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Physical Activity of Patients with Chronic Schizophrenia and Related Clinical Factors

Sook-Hyun Lee[1], Gyurin Kim[1], Chul-Eung Kim[2], and Seunghyong Ryu[1] ✉

[1]Department of Mental Health Research, National Center for Mental Health, Seoul, Republic of Korea
[2]Mental Health Research Institute, National Center for Mental Health, Seoul, Republic of Korea

Objective This study aimed to investigate clinical factors contributing to the low physical activity (PA) of patients with chronic schizophrenia.

Methods PA was measured in 50 outpatients with chronic schizophrenia using the International Physical Activity Questionnaire Short Form (IPAQ-SF). Psychopathology, psychosocial functioning, and extrapyramidal symptoms were assessed using the 18 item-Brief Psychiatric Rating Scale (BPRS-18), Global Assessment of Functioning (GAF), and Drug-Induced Extrapyramidal Symptom Scale (DIEPSS), respectively. We examined differences in these clinical variables between "inactive," "minimally active," and "health enhancing physical activity" groups. Linear regression analysis was used to examine the clinical factors explaining low PA levels in patients with schizophrenia.

Results Subjects spent an average of 130.18±238.89 min/wk on moderate/vigorous-intensity PA and only 26% of them met the recommended PA guideline of 150 minutes of at least moderate PA per week. The inactive group showed significantly higher BPRS-18 and DIEPSS scores, and a lower GAF score than the other groups. Linear regression analysis showed that DIEPSS scores independently explained the amount of total PA (p=0.001) and time spent being sedentary (p=0.028).

Conclusion This study provides preliminary evidence that extrapyramidal symptoms could be a major impediment to the PA of patients with schizophrenia.

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Key Words Schizophrenia, Physical activity, Sedentary lifestyle, Extrapyramidal symptoms.

INTRODUCTION

Patients with schizophrenia have a lower life expectancy owing to higher premature mortality than the general population.[1] A large cohort study showed that the mortality rate of patients with schizophrenia was 3.7 times higher than that of the general population, and their loss of life expectancy was estimated to be 28.5 years.[2] According to epidemiological studies, cardiovascular disease is the most common cause of premature mortality in patients with schizophrenia.[3,4] In particular, low physical activity (PA), sedentary lifestyle, and subsequent obesity and metabolic syndrome are considered major contributors to the high incidence of cardiovascular diseases and premature mortality in patients with schizophrenia.[5,6]

Recent studies suggest that PA can lower the risk of cardiometabolic disease and improve cardiopulmonary fitness,[7,8] but also alleviate negative symptoms and cognitive decline in patients with schizophrenia.[9,10] However, many patients with schizophrenia suffering from negative symptoms and cognitive impairment are socially withdrawn and less physically active, spending a lot of time sitting or lying down.[11,12] They often lack the will to improve their health through PA.[13,14] Insufficient PA may contribute to an increase in the prevalence of obesity and metabolic syndrome, which are well-known causes of cardiovascular and respiratory diseases, among patients with schizophrenia.[15] Moreover, limitations in activity due to a decline in cardiopulmonary function results in a vicious cycle in which PA is further reduced.[16,17] In addition, low PA may exacerbate depressive symptoms, low self-esteem, and impairment of psychosocial functioning in patients with schizophrenia, resulting in lower quality of life.[18]

As life expectancy increases, patients with schizophrenia are more likely to be exposed to chronic physical illnesses

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✉ **Correspondence:** Seunghyong Ryu, MD
Department of Mental Health Research, National Center for Mental Health, 127 Youngmasan-ro, Gwangjin-gu, Seoul 04933, Republic of Korea
Tel: +82-2-2204-0109, **Fax:** +82-2-2204-0393, **E-mail:** seunghyongryu@gmail.com

such as diabetes and cardiovascular diseases.[19] As a result, social costs may be expected to rise. Considering that adequate PA can reduce the risk of cardiovascular disease and premature mortality, attempts are needed to increase PA in patients with schizophrenia. As mentioned above, PA is also closely related to mental health, including self-esteem, social functioning, and quality of life. In order to improve the physical health of patients with schizophrenia, it is necessary to first examine the clinical factors affecting PA in these patients. The purpose of this study was to investigate PA levels in Korean patients with chronic schizophrenia and to identify the clinical factors related to their PA.

