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Levels of physical activity in a large international cohort of patients with systemic lupus erythematosus

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ABSTRACT

Introduction Physical activity (PA) holds a pivotal role in the improvement of mental health or depressive symptoms, as well as in the prevention of cardiovascular diseases (CVDs). Patients with SLE are exposed to an increased risk of CVDs and suffer from deteriorated quality of life compared with the general population. The aim of this study was to assess PA level and characteristics in a large international cohort of patients with SLE.

Methods PA was assessed in metabolic equivalent of tasks (METs) using the International Physical Activity Questionnaire (IPAQ) and classified into three levels: low, moderate and high PA. Other data such as fatigue, disease activity, pain, insomnia, anxiety, depression, stress and fibromyalgia were collected using validated patient-reported instruments, using the Lupus Expert system for the Assessment of Fatigue (LEAF) digital tool.

Results 1029 LEAF participants with SLE (986 (95.8%) women) with a median age of 43 years were analysed. The median physical expenditure was 936 METs/week (IQR: 297–2622). 456 (44.3%) participants were classified as having low PA levels. Increased fatigue according to the Functional Assessment of Chronic Illness Therapy–Fatigue Scale (p<0.0001), the Multidimensional Fatigue Inventory (p<0.0001), Visual Analogue Scale for fatigue (p=0.02), pain (p=0.009), depression (p=0.02) and stress (p<0.0001) were significantly more prevalent in less active patients, in IPAQ classification.

Conclusion In this large international study, more than 40% of patients with SLE were not active enough. We found an inverse association between PA levels and fatigue, pain, stress or depression. This points out the necessity to better assess PA in patients with SLE, as well as the aforementioned comorbidities to improve quality of life and reduce cardiovascular risk.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Compared with the general population, patients with SLE had lower levels of physical activity (PA).

⇒ Fatigue, depression, stress, anxiety and poor quality of sleep are highly prevalent in SLE.

WHAT THIS STUDY ADDS

⇒ Analysing PA with a validated instrument revealed important barriers that patients with lupus may encounter.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ By identifying several important barriers to PA, this study will inform a better promotion of PA in patients with SLE.

INTRODUCTION

SLE is a multisystem chronic disease associated with an increased risk of cardiovascular events and is a leading cause of death in young women.[1–4] In SLE, cardiovascular events typically occur at an earlier age compared with the general population because of the interplay between inflammation, autoimmunity, medications such as glucocorticoids and traditional risk factors.[5] Similarly, insufficient physical activity (PA) is the world's fourth leading cause of death.[6–9] People who are insufficiently physically active have 20%–30% increased risk of all-cause mortality, mostly due to cardiovascular disease.[8 9]

In line with this, PA has widely demonstrated its benefits on mortality and global morbidity,[8] but in 2016, 27.5% of all adults from the general population were having insufficient PA levels, according to the WHO recommendations.[7] Moreover, PA has shown clear benefits on both physical and psychological health,[10] with studies showing that PA is associated with increased life satisfaction, happiness[11] and decreased prevalence of depression.[12]

Currently, life expectancy for patients with SLE has been reported to be over 90% at 10 years in most Western countries.[13 14] However, patients with SLE still have to deal with poor health-related quality of life (HR-QoL).[15 16] Limited data suggest that patients with SLE have lower PA levels than the

general population.[17–19] Preventing cardiovascular risk and improving overall health outcomes by increasing PA and exercise therefore appear necessary to enhance the condition of people living with SLE, and is currently recommended by EULAR.[20]

Given the importance of PA in the non-pharmacological management of SLE, the limited available data on PA in patients with SLE[18] and the potential impact of fatigue,[21] depression, stress, anxiety and poor quality of sleep on HR-QoL in SLE,[19] we sought to analyse the characteristics of PA, as well as the main determinants of PA levels in a large international cohort of patients with SLE .

