RESULTS

The demographic characters of SLE patients and healthy controls are shown in table (3) and fig. (5) .In SLE patients the mean age was 27.6 ± 9.7 and ranged between 13 to 42 years, while in healthy controls the mean age was 24.4 ± 7.6 and ranged between 18 to 30 years. Male to female ratio was 1 : 19 in SLE patients while in healthy controls it was 1 : 9 ,there was no statistically significant difference between both groups regarding age and sex ($P > 0.05$).

The disease duration ranged between 1 to 19 years in SLE patients while the mean was 3.5 ± 1.7 years and there was no statistically significant difference between patients with and without neuropsyciatric manifestations regarding disease duration .

The frequency of different clinical manifestations in SLE patients are displayed in table (4) and fig. (6) with 55% of patients had fever, 80% had skin manifestations, 85% had arthritis, 55% had renal manifestations, 5% suffered from cardiac problems, 35% with pulmonary symptoms and 30% had CNS manifestations.

Table (5) and fig. (7) show the laboratory findings in both SLE patients and healthy controls, the rang of ESR in SLE

patients was 11 to 135 while the mean value was 45.3 ± 38.8 mm/1st h and in healthy controls the rang was 10 to 28 while the mean value was 16.8 ± 6.48 mm/1st h ,heamoglobin (Hb) was 10.48 ± 1.36 gm/dl in SLE patient and 11.3 ± 0.95 gm/dl in healthy controls, WBCs was 5570 ± 1170/cmm in SLE patients and 5300 ± 1680/cmm in healthy controls. There was no statistically significant difference in these variables ($P > 0.05$) between both SLE patients and healthy controls except in ESR where a statistically significant difference was found ($P < 0.05$).

Table (6) and fig. (8)show the immunological findings in SLE, in patients with neuropsychiatric manifestation 66.6% had anti-DNA Ab and anti-cardiolipin Ab while in patients without neuropsychiatric manifestation 71.9% had anti-DNA Ab and 7.1% had anticardiolipin Ab .All SLE patients had ANA (anti-nuclear antibodies). A statistically significant difference was found between SLE patients with and without neuropsychiatric manifestations regarding anti-cardiolipin Ab while no significant difference was found regarding anti-DNA Ab .

The frequencies of the clinical manifestations in SLE patients with and without neuropsychiatric manifestations are shown in table (7) including fever, skin, arthritis, renal, cardiac and pulmonary manifestations.

Table (8) and fig. (9) show the grading of disease activity in SLE patients, 5% had severe, 40% had moderate and 55% had mild disease activity.

There was a statistically significant difference ($P < 0.05$) between SLE patients with and without neuropsychiatric manifestations regarding disease activity grading , table (9)

As regard to the radiological studies , 50% of the NPSLE patients had abnormal MRI findings as partial atrophy, white matter hyperintensities in T_2 [image (1)], some showed areas of infarctions. Only 14.2% patients without neuropsychiatric manifestation had white matter hyperintensities in T_2 weight images(table 10, fig. 10).

As regard to MRS findings, abnormal MRS findings were found in 83.3% of NPSLE patients and in 28.5% of patients without neuropsychiatric manifestation as illustrated in graph(1,2,3,4,5). There was neither MRS nor MRI abnormality in healthy controls(table 11, fig. 10)..

Table (12) and fig. (11) Show a highly significant difference in NAA/Cr ratios in basal ganglia between SLE patients and healthy controls ($P < 0.001$), with lower ratio in the patients.

But there was no statistically significant difference in NAA/Cr ratios in white matter between SLE patients and healthy controls (P > 0.05)(table 13 ,fig. 12).

Table (14) , fig. (13) and table (15) , fig. (14) show a statistically significant difference (P < 0.05) in Cho/Cr ratios(in both basal ganglia and white matter) between SLE patients and healthy controls ,with higher ratio in the patients.

