approaches and psychosocial interventions regarding the treatments.

Over the last decades, scientific evidence regarding the relevance of physical activity (PA) for individuals with schizophrenia is unquestionable, with recognized effect on morbidity and mortality reduction. However, there is a lack of studies focusing on the benefits of regular participation in PA programs for Portuguese individuals with schizophrenia. Moreover, no valid and reliable instruments to assess PA in Portugal are available.

This doctoral thesis aimed to develop strategies and tools related with PA in order to improve the QOL of outpatients with schizophrenia in the Portuguese reality, by converging some essential studies about schizophrenia, PA and QOL, and therefore adding knowledge to the area of mental health.

In the **chapter 2** we aimed of to examine the differences in QOL and PA levels between outpatients with schizophrenia and healthy controls paired for age, gender, BMI, hip and waist circumference measures. This manuscript demonstrated that outpatients with schizophrenia had lower QOL and PA levels compared to healthy controls. In addition, individuals with schizophrenia that had lower counts per minute; moderate and moderate to vigorous PA were

associated with increased number of cigarettes smoked per day; heaviest weight, lower scores in mental domain of the WHOQOL-BREF and higher BMI were significantly associated with lower scores in physical domain of the WHOQOL-BREF. This manuscript confirmed the low levels of QOL and PA in individuals with schizophrenia, as reported previously in the literature. Therefore, we suggest that future interventions that comprise PA programs should include educational programs about healthy lifestyles (e.g., weight loss). However, our findings have to be analyzed with caution, due to the reduced sample size and the non-random selection of sampling.

In **chapter 3** we explored the test-retest reliability and validity of the 6MWT. Our efforts were developed in order to validate a pre-existing instrument to measure functional exercise capacity for individuals with schizophrenia. The 6MWT revealed high values of intraclass correlation coefficient, indicating good reliability; and the 6MWT correlated with the $VO_{2peak,}$ which indicates the instrument validity. In our opinion, this manuscript provides relevant information for research and clinical practice. Future studies should develop a prediction equation to estimate VO_{2peak} through of 6MWT in individuals with schizophrenia.

Chapter 4 comprised two manuscripts that aimed to contribute to the development of PA programs specifically design to the needs of individuals of schizophrenia**.** The first study aimed to determine which type of PA was the most enjoyable and effective. Our findings demonstrated that, across three different types of PA sessions (walking, dancing and small-sided games), the most enjoyable session was small-sided games and the most effective was

walking. Accordingly, we suggest that PA programs, specifically designed for this population, should offer a combination of both small-sided games and walking. This is an innovative approach that at the best of our knowledge was not reported in the literature, which can represent an important strategy to increase motivation to practice and, consequently, the adherence rates to PA programs. However, it is important highlight that this study was the first one that focused on enjoyment and we can only discuss these preliminary results.

In the second study included in **chapter 4**, we evaluated the effects of a 16-week group PA program on physical fitness and QOL in outpatients with schizophrenia. We assessed anthropometric measures, body composition busing DXA (Dual energy x-ray absorptiometry), functional exercise capacity (6MWT), PA levels (accelerometers) and quality of life (WHOQOL-Brief). During the program, different strategies were implemented to ensure the participants' adherence, and a high rate was achieved. After the PA program, the experimental group showed decreased hip circumference, as well as increased its moderate to vigorous PA (MVPA) level and the score for environment domain (WHOQOL-Brief). Hence, our findings suggest that a group from PA program can be successfully implemented for outpatients with schizophrenia and have a positive effect in their QOL and PA level. However, futures studies should include larger samples and perform clinical trials to support these preliminary results providing stronger conclusions.

Finally, in **chapter 5** we explored the reliability and validity of the IPAQ-SF for outpatients with schizophrenia in the Portuguese reality. Our efforts were

towards preliminary validation of an easy to administer, inexpensive and safe instrument that measures PA, which may help researchers and clinical professionals in the mental health field. Our findings demonstrated that IPAQ-SF has acceptable validity for measurement of total minutes of PA and good reliability coefficients. Futures studies should replicate the reliability and validity of IPAQ-SF in large multicenter studies across different countries, to develop comparable measures of PA.

In our opinion this doctoral thesis provides new and relevant information about strategies to improve PA and QOL of outpatients with schizophrenia. Our findings showed that PA can have a positive impact on the QOL of those patients, which may be considered as a *stimulus* to mental health care professionals to include PA programs in their centers. Therefore, we hope that our outcomes can have an indirect impact on the decrease of re-hospitalization rates of outpatients with schizophrenia.