METHODS

Subjects

A total of 50 subjects were recruited from an outpatient clinic at the National Center for Mental Health. Inclusion criteria were as follows: 1) aged 20–60 years; 2) met the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) criteria for schizophrenia; 3) received antipsychotic treatment for more than 2 years without major changes in medications; and 4) appeared clinically stable without hospitalization for the past year and could provide reliable information. Patients with other psychiatric disorders, neurological diseases, and physical disability were excluded. This study was initiated after approval from the Institutional Review Board of the National Center for Mental Health (IRB No: 116271-2016-42), and written informed consent was obtained from all subjects.

Assessments

All subjects completed the Korean version of the International Physical Activity Questionnaire Short Form (IPAQ-SF),[20,21] which was developed by the World Health Organization (WHO) for surveillance and global comparison of PA. A trained interviewer (SHL) helped the subjects understand the questionnaire. The 7 items of the IPAQ-SF recorded the total minutes spent on vigorous-intensity PA, moderate-intensity PA, walking, and sedentary behavior (SB) over the 7 days prior to taking the survey. The amount of PA was standardized according to the metabolic equivalent task (MET) minutes per week (MET-min/wk). Using the Ainsworth et al.[22] compendium, a MET score for each type of activity was estimated by weighting the reported minutes per week by a MET energy expenditure estimate assigned to each type of activity: MET-min/wk=duration×frequency per week×MET intensity (vigorous PA=8.0 METs, moderate PA=4.0 METs, and walking=3.3 METs). Total PA (total MET-min/wk) was calculated as a sum of vigorous PA, moderate PA, and walking MET-min/wk scores. In addition, body weights and waist circumferences were measured, and body mass indexes (BMI, kg/m^2) were calculated.

The clinical assessments were performed by an experienced psychiatrist (SR) using a direct interview and clinical-rating scales. The overall level of psychopathology was evaluated using the 18 item-Brief Psychiatric Rating Scale (BPRS-18).[23,24] The "affect," "positive symptoms," "negative symptoms," "resistance," and "activation" subscales of BPRS-18 were analyzed according to the factor structure proposed by Shafer.[25] The Global Assessment of Functioning (GAF) was used for assessing the overall level of the patients' functioning.[26] Extrapyramidal symptoms of the patients were assessed using the Korean version of the Drug-Induced Extrapyramidal Symptom Scale (DIEPSS),[27,28] which was developed to measure drug-induced movement disorders addressing 8 individual items (gait, bradykinesia, sialorrhea, muscle rigidity, tremor, akathisia, dystonia, and dyskinesia) and a global item. Assessments of drug-induced parkinsonism using the DIEPSS were performed by calculating the summed total score of five items, namely gait, bradykinesia, sialorrhea, muscle rigidity, and tremor.[28]

Statistical analyses

The amount of PA was analyzed using descriptive statistics. We calculated the proportion of the patients meeting the recommended 150 minutes of moderate/vigorous-intensity PA per week for substantial health benefits in patients with schizophrenia according to the International Organization of Physical Therapy in Mental Health (IOPTMH) consensus.[29] In addition, we measured the mean time of SB in the patients per day.

We classified the subjects into "inactive," "minimally active," and "health enhancing physically active" groups according to the IPAQ scoring protocol.[20] Following this, we compared the BPRS-18, GAF, and DIEPSS scores among the 3 groups using the Kruskal-Wallis test, followed by pair-wise comparisons using the Mann-Whitney test, with adjusted p value of less than 0.017. In addition, we analyzed the subscales of BPRS-18 (affect, positive symptoms, negative symptoms, resistance, and activation) and DIEPSS (parkinsonism, akathisia, and dyskinesia) using the same statistical tests. To explore the clinical factors (BPRS-18, GAF, and DIEPSS scores) that could explain the total PA (total MET-min/wk) or SB in patients with schizophrenia, we performed linear regression analyses, controlling for sex, age, and duration of illness. Total MET-min/wk followed a normal distribution.

All statistical analyses were performed using Predictive Analytics Software (PASW) version 17.0 (SPSS Inc., Chicago, IL, USA). P values of less than 0.05 were considered statisti-

cally significant, except in the adjusted test for multiple comparisons ($p<0.017$).

