Zagazig University Medical Journal
www.zumj.journals.ekb.eg

https://doi.org/10.21608/zumj.2024.234154.2873 Volume 30, Issue 1.7, Oct. 2024, Supplement Issue

Manuscript ID: ZUMJ-2011-1994 **Doi: 10.21608/ZUMJ.2021.48340.1994**

ORIGINAL ARTICLE

Assessment of Spirometric Parameters in Systemic Lupus Erythematosus Children with Lupus Nephritis

Tarek Hamed Attia[1], Ezzat Kamel Amien [1], Hibah Shuayb Asrafeel [2]

[1]Pediatrics Department, Faculty of Medicine, Zagazig University, Zagazig, Sharkia, Egypt.
[2]Pediatrics Department, Faculty of Medicine – Omar Al Muktar University, Libya.

Corresponding author*
Hibah Shuayb Asrafeel.

Email:
hebaasrafel@gmail.com

Submit Date 13-10-2020
Revise Date 01-07-2021
Accept Date 28-12-2021

ABSTRACT

Background: Childhood-onset systemic lupus erythematosus is a multisystem, autoimmune disease, beginning before the age of 18 that may affect any organ system. The study aimed to assess the role of spirometry in detection of pulmonary involvement in children with lupus nephritis and to correlate spirometric parameters with a degree of renal affection. **Methods:** This cross-sectional study was conducted in Nephrology Unite at Zagazig University Hospital on 24 cases that diagnosed SLE patients during the period from Oct 2019-Mar 2020. Patients in the study were subjected to complete history taking, Laboratory investigations included hematological examination of urine, kidney function test, Chest X-ray, ultrasonography of chest and Renal biopsy, pulmonary function test, and SLED score. **Results**: Restrictive lung disease was prevalent in 54.2% of patients, a mean value of FEV1 was (86.208 ± 23.268), forced vital capacity was (79.321± 23.79), FEV1/FVC was (108.14±11.731), MEF75 was (88.404±19.703). MEF50 was (93.358±25.616). MEF25 was (107.808±47.54), and PEF was (84.4± 18.865) there was a statistically significant negative correlation between systemic lupus erythematous Disease score and Forced expiratory Volume in 1 sec, forced vital capacity and forced expiratory flow at 25% FVC There is a statistically significant negative correlation between grades of nephropathy by renal biopsy and forced expiratory flow at 25% FVC. **Conclusions:** The present study showed that pulmonary diseases occur frequently in childhood-onset Systemic lupus erythematosus. Serial PFT studies may be useful in assessing the presence of lung involvement in childhood-onset SLE and monitoring of course and activity of the disease

Keywords: Pulmonary function tests; Spirometry; Systemic lupus erythematosus.

INTRODUCTION

Systemic lupus erythematosus (SLE) is a chronic systemic disease involving multiple organs such as the kidneys, skin, and brain. The lung is another organ that can be affected. Several pulmonary complications including pleurisy, pneumonitis, infectious pneumonia,

pulmonary hemorrhage, pulmonary hypertension, and pneumothorax have been reported in patients with SLE. The lung involvement in SLE patients may be a direct involvement, or the lungs may be affected as a consequence of other organ impairments [1].

Lungs are commonly involved among the other organs. Damage and dysfunction is mediated by autoantibodies and immune complex formation. At some time during the disease course, about 50% of patients with systemic lupus erythematosus show signs of involvement of the lung, its vasculature, the pleura, and the diaphragm. Pleuritic chest pain, coughing, and shortness of breath are often the first clues to the lung involvement of SLE itself [2].

Symptomatic pleuro-pulmonary disease in SLE is well-described in both adults and children. There is considerable debate concerning the relative frequency, with some studies reporting a higher incidence in adults, and others similar proportions. The types of pulmonary manifestations reported are diverse and may involve any portion of the pulmonary organ system including the pleura, diaphragm, parenchyma, and vasculature. The wide range of prevalence estimates found in the literature may be due to known racial and ethnic phenotypic variability, as well as different approaches taken to determine the presence of pulmonary involvement with cSLE [3].

