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Physical Activity Program Is Helpful for Improving Quality of Life in Patients with Systemic Lupus Erythematosus

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Given the crucial events in systemic lupus erythematosus (SLE) such as joint and muscle pain, fatigue, depression, obesity and osteoporosis, the very thought of exercising can be challenging. This prospective study included 60 patients diagnosed with SLE in stable condition. A randomly selected group of 30 women had aerobic training on a bicycle ergometer for a period of 15 minutes, 3 times per week for 6 weeks, while the second group of 30 women performed isotonic exercises (to stretch and lengthen muscles and improve the range of motion) for 30 minutes, 3 times per week during the same period. Fatigue Severity Scale (FSS), Short Form 36 (SF36) questionnaire on the quality of life and Beck depression inventory (BDI) were analyzed at baseline and after 6 weeks. At baseline FSS score was 53.8 ± 5.7 and after the physical activity FSS score was 29.1 ± 7.8 (FSS ≥ 36; fatigue is present). The largest number of patients (66.7%) was in a moderate depressed state at the baseline, while after physical activities 61.7% of patients, had a mild mood disturbance. There were significant differences ($p < 0.001$) in values of all areas of quality of life questionnaire SF36 before and after the implementation of physical activity. The type of physical activity had no influence in FSS and BDI values. Continuous physical activity, regardless of its type, significantly improved quality of life of SLE patients. We recommend regular physical activity as an integral part of modern therapeutic approach in this patient population.

Keywords: depression; fatigue; physical activity; quality of life; systemic lupus erythematosus
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Introduction

Systemic lupus erythematosus (SLE) is an autoimmune chronic inflammatory disease of unknown etiology that affects multiple organs and systems. It occurs predominantly in women at a ratio of 5-10:1 (Hochberg 1997). Because of its chronic nature, unpredictable course and widespread potential for harm, these patients have a shorter life expectancy and reduced quality of life compared to healthy sedentary population (Tench et al. 2002).

Although physical activity can prevent long-term consequences of SLE such as obesity, osteoporosis and premature cardiovascular and cerebrovascular diseases risk (Petri et al. 1992; Svenungsson et al. 2001; Bruce et al. 2003; Oeser et al. 2005; Goldberg et al. 2009; Gustafsson et al. 2009; Urowitz et al. 2008; Volkmann et al. 2010), in John Hopkins Lupus Cohort, 70% of patients reported a sedentary lifestyle (Petri et al. 1992). Although physical activity reduces the patients' fear of disability, there is still a great difference of opinion about the time of onset, type and intensity of that activity. Knowing the physiology of physical activity will be reasonable to apply it during treatment or as an early prevention of the disease's sequelae (Krupp et al. 1991; Gustafsson et al. 2009; Volkmann et al. 2010). It is unknown which type and intensity of physical activity contributes most to the treatment.

The aim of this study was to determine which form of physical activity in SLE patients improves their quality of life.

Patients and Methods

This prospective study included 60 patients, with a mean age of 43.4 ± 12.8 years and average disease duration 6.8 ± 2.9 years and has been conducted at University Medical Centre "Bezanijska Kosa", Belgrade, Serbia. All patients met the American College of Rheumatology (ACR) classification criteria for SLE (Tan et al. 1982). Disease activity was assessed at the time of enrollment in the study using the SLEDAI score and all patients were in stable condition according to laboratory findings (erythrocyte sedimentation rate and C-reactive protein) and SLEDAI ≤ 5 (Bombardier et al. 1992). All patients were under treatment of low dose steroids and no immunosuppressive therapy. There were no significant comorbidities in the means of diabetes mellitus or cardiovascular diseases in both groups

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of patients. The data regarding physical activity before the disease was diagnosed, were unknown. The study fulfills the ethical guidelines of the most recent declaration of Helsinki (World Medical Association 2000) and has received approval from the Ethical Committee of University Medical Centre "Bezanijska Kosa."

