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ORIGINAL RESEARCH ARTICLE

Levels of Physical Activity in Patients with Severe Psoriasis: A Cross-Sectional Questionnaire Study

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Abstract
Background Psoriasis is a chronic inflammatory disease associated with increased cardiovascular mortality, secondary to the increased prevalence of cardiovascular risk factors and premature atherosclerosis. Physical activity is a vital component in prevention and management of cardiovascular disease. Few studies have examined the level of physical activity in psoriasis patients, using validated questionnaires or other objective assessment tools.
Objective The aim of this study was to analyze and compare physical activity undertaken by patients with severe psoriasis and healthy controls, using the International Physical Activity Questionnaire—Short Form (IPAQ-S), a validated instrument for assessing physical activity.
Methods Ninety patients with severe plaque-type psoriasis and 160 healthy subjects were enrolled in the present study. Physical activity was evaluated using IPAQ-S.
Results Psoriasis patients had reduced levels of physical activity compared with non-psoriasis patients, regardless of sex or whether the variable was continuous or categorical. The odds ratio for low-level physical activity for psoriasis patients, compared with controls, was 3.42 (95 % CI 1.47–7.91), indicating that this severe psoriasis population did not undertake recommended levels of physical activity.
Conclusions Psoriasis patients exhibit decreased levels of physical activity, possibly for both psychological and physiological reasons. The lack of physical activity may contribute to the increased risk of cardiovascular disease in psoriasis patients, in addition to the intrinsic risks related to systemic inflammation and psoriasis-linked comorbidities. Regular physical activity should be encouraged in all psoriasis patients because of its beneficial effects on systemic inflammation and cardiometabolic comorbidities associated with psoriasis.

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1 Introduction

Psoriasis is a chronic, systemic, inflammatory skin disease, which affects 1–3 % of the general population [1]. Psoriasis has been associated with increased cardiovascular mortality, because of a higher prevalence of traditional cardiovascular risk factors (such as hypertension, dyslipidemia, diabetes, obesity, and tobacco use) and premature atherosclerosis, probably as a consequence of systemic inflammation [2–7]. Currently, it is well accepted that all

psoriasis patients should be encouraged to correct their modifiable cardiovascular risk factors, particularly obesity and smoking, and to adopt healthy lifestyle behaviors such as regular physical activity [8]. It is well known that physical activity is vital for the prevention and management of cardiovascular disease, and it has beneficial effects on obesity, diabetes, metabolic syndrome, and other cardiovascular risk factors [9, 10].

Few studies have examined the physical activity of psoriasis patients, and even fewer have used validated questionnaires or objective tools such as accelerometers in their analyses. Instead, in most studies on the physical activity of psoriasis patients, physical activity was analyzed as a secondary objective rather than as a primary study objective, and control groups were lacking, assessment of physical activity was based on a limited number of questions, and study definitions were inconsistent [11].

Despite these shortcomings, previous studies have suggested that physical activity was decreased in psoriasis patients and could be related to the incidence, prevalence, and severity of psoriasis. By contrast, other studies have shown no significant difference in mean physical activity between psoriasis and non-psoriasis patients [12, 13]. A recent study of 30 patients with mild to moderate psoriasis showed that daily physical activity, measured with an accelerometer, was greater in the psoriasis group than in the control group [14].

The aim of this study was to analyze and compare physical activity in patients with severe psoriasis and healthy controls, using a validated instrument to assess physical activity.

2 Methods

Consecutive adult patients with severe plaque-type psoriasis (defined as >10 % of the body surface area [BSA] covered by lesions and/or disease requiring systemic therapy or phototherapy) managed at our Psoriasis Center were enrolled in this cross-sectional study. The control group consisted of relatively healthy patients referred to the dermatology outpatient clinic for management of benign conditions such as nevi, benign skin tumors, or skin infections such as tinea or warts. All recruited patients were more than 18 years old.

Patients were excluded if any of the following were present: psoriatic arthritis (previous/current signs/symptoms indicative of joint involvement); cardiovascular disease, including coronary heart disease (a history of myocardial infarction, angina, angioplasty, or coronary artery bypass grafting), cerebrovascular disease (a history of stroke or transient ischemic attack), or peripheral vascular disease; systemic inflammatory disease (such as lupus erythematous, rheumatoid arthritis, or spondyloarthropathies); or conditions that could impair normal physical activity, such as neurological disease or amputations.