PATIENTS AND METHODS

Study population

All participants took part in the Lupus Expert system for Assessment of Fatigue (LEAF) study.[22] Briefly, LEAF is an online digital tool providing a holistic assessment of fatigue, anxiety, stress, depression, sleep quality and PA in patients suffering from SLE. Participants were recruited by sharing the internet link to LEAF with patient associations as well as on social media such as Twitter or Facebook, or during the medical consultation. The inclusion criterion was a self-reported diagnosis of SLE that had been confirmed by a medical doctor. We excluded participants under the age of 18 years. Following this initial assessment, LEAF provides personalised feedback and recommendations to help patients with SLE cope with fatigue. LEAF was approved by the ethics review board of Strasbourg University (#CE-2021-23) and all participants gave informed consent.

Assessment of PA

PA is assessed in a standardised manner in LEAF, using the short form of the International Physical Activity Questionnaire (IPAQ).[14 23–26] This self-administered questionnaire assesses three types of PA undertaken during the past 7 days: walking, moderate-intensity activities and vigorous-intensity activities. The frequency (measured in days per week) and duration (time per day) of PA are collected separately for each category. The measure of the overall PA is computed by weighting each type of activity by its energy requirement defined in metabolic equivalent of task (METs), which reflect the energy cost of each PA category. One MET is set by convention at an absolute consumption of 3.5 mL of oxygen/kg/min or approximately 1.0 kcal/kg/hour. This standard MET is commonly used to allow comparison of PA values between studies.[27 28] To facilitate the analysis and reproducibility and to allow comparison of different activities, the Compendium of Physical Activities has attributed an average MET value for each type of PA.[28] As recommended, the following values were used to analyse IPAQ data: walking (3.3 METs), moderate PA (4.0 METs) and vigorous PA (8.0 METs). Those selected MET values come from work undertaken during the IPAQ Reliability Study.[26 29]

Categorisation of PA levels

Per *IPAQ calculation rules*,[25] we excluded participants under the age of 18 or above 70 years, as well as those having a sum of all walking, moderate and vigorous time variables greater than 960 min (>16 hours per day). As recommended, all walking, moderate and vigorous time activity exceeding 240 min per week were truncated to be equal to 240 min. Also, only values of ≥10 consecutive minutes of activity were included in the calculations.

PA levels were analysed using categorical variables. Per IPAQ calculation rules,[25] the definitions used for the three categorical levels of PA were the following: high category or HEPA (health-enhancing PA) for participants doing vigorous-intensity activity ≥3 days a week and accumulating ≥1500 MET-minutes/week or doing any combination of walking, moderate-intensity or vigorous-intensity activities for 7 days achieving ≥3000 MET-min/week (category 3). The moderate category (moderate active) corresponds to participants doing: ≥3 days of ≥20 min of vigorous activity per day, or ≥5 days of ≥30 min of moderate-intensity activity or walking per day or ≥5 days of at least 600 MET-min/week of any combination of walking, moderate-intensity or vigorous-intensity activities (category 2). Finally, the low PA category (inactive, category 1) describes people who do not do PA or do not meet the moderate or high PA categories.

Assessments of other variables

The detailed strategies and instruments for assessing disease activity, pain, fatigue, sleep issues, stress, depression and anxiety are described in the main LEAF paper.[22] Briefly, self-reported disease activity and pain were measured using the Numerical Rating Scale ranging from 0 to 10.[30] Fatigue was assessed using the Functional Assessment of Chronic Illness Therapy–Fatigue Scale (FACIT-Fatigue),[31 32] the Multidimensional Fatigue Inventory (MFI),[33] as well as a 0–10 Visual Analogue Scale (VAS). Insomnia was evaluated using the Insomnia Severity Index, a seven-item questionnaire designed to evaluate the severity of insomnia.[34] The stress level was measured by the Perceived Stress Scale 10 (PSS-10).[35] Anxiety and depression were assessed according to the Hospital Anxiety and Depression Scale (HADS).[36] The Fibromyalgia Rapid Screening Tool (FiRST) was suggested to patients who reported chronic and diffuse pain and was used to screen for fibromyalgia but was optional.[37]