Randomly selected SLE patients were divided into two groups. The first group comprised of 30 patients, mean age 38.8 ± 12.6 years and the mean disease duration 5.5 ± 4.1 years, had an aerobic training on a bicycle ergometer for 15 minutes, 3 times a week for 6 weeks. The second group comprised of 30 patients, mean age 47.9 ± 11.5 years and the mean disease duration 7.5 ± 6.9 years, performed isotonic exercises (increase range of motion and muscle strength), for 30 minutes, 3 times a week for 6 weeks. Muscle strength and flexibility were combined with a focus on concentration, balance, breathing and relaxation. Training has the objective of building up strength in the entire body with an emphasis on the abdominal and the back muscles.

Before and after physical training, all patients completed the fatigue scales (Fatigue Severity Scale; FSS) (Krupp et al. 1991), Beck-questionnaire for the assessment of depression severity (Beck et al. 1988), and a questionnaire on the quality of life (Short Form 36; SF36) (Katz 1987; Brazier et al. 1992; Higginson and Carr 2008). Presence of fatigue was validated if the FSS score was ≥ 36. We graduated depression according to Beck-questionnaire score as follows: 0-9 points normal condition, 10-15 mild mood disturbance, 16-19 borderline clinical depression, 20-29 moderate depression, 30-36 severe depression.

Statistical analysis

Data were analyzed by statistical analysis software SPSS (version 11.5 for Windows). Numerical variables were expressed as mean ± SD for normal distribution or median (interquartile range) for non-normal distribution, or with frequency and percentage for categorical data. Comparison of groups was performed using Student's t-test for normally distributed data and/or Mann-Whiney U-test for data that were not normally distributed. Paired t-test was used to evaluate the continuous values of the same group. χ^2 analysis was used to test the relation between non-continuous variables. All statistical tests were observed at the level of the null hypothesis significance of $p < 0.05$.

Results

Results for the entire group of patients

Fatigue was present in all patients (FSS score 53.8 ± 5.7) before starting the physical activity. After conducting physical activity, fatigue was present in 11 patients (18.3%), while 49 patients (81.7%) did not show fatigue (FSS score 29.1 ± 7.8). There was a statistically significant difference in fatigue before and after the physical activity ($p < 0.001$, Table 1).

According to the values of Beck depression inventory (BDI) questionnaire used to assess the depressive behavior, the results show that before starting the physical activity 40 patients (66.67%) were in a moderate depressed state, and after performing physical activities 37 patients (61.66%) were in a mild depressed state (Table 2).

In all areas of quality of life the questionnaire SF36 proved a high statistical difference in values before and after the implementation of physical activity ($p < 0.001$, Fig. 1).

The results of the group of patients with physical activity on the bicycle ergometer

Fatigue was present in all patients (FSS value 53.6 ± 6.3; min 39, max 63) before starting the exercise. After conducting physical activity, fatigue was present in 6 patients (20%), while 24 patients (80%) did not show fatigue (FSS value 29.2 ± 7.9; min 18, max 45). The results are shown in Table 3.

Before starting the exercise 20 patients (66.7%) were in a moderate depressed state, while after performing physi-

Table 1. Fatigue among the entire group of SLE patients.

	FATIGUE	#	%	XSR ± SD	MIN	MAX	P
Before activity	yes	60	100	53.8 ± 5.7	39	63	p < 0.001**
	no	0	0				
After activity	yes	11	18.3	29.1 ± 7.8	18	45	
	no	49	81.7				

**highly statistically significant difference.

Table 2. Depressive behavior among the entire group of SLE patients.

Beck depression inventory (BDI)	BEFORE		AFTER		P
	#	%	#	%	
Normal condition	0	0	6	10.0	p < 0.001**
Mild mood disturbance	5	8.3	37	61.6	
Borderline clinical depression	13	21.7	11	18.3	
Moderate depression	40	66.7	6	10	
Severe depression	2	3.3	0	0	