The following patient data were recorded: age, sex, height, weight, presence of cardiovascular risk factors (a previous medical diagnosis or current treatment for hypertension, diabetes, dyslipidemia, tobacco use, and a family history of cardiovascular disease), and current medications. Psoriasis characteristics, including family history, disease duration, current and previous treatments, and severity (as assessed by the Dermatology Life Quality Index [DLQI] questionnaire and BSA covered by lesions, assessed by the same dermatologist, T.T.) were also recorded.

Physical activity was evaluated using a validated, self-report questionnaire known as the International Physical Activity Questionnaire (IPAQ). IPAQ is an instrument designed to assess levels of physical activity, and short and long forms of the questionnaire have been developed on the basis of self-report population surveys. In the present study, the IPAQ Short Form (IPAQ-S) was selected to reduce the burden on participants. IPAQ-S has been developed for adults (15–69 years of age) and tested in this population, and the instrument has been validated in different languages, including Portuguese [15]. IPAQ-S asks participants to report activities that have been performed for at least 10 min in the past 7 days. The amount of physical activity is indicated by the time spent in physical activity during leisure-, work-, domestic- and transport-related activities at three different levels of intensity, which are categorized as "walking", "moderate", and "vigorous" activities. Examples of activities that represent each intensity are provided. Using the instrument's scoring protocol, total weekly physical activity is estimated by weighting time spent in each activity intensity, with its estimated metabolic equivalent (MET) energy expenditure. MET-minutes (MET-min) are calculated by multiplying the MET score of an activity by the minutes for which it is performed, and are equivalent to kilocalories for a 60 kg person. IPAQ-S was found to have fair to moderate agreement with accelerometer-measured physical activity (pooled $r = 0.30$) [15]. IPAQ-S also allows physical activity to be measured as a categorical variable, with the categories defined as "low", "moderate", or "high" levels of physical activity [16]. The definitions for low, moderate, and high levels of physical activity are described in Table 1. Finally, physical activity was separated into either "low-level" or "non-low-level" physical activity, to understand the influence of non-compliance with the recommended physical activity, considering the recent update of the 1995 recommendations on the physical activity needed to improve and maintain health, by the Committee on Exercise and Cardiac Rehabilitation of the American Heart Association: healthy

Table 1 Definitions of low, moderate, and high levels of physical activity [14]

	Definition
Low level	The lowest level of physical activity; it includes the individuals who do not meet criteria for moderate or high physical activity level
Moderate level	Half an hour of at least moderate-intensity physical activity on most days; it includes individuals who meet at least one of the following criteria: (a) 3 or more days of vigorous-intensity activity of at least 20 min per day; (b) 5 or more days of moderate-intensity activity and/or walking of at least 30 min per day; (c) 5 or more days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week
High level	At least 1 hour per day, or more, of at least moderate-intensity activity above the basal level of physical activity—basal activity may be considered to be equivalent to approximately 5,000 steps per day, i.e. those who move at least 12,500 steps per day or the equivalent in moderate and vigorous activities; it includes individuals who meet one of the following criteria: (a) vigorous-intensity activity on at least 3 days, achieving a minimum total physical activity of at least 1,500 MET-minutes/week; (b) 7 days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving a minimum total physical activity of at least 3,000 MET-minutes/week

MET metabolic equivalent

adults aged between 18 and 65 years should have moderate-intensity aerobic physical activity for a minimum of 30 min on 5 days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on 3 days each week—grade of evidence IA [17].

2.1 Statistical Analysis

Continuous variables were expressed as either means ± SDs or medians and interquartile ranges. Categorical variables were expressed as percentages. Variable distribution was tested for normality, using the Kolmogorov–Smirnov test. Patients and controls were compared using the Student's *t* test and the Mann–Whitney *U* test for normally and non-normally distributed continuous variables, respectively. The χ^2 test was used for categorical variables. The odds ratios (ORs) and corresponding 95 % confidence intervals (CIs) were calculated.

The association between disease status (psoriasis patients and controls) and outcome variables was assessed using multivariable logistic and linear regression models, for categorical and continuous variables, respectively, with adjustment for confounders of age and sex.

Pearson's or Spearman's rank correlation coefficients were used to assess the bivariate relationships between continuous and categorical variables and total MET-min among psoriasis patients. The independent association was examined by multivariate linear regression with adjustment covariates of age.

The level of statistical significance was set at $\alpha = 0.05$.

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) Version 21 (SPSS, Chicago, IL, USA).