All components of the respiratory system may be affected during disease. The spectrum of pulmonary manifestations caused by SLE includes pleural disease, upper and lower airway dysfunction, primary pulmonary hypertension, pulmonary thromboembolism, acute reversible hypoxemia, diffuse interstitial lung disease, acute lupus pneumonitis, diffuse alveolar hemorrhage, and shrinking lung syndrome. Some patients may have more than one form of pleuropulmonary involvement during their disease. The severity of these respiratory complications is highly variable and ranges from subclinical to potentially life-threatening conditions [4] **.**

The pleuropulmonary manifestations of Systemic Lupus Erythematous (SLE) are pleuritis, acute lupus pneumonitis, a chronic interstitial lung disease with fibrosis, alveolar hemorrhage, respiratory muscle and diaphragmatic dysfunction, atelectasis, bronchiolitis obliterans, pulmonary vascular disease with pulmonary hypertension and pulmonary embolism. The pleura is the most common thoracic localization of SLE. Record studies with the use of imaging techniques like high resolution computed tomography (HRCT) chest suggest that not only pleural diseases are common but airway disease, lymphadenopathy and interstitial lung diseases are also common than previously thought [5]**.**

This study aimed to assess the role of spirometry in detection of pulmonary involvement in children with lupus nephritis and to correlate spirometric parameters with a degree of renal affection**.**

METHODS

This cross-sectional comparative study was carried out from Oct 2019- Mar 2020 in the pediatric nephrology unit at Zagazig University Hospital, after obtaining clearance from the Institutional Ethics Committee. Written informed consent was

obtained from all childers' parents and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion Criteria: Patient with pulmonary manifestation. All the patient meeting systemic lupus international collaborating clinic (SLICC 2012) for diagnosis of systemic lupus erythematous with lupus nephrties without evidence of other connective tissue diseases. Several age-sex, height- and weight-matched controls were recruited from patients attending OPD with minor ailments and no rheumatic or respiratory disorders.

Exclusion criteria: Patients under 5 years of age were not included as they failed to understand the instructions for spirometry. Resting tachycardia. Patient with concurrent congenital heart disease. Patients with a history of surgery in the head and neck region were excluded.

Patients in the study were subjected to Complete history taking including name, age, gender, Family history of SEL, Duration of SEL, SLE score, Laboratory investigations including hematological and serological investigations, examination of urine, kidney function test, Chest X-ray, ultrasonography of chest and Renal Biobsy, pulmonary function test, SLED score. Disease Activity was assessed at the time of study enrollment and scored according to the systemic lupus erythematous Disease Activity Index (SLEDAI) disease was considered active when the index was 10 or more [6].

American Thoracic Society (ATS) criteria for acceptability and repeatability of spirometry were followed. Spirometry was done using a Windows-based digital spirometer (Spirowin version 2.0) after explanation and demonstration to the subject. The nose was manually closed by the examiner while they were asked to take maximal inspiration and then to blow into the mouthpiece as quickly, forcefully, and maximally as possible. Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio, Forced expiratory flow MEF75, MEF50, MEF25, and peak expiratory flow rate (PEFR) were noted.

FEF25-75% is the most sensitive measure of airflow in peripheral airways where primary airflow obstruction originates and it is reduced in early bronchial impairment, which is associated with small airway disease. maximal mid expiratory flow FEF25–75; the maximum rate of airflow measured between expired volumes of 25 and 75 percent of the vital capacity during a forced expiration; represented graphically as the slope of the line connecting the points on the forced expiratory volume curve at 25 and 75 percent of the forced vital capacity [7].