**highly statistically significant difference.

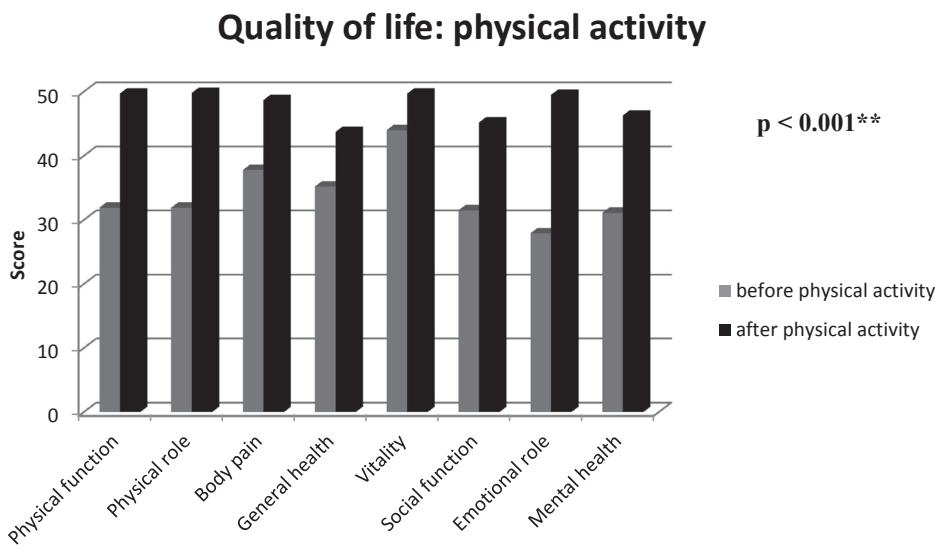

Fig. 1. Quality of life: the entire study group of patients.
**highly statistically significant difference.

Table 3. Fatigue among the SLE patients with physical activity on the bicycle ergometer.

	FATIGUE	#	%	XSR ± SD	MIN	MAX	P
Before activity	yes	30	100	53.6 ± 6.3	39	63	p < 0.001**
	no	0	0				
After activity	yes	6	20	29.2 ± 7.9	18	45	
	no	24	80				

**highly statistically significant difference.

Table 4. Depressive behavior among the SLE patients with physical activity on the bicycle ergometer.

Beck depression inventory (BDI)	BEFORE		AFTER		P
	#	%	#	%	
Normal condition	0	0	4	13.3	p < 0.001**
Mild mood disturbance	2	6.7	18	60.0	
Borderline clinical depression	7	23.3	5	16.7	
Moderate depression	20	66.7	3	10.0	
Severe depression	1	3.3	0	0	

**highly statistically significant difference.

cal activities18 patients (60%) were in a mild depressed state (Table 4).

Statistical significance in all areas of quality of life questionnaire SF36 was proven for patients with the bicycle ergometer before and after the implementation of physical activity ($p < 0.001$, Fig. 2).

The results of the group of patients with physical activity on isotonic exercises

Fatigue was present in all patients before starting the exercise (FSS value 53.6 ± 6.3; min 39, max 63). After conducting physical activity fatigue was present in 5 patients (16.7%), while 25 patients (83.3%) did not show fatigue (FSS value 29.2 ± 7.9) (Table 5).

The greatest number of patients, 20 (66.7%), were in a moderate depressed state before starting a physical activity. After performing physical activities the greatest number of patients, 19 (63.3%), were in a mild depressed state (Table 6).

There was statistically significant difference between the results in all areas of quality of life questionnaire SF36 before and after the implementation of physical activity of exercises ($p < 0.001$, Fig. 3).