However, it is also important to mention the limitations of this doctoral thesis. All participants were volunteers, and hence these individuals may have a healthier lifestyle, level of health and less chronic diseases, which made them more interested to participate. Regarding the design of effective programs, we consider that it would be useful to develop PA intervention combined with educational sessions about healthy lifestyle (e.g., dietary habits, reduced smoking and alcohol consumption, quality of sleep). In addition, we believe that is important to develop follow-up measurements, in order to assess the effects of PA programs over time. Variables such as age, illness duration, education

level, smoking status, dietary intake, medication condition and psychiatric symptoms should be further analyzed.

APPENDIX

Instrumentos de avaliação da capacidade funcional de indivíduos com esquizofrênia ou transtorno esquizoafetivo: uma revisão de literatura

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Palavras-chave: Esquizofrenia, Transtorno Esquizoafetivo, capacidade funcional, avaliação

Objetivos:A investigação da funcionalidade em pacientes com Esquizofrenia esta cada vez mais difundida, com isso, o presente estudo analisou a produção científica dos instrumentos disponíveis para avaliação da capacidade funcional nesta população.**Métodos e resultados:** As bases de dados selecionadas para a identificação dos estudos foram: PubMed, LILACS/BVS, IBECS/BVS, SCOPUS e *Web of Science*, publicado no período de 2007 a 2010; nos idiomas inglês, português e espanhol. Os descritores utilizados foram Esquizofrenia, capacidade funcional e avaliação. As categorias eleitas foram: a) instrumentos utilizados para a avaliação; b) domínios presentes nos instrumentos; c) materiais utilizados nos instrumentos; d) tempo de aplicação; e) capacitação específica dos profissionais; f) condição de residência da amostra; g) tipo de estudo e h) adaptação transcultural e linguística dos instrumentos. Foram identificados 6 instrumentos, nos quais estão incluídos os de *performance*, questionários e entrevista. Os domínios encontrados foram financeiro, atividades de vida diária, relações interpessoais, ocupacional, lazer e auto-cuidado. São necessários materiais nos instrumentos de *performance*. As amostras presentes nos estudos são na maioria de países de língua inglesa e semelhante observação pode ser feita sobre as versões dos instrumentos. A maioria dos estudos identificados era longitudinal e tinham como amostra usuários residentes na comunidade. **Conclusão:** O conceito de capacidade funcional esta ligado às atividades de vida diária. Os estudo e as versões dos instrumentos serem, na sua maioria, em língua inglesa pode limitar discussões científicas e clínicas do tema entre os profissionais dos países de língua não inglesa, bem como entre equipes de diferentes países.

Percepção do nível de atividade física em pacientes com esquizofrenia – Um estudo de revisão sistemática.

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Palavras-Chave: revisão de literatura, avaliação subjetiva, Esquizofrenia, nível de atividade física.

Objetivos
A escassez de instrumentos válidos, fiáveis e aplicáveis é uma das limitações da investigação na área da atividade física adaptada. São recentes os estudos que investigam os níveis de atividade física no grupo populacional com Esquizofrenia. Assim sendo, o objetivo deste estudo foi analisar a produção científica dos instrumentos disponíveis para a avaliação subjetiva do nível de atividade física em pacientes com Esquizofrenia.
Métodos e Resultados
As fontes seleccionadas para a pesquisa bibliográfica foram as bases de dados: PubMed, Scopus e EBSCO, no período de publicações compreendido entre 2005 a 2011, nos idiomas inglês, português e espanhol. Os descritores utilizados foram Esquizofrenia, Actividade Física, Avaliação e Questionários. Os resultados da pesquisa indicaram 11 artigos e 8 questionários, nomeadamente: i) Active Austrália Survey (AAS), ii) Past Week Activity (PWA) iii) Community Healthy Activities Model Program for Seniors (CHAMPS), iv) National Health and Nutrition Examination Survey (NHANES III), v) Godin Leisure Time Exercise Questionnaire (GLTEQ), vi) Baecke Physical Activity Questionnaire (BPAQ), vii) Yale Physical Activity Survey (YPAS) e, viii) International Physical Activity Questionnaire (IPAQ). As categorias comuns encontradas entre os questionários foram: Tipo de Actividade, Duração, Frequência, Intensidade e Período de Realização da Actividade.
Conclusão
O IPAQ foi o questionário mais utilizado nos estudos analisados estando presente em três dos mesmos. Foi o único questionário a ser validado para o uso em pacientes com Esquizofrenia, sendo identificado como de fácil acesso e com versões traduzidas em vários idiomas.

