

## Sunscreen use among lupus erythematosus patients in Saudi Arabia

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**ABSTRACT**

*Background:* Lupus erythematosus is a chronic inflammatory autoimmune disease that affects various body systems and results in a wide range of clinical symptoms, including photosensitivity. Sun exposure/UV light is a well-known factor for disease activity. Therefore, photoprotective measures are used in patients with lupus erythematosus. This study aimed to estimate the prevalence of sunscreen use, limitations and association with disease flares among patients with lupus erythematosus at King Fahad University Hospital, Al Khobar, Saudi Arabia. *Methods:* A cross-sectional questionnaire-based study was conducted on patients with lupus erythematosus at King Fahad University Hospital between January and March 2022. *Results:* A total of 146 patients with lupus erythematosus participated in the study and the prevalence of sunscreen use was found to be 46.6% in the week before completing the survey. The study also showed that patients who were young, female, married, had a higher education level and had experienced an increased number of lupus erythematosus flares tended to use sunscreen more often. On the other hand, the most common barrier to sunscreen use was finding it inconvenient; 80% of those who found it inconvenient did not use it in the week prior the questionnaire ( $p=0.001$ ), followed by those who believed that sunscreen did not prevent lupus erythematosus flares (74.7%,  $p=0.002$ ) and those who found sunscreen to be expensive (63.0%,  $p=0.014$ ). *Conclusion:* This study revealed a low prevalence of sunscreen use among patients with lupus erythematosus. Therefore, efforts should be done to raise the awareness of importance of sunscreen use among patients.

**Keywords:** Lupus erythematosus, Cutaneous lupus, Saudi Arabia, Sunscreen, Photoprotection.

**1. INTRODUCTION**

Lupus erythematosus is a chronic inflammatory autoimmune disease affecting numerous organ systems, resulting in multiple clinical manifestations. Systemic lupus erythematosus (SLE) is the most common type. Other types include neonatal, cutaneous and drug-induced. Due to abnormal immunologic function and the formation of autoantibodies, patients with

lupus erythematosus end up losing self-tolerance, which leads to the production of immune complexes that can damage healthy tissues. Although the exact etiology is still not clear, genetic, hormonal and environmental factors, as well as immunological disorders, can all be implicated (Maidhof & Hilas, 2012).

SLE can manifest with constitutional symptoms in the form of fever, malaise, arthralgia and most commonly, fatigue. SLE can also present with cardiac, vascular, ocular, obstetric, endocrine, musculoskeletal, dermatological, renal, neuropsychiatric, pulmonary, gastrointestinal and/or haematological manifestations (Cojocar et al., 2011). Most SLE patients experience bouts of flares, defined as increased disease activity, new or worsening manifestations, changes in the physician's global assessment, or the need for more treatment (Adamichou & Bertias, 2017).

Cutaneous lupus erythematosus (CLE) is a skin-specific manifestation of lupus erythematosus that may occur independently or as a manifestation of SLE and is mainly divided into three types: Acute, subacute and chronic. Clinical manifestations vary depending on the type; however, different types may coexist. Patients may develop facial erythema (malar rash), maculopapular rash, scaly plaques, extreme photosensitivity, or scarring alopecia (Okon & Werth, 2013). A worldwide systemic study found that the United States holds the highest estimates of incidence, with 23.2 cases per 100,000 and the lowest in Africa and Ukraine, with 0.3 cases per 100,000 (Rees et al., 2017). In Saudi Arabia, a study conducted in the Qassim region estimated the incidence of SLE to be 19.28 cases per 100,000 in Central Saudi Arabia (Al-Arfaj et al., 2002).

There is a clear relationship between sunlight exposure and cutaneous manifestations of lupus erythematosus (Orteu et al., 2001). The mechanism by which photosensitivity is increased in SLE patients is due to the phagocytic dysfunction of apoptotic cells after ultraviolet radiation exposure. Under normal conditions, phagocytes clear the apoptotic cells; however, due to phagocytic dysfunction in patients with SLE, delayed apoptotic cell clearance leads to the development of an autoimmune process that manifests as inflammatory cutaneous lesions (Ahluwalia & Marsch, 2019). According to the WHO, environmental factors affecting the UV radiation index include latitude, altitude, ozone, time of year and time of day, clouds and haze and ground reflection.