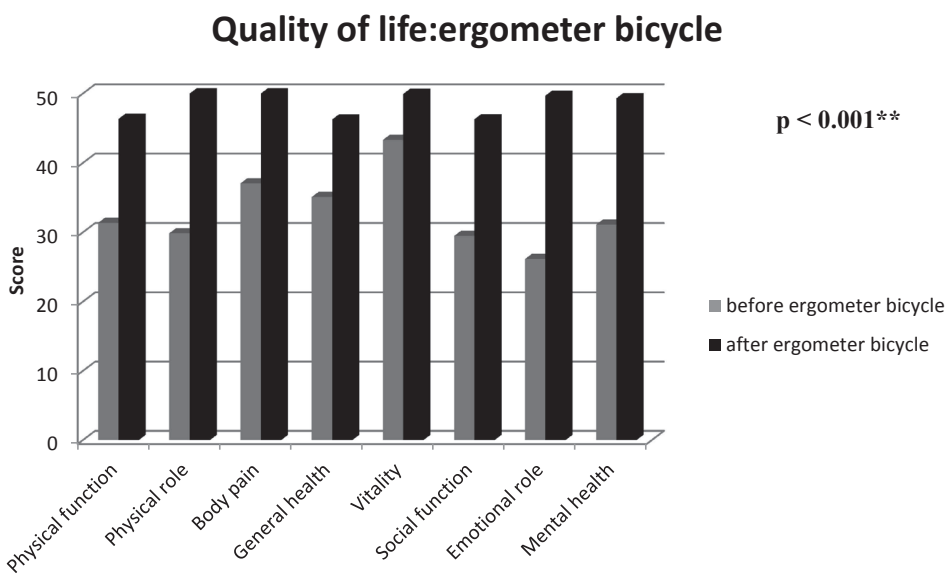

Fig. 2. Quality of life: the results of the group of patients with physical activity on the ergometer bicycle. **highly statistically significant difference.

Table 5. Fatigue among the SLE patients with physical activity on isotonic exercises.

	FATIGUE	#	%	XSR ± SD	MIN	MAX	P
Before activity	yes	30	100	53.6 ± 6.3	39	63	p < 0.001**
	no	0	0				
After activity	yes	5	16.7	29.2 ± 7.9	18	45	
	no	25	83.3				

**highly statistically significant difference.

Table 6. Depressive behavior among the SLE patients with physical activity on isotonic exercises.

Beck depression inventory (BDI)	BEFORE		AFTER		P
	#	%	#	%	
Normal condition	0	0	2	6.7	p < 0.001**
Mild mood disturbance	3	6.6	19	63.3	
Borderline clinical depression	6	23.3	6	23.3	
Moderate depression	20	66.7	3	6.6	
Severe depression	1	3.3	0	0	

**highly statistically significant difference.

The results of comparison of physical activity on bicycle-ergometer and isotonic exercises

There was no significant difference in reducing fatigue measured by FSS scale and BDI questionnaire values after different types of physical activity ($p > 0.05$), while there was a statistically significant difference in reducing the parameters of pain, general health and mental health in the group that had a physical activity on a bicycle ergometer evaluated by SF36 questionnaire (Fig. 4).

Discussion

SLE is the most common autoimmune disease in women of childbearing age. Previous studies have shown that these patients have lower physical capacity, increased fatigue and poorer quality of life compared to healthy population (Krupp et al. 1990; Wekking 1993; Dobkin et al. 1999; Bruce et al. 1999; Iverson et al. 2001; Stoll et al. 2001; Tench et al. 2002, 2003; Jolly 2005; Stojanovich et al. 2007), each of which is a possible consequence of fatigue, depressed behavior, obesity and association with

