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Impact of Physical Activity on Metabolic Syndrome in Patients with Schizophrenia

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Abstract **Review Article**

Schizophrenia is a chronic psychotic disorder associated with high rates of sedentary behavior, metabolic syndrome, and cognitive impairment. Physical activity (PA) has been shown to improve psychiatric symptoms, cognitive function, and overall quality of life, yet few patients engage in regular PA. This study evaluated PA levels in 124 outpatients with schizophrenia using the short-form IPAQ and examined associations with sociodemographic, clinical, and metabolic factors. The majority of patients (86.3%) were classified as physically inactive, while 11.3% engaged in moderate PA and 2.4% in vigorous PA. Low PA was associated with older age, female sex, unemployment, and social isolation, whereas higher PA levels were linked to fewer hospitalizations and absence of metabolic syndrome. These findings highlight the importance of incorporating structured PA into therapeutic and psychosocial interventions for patients with schizophrenia.

Keywords: Schizophrenia, physical activity, metabolic syndrome, antipsychotics.

INTRODUCTION

Psychotic disorders constitute a group of severe and chronic mental illnesses characterized by the presence of psychotic symptoms such as hallucinations, delusional ideas, disorganized speech or behavior, and cognitive disturbances. These disorders profoundly affect individuals' daily functioning, both personally, socially, and professionally [1]. They are also associated with a significant clinical impact, with a high risk of disability, as well as negative outcomes for physical health, including heart disease, back problems, and headaches [2]. Schizophrenia is the most well-known and disabling psychotic disorder. It affects approximately 24 million people worldwide, or about 1 in 300 individuals (WHO, 2022) [1]. Its prognosis and life expectancy are also among the least favorable [8,9]. Metabolic syndrome (a cluster of risk factors for heart disease), physical inactivity, smoking, diet, alcohol and drug use, and suicide partially explain this situation [3].

Compared to the general population, individuals with schizophrenia are at increased risk of low physical activity levels and spend more time engaged in sedentary behaviors [4].

In addition to its effects on physical health, recent evidence indicates that physical activity and exercise interventions have positive effects on both the negative and positive symptoms of psychosis, as well as on quality of life [5]. Research conducted in the general population has shown that regular physical activity is associated with improved cognitive functioning, reduced negative affect, delayed age-related cognitive decline, and slower neurodegeneration [12].

Little is known about the practice of physical activity among patients with schizophrenia in Morocco. The objective of this study was to assess the amount of physical activity among individuals with schizophrenia and its impact on metabolic syndrome and overall health.

METHODOLOGY

Type of study:

This is a prospective study conducted using a questionnaire that included sociodemographic and clinical criteria, as well as the short version of the International Physical Activity Questionnaire (IPAQ). Data collection took place from October 2024 to January 2025, allowing for a representative assessment of physical activity levels over several months.

Inclusion criteria:

The study included participants of both sexes, aged 18 years or older, with a diagnosis of schizophrenia established according to DSM-5-TR criteria. Participants were required to be regularly followed up in outpatient psychiatric care and to be in a clinically stable condition at the time of inclusion. These criteria ensured the reliability of responses and the stability of behaviors related to physical activity.

Exclusion criteria:

Patients in the acute phase of the illness were excluded, as their clinical condition would not allow for a reliable evaluation of physical activity. Likewise, individuals with associated intellectual disabilities were excluded to avoid biases related to comprehension and the reliability of questionnaire responses.

Assessment tools:

The main assessment tool used was the International Physical Activity Questionnaire (IPAQ, short version (Craig *et al.,* 2003). The data collected from this instrument were classified into three levels of physical activity: low, moderate, and high. Physical activity (PA) was expressed as a continuous measure corresponding to the amount of energy expended (in METs) over a seven-day period. The intensity of activity was also measured, generating distinct scores for walking, moderate-intensity activities, and vigorous-intensity activities.

IPAQ results were presented both in categorical form (low, moderate, or high activity) and continuous form, allowing for a detailed analysis of the amount and intensity of physical activity practiced by participants.

Statistical analysis:

Statistical analysis was performed using IBM SPSS software, ensuring rigorous data management and reliable interpretation of results. Variables were classified into two main categories: quantitative variables (e.g., age, scale scores) and qualitative variables (e.g., sex, medical history, intervention group). This distinction made it possible to apply appropriate statistical methods according to the nature of the data analyzed.

For descriptive statistics, quantitative variables were summarized using the mean and standard deviation, or, in cases of non-normal distribution, using the median and interquartile range. Qualitative variables were presented as absolute and relative frequencies (percentages) to describe the sample characteristics.