RESULTS

Demographic and clinical characteristics

Table 1 summarizes the demographic characteristics of subjects. A high proportion of the patients were unmarried (85%) or unemployed (82%). Eighteen (36%) patients suffered from one or more of the following: hypertension, diabetes, and hyperlipidemia. More than half (64%) of the patients had been receiving antipsychotic polypharmacy. Risperidone was the first prescribed antipsychotic drug (34%), followed by clozapine (30%), quetiapine (22%), olanzapine (14%), paliperidone (14%), amisulpride (14%), haloperidol (10%), blonanserin (8%), zotepine (8%), aripiprazole (6%), sulpiride (6%), chlorpromazine (4%), and ziprasidone (2%). On average, the patients showed a high level of psychopathology (mean BPRS-18 score=39.12±9.08) and a low level of psychosocial functioning (mean GAF score=49.26±9.48). The mean DIEPSS score was 6.68±4.32. There was a weak but significant correlation between the DIEPSS score and antipsychotic dose ($r=0.36$, $p=0.010$). In addition, 66% of the patients exceeded the BMI cutoff for obesity in Korea (BMI ≥25) and 80% had abdominal obesity (waist circumference ≥90 cm for men and ≥85 cm for women in Korea).

Physical activity and sedentary behavior of patients with schizophrenia

Table 2 demonstrates the time patients spent on each type of PA and the amount of PA they engaged in during one week. On average, the patients engaged in 389.74±401.18 min/wk of total PA, which was equivalent to 1382.07±1453.40 MET-min/wk. Walking accounted for about 60% of the amount of total PA. The patients spent 130.18±238.89 min/wk on moderate/vigorous-intensity PA. Only 26% of them (13/50) met the IOPTMH-recommended PA guideline of 150 minutes of at least moderate-intensity PA per week. The patients were divided into either an inactive group (n=22), minimally active group (n=20), or health enhancing physically active group (n=8) according to the IPAQ scoring protocol. In addition, the patients spent an average of 7.31±3.07 hours per day being sedentary. There was a significant difference in SB time among inactive, minimally active, and health

Table 1. Demographic and clinical characteristics (N=50)

Variable	Mean±SD or N (%)
Age, y	47.40±7.24
Sex (male/female), N (%)	29 (58)/21 (42)
Marital status, N (%)	
Single/divorced/married	36 (72)/7 (14)/7 (14)
Education beyond high school, N (%)	16 (32)
Employment status, N (%)	
Employed/housewife/student/unemployed	2 (4)/7 (14)/0 (0)/41 (82)
Comorbidity, N (%)	
Hypertension/DM/hyperlipidemia	8 (16)/15 (30)/6 (12)
Smoking history, N (%)	
Non-smoker/quit smoking/smoker	33 (66)/3 (6)/14 (28)
Onset age, y	25.98±8.46
Duration of illness, y	21.32±7.94
Current antipsychotic dose (chlorpromazine equivalents), mg	866.65±461.70

Table 2. Mean amount of physical activity in patients with chronic schizophrenia

	Time (min/wk)	MET-min/wk	Ratio of MET (%)
Walking	259.56±292.22	856.55±964.31	61.98
Moderate PA	128.98±238.32	515.92±953.29	37.33
Vigorous PA	1.20±8.49	9.60±67.88	0.69
Total PA	389.74±401.18	1382.07±1453.40	100

MET-min/wk: metabolic equivalent task-minutes per week, PA: physical activity

enhancing physically active groups (χ^2=23.53, p<0.001); patients in the inactive group engaged in more SB than those in minimal active group (U=70.00, p<0.001) or health enhancing physically active group (U=0.00, p<0.001).

Association between physical activity and clinical factors in patients with schizophrenia

We found significant differences in BPRS-18 (χ^2=16.98, p<0.001), GAF (χ^2=16.49, p<0.001), and DIEPSS scores (χ^2=24.82, p<0.001) among inactive, minimally active, and health enhancing physically active groups (Table 3). Pair-wise comparisons confirmed that BPRS and DIEPSS scores in the inactive group were significantly higher than those in the minimally active group (BPRS: U=78.50, p<0.001; DIEPSS: U=71.00, p<0.001) or health enhancing physically active group (BPRS: U=22.00, p=0.001; DIEPSS: U=1.50, p<0.001). Specifically, physically inactive patients suffered from a significantly higher level of affective, positive, and negative symptoms as well as drug-induced parkinsonism than minimally active (affect: U=106.00, p=0.004; negative: U=113.00, p=0.006; parkinsonism: U=75.00, p<0.001) or health enhancing physically active patients (positive: U=33.00, p=0.008; negative: U=7.00, p<0.001; parkinsonism: U=3.50, p<0.001). In addition, the inactive group also showed a significantly lower GAF score than minimally active (U=107.50, p=0.004) and health enhancing physically active (U=16.00, p<0.001) groups. Linear regression analysis showed that the DIEPSS score independently explained the amount of physical activity (B=-264.88, t=-3.60, p=0.001) and SB time (B=0.35, t=2.27, p=0.028) (Table 4).