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Applicability of the 6MWT in patients with schizophrenia: a preliminary study

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The existence of proper instruments to evaluate and monitor functional exercise capacity of people with Schizophrenia can be a limitation to the intervention in the field of Adapted Physical Activity (APA). **PURPOSE:** This study is a part of the implementation of a physical activity program for outpatients at the Psychiatric Department of a Public Hospital. The goal of this study was to assess the applicability the Six-Minute Walk Test (6MWT) (ATS, 2002) according to the following variables: i) time spent during application, ii) perceived exertion of the participants, and iii) the sample understands properly the 6MWT. **METHODS:** The research was approved the Ethics Committee and all participants gave their informed consent. The sample was selected by convenience and they did a psychiatric assessment and cardiac exams. Six males and four females (M=42.50 yrs; SD = 9.3 yrs) diagnosed with Schizophrenia were selected from a group of outpatients supported by the Psychiatric Department of a Public Hospital. This group didn´t participate in structured physical activity programs previously. The original protocol of the 6MWT (ATS, 2002) was followed. Participants stayed 10 minutes resting, walked during six minutes, and rested for 10 minutes after test. The total time of the protocol application was determined. Heart rate and blood pressure of the participants were measured before and after the test as well as the perceived exertion using the Borg Scale (Borg, 1998). **RESULTS**: Regarding the time spent in the test application, there was an average of 22:00 ± 2:29 minutes. This sample understood the 6MWT protocol. This finding is similar to the protocol suggestions and no adaptations seem to be necessary in this group. However, the records pointed to difficulties on the perceived exertion. Differences were spotted between the self evaluation and the objective measures from the heart rate. **CONCLUSIONS:** The findings suggested that the 6MWT can be used with people with Schizophrenia but limitations about the perceived exertion are clear.

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Program of adapted physical activity for people with mental illness: a Portuguese case.

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Keywords: Adapted physical activity program, adherence, mental illness, Schizophrenia

Introduction: Since adapted physical activity (APA) can have an important role in the rehabilitation process of people with mental illness, the Faculty of Sport – University of Porto has planned and implemented a program concerning APA in the Psychiatric Department of a Portuguese public hospital. The aim of this study was to describe the impact and adherence to the program. **Methods:** Six males and four females (M=42.50yrs; SD=9.3yrs) with schizophrenia participated in the program for 3 months, twice a week, in the facilities of the hospital. A structured program of APA was developed by two physical education teachers. Different strategies (*e.g.* positive reinforcement, after sessions talk, telephone contact) promoted the adherence to the program. The battery of instruments used included the 6MWT (Six-Minutes Walk Test) (ATS, 2002), the IPAQ (International Physical Activity Questionnaire) (Craig, 2003), a check-list and field notes. **Results:** Participants were receptive to all activities proposed during the program, including the evaluation sessions. They revealed satisfaction and were open to dialogue after the sessions. Positive interactions were observed within the group. The average attendance at the sessions was 72.3% and there was no dropout. General improvements in the physical and motor performance were registered. Participants acknowledge the impact of the physical activity in their daily lives. **Conclusion:** Participants were receptive to the program and reported a positive impact in their lives. The findings suggested that the APA program was developed with success and it can be an important factor in the psychosocial rehabilitation of this population.

American Thoracic Society (2002). ATS Statement: Guidelines for the Six Minute Walk Test. *The American Journal of Respiratory and Critical Care Medicine.* 166, 06.

PHYSICAL ACTIVITY LEVELS OF OUTPATIENTS WITH SCHIZOPHRENIA ATTENDING A STRUCTURED PHYSICAL ACTIVITY PROGRAM

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In general, individuals with schizophrenia present high rates of mortality and co-morbidities, a situation aggravated by the presence of diabetes mellitus, hypertension, coronary heart disease and obesity. Therefore, interventions based on physical activity focused on individuals living in the community are essential. Such actions improve the body mass control, lipid profile control and self-esteem, as well as improve social functioning. These benefits directly reflect an improvement in their quality of life. For this reason, the Department of Special Physical Education of the Faculty of Sport of the University of Porto established partnerships with one Mental Health Institution and two Public Hospitals in Porto, Portugal to develop a structured physical activity (PA) program for people with Schizophrenia.

Objective: This study aimed to assess the level of PA in outpatients with Schizophrenia in their daily activities, before the beginning of the structured PA program, and verify the correlation between body mass index (BMI) and level of PA.

Methods: In its first stage, the project have twenty one males and eight females (M=40,3 yrs; SD=7,3 yrs) diagnosed with Schizophrenia. The level of PA was obtained with Actigraph accelerometer model GT3X. Spearman correlation test was used to compare the level of PA with the BMI ($P<0,05$), and evaluate its statistical significance.

