

Original Article

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Self-reported physical activity in Danish patients with systemic lupus erythematosus

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ABSTRACT

Introduction. Physical activity is acknowledged as an important factor for enhancing health, and the WHO recommends performing physical activity weekly. The aim of this study was to describe self-reported physical activity in a population of patients with systemic lupus erythematosus.

Methods. The patients were enrolled at outpatient consultations where patient and disease characteristics such as age, gender, disease damage (SLICC/ACR-DI), disease activity (SLEDAI-2K) and medication were registered. Self-reported physical activity was evaluated using the International Physical Activity Questionnaire (IPAQ), and a continuous variable on energy requirement in the form of the metabolic equivalent (MET) was calculated. Depression was evaluated with the Major Depression Inventory (MDI) questionnaire.

Results. A total of 210 patients reported a mean total MET score of $5,319 \pm 3,650$ (mean \pm standard deviation) MET-min./week, and they spent an average of 194 ± 118 min./day being physically active. 70.5% of the patients reported a high level of physical activity and 89.5% met the WHO recommendations. The MDI questionnaire found that 10.5% were depressed. Severely depressed patients had lower MET scores, but this group only included six patients. Physical activity was inversely associated with time spent sitting according to the IPAQ ($p = 0.001$), disease duration ($p = 0.02$) and the SLICC/ACR DI score ($p = 0.01$), but not with the MDI ($p = 0.26$).

Conclusion. A large share of the patients reported a high level of physical activity and met the WHO recommendations.

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Trial registration. not relevant.

Systemic lupus erythematosus (SLE) is a chronic autoimmune rheumatic disease that may affect multiple tissues and organ systems, e.g. joints, cardiac and neurological systems. The clinical presentation of SLE is heterogeneous. It has a female preponderance and its incidence peaks at the age of 20-29 years [1].

Physical activity is acknowledged as an important factor for enhancing health, and the World Health Organization (WHO) recommends that adults aged 18-64 years engage in at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity weekly [2]. A Swedish study found that SLE patients reported a lower frequency and capacity of exercise than a control group [3]; and in an Italian study, 60% of the SLE patients failed to meet WHO's recommendations on physical activity [4].

Mental health is important for the individual's level of physical activity, and studies have demonstrated that any level of physical activity may prevent future depression [5]. A systematic review found that prevalence estimates

of depression in SLE patients varied widely from 2% to 91.7%, measured with a range of different assessment tools, including questionnaires like the Beck Depression Inventory and classification systems including the Diagnostic and Statistical Manual of Mental Health (DSM) [6]. A meta-analysis of studies on depression in SLE based on the DSM or the International Classification of Diseases (ICD) showed a prevalence of 24% (95% confidence interval (CI): 16-31%) [6]. A study of the Danish general population using the Major Depression Inventory (MDI) showed a prevalence of 2.3% [7].

The aim of this study is to describe patterns of self-reported physical activity in a population with SLE.

METHODS

A cross-sectional study was conducted at the Department of Rheumatology at Odense University Hospital, Denmark, between October 2018 and September 2019. The study population included Danish SLE patients from a cohort followed since 1995 in which data on patient characteristics such as age, gender, disease duration, etc. were collected. Patients who were unwilling or did not have the skills to answer questionnaires were not included.

The study was conducted as a part of a study approved by the Local Ethics Committee (project ID:S-20100015) and was approved by the Regional Data Protection Agency (18/21749).

Two questionnaires were handed out to the patients before routine outpatient consultation: the self-administered International Physical Activity Questionnaire (IPAQ), which was used to collect data about physical activity, and the MDI questionnaire, which was used to screen for depression. Information on present hydroxychloroquine and prednisolone intake was registered, but no information regarding medicine doses or other immunosuppressive treatment was accessible. Disease activity and damage were scored by the Systemic Lupus Erythematosus Disease Activity Index (SLEDAI)-2K [8] and the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index (SLICC/ACR DI) [9].

The IPAQ, which is an internationally used questionnaire [10], quantifies physical activity during the past seven days by five domains including job-related physical activity, transportation, housework, leisure time and time spent sitting. A total score summarising the duration and frequency of activity was calculated. A continuous variable on energy requirement in the form of the metabolic equivalent (MET) was calculated and the total physical activity was described in time-related measures (MET-min./week). According to the IPAQ instructions, the patients were divided into three categories: low, moderate, and high level of physical activity. High: vigorous activity $3 \leq$ days and accumulating $1,500 \leq$ MET-min./week odds ratio or $7 \leq$ days with any combination of walking, moderate or vigorous activity accumulating $3,000 \leq$ MET-min./week. Moderate: either $3 \leq$ days with vigorous activity $20 \leq$ min. per day OR $5 \leq$ days with moderate activity or walking $30 \leq$ min. per day OR $5 \leq$ days with any combination of activity achieving $600 \leq$ MET-min./week. The low level does not meet any of the criteria above [11]. IPAQ has been validated in Danish [12]. An average number of minutes with physical activity per day was calculated.