DISCUSSION

In this study, we assessed the PA levels of patients with schizophrenia using the IPAQ-SF and identified clinical factors associated with their PA. To the best of our knowledge, this is the first study to investigate the PA of outpatients with chronic schizophrenia in Korea. We found that over 70% of patients with schizophrenia did not meet the recommended PA guideline of 150 minutes of moderate/vigorous-intensity PA per week. About half of the patients in this study were classified as inactive according to the IPAQ scoring protocol, and they showed higher levels of psychopathology and EPS, and lower levels of psychosocial functioning than physically active patients. In particular, we observed that the level of EPS independently explained the amount of total PA in patients with schizophrenia.

We observed that Korean patients with chronic schizophrenia spent about 400 min/wk engaging in PA of about 1400 min-MET/wk. This is comparable to the result of a Belgian study in which patients with schizophrenia spent about 330 min/wk engaging in PA, which was equivalent to about 1300 min-MET/wk.[8] However, considering that the mean amount of PA in the general population was about 3000 min-MET/wk in the validation study of Korean version of IPAQ-SF,[21] it is clear that patients with schizophrenia are less physically active than the general population in Korea. Furthermore, patients with schizophrenia spent about 130 min/wk engaging in moderate/vigorous-intensity PA. Only 26% of them met the IOPTMH-recommended PA guideline for minimizing cardio-metabolic risk in patients with schizophrenia of 150 minutes of at least moderate-intensity PA per week. This pro-

Table 3. Association between physical activity and clinical factors in chronic patients with schizophrenia

	Inactive (N=22)	Minimally active (N=20)	Health enhancing (N=8)	Statistics†
BPRS-18‡	44.86±8.52	35.60±7.15*	32.13±5.03*	χ^2=16.98, p<0.001
Affect	9.27±2.59	6.80±2.46*	7.00±1.77	χ^2=10.32, p=0.006
Positive	11.55±3.54	9.55±2.86	7.50±3.12*	χ^2=8.96, p=0.011
Negative	12.36±1.97	9.75±3.06*	8.00±1.31*	χ^2=18.06, p<0.001
Resistance	5.48±1.97	4.50±1.70	4.38±1.30	χ^2=3.84, p=0.147
Activation	5.18±1.71	4.00±1.17	4.25±0.89	χ^2=6.30, p=0.043
GAF	44.00±9.72	51.35±6.85*	58.50±4.69*	χ^2=16.49, p<0.001
DIEPSS§	9.91±2.84	5.10±3.70*	1.75±1.28*	χ^2=24.82, p<0.001
Parkinsonism	6.95±1.86	3.70±2.62*	1.38±1.19*	χ^2=23.81, p<0.001
Akathisia	0.50±0.80	0.25±0.64	0.25±0.46	χ^2=1.57, p=0.456
Dyskinesia	0.36±0.73	0.10±0.31	0.00±0.00	χ^2=4.15, p=0.126

*p<0.017 comparing inactive and minimally active groups or comparing inactive and health enhancing groups using Mann-Whitney test, †Kruskal-Wallis test, ‡total score and subscale scores according to the factor structure proposed by Shafer[25], §total score and subscale scores. Parkinsonism score is the summed score of 5 items for gait, bradykinesia, sialorrhea, muscle rigidity, and tremor.[28] BPRS-18: 18 item-Brief Psychiatric Rating Scale, GAF: Global Assessment of Functioning, DIEPSS: Drug-Induced Extrapyramidal Symptom Scale

Table 4. Clinical factors contributing to physical activity and sedentary behaviora*

	B	SE	t	P
Total physical activity (total MET-min/wk)†				
Sex	-109.06	328.75	-0.33	0.742
Age	10.44	24.37	0.43	0.670
Duration of illness	-5.98	24.90	-0.24	0.811
BPRS-18	49.42	26.54	1.86	0.069
GAF	20.39	18.46	1.11	0.275
DIEPSS	-264.88	73.68	-3.60	0.001
Sedentary behavior‡				
Sex	0.91	0.68	1.35	0.186
Age	0.01	0.05	0.21	0.838
Duration of illness	-0.04	0.05	-0.69	0.495
BPRS-18	0.09	0.06	1.69	0.099
GAF	0.01	0.04	0.17	0.866
DIEPSS	0.35	0.15	2.27	0.028