Results: The results correspond to the first stage of the project. The majority of this group (51,7%) did not performed at least 30 minutes of moderate to vigorous physical activity per day, as recommended by American College of Sports and Medicine Guidelines. There was a significant weak negative correlation between level of PA and BMI ($p=0,036$; $r=-0,39$).

Conclusion: Most participants presented a low level of PA before the beginning of the structured PA program. The results demonstrate a negative correlation between BMI and level of PA, indicating the importance to encourage the development of more PA programs for this population. This action may help to decrease co-morbidities and mortality, as well as to improve the quality of life of these patients.

EFFECT OF A PHYSICAL ACTIVITY PROGRAM ON MANUAL DEXTERITY ON INDIVIDUALS WITH SCHIZOPHRENIA: PRELIMINARY ANALYSIS.

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The regular practice of physical activity (PA) has an important role in the improvement of the quality of life of individuals with Schizophrenia. So, besides acting as a complement to the treatment, improving the physical health, increasing the self-esteem and providing social interaction opportunities, PA programs also demonstrates beneficial effects in the development of motor abilities, namely, concerning global and fine manual dexterity. Thus, having a better development in diverse tasks involving manual dexterity, both at work and in daily activities, individuals with Schizophrenia get more improvement and autonomy in their life.

Objectives: This study aimed to evaluate the effects of a PA program on Fine Manual Dexterity (FMD) and Global Manual Dexterity (GMD), according each hand and two-hands combined, in individuals with Schizophrenia.

Methods: The sample comprised 11 adults, belonging to a Psychiatry Unit from the city of Porto, Portugal. The Edinburgh Handedness Inventory (Oldfield, 1971) evaluated the manual preference. The FMD and the GMD were evaluated, through Purdue Pegboard Test (2002) and Minnesota Manual Dexterity Test (1998) respectively, before and after the implementation of a structured PA program, along 12 weeks, with twice a week sessions of 50 minutes each. It was calculated the manual asymmetry (absolute difference between preferred and nonpreferred hands). On statistical procedures the Wilcoxon and Mann-Whitney tests were applied.

Results:
On the FMD, from initial to final evaluation, the participants showed statistically significant improvement with respect to the preferred hand, nonpreferred hand and two-hands combined. Manual asymmetry decreased but not significantly.
Concerning DMG, from initial to final evaluation, the sample showed statistically significant improvement on nonpreferred hand and on two-hands combined. According to the preferred hand, improvements were not significant. Manual asymmetry decreased but not significantly.

Conclusions: The applied PA program had influence on FMD and DMG of individuals with Schizophrenia. The improvement was most notorious on FMD. Furthermore, through observation and not involving a statistical analysis, we found that the PA program promoted positive changes in participants, with respect to mental health, self-esteem, wellbeing and social relations.

Effects of 24 weeks of physical activity in functional exercise capacity of individuals with schizophrenia

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Abstract

Individuals with Schizophrenia have an impaired functional capacity and present an insufficient level of daily physical activity for maintaining their general health. Therefore, the development of strategies to change such situation is very important to improve the quality of life of patients with Schizophrenia. PURPOSE: This study aimed to assess the effects of a physical activity (PA) program on the functional exercise capacity of patients with Schizophrenia. METHODS: The sample comprised six males and four females (M=42.50 yrs; SD=9.3 yrs) with Schizophrenia diagnose convenient selected from a Psychiatric Department of a Public Hospital. Patients who had not been engaged in PA programs on the last month before intervention were selected. Participants were excluded if they had co-morbid substance abuse, cardiovascular or neuromuscular disease. The PA sessions occurred twice a week, with duration of 50-55 minutes/day during 24 weeks. The perceived exertion during the sessions were controlled by the Borg Scale. The Six-Minute Walk Test was used to assess the functional exercise capacity at baseline (M0), after 12 weeks (M1) and after 24 weeks (M2) of intervention. The Wilcoxon test ($p<0.05$) was used for statistical analysis. The adherence to the program was of 80% and the frequency of outpatients on the sessions are in average 72,3%. RESULTS: Statistically significant improvements were observed between M0-M1(474,80 ± 81,4m; 537,7m ± 99,1; SD=0,037) and M0-M2 (474,80 ± 81,4m; 601,62 ± 96,99m; SD=0,000). No statistically significant differences were reported between M1-M2 (537,7 ± 9,1m; 601,62m ± 96,99; SD=0,17) although we notice a slightly increase in the average walked distance. CONCLUSIONS: The results of this pilot study suggest that the participation in a PA program tend to improve the functional exercise capacity of individuals with Schizophrenia. Further studies should use a control group and increase the sample size.