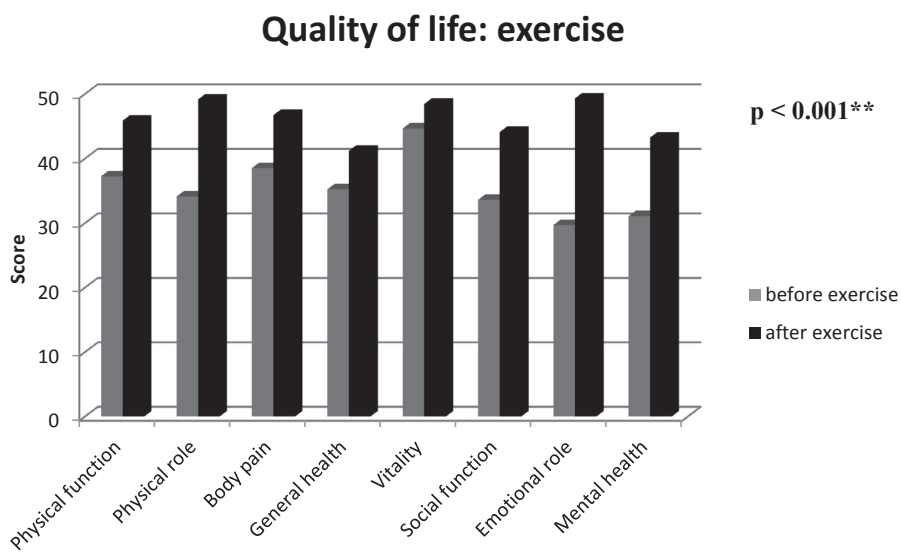

Fig. 3. Quality of life: the results of the group of patients with physical activity-isotonic exercises.
**highly statistically significant difference.

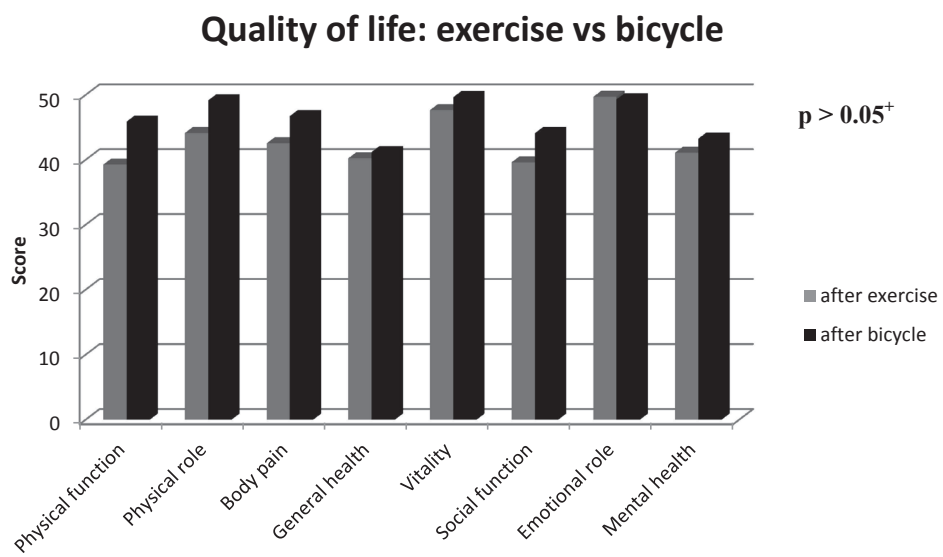

Fig. 4. Quality of life: the results of comparison of physical activity on the bicycle ergometer and isotonic.
+no statistically significant difference.

other autoimmune diseases, such as fibromyalgia, diabetes, and thyroid function disorder (Petri et al. 1992; Svenungsson et al. 2001; Bruce et al. 2003; Oeser et al. 2005; Urowitz et al. 2008; Goldberg et al. 2009). According to current literature, patients with SLE may benefit from exercise through prevention of cardiovascular and cerebrovascular diseases (Cronin 1988; Ayan and Martin 2007; Mancuso et al. 2011). Exercise increases plasma levels of high-density lipoprotein cholesterol and reduces triglyceride levels, thereby preventing the occurrence of hypercholesterolemia, which is an important factor in the development of atherosclerosis (Urowitz et al. 2008; Volkmann et al. 2010). By reducing the obesity of the stomach region i.e. the number of omental adipocytes, it reduces the level of IL-6 and tumor necrosis factor (TNF) as well as insulin resistance which improves the immune status and the quality of life (Gustafsson et al. 2009; Ekblom-Bak et al. 2009). Increased physical fitness improved the quality of life of patients, and decreased psychic and social problems (Ayan and Martin 2007).