Photosensitivity is prevalent in people with SLE, as 40% to 70% of lupus erythematosus patients experience flares in their disease activity by exposure to UV radiation from sunlight or artificial light (Lupus Foundation of America, 2013). Therefore, photoprotective measures are important in the management and prognosis of lupus erythematosus, with a significant reduction in renal symptoms (30%), thrombocytopenia (26.7%) and hospitalizations (50%) (Vilá et al., 1999). A cross-sectional questionnaire-based study in the United States aimed to assess the frequency, pattern and limitations of sunscreen use in patients with lupus erythematosus. The study included only those who completed the questionnaire (100 of 148). The study concluded that 60% of patients used sunscreen, including 32% who used sunscreen daily and 40% who did not use sunscreen (Gutmark et al., 2015).

Another study aimed to determine factors that affect the use of sunscreen and barriers to compliance. The study included 429 patients from the dermatology clinic. The results of the study demonstrated that the factors associated with increased use of sunscreen were higher income, increased level of education, young age, history of melanoma and being female. Appearance and unsatisfactory feelings about the sunscreen were barriers to using sunscreen in 33.7%, high prices in 16.4% and time consumption in 15.3% (Weig et al., 2020).

A study with the aim of investigate whether it is possible to improve sunscreen use compliance by relocating where sunscreen is stored. The study included 62 Caucasian women, who were divided into two groups: Group A (received sunscreen only) and Group B (received sunscreen/storage unit) and were told to put the sunscreen with their toothpaste in the same storage unit. Both groups were educated on the benefits of sunscreen, along with instructions to use it. Results showed that participants of Group A used 37.0 grams (SD=17.2) of sunscreen provided and Group B participants used 44.1 grams (SD=18.0), which is not a significant number but is still considered a 20% difference in usage between the two groups over a short period of six weeks (Wang et al., 2017).

### **Purpose**

This study aimed to determine the prevalence of sunscreen use among patients diagnosed with lupus erythematosus at King Fahad University Hospital, Al Khobar, Eastern Province, Saudi Arabia, as well as the factors that may contribute to the use of photoprotective measures and their association with disease flares.

## 2. MATERIAL AND METHODS

### Study design

A cross-sectional questionnaire-based study

### Data collection

Questionnaires were either administered physically in the lupus clinic or completed through direct phone contact with patients diagnosed with lupus erythematosus based on the American College of Rheumatology (ACR), Systemic Lupus International Collaborating Clinics (SLICC), or European League Against Rheumatism (EULAR)/ACR classification criteria (Aringer et al., 2019; Piette, 1998; Tan et al., 1982). The sample study was attained using consecutive sampling technique through patient lists in those who were followed up in rheumatology clinics at King Fahad University Hospital (KFUH), Al Khobar, Eastern Province, Saudi Arabia, from January to March 2022.

### Study population (inclusion/exclusion criteria)

A total of 146 patients were randomly picked from the lupus erythematosus clinic patients list, who were 16 years or older and were diagnosed with lupus erythematosus for a year or more before administering the questionnaire. Patients who were not currently followed up in the KFUH, those who did not complete the survey, and those who were older than 70 years were excluded.

### Data analysis

Data analysis was performed using the Statistical Package of Social Sciences (SPSS) version 26 (Armonk, NY: IBM Corp. USA). Normality was examined using the Kolmogorov-Smirnov test. Continuous variables were summarised as the mean ± standard deviation (SD) or median and interquartile range (IQR), whereas categorical variables were summarised using frequencies and percentages. One-way analysis of variance (ANOVA) or the Kruskal Wallis test was used to test the significance of the variables in more than two groups. A multiple comparison test was performed using the Bonferroni correction. The chi-square and Fisher's exact tests were used to test the association between the variables. The level of significance was set at a two-sided  $P < 0.05$ .

## 3. RESULTS

A total of 146 lupus erythematosus clinic patients in KFUH participated in the study, with a mean age of 39.64 years (SD=10.78) and a mean of 10.38 years since diagnosis (SD=7.41). Of 146 participants, 93.8% (n=137) were females, 65.8% (n=96) were married and 93.2% (n=136) were diagnosed with SLE (Table 1).