Keywords: *Schizophrenia, outpatients, Physical Activity Program, Six-Minutes Walk Test*

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Effect of a Physical Activity Program on Fine Manual Dexterity: Study on Individuals With Schizophrenia

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Abstract

In individuals with schizophrenia, the deficits on fine motor dexterity are a predominant motor dysfunction, committing their daily life activities. The practice of regular physical activity (PA) has shown beneficial effects on motor coordination in general and, specifically, in the manual dexterity. **PURPOSE:** This study aimed to evaluate the effects of a PA program, on the Fine Manual Dexterity (FMD) level, in individuals with Schizophrenia, according to previous practice of PA. **METHODS:** The sample comprised 11 adults, belonging to a Psychiatry Unit from the city of Porto, Portugal. The participants were divided into two groups according to the preceding PA practice. Group 1 (G1), involved five people who had recent experience of PA practice. Group 2 (G2), involved six people who had no previous PA experience. The Edinburgh Handedness Inventory (Oldfield, 1971) evaluated the manual preference. The FMD was evaluated, through Purdue Pegboard Test (2002), before and after the implementation of a structured PA program, along 12 weeks, with twice a week sessions of 50 minutes each. It was assessed the dominant and nondominant hands and calculated the manual asymmetry (difference between hands). Statistical procedures: Wilcoxon and Mann-Whitney tests. **RESULTS:** From initial to final evaluation, G1 showed statistically significant improvement on both hands, and manual asymmetry decreased. The G2 showed statistically significant improvements on dominant hand while on nondominant hand improvements was not significant. The manual asymmetry increased slightly but no significant differences were reported in G2. Comparing both groups on the initial evaluation, G2 showed a significantly better performance on nondominant hand and was significantly more asymmetric. On final evaluation, G1 showed a significantly better performance on nondominant hand. **CONCLUSIONS:** The applied PA program had influence on FMD of individuals with Schizophrenia. The improvement was most notorious in the group G1, with recent experience on PA practice.

Keywords: *Physical Activity Program, Schizophrenia, Fine Manual Dexterity*

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DESTREZA MANUAL E ESQUIZOFRENIA: ESTUDO PILOTO SOBRE OS BENEFÍCIOS DE UM PROGRAMA DE ATIVIDADE FÍSICA

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Os indivíduos com Esquizofrenia apresentam limitações na concretização das atividades diárias, o que afeta a sua autonomia e, consequentemente, a qualidade de vida. A realização destas atividades implica uma correta funcionalidade da mão, que em muitos casos é afetada pelos distúrbios na lateralização cerebral, caraterísticos da doença. Desta forma, a prática de atividade física (AF) regular pode ser benéfica para a melhoria da coordenação geral, e especificamente, da destreza manual nesta população. O objetivo deste estudo foi verificar a influência de um programa de AF na destreza manual fina (DMF) e na destreza manual global (DMG), em indivíduos com Esquizofrenia. Para avaliar a preferência manual, de 11 indivíduos adultos, foi aplicado o questionário Edinburgh Handedness Inventory. A DMF e a DMG foram avaliadas pelos testes Purdue Pegboard e Minnesota Manual Dexterity, respetivamente, antes e após a aplicação do programa de AF que teve a duração de 12 semanas. Na análise estatística foi aplicado o teste de correlação de Spearman. Na DMF e na DMG, verificou-se um aumento significativo dos coeficientes de correlação entre a mão preferida e a mão não preferida. Relativamente ao desempenho da mão não preferida verificamos entre ambas as capacidades uma correlação positiva e elevada. A semelhança no desempenho entre mãos, ou seja, a diminuição da assimetria manual, em ambas as capacidades, parece estar associada ao desempenho da mão não preferida. Julgamos, assim, que o desempenho da mão não preferida tornou-se mais eficiente, e semelhante ao desempenho da mão preferida, devido à exercitação regular no programa de AF.

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APLICAÇÃO DO IPAQ (VERSÃO CURTA) EM INDIVÍDUOS COM ESQUIZOFRENIA APÓS 24 SEMANAS DE UM PROGRAMA DE ATIVIDADE FÍSICA