3 Results

A total of 90 patients with severe psoriasis and 160 healthy subjects were studied. The two groups were similar in terms of sex and age (Table 2). Psoriasis patients had a mean disease duration of 22.1 ± 11.5 years; 39 % had a family history of psoriasis; and their mean BSA covered by lesions and DLQI score were 11.1 ± 7.4 % (54.8 % with BSA > 10 % coverage) and 7.5 ± 6.5 (43.8 % with a DLQI score > 10), respectively. Most patients (83.3 %) were receiving or had previously received systemic therapy or phototherapy.

With respect to cardiovascular risk factors, patients with psoriasis were more likely than controls to have hypertension, diabetes, dyslipidemia, obesity, and an increased body mass index (BMI). No significant statistical differences were observed for a family history of cardiovascular disease and tobacco use. Patients with psoriasis had an increased likelihood (adjusted for age and sex) of having hypertension (OR 2.50, 95 % CI 1.29–4.88), diabetes (OR 4.19, 95 % CI 1.53–11.44), dyslipidemia (OR 1.91, 95 % CI 1.04–3.53), and obesity (OR 2.42, 95 % CI 1.30–4.51) (Table 2).

Analysis of physical activity revealed that the mean total MET-min of psoriasis patients was significantly decreased compared with that of controls ($p = 0.001$). Levels of physical activity of psoriasis patients in each category of intensity (walking, moderate, and vigorous) was less than that of controls, with statistical significance for walking ($p = 0.024$) and moderate intensity ($p = 0.008$), and an underlying trend toward decreased physical activity of vigorous intensity in psoriasis patients ($p = 0.059$). Adjusting for age and sex, the total MET-min and the MET-min in moderate intensity remained statistically significant ($p = 0.002$ and 0.011, respectively), while trends

Table 2 Characteristics of the study subjects

	Psoriasis patients ($n = 90$)	Controls ($n = 160$)	p value[#]	Adjusted p value*	OR (95 % CI)*
Age [years]	47.7 ± 10.9	46.8 ± 12.2	0.538		
Sex, male [%]	61.1	56.9	0.514[+]		
Height [m]	1.68 ± 0.10	1.68 ± 0.08	0.982	0.757	
Weight [kg]	80.8 ± 17.4	72.8 ± 13.2	**<0.001**	**<0.001**	
BMI [kg/m^2]	28.6 ± 5.4	25.8 ± 3.9	**<0.001**	**<0.001**	
BMI categories [%]					
Normal weight	21.1	41.3			
Overweight	46.7	41.9	**0.001**[+]		
Obese	32.2	16.9			
Cardiovascular risk factors [%]					
Hypertension	36.7	22.3	**0.018**[+]		**2.50 (1.29–4.88)**
Diabetes	15.6	5.0	**0.007**[+]		**4.19 (1.53–11.44)**
Dyslipidemia	40.0	27.3	**0.045**[+]		**1.91 (1.04–3.53)**
Obesity	32.2	16.9	**0.005**[+]		**2.42 (1.30–4.51)**
Tobacco use	32.2	26.6	0.361[+]		1.35 (0.74–2.47)
Family history of CVD	5.6	10.8	0.170[+]		0.49 (0.17–1.43)
Physical activity assessment [MET-minutes]					
Walking intensity	792 (198–1,675)	1,188 (462–2,376)	**0.024**[+]	0.062	
Male	1,407.1 ± 1,333.9	1,371.3 ± 1,260.5	0.871	0.801	
Female	781.2 ± 863.0	1,609.1 ± 1,307.3	**0.001**	**0.001**	
Moderate intensity	960 (0–1,800)	1,440 (480–2,880)	**0.008**[+]	**0.011**	
Male	480 (0–1,440)	1,080 (240–2,160)	**0.010**[+]	**0.016**	
Female	1,841.1 ± 1,723.5	2,213.7 ± 1,443.5	0.247	0.241	
Vigorous intensity	0 (0–1,260)	480 (0–1,440)	0.059[+]	0.066	
Male	0 (0–1,440)	480 (0–1,920)	0.296[+]	0.393	
Female	0 (0–720)	0 (0–1,440)	0.101[+]	0.070	
Total	3,341.5 ± 3,096.8	4,688.7 ± 3,186.1	**0.001**	**0.002**	
Male	3,413.0 ± 3,104.2	4,305.7 ± 3,354.4	**0.003**	**0.002**	
Female	3,229.2 ± 3,126.8	5,193.9 ± 2,896.3	**0.002**	**0.002**	
Low-level	18.9 %	6.3 %			
Moderate-level	32.2 %	31.3 %	**0.006**[+]		
High-level	48.9 %	62.4 %			
Non-low-level	81.1 %	93.7 %			
Low-level	18.9 %	6.3 %	**0.002**[+]		**3.42 (1.47–7.91)**