Table (16) to (19) show no statistically significant difference in NAA/Cr and Cho/Cr ratios in white matter and basal ganglia between patients with and without neuropsyciatric manifestations (P > 0.05)this can be an indicator that MRS may be considered as predictor for detection of early changes in the brain inspite the absence of MRI findings and absence of the neuropsychiatric manifestations as there was no statistically significant difference between patients with and without neuropsyciatric manifestations but there was statistically significant difference between NPSLE and healthy controls.

Fig. (15) Shows 25% abnormal MRI in SLE patients, and fig. (16) Shows45% abnormal MRS in SLE patients.

A statistically significant difference was found between abnormal MRS cases of SLE patients with and without neuropsychiatric manifestations in relation to disease activity grading (table 20, fig. 17).

But no significant difference was found between abnormal MRI cases of SLE patients with and without neuropsychiatric manifestations in relation to disease activity grading in table (21) and fig. (18) ($P > 0.05$).

Table (22) shows correlation coefficient between MRI and MRS findings in patients with NPSLE in relation to age, sex, disease duration, disease activity, ESR, anti-DNA Ab, anti-cardiolipin Ab ,MRI and MRS findings: there was a positive statistically significant correlation found between abnormal MRI findings and sex, disease activity and abnormal MRS findings. Also a positive statistically significant correlation was found between abnormal MRS findings and disease activity and abnormal MRI findings ($P < 0.05$).

Also table (23) shows correlation coefficient between MRI and MRS findings in patients without neuropsychiatric manifestations in relation to age, sex, disease duration, disease activity, ESR, anti-DNA Ab, anticardiolipins Ab, MRI and MRS findings.

There was a positive statistically significant correlation between abnormal MRI findings and disease activity and between abnormal MRS findings and disease activity ($P < 0.05$).

Table (3): Demographic characters among the studied groups

Variables		SLE patients	Healthy controls		p-value
Age	Mean ± SD	27.6 ± 9.7	24.9 ± 7.6	t= 0.8	> 0.05 (NS)
Sex	male:female	1: 19	1 :9	$\mathbf{X^2}$ = 0.67	> 0.05 (NS)
Disease duration Mean ± SD	SLE patients	3.5 ± 1.7		-	-
	NPSLE patients	3.2 ± 1.6		t = 1.1	> 0.05 (NS)
	Without NPSLE	5.5 ± 4.3			

Table (4): Frequency of different clinical manifestations in SLE patients

Clinical manifestations	No. of patients	%
Fever	11	55%
Skin	16	80%
Arthritis	17	85%
Renal	11	55%
Cardiac	1	5%
Pulmonary	7	35%
CNS	6	30%