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Indivíduos com Esquizofrenia apresentam saúde física mais debilitada quando comparado com a população em geral (Roick et al., 2007). Somado a isso, estudos pontam que estes indivíduos apresentam níveis de atividade física insuficiente para manter a sua saúde geral (Faulkner et al., 2006). Diferentes abordagens e intervenções psicossociais têm sido desenvolvidas para estas pessoas com o objetivo de melhorar a sua qualidade de vida (Vancampfort et al., 2009). Uma das intervenções que tem despertado interesse dos especialistas para melhoria da saúde desta população é a do exercício físico (Faulkner et al., 1999). Objetivo: Avaliar o nível de atividade física (AF) de indivíduos com Esquizofrenia, residentes na comunidade que participaram num programa de AF de 24 semanas. Pacientes com Esquizofrenia (n=10), residentes na comunidade, apresentaram média de idade de 42,50±9,3 anos. O Questionário Internacional de Atividade Física, versão curta (IPAQ-SF) foi aplicado no início (M1) e após 24 semana (M2) de intervenção. Após 24 semanas de intervenção, observou-se um aumento não significativo ($p<.05$), em todos os itens que abrange o IPAQ-SF, nomeadamente, minutos AF por semana, minutos AF moderada por semana, minutos AF vigorosa por semana, minutos caminhada por semana, total MET/minutos por semana. Os programas de AF apresentam-se como uma importante terapia psicossocial na medida em que podem melhorar níveis de AF da população com Esquizofrenia, refletindo na melhoria da qualidade de vida. No entanto, futuros estudos devem aumentar o número de participantes, bem como incluir a participação de grupo controle para melhor análise dos resultados.

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LEVEL OF PHYSICAL ACTIVITY OF PEOPLE WITH SCHIZOFRENIA INCLUDED IN A PHYSICAL ACTIVITY PROGRAM: A PILOT STUDY USING ACCELEROMETERS

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Abstract: Although it is acknowledged that physical activity (PA) improves physical and mental health of people with schizophrenia, the optimal level of PA recommended for this population is not yet known. Therefore, the aim of this study was to analyze the PA levels of people with schizophrenia who participated in a PA program. Specifically, we intended to verify the differences in the level of PA between week days with sessions of PA, week days without sessions of PA and weekend days. A convenient sample of six adults (male=4, female=2) was recruited according to specific inclusion criteria. The GT3X accelerometer was used to assess the daily PA over 7 consecutive days. ANOVA test was used to analyze the level of PA, in the three moments of evaluation, according to: i) number of counts, ii) number of minutes in sedentary activities, and iii) number of minutes in moderate to very vigorous activities. The level of significance was established in $p \leq .05$. All participants achieved the guidelines (i.e., minimum of 150 min.) for PA per week (min=253.66min; máx= 510.75min.). Significant differences were found in the average number of counts/min^{-1} in the week days with PA sessions (M= 1019.58; SD=235.07) in comparison with the week days without PA sessions (M= 620.85; SD=164.09) and the weekend days (M=545.82; SD=162.24). Similarly, significant differences were found in the time spent in moderate to very vigorous activities during the week days with PA sessions (M=84.17; SD=26.80) in comparison with the week days without PA session (M=51.58; SD=15.79) and the weekend days (M=39.23; SD=23.15). No significant differences were found regarding the time spent in sedentary activities. This study highlighted the importance of structured physical activity programs to improve daily physical activity in people with schizophrenia.

Keywords: schizophrenia, accelerometers, physical activity program.

Introduction

Schizophrenia is a psychiatric disorder that alters the perception, thought, affection and behavior of the individual (National Institute of Mental Health [NIMH], 2009). People with schizophrenia often have risk behaviors such as physical inactivity, poor diet, alcohol and drug abuse (Von Hausswolff - Juhlin et al., 2009). Thus, this population has a higher rate of diseases (i. e., cardiovascular diseases, metabolic syndrome) than the general population (Roick et al., 2007). Researchers of this field have demonstrated the importance of physical activity (PA) schizophrenia to improve physical and mental health in people with schizophrenia (Faulkner & Biddle, 1999). Therefore, it is important to know the PA levels of this population for an adequate prescription of exercise in accordance with the individual needs. Thus, the aim of this study was to analyze the PA levels of people with schizophrenia who participated in a PA program. Specifically, we intend to verify the differences in PA levels between days with PA sessions, days without PA sessions and weekend days.

Methodology

The sample consists of 6 adults (4 men and 2 women) (M = 43.83 years; SD = 7.52 years) with schizophrenia. PA levels were assessed by the GTX3 accelerometer (Actigraph, Florida) on the right hip using an adjustable belt.

Results

By performing an individual analysis of the time spent in moderate to very vigorous physical activity (MVPA), we found that all participants performed the minimum 150 minutes per week (min = 253.66 minutes, max = 510.75 minutes).

Significant differences were found in the average number of days counts/min-1 in the week with PA sessions (M = 1019.58, SD = 235.07) in comparison with the week days without PA sessions (M = 620.85, SD = 164.09, p = .03) and the weekend days (M = 545.82, SD = 162.24, p = .02). Finally, in Table 1 are the results about the time (minutes) spent in MVPA.