Results are expressed as percentages, medians (interquartile ranges), or means ±standard deviations, as appropriate

Statistically significant p values are labeled with bold text

BMI body mass index, *CI* confidence interval, *CVD* cardiovascular disease, *MET* metabolic equivalent, *OR* odds ratio

[#] Derived using a Student's t test, except where [+] denotes use of a Mann–Whitney U test and [+] denotes use of a χ^2 test

* Adjusted for age and sex or only age when analyzing physical activity separately by sex

toward decreased MET-min for walking and vigorous intensity were observed in psoriasis patients ($p = 0.062$ and 0.066, respectively) (Table 2).

If the findings were analyzed separately by sex, both male and female psoriasis patients had lower MET minute values than their healthy counterparts. After adjustment for age, the total MET-min and walking MET-min values of female psoriasis patients were significantly decreased, compared with those of female controls ($p = 0.002$ and $p = 0.001$, respectively). In the male group, the total MET-min and moderate-intensity MET-min values were significantly decreased in psoriasis patients compared with controls ($p = 0.002$ and $p = 0.016$, respectively) (Table 2).

Table 3 Impact of physical activity levels on cardiovascular risk factors in psoriasis

	Low-level physical activity [%]	Non-low-level physical activity [%]	*p* value[∓]	OR (95 % CI)[a]
Hypertension	47.1	34.2	0.324	1.81 (0.52–6.23)
Diabetes	29.4	12.3	0.130	3.42 (0.88–13.28)
Dyslipidemia	52.9	37.0	0.227	1.87 (0.57–6.14)
Obesity	58.8	26.0	**0.009**	**4.68 (1.47–14.85)**
Tobacco use	23.5	34.2	0.394	0.60 (0.18–2.08)

Statistically significant *p* values are labeled with bold text

CI confidence interval, *OR* odds ratio

[∓] χ^2 test

[a] Multivariable logistic regression was used to adjust for age and sex

Categorizing the level of physical activity as low, moderate, or high, there was a statistically significant difference between the psoriasis and control groups ($p = 0.006$). If the level of physical activity was defined as either "low" or "non-low", the sex- and age-adjusted OR for a low level of physical activity among psoriasis patients, versus controls, was 3.42 (95 % CI 1.47–7.91) (Table 2).

In patients with psoriasis, the total MET-min was negatively correlated with weight and BMI ($p = 0.002$ and $p = 0.013$, respectively), although statistical significance was not reached after adjustment for age and sex. No association was observed between total MET-min and psoriasis severity as assessed by BSA coverage ($p = 0.160$) and DLQI score ($p = 0.410$).

Psoriasis patients with "low-level" physical activity (not complying with the recommendations of the American Heart Association) had sex- and age-adjusted OR for obesity of 4.68 (95 % CI 1.47–14.85), compared with psoriasis patients who performed "non-low-level" physical activity, while no significantly higher risk of the other cardiovascular risk factors was observed (Table 3).

4 Discussion

This study showed that psoriasis patients have reduced levels of physical activity, compared with non-psoriasis patients, using a validated instrument, the IPAQ-S.

This decrease in physical activity was observed in both sexes and regardless of whether physical activity was defined as a continuous or categorical variable. The OR for low-level physical activity among psoriasis patients, versus controls, was 3.42 (95 % CI 1.47–7.91), clearly indicating that this severe psoriasis population did not meet the recommendations for healthy physical activity behavior.

In the psoriasis group, the patients who did not meet the recommended levels of physical activity were at greater risk of being obese (OR 4.68, 95 % CI 1.47–14.85) than those who met the recommendations. This finding is particularly important because obesity is a relevant comorbidity in psoriasis.

Consistent with other studies [2–5], the present study demonstrated that patients with severe psoriasis had increased risks of hypertension, diabetes, dyslipidemia, and obesity.