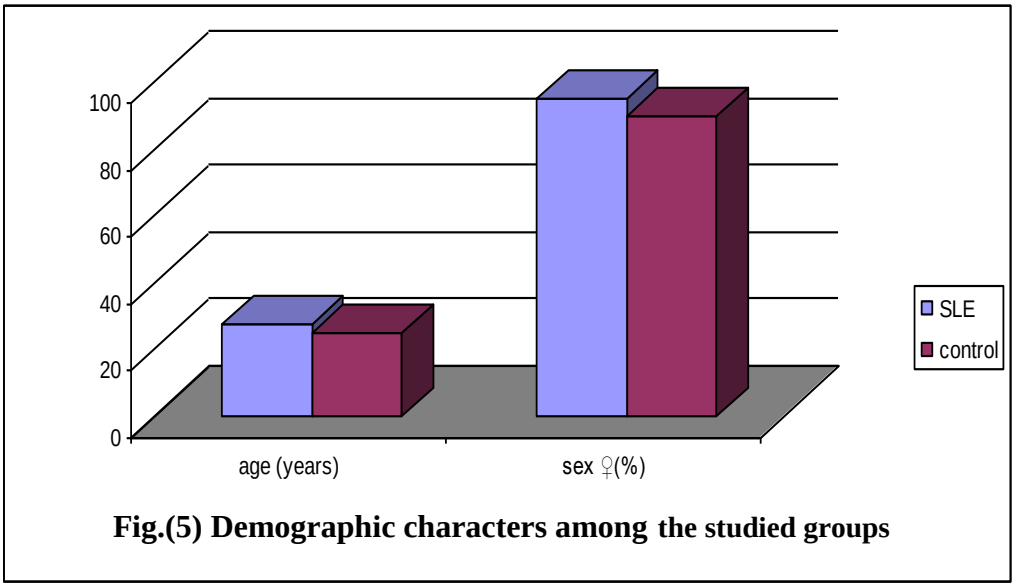


Fig.(5) Demographic characters among the studied groups

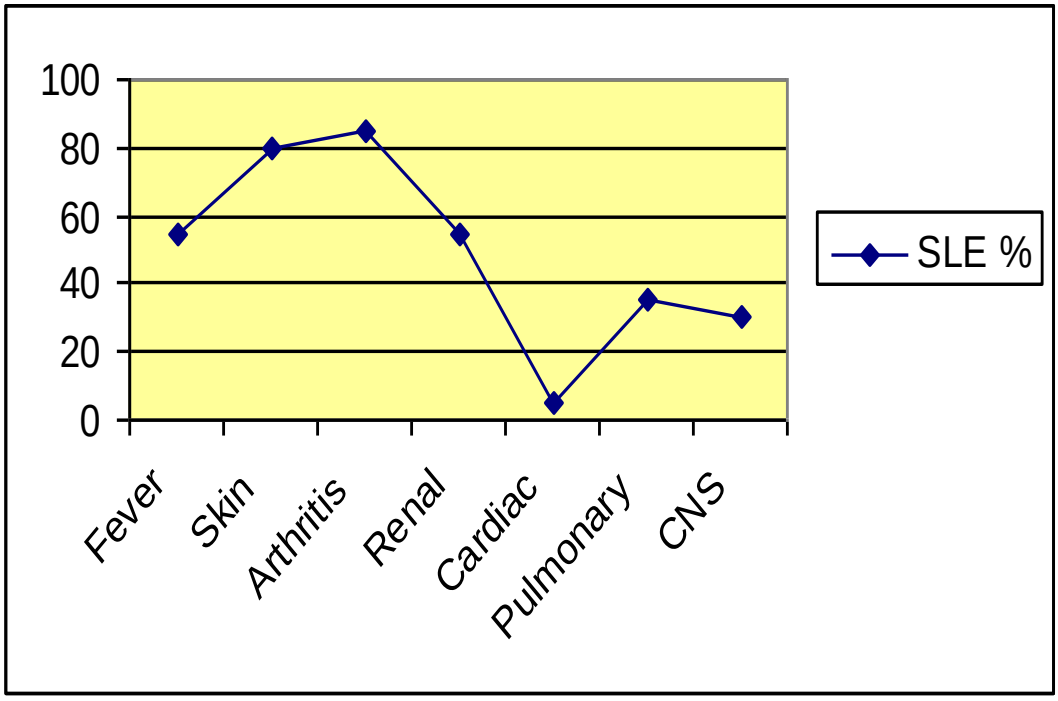


Fig. (6)The frequency of different clinical manifestations in SLE patients

Table (5): Laboratory results of the studied groups

Variables	SLE Mean ± SD	Healthy controls Mean ± SD	t	P-value
ESR mm/1sth	45.3 ± 38.8	16.8 ± 6.48	2.9	< 0.05 (S)
Hb gm/dL	10.48 ± 1.36	11.3 ± 0.95	1.7	> 0.05 (NS)
WBCs No/cmm	5570 ± 1170	5330 ±1680	0.12	> 0.05 (NS)

Table (6): Immunological findings in SLE groups

Variables	NPSLE		Without NPSLE		X^2	P
	Frequency	%	Frequency	%		
Anti-DNA Ab	4	66.6	10	71.4	0.102	> 0.05 (NS)
Anti-cardiolipin Ab	4	66.6	1	7.1	5.08	< 0.05 (S)
ANA	6	100	14	100	-	-