Statistical analyses

Categorical data were expressed as counts and percentages, and continuous data as the median and 25th–75th percentile IQR. Comparison of PA across groups was performed using the Mann-Whitney U test. Statistical tests were two-sided and a p value <0.05 was considered significant. All statistical analyses were performed using JMP V.13.0 (SAS Statistical Computing, USA).

Table 1 Characteristics of weekly walking, moderate and vigorous activities, as reported by the 1029 LEAF participants

Type of activity	PA intensity
Walking, median (IQR)	
Number of sessions per week (days)	4 (2–7)
Duration per session (minutes)	30 (15–60)
Total (METs per week)	396 (132–1014)
Moderate activity, median (IQR)	
Number of sessions per week (days)	1 (0–3)
Duration per session (minutes)	20 (0–60)
Total (METs per week)	60 (0–540)
Vigorous activity, median (IQR)	
Number of sessions per week (days)	0 (0–2)
Duration per session (minutes)	0 (0–45)
Total (METs per week)	0 (0–480)
Total activity, median (IQR)	
Number of sessions of any activity per week	7 (3–9)
Total minutes of any activity per week (minutes)	240 (90–630)
METs, median (IQR)	936 (297–2622)
IPAQ categories, n (%)	
Category 1 (low)	456 (44.3%)
Category 2 (moderate)	369 (35.9%)
Category 3 (high)	204 (19.8%)

IPAQ, International Physical Activity Questionnaire; LEAF, Lupus Expert system for the Assessment of Fatigue; MET, metabolic equivalent of task.

RESULTS

Data regarding 1029 LEAF participants with SLE (986 (95.8%) women) with a median age of 43 years old (IQR: 34–52) were analysed. Participants originated from 68 countries, mostly from Europe (n=643; 63.2%, data available in 1018 patients). These participants reported a median number of 7 (IQR: 3–9) PA sessions per week (including walking sessions), totalling a median of 240 (90–630) min of PA per week (table 1). The median total PA was 936 (IQR: 297–2622) METs per week. The number of sessions per week, duration per session and total METs for walking, moderate and vigorous activities are shown in table 1.

According to IPAQ classification,[26] 456 (44.3%) participants were considered to have low PA (IPAQ category 1), 369 (35.9%) moderate PA (IPAQ category 2) and 204 (19.8%) high PA (IPAQ category 3). The detailed number of sessions per week, duration per session and total METs by IPAQ categories are shown in table 2.

Parameters associated with PA

Comparison of participants (table 3) with SLE with low PA levels to those with moderate and high PA revealed no significant difference in terms of age (p=0.40) and gender (p=0.13), while we found significant associations with fatigue according to the FACIT-F score (<0.0001), MFI-score (p<0.0001) and VAS for fatigue (p=0.02), as well as with pain (p=0.009), depression (p=0.02) and stress (p<0.0001). Detailed comparison for the three IPAQ categories are shown in the online supplemental file.

DISCUSSION

In the present study, we evaluated the physical expenditure of patients with SLE and the relation between PA and a wide range of relevant outcomes such as fatigue, pain, anxiety, stress and depression. This cross-sectional survey evaluated a large cohort of 1029 patients with SLE worldwide.

Importantly, almost half of the participants were insufficiently active, as they did not achieve the physical expenditure recommended by the WHO. A comparison between active (IPAQ category 2 and 3) and non-active (category 1) patients revealed that PA was inversely associated with fatigue, pain, stress and depression. Therefore, promotion of PA among patients with SLE is a major necessity.