Table 1 - Minutes spent in moderate to very vigorous physical activity (MVPA) in the three stages of assessment and significance level (p <.05)

Time spent per day (min)	M	SD
MVPA working days with PA sessions	84.17	26.80
MVPA working days without PA sessions	51.58	15.79
MVPA during the weekend	39.23	23.15

MVPA		*p*
Working days with PA sessions	Working days without PA sessions	.02*
	Weekend	.01*
Working days without PA sessions	Weekend	.26

M = Mean; SD = Standard Deviation

Conclusion

All participants performed an average of 150 minutes of MVPA per week, which follows the recommendation of the American College of Sports Medicine (2010) for adults. Furthermore, the MVPA in working days with PA sessions were significantly higher than those in the working days without PA sessions and during the weekend. Thus, this study highlighted the importance of structured PA programs to improve daily physical activity in people with schizophrenia.

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Functional exercise capacity in outpatients with schizophrenia attending in a sports program

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Introduction: Individuals with schizophrenia have health and functional capacity (FC) below recommended comparing to general population (Hennekens et al., 2005). Physical activity is one of the psychosocial interventions recognized in the rehabilitation of this group.

Objectives: The goal of this study was to evaluate the FC in outpatients with schizophrenia at baseline and after 16 weeks of a sports program.

Methods: The sample consisted of 19 outpatients (EG=8, CG=11; age: 39 ± 6 years) diagnosed with schizophrenia. The sports program was implemented during 16 weeks, twice a week and each session had 55 minutes of duration. FC was assessed by Six Minutes Walk Test (6MWT) (American Thoracic Society, 2002).

Results: There were no significant differences from baseline to 16 weeks in the walking distance performed by EG (p = 0.18) and CG (p = 0.21). However, it was found that 75% of the participants of the EG improved their walked distance and improved their FC according to Vancampfort et al. (2010) criteria.

The functional exercise capacity in the EG did not reach significant improvement. The lack of statistical significance may be explained by the small sample size and, consequently, inadequate statistical power. This problem was also reported in similar studies which measured 6MWT outcome in outpatients with schizophrenia participating in a physical activity program (Marzolini et al., 2009).

Conclusions: Despite the lack of significant differences, the sports program has been beneficial for the improvement of the FC of individuals with schizophrenia.

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Bone and body composition in outpatients with schizophrenia attending to a PA program

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Keywords: schizophrenia, physical activity program, bone and body compositior.

Introduction

An important point in the treatment of schizophrenia is use regularly antipsychotic medications. However, these drugs have side-effects such as weight gain and loss of bone mineral density (BMD) (Crews et al. 2012). The reduction of BMD is related with non-traumatic fracture that prevalence in individuals with schizophrenia (Abraham, 1995). One of the strategies to maintain the peak bone mass is to practice regular exercise. The goal of this study was to evaluate the effects of 16 weeks of a physical activity (PA) program in BMD, lean mass (LM) and fat mass (FM) in outpatients with schizophrenia.

Methods

The sample consisted of 8 outpatients (age: 39 ± 6 years) diagnosed with schizophrenia. The PA program was implemented during 16 weeks, twice a week and each session had 55 minutes of duration. The BMD, LM and FM was assessed by Dual-energy X-ray absorptiometry (DXA; QDR 4500A; Hologic, Bedford, MA). The Student's T test for paired samples and Wilcoxon Test were used to determine changes from baseline to post training.

Results and Discussion

There were no significant differences from baseline to 16 weeks of intervention in the BMD (p = 0.34), LM (p = 0.73), and FM (p = 0.23) regarding the participants of the PA program. We also proceeded with an individual analysis of the data and identified that 25% of participants improved their BMD; 37,5% of participants reduced FM and 50% of participants improved LM. The activities developed by the program may reflect in a reduction on potential risk factors for falls and fractures. However, the lack of information about eating habits of both groups during the program limits the discussion about these results (Marzolini et al., 2009).

Conclusions

The PA program promoted activities that improved BMD, LM and FM in outpatients with schizophrenia. Our study supports the evidence that PA can be one of the strategies to help reducing the potential risk factors for falls and fractures, common in this population. Futures studies should assess others variables during a PA program for this population, such as, eating habits, functional capacity and PA levels.

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Soccer as a therapeutic approach for individuals with severe mental illness: a systematic review.

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Keywords: Exercise, Severe mental disorder, Systematic review

Introduction:
Soccer is one of the most popular and practiced sport with recognized health benefits for the general population (1). Recently, soccer has also been acknowledged as an important tool to improve physical and mental health in patients with severe mental illness (2-3). Severe mental illness was defined by diagnosis, disability and duration, and included psychotic disorders such as schizophrenia, manic-depressive disorder, autism and other serious disorders such as major depression, panic disorder and obsessive-compulsive disorder (4).
Therefore, the goal of this study was to conduct a systematic review focusing on the benefits of soccer as a therapeutic approach for individuals with mental illness. Specifically, we intend to identify the research design, the type of variables and instruments used, as well as the main results achieved in this field.