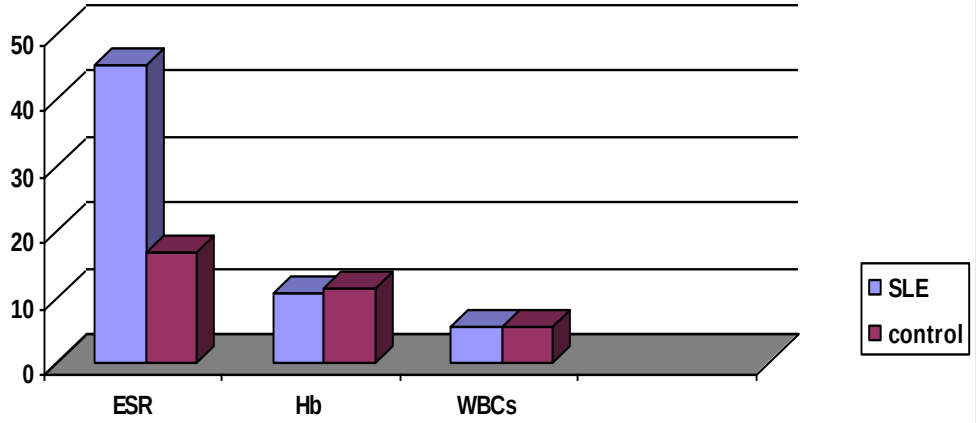


Fig.(7) Laboratory results of the studied groups

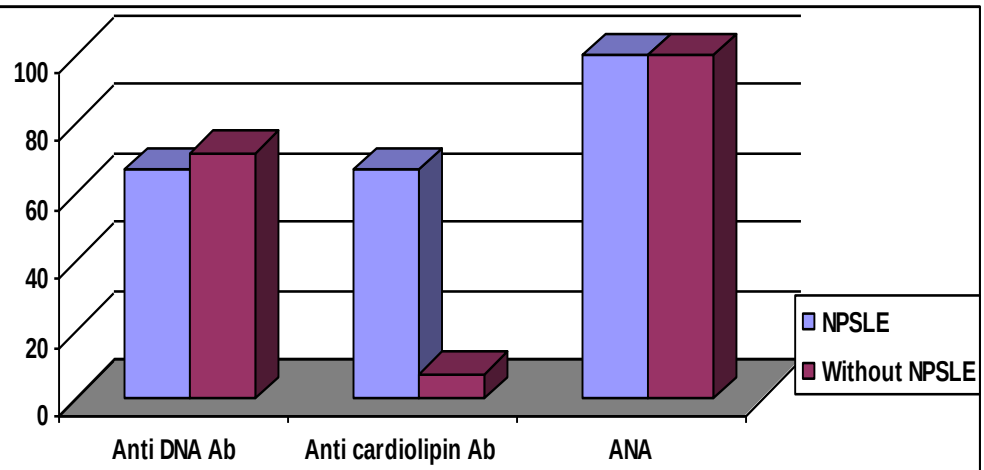


Fig. (8): : Immunological findings in SLE groups.

Table (7): Clinical manifestations in SLE groups

Clinical	NPSLE		Without NPSLE		X^2	p-value
	Frequency	%	Frequency	%		
Fever	4/6	66.6	7/14	50	2.33	> 0.05
Skin	5/6	83.3	11/14	78.5	0.134	> 0.05
Arthritis	6/6	100	11/14	78.5	0.29	> 0.05
Renal	5/6	83.3	6/14	42.8	1.39	> 0.05
Cardiac	1/6	16.6	0/14	0	0.2	> 0.05
Pulmonary	3/6	50	4/14	28.5	0.17	> 0.05 (NS)