The diminished physical activity of psoriasis patients may be related to psychological barriers. The stigma of psoriasis and social avoidance of these patients might discourage physical activity. In a study of 104 psoriasis patients, most patients showed social avoidance, including avoidance of sports (40 %), collective showers (64 %), wearing sport clothes (64 %), and leaving their home (11.5 %) [18].

Interestingly, in our study, decreased physical activity was not associated with psoriasis severity, assessed using BSA coverage and DLQI scores, even though the two DLQI questions related to sport and leisure activities. In these patients, at least, greater BSA coverage or a greater impact of the disease on patients' quality of life were not associated with decreased physical activities. However, it is currently accepted that psoriasis may present significant cumulative life course impairment, because of the substantial physical, psychological, social and economic burden, which may result in failure to achieve "full life potential" in some patients, as psoriasis influences major life-changing decisions and alters the course of patients' lives, with potentially permanent consequences [19]. Thus, it is possible that, even in lower-severity phases (for example, due to treatment), the previous impact of the disease influences the willingness to do physical exercise.

Physiological barriers may also play a role. Psoriatic patients may not tolerate the same exercise intensity in hot or humid conditions as non-psoriatic individuals do, as psoriatic skin is less effective at dissipating heat and may interfere with sweating [20].

Physical activity may be more important in psoriasis than previously thought. It has recently been shown that reduced physical activity is associated with an increased risk of developing psoriasis. Frankel et al. [21] prospectively evaluated the association between physical activity and the incidence of psoriasis in a large cohort of American women, and observed that vigorous physical activity was independently associated with a reduced risk of psoriasis, which remained significant after adjustment for BMI. This may be due to the modulation of the chronic inflammation that predisposes to the development of psoriasis [21]. Moreover, physical activity appears to have anti-inflammatory effects independent of its effect on fat loss. There is evidence that increasing physical activity can reduce the levels of inflammatory molecules such as tumor necrosis factor (TNF)-α, interleukin (IL)-6, interferon (IFN)-γ, and C-reactive protein—some of which are implicated in the link between psoriasis and its cardiometabolic comorbidities and atherosclerosis—and can elevate levels of anti-inflammatory cytokines such as adiponectin [22, 23]. Finally, physical activity is beneficial in the prevention and management of cardiovascular disease and associated cardiovascular risk factors, which are important contributors to morbidity and mortality in psoriasis. Thus, physical activity may have a role in the treatment and prevention of these conditions in psoriasis patients. Physical activity is essential in weight control and has been demonstrated to decrease leptin levels and increase adiponectin levels, along with enhancing weight loss [24]. Several studies have reported an improvement in psoriasis after weight loss, which was possibly due to a decrease in the levels of proinflammatory mediators associated with excessive adiposity [25–27].

Some limitations of the present study warrant mention. First, the cross-sectional method of the study provided a "snapshot" of a group of individuals but did not allow evaluation of causal relationships. Also, it was not possible to analyze the effect of physical activity on different aspects of the disease. Second, although the use of a validated instrument to evaluate physical activity may be regarded as a strength of this study, IPAQ-S is a self-report assessment of physical activity and has been shown to overestimate physical activity, when compared with data measured by an objective method [28]. Thus, the actual physical activity of study subjects may have been even lower than was reported in the present study. Prospective studies using objective tools such as accelerometers or pedometers are needed to evaluate the influence of physical activity on psoriasis severity, response to treatment, and psoriasis comorbidities.

Despite these limitations, the authors believe that the present study is important because it assessed the physical activity of severe psoriasis patients, using a validated instrument in the presence of a considerable control group.

5 Conclusion

This study has demonstrated that patients with severe psoriasis have decreased levels of physical activity compared with non-psoriasis individuals, probably for both psychological and physiological reasons. Psoriasis patients, particularly those with severe disease, have recognized increased risks of cardiovascular disease and cardiometabolic comorbidities. In addition, it appears that physical activity—an important preventive measure and an effective treatment for these cardiovascular conditions—is reduced in psoriasis patients. Thus, besides the intrinsic risks related to systemic inflammation and psoriasis-linked comorbidities, the lack of physical activity may represent an additional risk factor for cardiovascular disease in these patients.

Physical activity may have a dual beneficial effect in psoriasis, affecting its risk and probably its severity, through effects on systemic inflammatory mediators, and having a positive effect on the cardiometabolic comorbidities associated with psoriasis.

All psoriasis patients should be encouraged to correct their modifiable cardiovascular risk factors, such obesity and smoking, and to adopt a healthy lifestyle that includes regular physical activity.

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