American Thoracic Society (ATS) criteria for acceptability and repeatability of spirometry were followed. Spirograms with satisfactory start and satisfactory exhalation were considered acceptable. The spirometric procedure was repeated until at least two acceptable spirograms showed FVC within 0.150 L of each other. A maneuver with the largest sum of FVC and FEV1 was used. Patients with unacceptable spirometry and/or inadequate effort were excluded.

STATISTICAL ANALYSIS

Analysis of the results was done via SPSS

computer software version 18 (Statistical Package of Social Science) [8] employing mean and standard deviation as descriptive tools and student's T test, Chi square test, and Pearson's correlation for comparisons. Results were considered significant at p-value <0.05.

RESULTS

Table (1), showed that females represented 70.8% of patients. They aged from 6 to 15 years with a mean of 11.333 years. BMI ranged from 15.306 to 32.653 kg/m^2 with a mean of 21.066 kg/m^{2}SLED score ranged from 3 to 33 with a mean of 16.58. Patients had lupus from 1 to 36 months with a mean of 16.792 months. Table (2), showed that FEV1 ranged from 31.7 to 124.9 with a mean of 86.208. FVC ranged from 28.3 to 140.6 with a mean of 79.321. FEV1/FVC ranged from 75.36 to 117.1 with a mean 108.14. MEF75 ranged from 49.4 to 127.4 with a mean of 88.404. MEF50 ranged from 52.1 to 142 with a mean of 93.358. MEF25 ranged from 18.9 to 199.2 with mean 107.808. PEF ranged from 45.1 to 117.9 with a mean of 84.4. Table (3), showed that This study showed that FEV1, FVC, and MEF25 were significantly lower in the active group than not active group. Figure (1), showed that there was negative correlation between grades of nephropathy by renal biopsy and all of FVC/ FEV1/FVC, MEF25, MEF50 and PEF. Figure (2), showed that there was statistically significant negative correlation between SLED score and FEV1, FVC and MEF25.

Table 1: Distribution of the studied patients according to demographic characteristics, disease severity and duration, and anthropometric measures

	N=24	%
Gender:		
Male	7	29.2
Female	17	70.8
Age (years):		
Mean ± SD	11.333 ± 2.632	
Range	6 - 15	
BMI (kg/m^2):		
Mean ± SD	21.066 ± 5.115	
Range	15.306 – 32.653	
SLED score:		
Mean ± SD	16.58 ± 9.03	
Range	4 - 33	
Disease duration (months):		
Mean ± SD	16.792 ± 11.088	
Range	1 – 36	

Table 2: Distribution of the studied patients according to spirometric measures

Parameter	**Value**
FEV1:	
Mean ± SD	86.208 ± 23.268
Range	31.7 - 124.9
FVC:	
Mean ± SD	79.321 ± 23.79
Range	28.3 – 140.6
FEV1/FVC:	
Mean ± SD	108.14 ± 11.731
Range	75.36 – 117.1
MEF75:	
Mean ± SD	88.404 ± 19.703
Range	49.4 - 127.4
MEF50:	
Mean ± SD	93.358 ± 25.616
Range	52.1 – 142
MEF25:	
Mean ± SD	107.808 ± 47.54
Range	18.9 – 199.2
PEF:	
Mean ± SD	84.4 ± 18.865
Range	45.1 – 117.9

Table 3: Relation between activity by SLED score and spirometer

	Active	Not	t	P
FEV1	78.61±12.54	100.36±33.58	2.452	0.015*
FVC	73.75±15.11	95.30±31.25	2.314	0.024*
FEV1_FVC	107.88±10.25	107.38±10.39	0.118	0.907
MEF75	89.97±18.16	85.70±25.92	0.476	0.639
MEF50	89.94±24.64	89.62±29.2	0.028	0.978
MEF25	93.45±30.58	130.78±43.81	2.265	0.036*
PEF	84.25±17.62	83.76±24.85	0.057	0.955