**Table 1** Sociodemographic data

Study Parameters		Mean±SD
Age (in years)		39.64±10.78
Years Diagnosed		10.38±7.41
		Percent (No.)
Sex	Female	93.8%(n=137)
	Male	6.2% (n=9)
Marital status	Single	26.7%(n=39)
	Married	65.8%(n=96)
	Divorced	7.5%(n=11)
Education level	Elementary	5.5% (n=8)
	Intermediate	11%(n=16)
	High school	24.7%(n=36)

	Diploma	4.8% (n=7)
	Bachelor	52.1%(n=76)
	High education	2.1% (n=3)
Typeof lupus erythematosus	SLE	93.2%(n=136)
	CLE	6.8%(n=10)

Moreover, 52.1% (n=76) of the study population had no lupus erythematosus flares in the 12 months preceding the questionnaire, 39% (n=57) had five or fewer flares and 8.9% (n=13) had more than five flares. Regarding time spent outdoors, 49.3% (n=72) spent less than 30 min/day and 5.5% (n=8) spent more than 4 h/day (Figure 1). In addition, the most common physical sun protective method used was long sleeves/abaya followed by hat/scarf/hijab (Table 2).

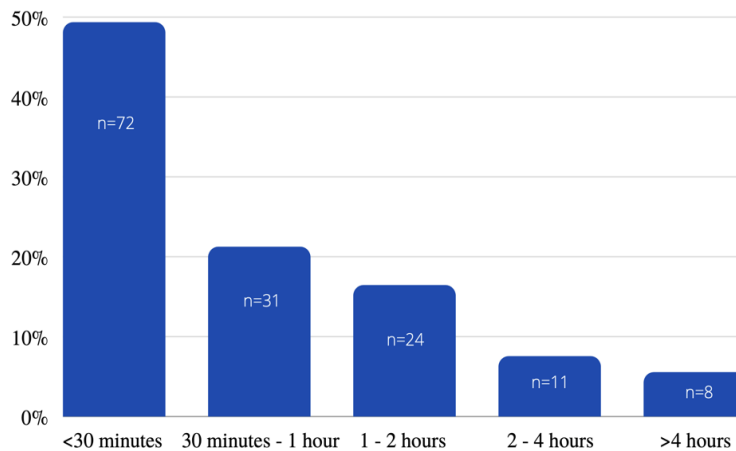


Figure 1 Average daily time spent outdoors

Table 2 Physical sun protective methods and the frequency of use

Physical barrier	Frequency of use	Percent (No.)
Long sleeves/ abaya	Never	6.2% (n=9)
	Occasionally	21.9%(n=32)
	Always	71.9%(n=105)
Sunglasses	Never	38.4%(n=56)
	Occasionally	19.9%(n=29)
	Always	41.8%(n=61)
Hat/scarf/hijab	Never	13.7%(n=20)
	Occasionally	16.4%(n=24)
	Always	69.9%(n=102)
Stay in shadow / umbrella use	Never	11%(n=16)
	Occasionally	44.5%(n=65)
	Always	44.5%(n=65)

Concerning sunscreen use in the seven days before completing the survey, 53.4% (n=78) did not use sunscreen, 16.4% (n=24) used sunscreen for six days or less and 30.1% (n=44) used sunscreen daily (Table 3). Furthermore, 42.5% (n=62) of the participants stated that they always applied sunscreen on sunny days. However, only 26.7% (n=39) always used sunscreen on cloudy days. A total of 53.4% (n=78) of participants reported an increase in sunscreen use after the diagnosis of lupus erythematosus.

**Table 3** Prevalence of sunscreen use in the previous 7 days

Number of days sunscreen was used	Percent (No.)
0 days	53.4% (n=78)
1-2 days	9.6% (n=14)
3-4 days	3.4% (n=5)
5-6 days	3.4% (n=5)
Everyday	30.1% (n=44)

Among those who used sunscreen, 65.8% (n=52) stated that they never reapplied during the day and 34.2% (n=27) reapplied once or more daily. Concerning the time sunscreen was applied before being exposed to the sun, 33% (n=26) immediately applied before going out, while 63.3% (n=50) and 3.7% (n=3) applied it in less than 30 min and more than 30 min before going outside, respectively. The most common sunscreen form and sun protection factor (SPF) were cream/lotion 87.3% (n=69) and 50+ SPF 79.7% (n=63), respectively.