For statistical tests, the normality of quantitative data distributions was first verified using the Kolmogorov-Smirnov test or the Shapiro-Wilk test, depending on the sample size. When the distribution was normal, the student's t-test was used to compare means between two groups. In the absence of normality, the nonparametric Mann-Whitney test was applied. Associations between qualitative variables were analyzed using the Chi-square test (χ^2).

Finally, a multivariate analysis (such as logistic or linear regression, depending on the nature of the main dependent variable) was performed to identify independent factors associated with this variable. This step allowed control for potential confounding effects and ensured statistically robust results. The threshold for statistical significance was set at $p < 0.01$

RESULTS

a. Sociodemographic data:

The mean age of the participants was 39.50 years (SD = 33.46), with the majority being male (87.9%). Approximately 62.1% of the participants had a modest socioeconomic status, 96% lived with their families, and 71.8% were single. Regarding education, almost 60% had dropped out of school at the secondary level, and only 10.6% were employed at the time of the study (see Table 1).

Table 1: Sociodemographic characteristics

	Frequency (n)	Percentage (%)
Sex		
Male	109	87,9
Female	15	12,1
Socioeconomic level		
High	10	8,1
Moderate	77	62,1
Low	37	29,8
Place of residence		
With family	119	96
Alone	4	3,2
Social center	1	0,8
Marital status		
Single	89	71,8
Married	19	15,3
Divorced	16	12,9

	Frequency (n)	Percentage (%)
Education level		
Unschooled	5	4
Primary	19	15,3
Middle school	74	59,7
High school	16	12,9
University	10	8,1
Employment		
Unemployed	110	89,4
Employed	14	10,6

B. CLINICAL DATA

All participants had a diagnosis of schizophrenia according to DSM-5-TR criteria. The duration of illness was over 10 years in 53.2% of participants, with positive insight observed in 66.1% (see Table 2).

Table 2: Clinical characteristics:

	Frequency (n)	Pourcentage %
Duration of schizophrenia		
Less than 1 year	4	3,2
Between 1 and 5 years	18	14,5
Between 5 and 10 years	36	29
More than 10 years	66	53,2
Insight		
Positive	82	66,1
Negative	42	33,9
Adherence to antipsychotics		
Good	91	73,4
Poor	33	26,6
Types of antipsychotics		
Olanzapine	42	33,9
Haloperidol	30	24,2
Risperidone	27	21,8
Amisulpride	11	8,9
Long-acting antipsychotic	10	8,1
Aripiprazole	2	1,6
Clozapine	2	1,6
Use of psychoactive substances	85	69,1
Tobacco	84	97,7
Cannabis	44	51,2
Alcohol	7	8,1
Benzodiazepines	1	1,2
Ecstasy	1	1,2

C. METABOLIC PARAMETERS

The evaluation of metabolic parameters in patients was based on the assessment of body mass index (BMI), the presence of diabetes, hypercholesterolemia, and hypertension (HTN).

The total number of patients with metabolic syndrome, according to the defined criteria, was 15 (12.1%) (see Table 3).

Table 3: Metabolic parameters

	Frequency(n)	Pourcentage %
BMI		
Normal	82	66,1
Overweight	30	24,2
Obesity	12	9,7
Diabetes		
Yes	10	8,1
No	106	85,5
Unknown	8	6,5

	Frequency(n)	Pourcentage %
Hypercholesterolemia		
Yes	16	13
No	79	64,2
Unknown	28	22,8
Hypertension (HTN)		
Yes	4	3,2
No	110	88,7
Unknown	10	8,1

d. Physical activity:

Participants were classified into low, moderate, or high activity groups according to their MET score. Low PA included participants with a MET score below 600 MET-minutes/week or those with no activity. Moderate PA included participants achieving at least 600 MET-minutes/week, and high PA included participants achieving at least 1500 MET-minutes/week (see Figure 1).