Table 2 Comparison of PA in LEAF participants based on IPAQ category

Characteristics	Low PA (category 1) (n=456)	Moderate PA (category 2) (n=369)	High PA (category 3) (n=204)	P value*
PA, median (IQR)				
Number of sessions per week	3 (1–4)	7 (6–9)	12 (9–15)	<0.0001
Total METs	268 (6–459)	1512 (987–2190)	5679 (4198–9340)	<0.0001
Walking, median (IQR)				
Number of sessions per week (days)	2 (0–3)	5 (3–7)	7 (5–7)	<0.0001
Total (METs per week)	148.5 (0–321.75)	693 (330–1039.5)	1683 (693–4158)	<0.0001
Moderate activity, median (IQR)				
Number of sessions per week (days)	0 (0–1)	2 (0–3)	4 (2–7)	<0.0001
Total (METs per week)	0 (0–60)	240 (0–540)	1440 (480–3360)	<0.0001
Vigorous activity, median (IQR)				
Number of sessions per week (days)	0 (0–0)	0 (0–2)	2 (0–5)	<0.0001
Total (METs per week)	0 (0–0)	0 (0–720)	1440 (0–3820)	<0.0001

*Statistical comparison across the three categories using the Mann-Whitney U test.
IPAQ, International Physical Activity Questionnaire; LEAF, Lupus Expert system for the Assessment of Fatigue; MET, metabolic equivalent of task; PA, physical activity.

Table 3 Comparison of parameters associated with PA, by IPAQ category

Characteristics	Category 1 (n=456)	Category 2 and 3 (n=573)	P value
Gender, n (%)*			0.13
Man	12 (2.6%)	25 (4.4%)	
Woman	443 (97.3%)	543 (94.8%)	
Age, median (IQR)	44 (35–52)	42 (34–51)	0.40
VAS for fatigue (0–10 scale), median (IQR)	7 (6–8)	7 (6–8)	0.02
VAS for activity (0–10 scale), median (IQR)	5 (3–7)	5 (3–7)	0.09
VAS for pain (0–10 scale), median (IQR)	6 (3–7)	5 (3–7)	0.009
FACIT-F score, median (IQR)	18 (12–25.75)	22 (16–29)	<0.0001
FACIT <34, n (%)	404 (88.6%)	489 (85.3%)	0.13
MFI, median (IQR)	80 (70–87)	72 (63–80)	<0.0001
FIRST >5, n (%)†	193 (61.7%)	217 (57.7%)	0.30
ISI sleep, median (IQR)	16 (11–19)	15 (10.5–19)	0.08
HADS-depression>11, n (%)‡	133 (30.7%)	133 (24.2%)	0.02
HADS-Anxiety>11, n (%)‡	203 (46.8%)	237 (43.1%)	0.25
PSS, median (IQR)	24 (18.25–28)	21.5 (16–27)	<0.0001

*Not reported by six participants.
†Available in 984 participants.
‡Available in 689 participants.
FACIT-F, Functional Assessment of Chronic Illness Therapy–Fatigue Scale; FIRST, Fibromyalgia Rapid Screening Tool; HADS, Hospital Anxiety and Depression Scale; IPAQ, International Physical Activity Questionnaire; ISI sleep, Insomnia Severity Index; MFI, Multidimensional Fatigue Inventor; PSS, Perceived Stress Scale; VAS-fatigue, Visual Analogue Scale for Fatigue Scale.

The WHO recommends 150–300 min/week of moderate-intensity PA, 75 min/week of vigorous-intensity PA or a combination of both.[6 38] According to the 2024 Adult Compendium of Physical Activities, this volume is similar to 500–1000 METs/week.[28] In our study, this expenditure corresponds to IPAQ categories 2 and 3 (health-enhancing and moderate active), considered sufficient to reduce risks of morbidity and mortality.