Regarding the age, patients who did not use sunscreen the week before the administration of the questionnaire had a mean age of 40.99 years (SD=11.45) and patients who used sunscreen every day had a mean age of 36.82 years (SD=8.467) (p=0.112). Among the females, the majority (50.4%, n=69) had not applied sunscreen on any of the days in the previous week, whereas 32.1% (n=44) had applied sunscreen everyday (Table 4).

**Table 4** Relationship between sunscreen use and socio-demographic

Characteristic	During the last week how many times did you apply sunscreen			P-value
	0days	1-6days	Everyday	
	Percent (No.)	Percent (No.)	Percent (No.)	
Age	40.99(SD=11.45)	40.46(SD=11.74)	36.82(SD=8.467)	0.112
Sex				0.020
Female	50.4%(n=69)	17.5%(n=24)	32.1%(n=44)	
Male	100% (n=9)	0.0% (n=0)	0.0% (n=0)	
Social status				0.367
Single	46.2%(n=18)	17.9%(n=7)	35.9%(n=14)	
Married	56.3%(n=54)	17.7%(n=17)	26%(n=25)	
Divorced	54.5%(n=6)	0.0% (n=0)	45.5%(n=5)	

Regarding patients diagnosed with SLE, 56.6% (n=77) never applied sunscreen in the last week and 28.7% (n=39) applied sunscreen daily, while patients with CLE, 10% (n=1) did not use sunscreen and 50% (n=5) applied sunscreen every day (p= 0.006). Moreover, among patients who had no flares in the previous 12 months, 60.5% (n=46) had never applied sunscreen in the last week, and 26.3% (n=20) had applied it every day. On the other hand, among patients who had one to five flares 47.4% (n=27) did not use sunscreen and 31.6% (n=18) applied it daily (p= 0.347). In consideration of treatment, for those who are not currently on any treatment, 54.2% (n=6) never applied sunscreen in the last week and 27.3% (n=3) applied it everyday. Among patients who received a single treatment, 46.9% (n=15) did not apply it, 40.6% (n=13) applied it daily and for those who received two or more treatments, 55.3% (n=57) did not use sunscreen and 27.2% (n=28) applied it daily (p=0.698) (Table 5).

**Table 5** Relationship between sunscreen use and disease characteristic and treatment

Characteristic	Last week how many times you applied sunscreen			P-value
	0days	1-6days	Everyday	
	Percent (No.)	Percent (No.)	Percent (No.)	
Type of lupus erythematosus				
SLE	56.6%(n=77)	14.7%(n=20)	28.7%(n=39)	0.006
CLE	10%(n=1)	40%(n=4)	50%(n=5)	
No. of flares				
0	60.5%(n=46)	13.2%(n=10)	26.3%(n=20)	0.347
1-5	47.4%(n=27)	21.1%(n=12)	31.6%(n=18)	
More than 5	38.5%(n=5)	15.4%(n=2)	46.2%(n=6)	
Treatment				
No treatment	54.5%(n=6)	18.2%(n=2)	27.3%(n=3)	0.698
Single treatment	46.9%(n=15)	12.5%(n=4)	40.6%(n=13)	
2 or more treatments	55.3%(n=57)	17.5%(n=18)	27.2%(n=28)	