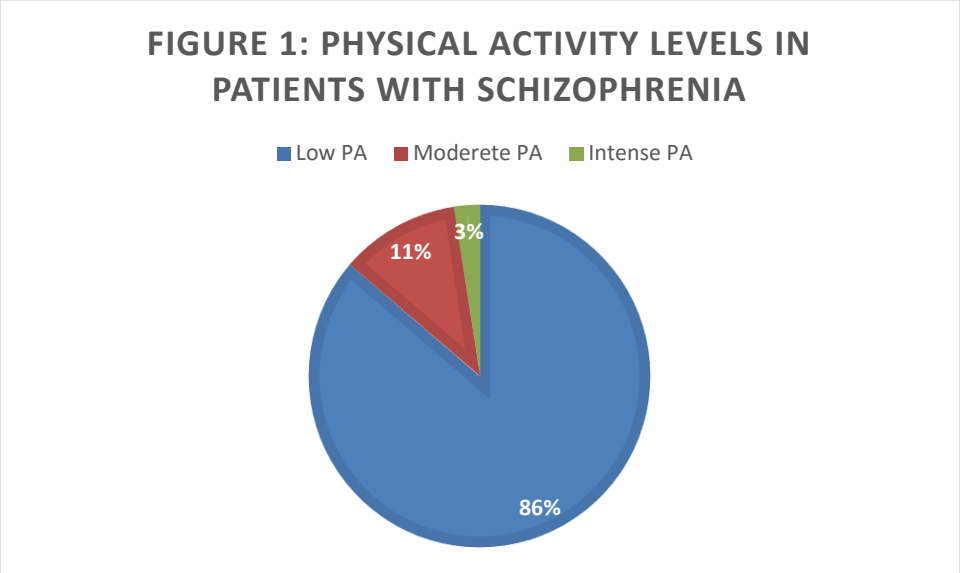

Figure 1: Presents the levels of physical activity (PA), classified into low, moderate, or high activity groups based on IPAQ scores for the entire sample. The results show that 11% of patients engage in moderate physical activity, and only 3% engage in vigorous PA, while 86% have a low level of physical activity.

Table 4: Comparison of sociodemographic characteristics and variables in patients with schizophrenia according to low versus moderate-to-high physical activity levels on the IPAQ

Variables	Total n=124	Low Physical activity N=107	Moderate to high physical activity N=17	P value
Age	39,5 (33-46)	40 (34-48)	36 (23,5-41,5)	**0,026**
Sex				**0,4**
Male	109 (87,9)	93 (86,9)	16 (94,1)	
Female	15 (12,1)	14 (13,1)	1 (5,9)	
Socioeconomic level				**0,21**
Low	37 (29,8)	29 (27,1)	8 (47,1)	
Medium	77 (62,1)	69 (64,5)	8 (47,1)	
High	10 (8,1)	9 (8,4)	1 (5,9)	
Place of residence				**0,068**
Alone	4 (3,2)	4 (3,7)	0	
With family	119 (96)	103 (96,3)	16 (94,1)	
Social center	1 (0,8)	0	1 (5,9)	
Marital status				**0,213**
Single	89 (71,8)	75 (70,1)	14 (82,4)	
Married	19 (15,)	16 (15)	3 (17,6)	
Divorced	16 (12,9)	16 (15)	0	

Variables	Total n=124	Low Physical activity N=107	Moderate to high physical activity N=17	P value
Education level				**0,437**
Unschooled	5 (4)	5 (4,7)	0	
Primary	19 (15,3)	16 (15)	3 (17,6)	
Middle school	74 (59,7)	65 (60,7)	9 (52,9)	
High school	16 (12,9)	13 (12,1)	3 (17,6)	
University	10 (8,1)	8 (7,5)	2 (11,8)	
Employment				**0,007**
Employed	13 (10,5)	8 (7,5)	5 (29,4)	
Unemployed	111 (88,7)	99 (91,6)	12 (70,6)	

Table 5: Comparison of clinical characteristics and variables in patients with schizophrenia according to low versus moderate-to-high physical activity levels on the IPAQ