In our study, the median PA was 936 METs/week and 44.3% of patients were not active enough according to the WHO recommendations, further confirming that patients with SLE have lower levels of PA than the general population and largely do not meet WHO recommendations.[39] Importantly, reaching the highest IPAQ category 3 is not necessarily a goal for these patients. However, increasing their PA to 500–1000 METs/week, as suggested by the WHO and our recent recommendations, may help improve their quality of life and prevent future cardiovascular events.[6 28]

Also, 75% of patients with SLE from category 1 (insufficiently active) and 60.6% of all patients with SLE, independently of the IPAQ category, did not do vigorous PA sessions. Nevertheless, it is well shown in the literature that high-intensity training is more efficient than moderate-intensity training to increase aerobic capacity. Vigorous PA is associated with significant enhancements in VO2max, significant reduction in cardiovascular risk,[40–42] as well as anxiety, stress and depression.[43] Vigorous PA also has positive impacts on fatigue.[44] Furthermore, the LEAF study showed that less active patients are also the most exhausted and stressed ones and their HADS-depression score was among the highest.[22]

Improvement in the diagnosis of the aforementioned comorbidities is also necessary, as these are highly prevalent in SLE and often neglected. Musculoskeletal pain and fatigue are both common in lupus and may lead to physical inactivity and avoidance of pain-related behaviours as shown in our study with an important proportion of inactive people. This puts them at risk of entering the vicious circle of chronic pain, fatigue, physical inactivity and depression described as the '*fear-avoidance model*'.[45]

PA plays a central role in breaking this process. Promoting adapted PA helps to combat the physical vicious circle, notably to fight avoidance behaviour and physical deconditioning.

However, there are some limitations to our study. Using the IPAQ to assess PA may overestimate PA compared with direct methods (such as pedometers or accelerometers) and does not directly capture short-term events. Nevertheless, it remains a standardised tool for evaluating patients' overall PA profiles over a recent period, effectively reflecting real-life circumstances and serving as a valid instrument for both study comparisons and internal analyses.[14 28]

Because of the study design, we do not have a formal demonstration that PA improves quality of life in SLE. However, the multiple studies already carried out on PA

in patients without lupus and the general population were unambiguous.

In addition, it would also be interesting to consider the 'sedentary lifestyle', which is different from physical inactivity in that the former state is characterised by any awakening activity with an energy expenditure of ≤1.5 METs.[46] Of note, the harmful effects of sedentary behaviour are similar to those of physical inactivity,[9 47 48] including association with anxiety and depression[49 50] independently from the effect of PA,[51] but sedentary behaviour was not captured in the LEAF study.

Due to the study design using an online tool, all data collected were self-reported by the patients, with no access to physician-reported medical information. Consequently, SLE diagnosis was not based on EULAR/ACR criteria but rather on the patient's declaration of a 'physician-confirmed lupus diagnosis'. Additionally, objective disease activity and damage assessments, which require physician-evaluated indices, could not be collected, limiting our ability to evaluate their impact on PA. Nevertheless, we assessed patient-reported SLE activity and found no significant association between PA levels and the VAS for disease activity. Previous findings by Eriksson *et al*[39] demonstrated that patients with SLE engage in lower levels of PA compared with matched controls, regardless of disease activity or damage, which highlights the importance of addressing other modifiable factors that are not directly related to disease severity. Moreover, PA has been reported to have no significant adverse effect on SLE disease activity and, in some studies, even demonstrated a trend towards improvement in disease activity following exercise interventions.[17]

CONCLUSION

This study assessed PA levels in a large international cohort of more than 1000 patients with SLE. Almost half of the participants were insufficiently active, according to WHO recommendations, and 61% of all SLE patients did not do vigorous PA sessions. The inverse relationship between PA and fatigue, pain, stress and depression points out towards the necessity of better assessing PA as well as the aforementioned comorbidities in patient with SLE to further promote PA as a non-pharmacological strategy to enhance the quality of life and reduce cardiovascular risk in SLE.

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Patient consent for publication Not applicable.

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