Data from the IPAQ were reviewed according to recommendations [11] and reported physical activity of less than 10 min. was categorised as 0, but the patients were not excluded. Daily average physical activity above 180 min. in a category (walking, moderate or vigorous activity) was truncated into 180 min. to avoid misclassification in the high level of physical activity category [11]. If the moderate activity category was truncated, the MET score was calculated from a chosen standard of four METs. Patients reporting a total score above 960 MET-min./week were excluded.

The MDI is based on the ICD-10 criteria for depression may be used as a diagnostic tool as well as a rating scale

of the severity of depression [13]. According to the MDI manual, the MDI questionnaire contains both core symptoms (items 1-3) and associated symptoms (items 4-10). When the ICD-10 algorithm is used to diagnose depression, the demands are: a mild depression requires two core symptoms and two associated symptoms; a moderate depression requires two core symptoms and four associated symptoms; and a severe depression requires three core symptoms and five associated symptoms. The MDI has been validated in Danish [14]. Data collected from the questionnaires were entered into a REDCap database.

Statistical analysis

In the summarised data, continuous variables are presented as means (\pm standard deviations (SD)) or medians (interquartile range (IQR)), and categorical variables are presented as frequencies and proportions.

To define potential explanatory variables, a univariate linear regression model was applied. To consider non-normality of the residuals, bootstrapping with 1,000 repetitions was applied, and a univariate regression adjusted for age was made. Even though data on time spent sitting was collected with the IPAQ, these data were not included in the calculation of the MET score; therefore, it was considered an independent variable and could be included in the univariate regression. A multivariate analysis was performed including the following possible predictors: SLICC/ACR DI, SLEDAI-2K, MDI score, time spent sitting, gender, age, disease duration and treatment with hydroxychloroquine or prednisolone.

The analyses were conducted in Stata 15.0.

Trial registration: not relevant.

RESULTS

A total of 215 patients completed the IPAQ and MDI questionnaires. Two patients declined to participate in the study. The characteristics of the study population are presented in **Table 1**.

TABLE 1 Baseline characteristics of the 210 SLE patients. Clinical profile of the patients including age, sex, ethnicity, SLE disease duration, ACR criteria, disease activity (SLEDAI-2K), damage score (SLICC/ACR DI), MDI depression score, MDI groups and medical treatment with hydroxychloroquine and prednisolone.

Age, mean (range) \pm SD, yrs	51.7 (20-86) \pm 15.2
Females, n (%)	188 (89.5)
Caucasian, n (%)	193 (91.9)
Disease duration, mean (range) \pm SD, yrs	16.1 (0-50) \pm 10.1
<i>ACR criteria, n (%)</i>	
Non-erosive arthritis	183 (87.1)
Renal disorder	73 (34.8)
Neurological disorder	29 (13.8)
Anti-DNA	175 (83.3)
SLEDAI-2K, median (IQR)	2 (0-4)
Organic Brain Syndrome according to SLEDAI-2K, n (%)	0
SLICC/ACR DI score, median (IQR)	1 (0-2)
Neurological disorder according to SLICC/ARC DI, n (%)	19 (9.0)
MDI score, mean (range) \pm SD	12.7 (0-43) \pm 10.1
<i>MDI group, n (%)</i>	
No depression	188 (89.5)
Mild depression	4 (1.9)
Moderate depression	11 (5.3)
Severe depression	6 (2.9)
<i>Hydroxychloroquine, n (%)</i>	
Ever	195 (92.8)
Present	151 (71.9)
<i>Prednisolone, n (%)</i>	
Ever	190 (90.5)
Present	87 (41.4)

ACR = American College of Rheumatology; DI = Damage Index; IQR = interquartile range; MDI = Major Depression Inventory; SD = standard deviation; SLE = systemic lupus erythematosus; SLEDAI = Systemic Lupus Erythematosus Disease Activity Index; SLICC = Systemic Lupus International Collaborating Clinics.