Table (8): Grading of disease activity among SLE patients

Grade	TOTAL	
	Frequency	**%**
Mild	11	55
Moderate	8	40
Sever	1	5

Table (9): Grading of disease activity in patients with and without neuropsychiatric manifestation

Grade	NPSLE (n=6)	Without NPSLE (n=14)	X^2	P
Mild	0%	55%	11.1	< 0.05 (S)
Moderate	25%	15%		
Severe	5%	0%		

Table (10): Abnormal MRI findings in studied groups

Groups	Abnormal MRI findings	
	Frequency	**%**
NPSLE	3/6	50
Without NP	2/14	14.2
Healthy controls	0/10	0

Table (11): Abnormal MRS findings in studied groups

Groups	Abnormal MRS findings	
	Frequency	**%**
NPSLE	5/6	83.3
Without NP	4/14	28.5
Healthy controls	0/10	0

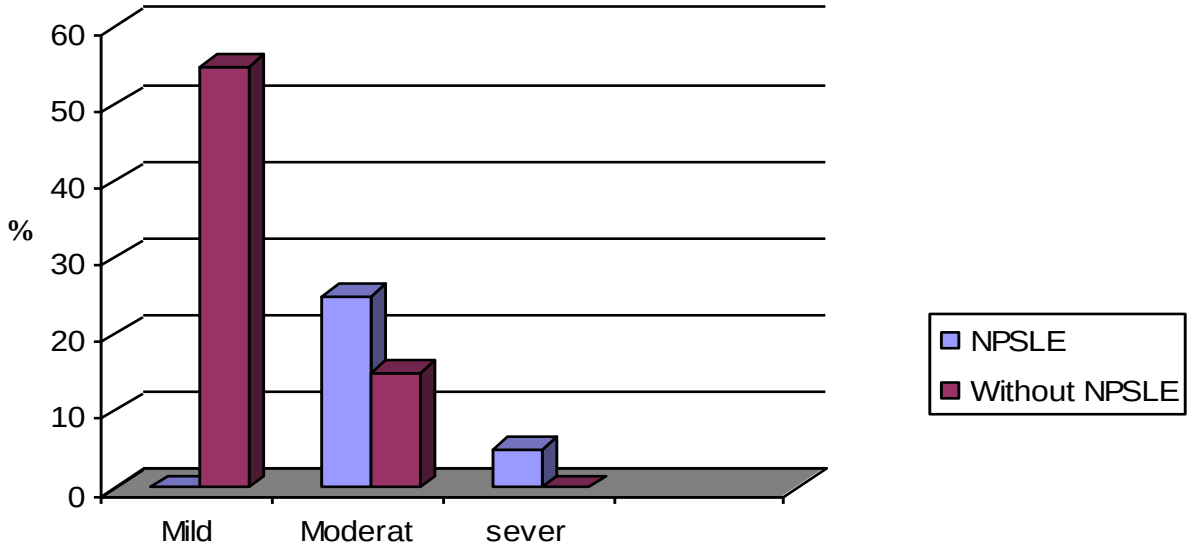


Fig. (9): Grading of disease activity among SLE groups

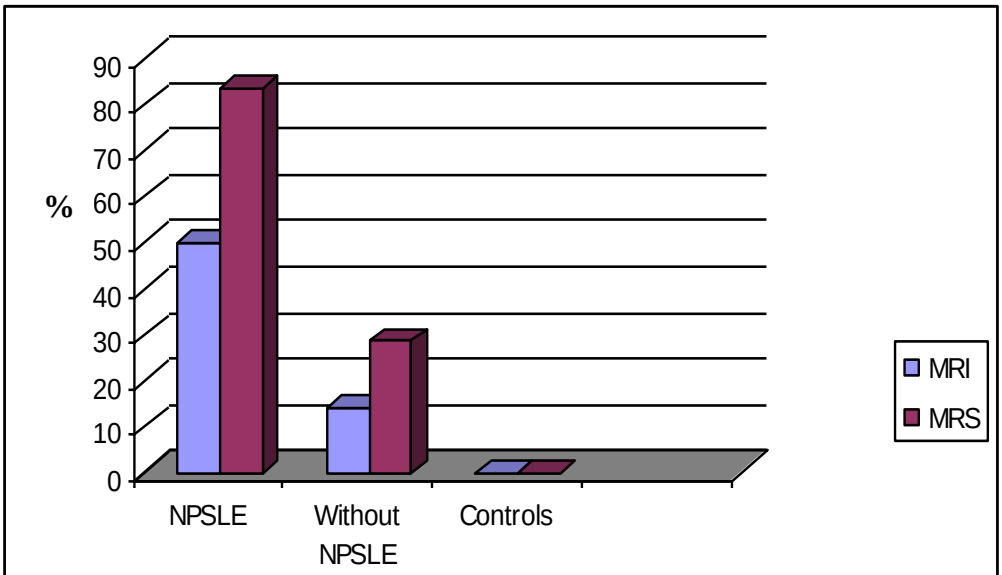


Fig. (10) Radiological data in studied groups

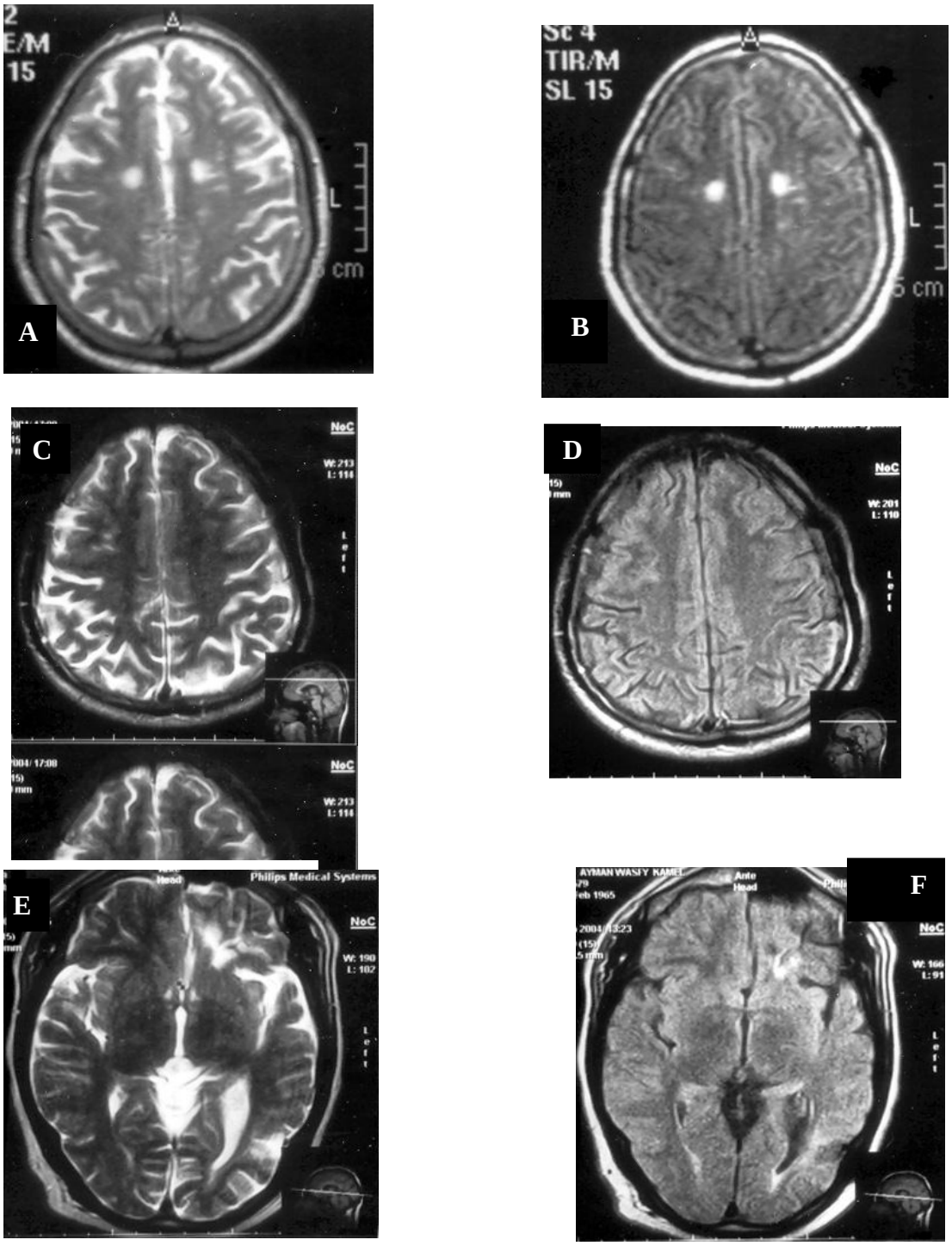
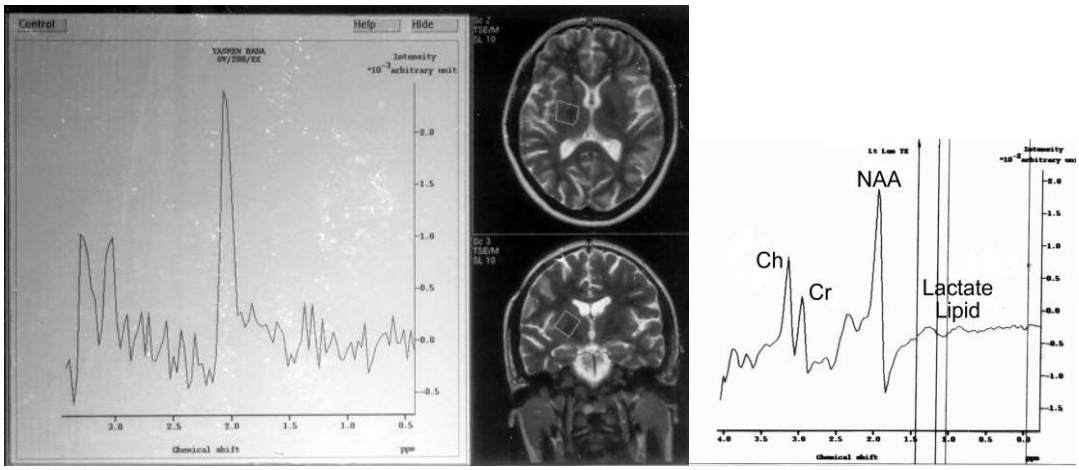
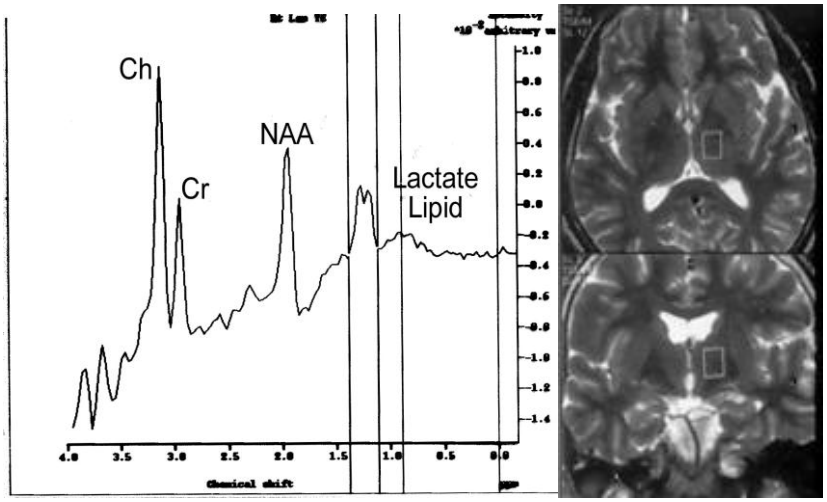