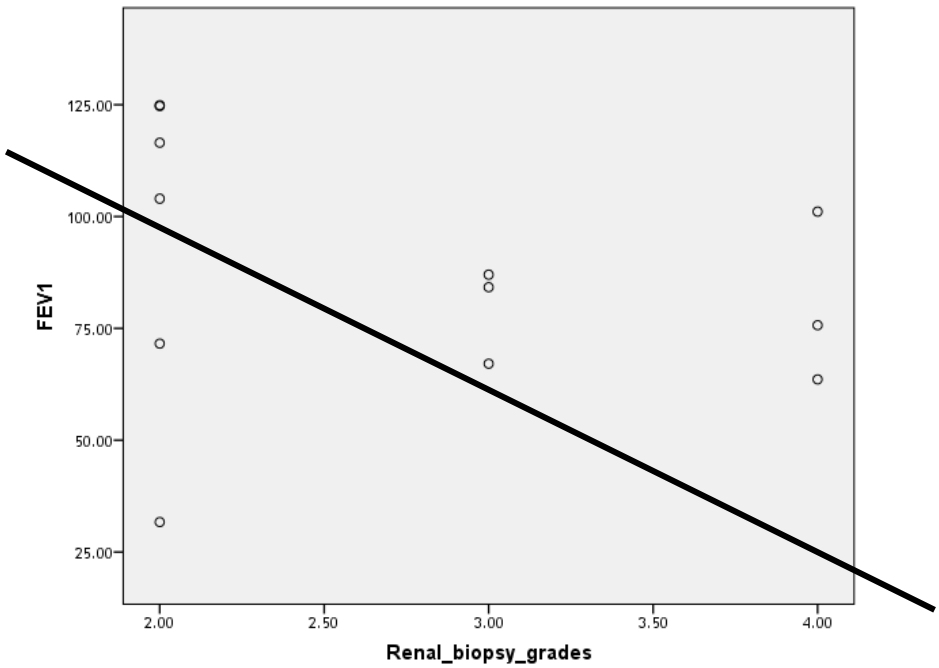

Figure 1: Correlation between FEV1 and renal biopsy grades Significant negative correlation between FEV1 and renal biopsy grades.