After assessing the use of sunscreen in the previous week in relation to factors preventing patients from using it, 63.0% (n=46) of patients who agreed that sunscreen was very expensive did not use sunscreen and 19.2% (n=14) used it daily. On the other hand, among patients who disagreed that sunscreen was very expensive, 43.8% (n=32) did not use sunscreen and 41.1% (n=30) used it daily (p=0.014). Furthermore, 61.7% (n=29) of patients who agreed that sunscreen was uncomfortable to use did not use it and 17% (n=8) used it daily. In comparison, among those who disagree, 49.5% (n=49) did not apply and 36.4% (n=36) applied it daily (p=0.054). Additionally, among patients who forgot to apply sunscreen, 57.1% (n=44) did not use sunscreen in the previous week, and 22.1% (n=17) used it daily (p=0.055). In addition, 24% (n=35) of the patients agreed that using sunscreen was inconvenient and 80% (n=28) of them did not use sunscreen in the previous week. However, 76.0% (n=111) disagreed that it was inconvenient, 45.0% (n=50) of them did not use sunscreen and 35.1% (n=39) used it daily (p=0.001). In examining patients' beliefs, a question was asked about whether they agreed or disagreed that sunscreen prevents lupus erythematosus flares, 74.7% (n=109) of patients agreed that it prevented flares and 36.7% (n=40) of them used it daily in the previous week (p=0.002) (Table 6).

**Table 6** Relationship between sunscreen use and barriers and limitations of sunscreen use

Characteristic	Last week how many times you applied sunscreen			P-value
	0days	1-6days	Everyday	
	Percent (No.)	Percent (No.)	Percent (No.)	
Very expensive				
Agree	63.0%(n=46)	17.8% (n=13)	19.2%(n=14)	0.014
Disagree	43.8%(n=32)	15.1% (n=11)	41.1%(n=30)	
Uncomfortable				
Agree	61.7%(n=29)	21.3% (n=10)	17%(n=8)	0.054
Disagree	49.5%(n=49)	14.1% (n=14)	36.4%(n=36)	
I like tanning				
Agree	57.1%(n=8)	0.0% (n=0)	42.9%(n=6)	0.169
Disagree	53%(n=70)	18.2% (n=24)	28.8%(n=38)	
Forgetfulness				
Agree	57.1%(n=44)	20.8% (n=16)	22.1%(n=17)	0.055
Disagree	49.3%(n=34)	11.6%(n=8)	39.1%(n=27)	
Inconvenient to use				
Agree	80%(n=28)	5.7% (n=2)	14.3%(n=5)	0.001
Disagree	45%(n=50)	19.8% (n=22)	35.1%(n=39)	
Skin irritation				
Agree	50%(n=6)	25%(n=3)	25%(n=3)	0.713

Disagree	53.7%(n=72)	15.7% (n=21)	30.6%(n=41)	0.002
Doesn't prevent flares				
Agree	78.4%(n=29)	10.8%(n=4)	10.8%(n=4)	
Disagree	45%(n=49)	18.3% (n=20)	36.7%(n=40)	

Regarding the physical protective methods in relation to sunscreen use in the previous week, 52.4% (n=55) of patients who always wore long sleeves/abaya did not use sunscreen (p=0.114), 45.9% (n=28) of patients who always wore sunglasses did not use sunscreen (p=0.327), 52% (n=53) of patients who always wore hat/scarf/hijab did not use sunscreen (p=0.225) and 43.1% (n=28) of patients who always stayed under shadows or used an umbrella did not apply sunscreen (p=0.095) (Table 7).

**Table 7** Relationship between sunscreen use and physical sun protection methods

Physical sun protection method	Last week how many times did you apply sunscreen			P-value
	0 days	1-6 days	Everyday	
	Percent (No.)	Percent (No.)	Percent (No.)	
Long sleeves/abaya				
Never	44.4% (n=4)	0.0% (n=0)	55.6% (n=5)	0.114
Occasionally	59.4% (n=19)	6.3% (n=2)	34.4% (n=11)	
Always	52.4% (n=55)	21% (n=22)	26.7% (n=28)	
Sunglasses				
Never	64.3% (n=36)	12.5% (n=7)	23.2% (n=13)	0.327
Occasionally	48.3% (n=14)	20.7% (n=6)	31% (n=9)	
Always	45.9% (n=28)	18% (n=11)	36.1% (n=22)	
Hat/scarf/hijab				
Never	65% (n=13)	0.0% (n=0)	35% (n=7)	0.225
Occasionally	50% (n=12)	16.7% (n=4)	33.3% (n=8)	
Always	52% (n=53)	19.6% (n=20)	28.4% (n=29)	
Stay in shadow/umbrella				
Never	68.8% (n=11)	0.0% (n=0)	31.3% (n=5)	0.095
Occasionally	60% (n=39)	15.4% (n=10)	24.6% (n=16)	
Always	43.1% (n=28)	21.5% (n=14)	35.4% (n=23)	

#### 4. DISCUSSION

Sunscreen application is a valuable method of photoprotection, especially in patients with lupus erythematosus, as it plays a significant role in the management and prognosis of the disease, reducing symptoms and hospitalizations (Vilá et al., 1999). In the general population of Saudi Arabia, the use of sunscreen was reported to be in the range of 8.3%–24% (Holman et al., 2018; Kim & Chong, 2013), whereas in the United States, sunscreen use was as high as 31.5% (Holman et al., 2018).