Fatigue is one of the most common symptoms and often the most disabling one experienced by individuals with SLE, affecting up to 80% of patients (Krupp et al. 1991). Over the years of disease duration in patients with SLE, with major or minor increase in fatigue intensity as opposed to healthy sedentary population (Tench et al. 2003). Although it has been long considered a consequence of the activity of disease itself, it is clear today that it has a

multifactorial origin. The cause of fatigue is not completely understood, and it is believed that it may be a result of the disease itself as well as sleep disorders and/or depressive behavior, glucocorticoids and immunounosuppressive drugs and obesity (Krupp et al. 1990; Wekking 1993; Bruce et al. 1999; Stoll et al. 2001; Oeser et al. 2005). The presence of fatigue is one of the important parameters of numerous tests used to evaluate the activity of the disease itself (Krupp et al. 1991). There is also a great difference of opinion among physicians when it comes to when and how SLE patients should be physically active. There are even recommendations that these patients rest in order to reduce the intensity of fatigue.

In our study, there was no statistically significant difference between the types of physical activity (on a bicycle ergometer or isotonic exercises) and the degree of fatigue reduction. In the SLE patients after 6 weeks of physical activity on the bicycle ergometer, 80% of patients did not show fatigue. This percentage in the patients with isotonic exercises was 83.3%.

Depressed behavior in SLE patients may be a symptom of an underlying disease, and also the consequence of cerebrovascular changes, brain infarct lesions or encephalopathy. Also the depression in these patients may be associated with dysfunction of the thyroid, chronic pain, fatigue, and the adverse effect of corticosteroid therapy, the changed lifestyle (inability to fulfill the social, family and professional obligations) (Wekking 1993; Iverson et al. 2001; Stoll et al. 2001; Stojanovich et al. 2007). The degree of psychological disorders ranges from light melancholy to a severe feeling of sadness.

In our study with 60 SLE patients, prior to the implementation of physical activity 66.7% of patients were in a moderate depression state, 21.7% of patients in borderline clinical depression, 8.3% in a mild mood disturbance and 3.3% of cases were in severe depression state. After conducting physical activity a significant improvement was observed: mild depressed state (from 8.3% to 66.1%), borderline clinical depression (from 21.7% to 18.3%) and a significant reduction in moderate depression state in SLE patients (from 66.7% to 10%). In 10% of SLE patients after physical activity depressed state was no longer registered. The documented difference in the intensity and type of depressive reactions before and after physical activity of SLE patients in our study was highly statistically significant and there was no difference after different types of physical activity.

The therapeutic advances in recent decades have significantly extended the lives of the majority of patients with SLE, but little is known about their quality of life (Dobkin et al. 1999; Bruce et al. 1999; Krupp et al. 1990; Tench et al. 2003; Jolly et al. 2005). Quality of life is a popular aspect of observing the outcome of the disease and has become a significant factor in the performance evaluation of therapeutic procedures where, for the first time, the patient can independently assess the performance (Stoll et al. 2001; Higginson and Carr 2008). It represents the perceptions of patients about the impact of disease and proper treatment of their physical and working ability, mental state, social communication and physical health (Katz 1987; Brazier et al. 1992; Higginson and Carr 2008).

Our research has shown that all patients had a reduced SEL quality of life in all parameters of SF36 scales and all were in stable condition of the disease according to the SLEDAI score. After six weeks of implementation of physical activity not a single case of worsening of the disease was registered according to SLEDAI score and a quality of life significantly improved. After the performed physical activity there was no difference in the summed functions of quality of life, physical function and mental function compared to the previous state. As for the kind of physical activity, statistically significant improvement was noticed when it comes to pain, general health and mental health of the patients that used the bicycle ergometer compared to the patients who have performed isotonic exercises. The summary assessment of quality of life showed statistically significant improvement in mental function in patients who have exercised on the ergometer bicycle compared to patients who have performed isotonic exercises.

In conclusion, SLE patients, even in the stable condition of the disease, feel fatigue, different degrees of depressed behavior - from mild to severe, and a decreased quality of life by all parameters. The implementation of prescribed physical activity, regardless of the type, leads to a significant reduction of fatigue and depressive behavior and improved quality of life, without deteriorating the activity of underlying disease. Regardless of the conflicting opinions, constant physical activity should be an integral part of the therapeutic approach to SLE patients.

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Conflict of Interest

The authors declare no conflict of interest.

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