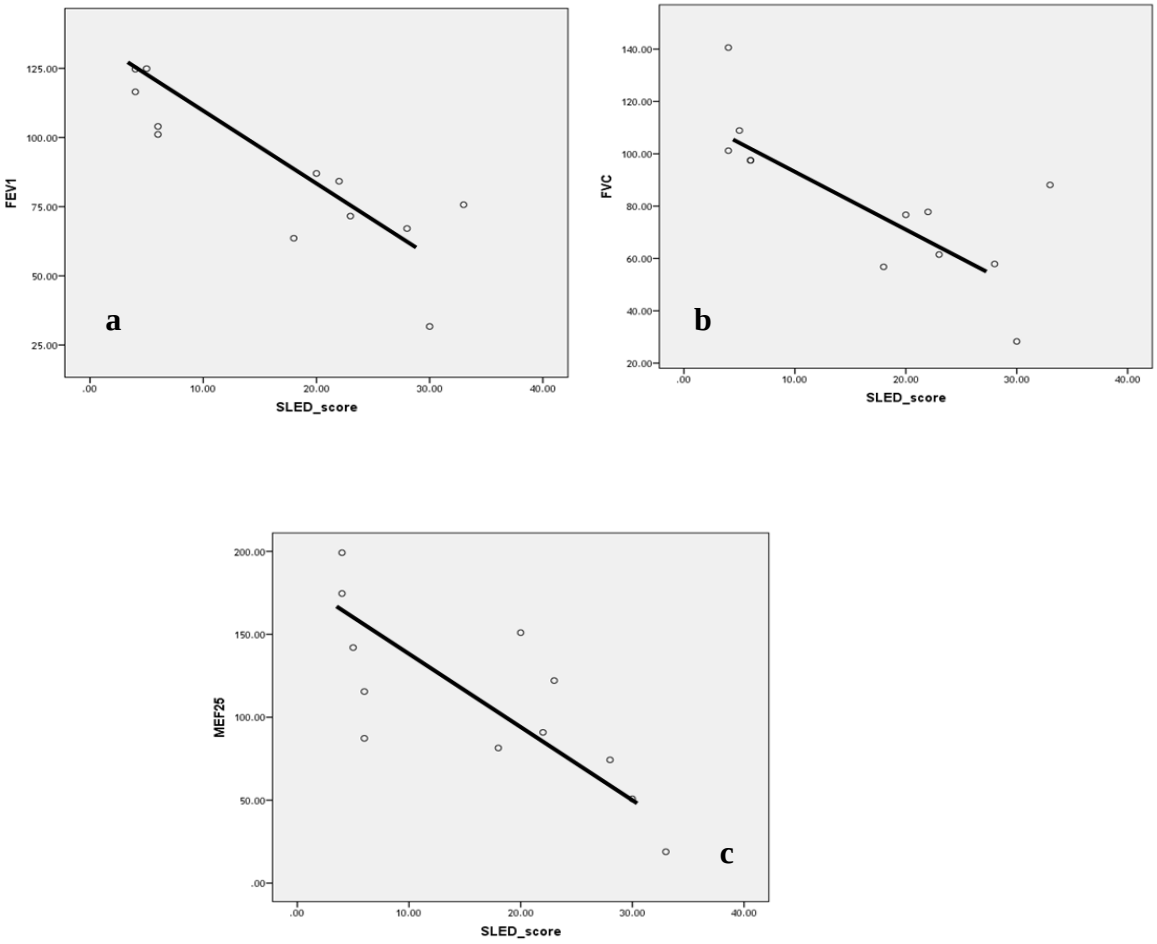

Figure 2: Correlation between SLED and FEV1(a), FVC (b) , MEF25 (c)

DISCUSSION

Lupus nephritis is one of the most serious manifestations of SLE, posing a considerable risk of morbidity and mortality. Early diagnosis and treatment with immunosuppressive agents are important for the better outcome of lupus nephritis. Thus, patients at risk of lupus nephritis should be identified as early as possible in the course of SLE [9].

The aim of the current study was to assess the role of spirometery in the detection of pulmonary involvement in children with lupus nephritis and to correlate spirometric parameters with a degree of renal affection.

The current study showed that females represented 70.8% of patients and males were (29.2%) with a mean age of 11.333 ± 2.632 years, the mean BMI was 21.066 ± 5.115 kg/m2, the mean SLED score was 16.58 ± 9.03, while the mean Disease duration was 16.792 ± 11.088 (months)

In agreement with our study, Mina et al., [10], reported that the mean age was 15.5 ± 2.7 years; (77%) were females and males were (23%) and the mean disease duration was 18.24 ± 0.69 (months).

In agreement with our study, Lotfy et al., [1], reported that the mean age was 14.8 ± 3.037 years; (85%) were females and males were (15%) and mean, but different in mean disease duration which was 4.9 ± 1.944 (years).

Current results showed BMI (kg/m2) was (21.066 ± 5.115) similar to the results of Singh et al. [11] who recorded a BMI (kg/m^2) of (21.17±3.43) and Disease duration was 13.6 ± 8.1 (months), but contrast with SELD score where it was 8.1 ± 7.4, while in the current study, it was 12.208 ± 8.236.

Current results showed that Restrictive lung disease was prevalent in 54.2% of patients, which is in agreement with Borrell et al., [12] who found that Restrictive lung disease was present in 52.3% of patients. On the other hand, Veiga et al., [13] reported that twenty (50%) patients exhibited some type of respiratory disturbance: nine (22.5%) restrictive, eight (20%) obstructive, and 3 (7.5%) mixed, while Mohammad, et al. [14] reported that pulmonary function tests in all studied patients revealed that the majority of the patients (80%) presented with restrictive lung diseases.