Patient characteristics

The population primarily consisted of women (89.5%) of Caucasian origin (91.9%). The mean age was 51.7 \pm 15.2 years, and the mean disease duration 16.1 \pm 10.1 years. The median SLEDAI-2K score was 2 (IQR: 0-4) and the median SLICC/ACR DI score was 1 (IQR: 0-2). In all, 71.9% of the patients received hydroxychloroquine and 41.4% prednisolone.

Physical activity

Five patients were excluded in the data cleaning process according to recommendations as they reported more than 960 min. of physical activity per day. The remaining 210 patients reported a mean total MET score for

physical activity of $5,319.9 \pm 3,650$ MET-min/week with an average of 194.3 ± 118 physically active minutes per day. Regarding sedentary behaviour, the participants reported 363.7 ± 201 min. per day of sitting time (Table 2).

TABLE 2 Physical activity among 210 SLE patients. IPAQ results of 210 SLE patients characterised by level of physical activity, total energy use per week, energy use according to physical activity, daily energy use by domain of activity, time spent sitting and compliance with WHO recommendations.

<i>IPAQ groups, n (%)</i>	
Low level physical activity	16 (7.6)
Moderate level physical activity	46 (21.9)
High level physical activity	148 (70.5)
Total MET score (MET-min./wk), median (IQR)	4,767.7 (2,664-7,539)
<i>MET scores by physical activity (MET-min./wk), median (IQR)</i>	
Walking	1,435.5 (495-3,267)
Moderate activity	2,355 (1,140-4,290)
Vigorous activity	0 (0-880)
<i>Domains of activity, (MET-min./day), median (IQR)</i>	
Work domain	42 (0-452.6) ^a
Transportation	99 (0-242.1) ^a
Domestic/garden	180 (64.3-360) ^a
Leisure time	72.2 (0-176.6) ^a
Time spent sitting (min/day), mean (\pm SD)	363.7 (\pm 201.8)
Complies with the WHO recommendations (150 min./wk of moderate-vigorous PA), n (%)	188 (89.5)

IPAQ = International Physical Activity Questionnaire; IQR = interquartile range; MET = metabolic equivalent; PA = physical activity; SD = standard deviation; SLE = systemic lupus erythematosus.

a) Data not truncated.

The distribution of total energy use per week in each of the domains is shown in Table 2. The patients reported the highest level of physical activity in the domestic domain (180 MET-min/day) and the least in the work domain (42 MET-min./day). The highest energy use was achieved through moderate activity (2,355 MET-min./week).

Associations

The mean MDI score was 12.7 ± 10.1 ; and if divided into groups, 89.5% were classified as not depressed, 1.9% had a mild depression, 5.3% a moderate depression and 2.9% a severe depression (Table 1). Mean MET scores in the four MDI groups showed that the severely depressed patients had significantly lower scores although this group only included six patients, whereas the three other groups did not differ (Table 3).

TABLE 3 Clinical variables determining the level of physical activity. Regression analysis of physical activity measured as total MET scores in 210 SLE patients. Explanatory variables include the SLICC/ACR DI, the SLEDAI-2K, MDI groups, total MDI score, time spent sitting, female sex, age, disease duration, hydroxychloroquine and prednisolone intake.

	Univariate linear regression		Adjusted for age		Multivariate linear regression	
	coefficient	p-value	coefficient	p-value	coefficient	p-value
SLICC/ACR DI	-355.5	0.01	-334.9	0.02	-87.0	0.56
SLEDAI-2K	-64.8	0.59	-88.1	0.47	-104.3	0.41
<i>MDI Groups</i>						
Mild depression	3,170.4	0.29	3,022.6	0.32	-	-
Moderate depression	224.4	0.85	88.4	0.94	-	-
Severe depression	-3,538	0.00	-3,450	0.00	-	-
MDI score	-27.3	0.26	-35.4	0.17	-29.5	0.23
Time spent sitting	-4.4	0.001	-4.4	0.001	-4.6	0.003
Female sex	12.1	0.99	-275.4	0.78	-87.9	0.93
Age	-20.0	0.23	-	-	-17.8	0.32
Disease duration	-54.3	0.02	-49.7	0.047	-45.1	0.09
Hydroxychloroquine treatment, present	-329.7	0.56	-400.1	0.49	-304.5	0.58
Prednisolone treatment, present	-860.9	0.08	-818.4	0.01	-702.7	0.18

ACR = American College of Rheumatology; DI = Damage Index; MDI = Major Depression Inventory; MET = metabolic equivalent; SLEDAI = Systemic Lupus Erythematosus Disease Activity Index; SLICC = Systemic Lupus International Collaborating Clinics.