Variables	Total n=124	Low physical activity N=107	Moderate to high physical activity N=17	P value
Duration of schizophrenia (SCZ)				**0,183**
< 1 year	4 (3,2)	3 (2,8)	1 (5,9)	
1 to 5 years	18 (14,5)	12 (11,2)	6 (35,3)	
5 to 10 years	36 (29)	34 (31,8)	2 (11,8)	
>10 years	66 (53,2)	58 (54,2)	8 (47,1)	
Insight				**0,49**
Positive	82 (66,1)	72 (67,3)	10 (58,8)	
Negative	42 (33,9)	35 (23,7)	7 (41,2)	
Adherence to antipsychotics	91 (73,4)	81 (75,7)	10 (58,8)	0,145
Types of antipsychotics				0,39
Olanzapine	41 (33,9)	38 (45,5)	4 (23,5)	
Risperidone	27 (21,8)	23 (21,5)	4 (23,5)	
Amisulpride	11 (8,9)	10 (9,3)	1 (5,9)	
Haloperidol	30 (24,2)	23 (21,5)	7 (41,2)	
Long-acting antipsychotic	10 (8,1)	10 (9,3)	0	
Clozapine	2 (1,6)	2 (1,9)	0	
Aripiprazole	2 (1,6)	1 (0,9)	1 (5,9)	
Number of hospitalizations	1 (0-2)	1 (0-2)	0 (0-0)	**<0,001**
Use of psychoactive substances	85 (68,5)	72 (67,3)	13 (76,5)	0,481
Ecstasy	1 (0,8)	0	1 (5,9)	**0, 012**
Alcohol	7 (5,6)	6 (5,6)	1 (5,9)	0,96
Cannabis	44 (35,5)	34 (31,8)	10 (58,8)	**0,031**
Tobacco	84 (67,7)	71 (66,4)	13 (76,5)	0,4
Anxiolytic medications	1 (0,8)	0	1 (5,9)	**0,012**

Table 6: Metabolic syndrome and level of physical activity

	Total n=124	Low physical activity N=107	Moderate to high physical activity N=17	P value
Metabolic syndrome	15 (12,1)	15 (14)	0(0)	**<0,01**
BMI				**0,143**
Normal	82 (66,1)	68 (63,6)	14 (82,4)	
Overweight	30 (24,2)	28 (26,2)	2 (11,8)	
Obesity	12 (9,7)	11 (10,3)	1 (5,9)	
Diabetes	10 (8,1)	10 (9,3)	0	0,84
Hypercholesterolemia	16 (12,9)	15 (14)	1 (5,9)	0,20
Hypertension	4 (3,2)	4 (3,7)	0	0,5

DISCUSSION

In our study, we evaluated the physical activity levels of patients with schizophrenia using the IPAQ scale and identified the clinical and sociodemographic factors associated with their physical activity. The majority (86.3%) of patients in this study were classified as inactive according to the IPAQ scoring protocol

(participants with a MET score below 600 MET-minutes/week or with no activity), while 11.3% engaged in moderate activity and only 2.4% engaged in vigorous physical activity. This is similar to the study by Snethen [8], where most patients with schizophrenia performed no physical activity and exhibited predominantly sedentary behavior, followed by moderate activity, with only 4 patients engaging in vigorous activity. Other studies [9-12] have also shown that patients treated for schizophrenia spend most of their week in sedentary behaviors, and a very small proportion rarely engage in low physical activity.

In another study conducted in South Korea by Lee SH [13], approximately 26% of patients engaged in moderate PA (1300 MET-minutes/week), higher figures than those found in our study. Research [14,15] has found that walking is the preferred form of physical activity among people with psychotic disorders.

In a study by Rosenbaum *et al.,*[16], regarding vigorous PA, individuals with schizophrenia reportedly engage in only 2.4 minutes per day on average. They observed interesting differences between moderate and vigorous PA levels depending on the context and assessment method. Significantly higher levels of moderate PA were observed in outpatient settings and with objective assessment methods, whereas the opposite was true for vigorous PA, meaning lower levels were recorded in outpatients and with objective methods. These data suggest that individuals with schizophrenia tend to underestimate their moderate PA levels and overestimate their vigorous PA levels.

In our study, we observed that several factors could influence the physical activity (PA) of patients with schizophrenia. Age is an important factor; PA decreases with age. This decline in physical activity with age is also observed in the general population. In individuals with schizophrenia, this reduction is often more pronounced due to disease-specific factors. In this study, we noted that male patients had higher moderate-to-vigorous activity levels compared to female patients, which is consistent with a study [17] that examined PA by sex. Another study observed the opposite and suggested that this could be due to the generally earlier onset of the illness in men, the greater burden of negative symptoms, substance use disorders, and lower remission and recovery rates [18]. These higher levels of inactivity may also partially explain the increased risk of cardiovascular diseases and premature mortality, particularly in men with psychosis [19,20].

Another predictive factor for low physical activity in this study is the absence of employment. This aligns with a study [21] showing that unemployment or social isolation due to low social functioning in patients with schizophrenia is correlated with reduced physical activity and increased sedentary behavior. Other studies [22,23] have shown that social withdrawal and unemployment, which may result from positive or negative symptoms, can lead to decreased PA in patients with schizophrenia.