The current study showed that the mean value of FEV1 was (86.208 ± 23.268), FVC was (79.321±23.79), FEV1/FVC was (108.14 ± 11.731), MEF75 was (88.404 ± 19.703). MEF50 was (93.358 ±25.616). MEF25 was (107.808. ± 47.54), and PEF was (84.4± 18.865). Lotfy et al., [1], found that the mean value of FEV1 was (96.9 ± 17.7), FVC was (89.175 ± 19.5), PEF25–PEF50 (99.250 ± 23.5).

The current study showed that FEV_1, FVC, and MEF_{25} were significantly lower in the active group than not active group studied groups. Which in agreement with the study of Abd El-Khalik et al., [15] reported that higher SLEDAI tended to be associated with lower PFTs, which reported similar results to our study.

In contrast to our results, the study of Mohammad et al., [14], found that there was no significant correlation between the activity of SLE according to SLED score and respiratory functions, also, a study by Abdulla et al., [16], concluded that there was no correlation between altered PFTs and disease duration, activity and/or immunological findings.

There was a statistically negative correlation between grades of nephropathy by SLED score and FEV_1, FVC, and MEF_{25} which is in agreement with the study of Deerojanawong et al., [17] who reported that there was a negative correlation between SLED score and respiratory functions. While in contrast to our results, the study of Al-Abbad et al. [18], who reported a that their was no significant correlation between SLED score and respiratory functions.

Our results showed there was a statistically significant negative correlation between grades of

nephropathy by renal biopsy and FEV_1.

Sharma et al., [19] reported that pulmonary function abnormalities are common among ESRD patients. A comparison of pre and post-hemodialysis parameters showed significant improvements.

Lotfy et al., [1] reported that occult pulmonary disease occurs frequently in childhood-onset SLE and that PFT abnormalities were found in 95% of these children.

CONCLUSION

The present study showed that pulmonary diseases occur frequently in childhood-onset Systemic lupus erythematosus. Serial PFT studies may be useful in assessing the presence of lung involvement in childhood-onset SLE and monitoring of course and activity of the disease

RECOMMENDATION

Further studies with a larger number of sample size with a long period follow-up are recommended to emphasize our conclusion and shed more light on the role of Spirometric Parameters in Systemic Erythematosus Children with Lupus Nephritis.