Disease duration was inversely associated with physical activity measured as total MET score in the univariate analysis, which means that for each year of disease duration, the mean MET scores decreased by 54 MET-min/week. The inverse association between physical activity and disease duration remained unchanged when adjusting for age, indicating the importance of disease duration. Correspondingly, increasing SLICC/ACR DI scores were associated with lower (-355.5 MET-min./week) physical activity measured as the total MET score. Disease activity measured as SLEDAI-2K scores and MDI were not associated with MET scores.

In the multivariate analysis, only time spent sitting was significantly associated with MET scores.

DISCUSSION

Among 215 Danish SLE outpatients, 89.5% reported to meet the WHO's recommendations for physical activity; according to the IPAQ description, 70.5% of the patients belonged to the category *high level* of physical activity.

The high level of physical activity among our patients is in line with a Brazilian study in which the IPAQ was used and which reported that 68% of the SLE patients were "physically active", 12% "irregularly physical active" and 20% "physically inactive" [15]. Conversely, an Italian study that also used IPAQ on SLE patients found that 44% had a low, 34% a moderate and 22% a high level of physical activity. The difference may be explained by higher disease activity among Italian patients measured as an SLEDAI-2K mean 3.6 [4] compared with the Brazilian SLE patients' mean score of 1.5 and a mean SLEDAI-2K of 2.4 in the present study.

A recent Canadian accelerometer study comprising 100 SLE patients reported that only 11% of their patients met the WHO recommendations, which is considerably lower than the 89.5% in this study. An accelerometer tracked the Canadian patients' physical activity, showing most time spent on light physical behaviour (mean 134 ± 38.3 min./day) and less on moderate-vigorous physical activity (mean 33.2 ± 22.5 min/day) [16]. Our patients self-reported most energy used per week (MET-min./week) during moderate physical activity.

A study assessed physical activity with the IPAQ in the Danish general population; the mean total time spent was 1,604 ± 957 min. per week [17]. This is opposed to our patients who reported an average of 1,360 min. per week. The general population included healthy people, a higher proportion of men (38.2% versus 10.5%) and a lower average age (39.3 versus 51.7 years) than our cohort [17]. Despite these differences, SLE patients apparently

report lower physical activity than the general Danish population.

A validation study found that the Danish version of the IPAQ had modest validity and reliability [12]. A study has compared the IPAQ and accelerometry data on individuals from six countries; Danish participants reported the highest total score for MET-min./week and recorded the highest discrepancy between self-reported and accelerometer-measured physical activity [17]. It is therefore possible that the Danish version of the IPAQ questionnaire tends to make participants overestimate activity.

Physical activity measured as total MET scores was inversely associated with disease duration. Nevertheless, in daily clinical practice, it is of interest that potentially adjustable factors such as sedentary activity and to some extent SLICC/ACR DI scores have a significant impact on physical activity. Therefore, advice to the patient about reducing sedentary activity along with a targeted clinical effort for lower damage accrual is indicated in the lupus clinic [5, 18].

Depression symptoms were reported by 10.5% of the SLE patients as compared with 2.3% in the general Danish population studied with the MDI [7]. The higher prevalence of depression in SLE patients was confirmed in previous studies. Thus, in a Danish registry study, the prevalence of depression in SLE patients was found to be 3.4% [19].

Our results found the six severely depressed patients to report a significantly lower physical activity, but the number is too limited to conclude as to any association. Furthermore, no association was found for SLE patients with mild or moderate depression. Similarly, the regression analysis did not find the depression score to be associated with the physical activity score, although reservations must be made given the low number of depressed patients. Studies on non-SLE populations have indicated that women with a low level of physical activity, in particular, may have an increased risk of depression compared with more physically active women [20]. It may therefore be relevant to encourage SLE patients to be physically active in order to potentially prevent depression and to achieve other effects of exercise, e.g. a reduced risk of cardiovascular disease [16].

It is a strength of our study that the patients had well-established SLE diagnoses and that the validated Danish language questionnaires were answered and handed in immediately in the outpatient clinic. As data were collected throughout a calendar year, no seasonal alterations are expected. Furthermore, only two patients declined to participate and therefore probably did not cause any bias. It is a weakness that our study was cross-sectional and thus unable to analyse causality. The results may indicate that patients reported a higher physical activity than was actually performed, but possible explanatory parameters such as cognitive deficits among SLE patients were unfortunately not available for analysis. Another consideration may be that some individuals perceive physical activity as a prestigious behaviour, which might make them overestimate their answers.

CONCLUSION

A high proportion of Danish SLE patients self-reported high physical activity, predominantly of moderate intensity according to MET scores.

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

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