*to explore what kind of clinical factors explains total physical activity or sedentary behavior, we performed linear regression analyses, controlling for sex, age, and duration of illness, †R^2=0.71, ‡R^2=0.92. MET-min/wk: metabolic equivalent task-minutes per week, BPRS-18: 18 item-Brief Psychiatric Rating Scale, GAF: Global Assessment of Functioning, DIEPSS: Drug-Induced Extrapyramidal Symptom Scale

portion is very low compared to the results of a meta-analysis conducted by Stubbs et al.,[11] in which 56.6% of patients with schizophrenia met the PA guideline, and suggests that the majority of patients with schizophrenia in Korea have not engaged in PA sufficient to improve their physical health.

Sedentary behavior, defined as an energy expenditure≤1.5 METs while in a sitting or reclining posture during waking hours,[30,31] is also known to be an independent risk factor for cardiovascular disease and mortality.[32] In this study, Korean patients with schizophrenia reported that they spent on average 7.31 hours per day being sedentary. A meta-analysis study of SB in patients with psychosis reported that the mean time of self-reported SB was 6.85 hours per day,[12] which is comparable to our findings. However, in the meta-analysis, the duration of SB increased to 12.6 hour per day when measured via objective measures such as an accelerometer.[12] In this regard, the IPAQ-SF may underestimate the time spent being sedentary in Korean patients with schizophrenia. Research on the general population demonstrated that engaging in SB for more than 3 hours per day was associated with a reduction in life expectancy by 2 years.[33] Therefore, reducing SB of patients with schizophrenia will be critical for lowering the rate of their premature mortality.

Some clinical factors might influence the PA of patients with schizophrenia. For example, social withdrawal due to positive or negative symptoms may lead to a decrease in PA of patients with schizophrenia.[34,35] Unemployment or social isolation due to low social functioning in patients with schizophrenia may also reduce their PA and increase the amount of time they spend being sedentary.[36] In addition, deterioration of physical fitness due to antipsychotic-induced EPS or weight gain may be an important factor hindering PA of patients with schizophrenia.[8,37] In this study, we observed that physically inactive patients suffered from a higher level of psychopathology and a lower level of social functioning than minimally active or health enhancing physically active patients. In particular, our findings suggested that factors contributing to physical inactivity in patients with schizophrenia encompass not only passive social withdrawal due to negative symptoms or low social functioning, but also active social avoidance due to residual positive or affective symptoms. In addition, physically inactive patients showed a higher level of drug-induced parkinsonism than minimally active or health enhancing physically active patients. Moreover, we found that the level of EPS to be an independent explanatory factor for the amount of total PA and time spent being sedentary in patients with schizophrenia. Patients with chronic schizophrenia are likely to have many risk factors for EPS.[38] In this study, many of the subjects were middle-aged and had been receiving high-dose antipsychotic polypharmacy. Their daily dose of antipsychotics was also significantly correlated with the level of EPS. Therefore, we need to recognize that EPS is a major impediment to the PA of patients with schizophrenia and should be monitored more carefully. In summary, our findings show that PA levels of patients with schizophrenia are associated with their levels of psychopathology, social functioning, and EPS. Effective treatment of residual symptoms and EPS, as well as social rehabilitation, will be

crucial for improving the PA and physical health of patients with schizophrenia.

This study has some methodological limitations. First, the reliance on self-reported recall of PA is an important limitation. Patients with schizophrenia may overestimate their PA level and underestimate SB time because they are considerably less active than the general population and may have difficulties in accurately recalling their PA intensity and SB time. Second, this study included many patients with relatively high levels of psychopathology and chronicity. Therefore, careful attention should be paid to interpretation of our findings as a representative result of the entire population of patients with schizophrenia. Third, because this study did not include healthy controls, we could not directly compare PA levels between patients with schizophrenia and healthy controls matched for age, sex, and BMI. Fourth, this study did not examine the laboratory markers of metabolic syndrome. As such, we could not investigate the association between PA and metabolic syndrome in patients with schizophrenia.

Taking these limitations into account, this study suggests that a large number of patients with schizophrenia face the risk of health deterioration due to lack of PA and attempts are needed to improve correctable clinical factors, such as EPS, as much as possible for the promotion of PA and prevention of SB. Future studies evaluating the PA of patients with schizophrenia and its related factors with objective measures, and a larger sample size are warranted.

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