Several studies, including Kramer *et al.,*[24], emphasize that the presence of depressive symptoms can represent a major barrier to engaging in physical activity. These symptoms can affect mood, energy, and general interest, making it difficult to take action. Moreover, lack of motivation and willpower is also a key factor limiting regular exercise. These two elements, often interconnected, play a crucial role in an individual's ability to maintain a consistent physical activity routine [22]. Additionally, it has been noted that physically inactive patients exhibit higher levels of medication-induced extrapyramidal symptoms compared to patients with some or high levels of PA [13]. Another study found that antipsychotic medication use is associated with lower physical activity and poorer physical health [25], and Pérez-Cruzado *et al.,*[26] confirmed that higher doses of antipsychotic medications are linked to lower levels of physical activity and fitness.

In our study, cannabis use was a significant factor. Studies exploring the relationships between physical activity, schizophrenia, and cannabis use are limited. However, a recent 2024 study by Merrill [27] examined the association between cannabis use and physical activity, showing that cannabis users were more likely to engage in physical activity than non-users, which aligns with our findings.

We also observed that higher levels of physical activity were associated with fewer hospitalizations and relapses ($p < 0.01$). This is comparable to the literature [28], which demonstrates that physical exercise can improve the physical health of patients with schizophrenia, acting as an effective adjunct therapy. The study by Lee SH *et al.,*[13] confirmed that physically inactive patients had significantly higher levels of affective, positive, and negative symptoms, with higher BPRS scores.

Numerous randomized controlled trials have demonstrated that regular physical activity leads to a significant reduction in the severity of both positive and negative symptoms in patients with schizophrenia. These studies have also shown a marked decrease in anxiety and depressive symptoms, as well as notable improvements in quality of life and overall functioning of the individuals concerned. These clinical benefits have been confirmed in patients at an early stage of the illness as well as in those at more advanced stages [29, 30]. Indeed, engaging in physical activity alongside standard treatments can improve certain cognitive functions impaired in schizophrenia, such as working memory, attention, and social cognition [31].

The literature also reports that regular physical activity can increase the expression of certain

neurotrophic growth factors, such as brain-derived neurotrophic factor (BDNF), in the central nervous system [32, 33], which are known to be decreased in patients with schizophrenia. The PA-mediated increase in BDNF has been positively correlated with improvements in specific cognitive domains (composite score of the MATRICS Consensus Cognitive Battery) [34] and cardiorespiratory fitness [35]. Thus, the BDNF increase may promote neurogenesis, synaptogenesis, and gliogenesis, suggesting that physical activity supports neuroplasticity [36].

Furthermore, regular physical activity reduces the risk of developing metabolic syndrome and also modulates the peripheral inflammatory response [37].

In our sample, 15 participants met the criteria for metabolic syndrome, all of whom had low or absent physical activity. Conversely, all patients who engaged in moderate-to-vigorous PA did not present with metabolic syndrome. In a study [38], among lifestyle domains, appropriate physical activity, weight control, dietary habits, medication adherence, and health management were shown to reduce the incidence of metabolic syndrome.

Patients with schizophrenia often have a lifestyle that increases their risk of developing metabolic syndrome: a sedentary lifestyle, lack of regular physical activity, poor diet, substance use, and high rates of smoking [39-41]. Some of these lifestyle factors are influenced by disease aspects, such as negative symptoms and stress vulnerability.

Body mass index (BMI) is a key indicator of metabolic syndrome and is easily measurable and quantifiable [42]. A high BMI indicates obesity, which is not only associated with an increased risk of metabolic syndrome but is also a major risk factor for chronic comorbid conditions such as hypertension, cerebrovascular disease, and diabetes [43]. In particular, compared to the general population, individuals with schizophrenia tend to have higher BMI and a threefold higher risk of obesity [44].

Interventions combining tailored dietary programs with physical exercise for individuals living with schizophrenia have been effective in reducing body weight, BMI, and abdominal circumference. These approaches also help prevent metabolic syndrome and reduce risks associated with its complications [44]. Sun *et al.,*[38] demonstrated that regular medication use and health check-ups were associated with a reduced risk of metabolic syndrome in people with schizophrenia. A previous study reported that disease awareness through health examinations motivates individuals to modify their lifestyle [45].

CONCLUSION

Sports play a key role in the management of schizophrenia. Low levels of sports participation and physical activity are associated with advanced age, female sex, unemployment, and social isolation, whereas regular engagement in sports improves symptoms, reduces hospitalizations, and lowers metabolic risk. These findings support the importance of integrating sports into therapeutic and psychosocial rehabilitation strategies, while considering individual and contextual barriers.

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