CONFLICT OF INTEREST

No Conflict of Interest

FINANCIAL DISCLOSURE

No financial disclosure

REFERENCES

1. **Lotfy HM, Halawa EF, El Baz M.** Pulmonary involvement in juvenile-onset systemic lupus erythematosus patients asymptomatic for respiratory disease. Egypt J Bronchol. **2015**; 9:59-63.
2. **Hamdani MA, Al-Arfaj AR, Parvez K, Naseeb F, Ibrahim AE, Cal JH.** Pulmonary manifestations of systemic lupus erythematosus patients with and without antiphospholipid syndrome. Pak J Med Sci. **2015;** 31(1), 70.
3. **Tarr T, Derfalvi B, Gyori N, Szántó A, Siminszky Z, Malik A, et al.** Similarities and differences between pediatric and adult patients with systemic lupus erythematosus. Lupus. **2015**; 24: 796–803.
4. **Wan SA, Teh CL, Jobli AT.** Lupus pneumonitis as the initial presentation of systemic lupus erythematosus: case series from a single institution. Lupus. **2016**; 25:1485–90.
5. **Asif S, Aflak Rasheed TE, Asghar A.** Frequency and predictors of pulmonary hypertension in patients with Systemic Lupus Erythematosus. Pak J Med Sci. **2019;** 35(1): 86.
6. **Gladman DD, Goldsmith CH, Urowitz MB, Bacon P, Fortin P, Ginzler E, et al.** the Systemic Lups international collaborating clinics/American Collaborating Clinics/ American collage of Rheumatology (SLICC/ACR) Damag index for systemic lupus erythemaosus international comparison. J Rheum. **2000**; 27:373-6.
7. **Kwon DS, Choi YJ, Kim TH, Byun MK, Cho JH, Kim HJ, Park HJ.** $FEF_{25-75\%}$ Values in Patients with Normal Lung Function Can Predict the Development of Chronic Obstructive Pulmonary Disease. Int J Chron Obstruct Pulmon Dis. 2020:12;15:2913-2921.
8. **Grjibovski AM, Ivanov SV, Gorbatova MA.**Univariate regression analysis using Statistica and SPSS software. Science & Healthcare 2017 (2), 5-33.
9. **Kwon OC, Lee JS, Ghang B, Kim YG, Lee CK, Yoo B et al.** Predicting eventual development of lupus nephritis at the time of diagnosis of systemic lupus erythematosus. Semin Arthritis Rheum. 2018; 48 (3) : 462-466.
10. **Mina R, Abulaban K, Klein-Gitelman MS, Eberhard BA, Ardoin SP, Singer N, et al.** Validation of the Lupus Nephritis Clinical Indices in Childhood-Onset Systemic Lupus Erythematosus. Arthritis care & Res. **2016;** 68(2): 195-202.
11. **Singh A, Ghosh R, Kaur P, Golay V, Pandey R, Roychowdhury A.** Protocol renal biopsy in patients with lupus nephritis: a single center experience. Saudi J Kidney Dis Transpl. **2014;** 25(4): 801.
12. **Borrell H, Narváez J, Alegre JJ, Castellví I, Mitjavila F, Aparicio M, et al.** Shrinking lung syndrome in systemic lupus erythematosus: A case series and review of the literature. Medicine, **2016;** 95 (33): e4626.
13. **Veiga CS, Coutinho DS, Nakaie CM,**

Campos LM, Suzuki L, Cunha M T, et al. Subclinical pulmonary abnormalities in childhood-onset systemic lupus erythematosus patients. Lupus, **2016;** 25(6): 645-51.

14. **Mohammad HA, Hassan AA, Osman NM, Mohamed MS.** Detection of pulmonary involvement in lupus patients with and without clinical pulmonary symptoms. Egypt J Chest Dis Tuberc. **2014;** 63 (2): 463-9.
15. **Abd El-Khalik KA, El-Sayed ZA, Faheem MS, Fouda E, Abdurrahman L, Abd El-Ghany S.** High resolution computed tomography and pulmonary function tests in childhood systemic lupus erythematosus and juvenile rheumatoid arthritis. Egypt. J. Ped. Aller. Immunol 2004; 2 (1): 8-15.
16. **Abdulla E, Al-Zakwani I, Baddar S, Abdwani R.** Extent of subclinical pulmonary involvement in childhood-onset systemic lupus erythematosus in the Sultanate of Oman. Oman Med J. 2012; 27(1): 36- 39.
17. **Deerojanawong J, Leartphichalak P, Chanakul A, Sritippayawan S, Samransamruajkit R.** Exhaled nitric oxide, pulmonary function, and disease activity in children with systemic lupus erythematosus. Pediatr Pulmonol. 2017; 52(10): 1335-13359.
18. **Al-Abbad AJ, Cabral DA, Sanatani S, Sandor GG, Seear M, Petty RE, et al.** Echocardiography and pulmonary function testing in childhood-onset systemic lupus erythematosus. Lupus. 2001; 10:32-7.
19. **Sharma A, Sharma A, Gahlot S, Prasher PK.** A study of pulmonary function in end-stage renal disease patients on hemodialysis: a cross-sectional study. Sao Paulo Med J. 2017; 135(6): 568-572.

Citation:

Asrafeel, H., Hamed Attia, T., Kamel Amien, E. Assessment of Spirometric Parameters in Systemic Lupus Erythematosus Children with Lupus Nephritis. *Zagazig University Medical Journal*, 2024; (4218-4226): -. doi: 10.21608/zumj.2021.48340.1994