Our study targeted lupus erythematosus patients who followed up in KFUH and found that as much as 53.4% of the participants did not use sunscreen routinely and only 30.1% used it daily. In addition, among the patients who used sunscreen, 65.8% stated that they never reapplied their sunscreen during the day. In comparison, a study published in the United States showed that 60% of CLE patients used sunscreen, including 32% who used sunscreen daily (Gutmark et al., 2015). The low rate of sunscreen uses among lupus erythematosus patients in our hospital compared to those in the United States may be due to the lack of awareness in the general population in our area.

The study also found that patients who were young, female, married and had a higher education level tended to use sunscreens more often. Similarly, a study conducted also reported an increase in the use of sunscreen associated with these factors (Weig et al., 2020). Moreover, 50% of CLE patients used sunscreen daily, whereas only 28.7% of SLE patients used it daily. This might be attributed to the fact that up to 100% of CLE patients present with photosensitivity compared to 59.5% of patients with SLE (Kim & Chong, 2013; Maria et al., 2016). However, our study included a small number of patients with CLE, which may have affected our results. Furthermore, participants with a higher number of lupus erythematosus flares showed a higher prevalence of sunscreen use which was expected because of the increase in disease activity.

Concerning barriers and limitations to sunscreen use, most patients felt that sunscreen was inconvenient, followed by those who believed that it did not prevent disease flares. Those who thought it was expensive did not use sunscreen routinely. To address these issues, public and targeted campaigns along with lupus erythematosus support programs can be initiated to increase awareness of sunscreen use among both patients with lupus erythematosus and the general population and to facilitate sunscreen acquisition by either government support programs or insurance coverage to those who cannot afford it, as such programs can decrease the healthcare burden and hospitalization.

## 5. CONCLUSION

In conclusion, we aimed to measure the prevalence of sunscreen use among patients with lupus erythematosus in KFUH. We found that sunscreen use was generally low, except for those with a higher number of flares. The study also found that the factors affecting sunscreen use were related to decreased knowledge and awareness of sunscreen. Therefore, measures should be taken to raise awareness about the importance of sunscreen use among caregivers and patients.

### **Application**

The results indicate that there is a need to increase the use of sun-protective methods in patients with lupus erythematosus. Targeted awareness campaigns, legislation and other methods may increase the prevalence of sunprotection among those who need protection the most.

### **Limitations and Recommendations**

The sample size was relatively small because it was from a single hospital. This issue can be avoided by extending the research time and widening the sample pool. Furthermore, there are no studies in the area that address lupus erythematosus patients and the use of sunscreen; moreover, there are relatively minimal data that address this issue globally. Further studies should be conducted on lupus erythematosus patients and their use of sunscreen in a larger sample. In addition, other studies can be used to validate the association between sunscreen and lupus erythematosus flares.

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### **Authors contributions**

All authors contributed equally and there is no author whose name is not listed in the authors list.

### **Ethical Approval**

This study was approved by the Institutional Review Board (IRB) of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia (IRB-UGS-2021-01-405). Informed consent was obtained from all participants.

### **Abbreviations**

ANOVA, one-way analysis of variance; CLE, cutaneous lupus erythematosus; IQR, interquartile range; KFUH, King Fahad University Hospital; SD, standard deviation; SLE, systemic lupus erythematosus; SPF, sun protection factor; SPSS, Statistical Package of Social Sciences

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This study has not received any external funding.

### **Conflict of interest**

The authors declare that there is no conflict of interests.

### **Data and materials availability**

All data sets collected during this study are available upon reasonable request from the corresponding author.



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