Methods:
Data collection included a search of published papers, written in English language, using electronic databases of reference (e.g. MEDLINE, PubMed, Scopus), depending on specific keywords (e.g. *soccer, football, mental health, mental illness*), from 2004 until April 2014. Eighty-five results have found and nine studies met the inclusion criteria.

Results:
Most of the analyzed studies focused in qualitative design and used subjective measures (i.e., questionnaires) to assess psychological variables (e.g., well-being, social relationships and self-expression). The majority of the samples comprised men participants. Studies are two types of intervention, play football in teams in the league or playing football in structured exercise programs. Mostly, the results showed benefits at psychological and social level, such as an increase of motivation, well-being and social opportunities. At physical level, studies revealed a decreased of body weight and better physical performance.

Conclusion:
This systematic review showed that research linking the benefits of soccer to the rehabilitation and treatment of patients with mental illness is scant. The results also suggested a research trend focusing on the use of qualitative methods to explore the benefits of soccer in psychological variables.

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QUALITY OF LIFE IN OUTPATIENTS WITH SCHIZOPHRENIA ATTENDING IN A SPORTS PROGRAM

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People with schizophrenia are more likely to experience impaired quality of life (Sugawara et al, 2013) and a reduced average life expectancy (Ösby et al., 2000). In this way, it is necessary a multi-modal care including psychosocial approaches to improve health and quality of life (QOL) in this population (Van Os & Kapur, 2009).

Objectives: The objective of this study was to evaluate the quality of life in outpatients with schizophrenia, at the beginning and after 16 weeks of a sports program.

Methods: The sample consisted of 19 outpatients (EG=8; CG=11), with an average age 39±6 years, diagnosed with Schizophrenia. The sports program was implemented during 16 weeks, twice a week and each session had 55 minutes of duration. The program comprised several sport exercises, such as volleyball, handball, basketball and soccer. The QOL was assessed by the Portuguese version of WHOQOL-Bref (Vaz-Serra et al., 2006).

Results: There was a significant improvement from baseline to 16 weeks in the environment domain score for the EG (p=0.02) with no significant improvement for the CG (p=0.9). Moreover, an individual analysis of the data showed that 50% of the participants of the EG increased the scores of physical, social and environment domains.

Conclusions: This study suggests that a PA program based on sports exercises brings benefits for the QOL in individuals with schizophrenia. This study showed that a sports program supervised and based on sports exercises can be successfully implemented for this population.

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MANUAL DEXTERITY IN MEN WITH SCHIZOPHRENIA: PILOT STUDY ABOUT THE INFLUENCE OF A PHYSICAL ACTIVTY PROGRAM

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Recent studies revealed that male patients, compared to female, have a higher lifetime risk of developing schizophrenia (McGrath et al., 2008). In these patients, motor dysfunction in manual dexterity affects functionality in daily activities and in professional performances (Keefe et al., 2006). The role of physical activity (PA) has become highly recognized on improving motor coordination and manual dexterity (Ranganathan et al., 2001).

OBJECTIVE: To evaluate the effects of a PA program on the Global Manual Dexterity (GMD), in men with schizophrenia, with and without previous PA practice.

METHODS: The sample comprises 9 men (43,6±7,5 years old) from a Psychiatry Unit at Porto city, Portugal. They were divided into two groups according to the preceding PA practice. G1: 4 men with one year of PA practice. G2: 5 men with no previous PA experience.
The Edinburgh Handedness Inventory (Oldfield, 1971) evaluated manual preference. The GMD was evaluated through Minnesota Manual Dexterity Test (each hand and two-hands combined), before and after the implementation of a PA program, along 12 weeks, with twice a week sessions of 50 minutes each. The Wilcoxon and Mann-Whitney tests were applied.

RESULTS: After the program, G2 showed significant improvements on nonpreferred hand. Without statistical significant we observed a general improvement, either in G1 and G2, concerning other parameters evaluated, and a decrease of the manual asymmetry.
Comparing both groups in each moment of evaluation, G1 showed a tendency to perform better with each hand and to be more asymmetric than G2. In two-hands combined G2 showed better performance. However differences between groups were not statistically significant.

CONCLUSION: After the implementation of a PA programme, a tendency to some improvements of GMD was found, although with significant relevance only to the G2's nonpreferred hand. More studies with a broad sample and including women with schizophrenia are recommended.

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