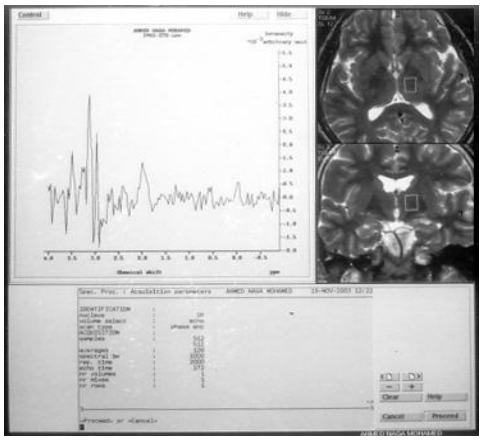
Image (1) Different cases of SLE showing multiple foci of bright signals. A & B (patient with NPSLE) MRI showed bilateral high parietal intensely bright foci in both T2 & FLIAR WIs. C& D (patient with SLE) MRI showed right anterior parietal subcortical foci of bright signals. E & F (Another patient with NPSLE) MRI showed left anterior fronto-parietal bright T2 & FLAIR signals



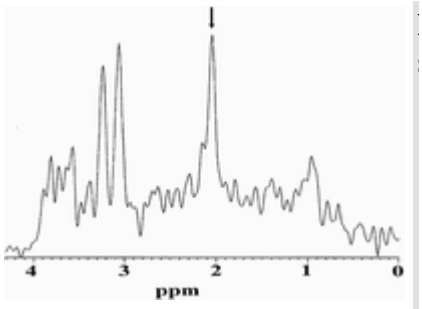
Graph (1) MRS showed normal study with the volume of interest was chosen to include mainly white matter, minimizing the cortical gray matter and cerebrospinal fluid (CSF) contaminating the voxel. B. Distribution of substance in spectroscopy curve with NAA peak at 2.0, Cho peak at 3.2 and Cr peak at 3.0



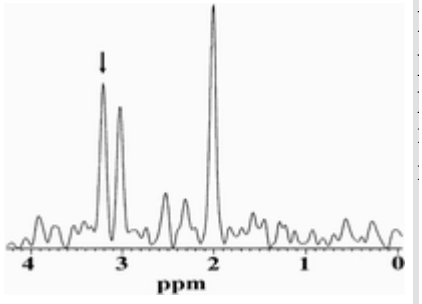
Graph (2) Illustrative curve of a female patient with NPSLE. MRI was normal while single voxel MRS left basal ganglia region showed significant reduction in the NAA peak with consequent reversal of the normal NAA/Cr relation.



Graph (3) Another patient with NPSLE. MRI was normal while single voxel MRS in left basal ganglia region showed significant reduction in the NAA peak with consequent reversal of the normal NAA/Cr relation. Associated relative elevation of the Cho peak is noted in relation to the Cr.



Graph (4) Typical MR spectrum of the basal ganglia shows a decreased NAA peak (arrow).



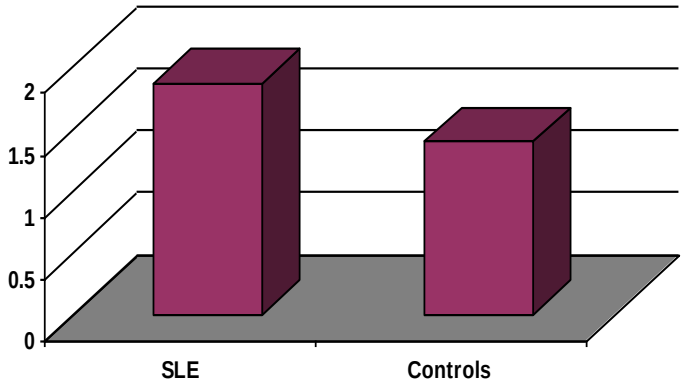
Graph (5) Typical MR spectrum of the peritrigonal white matter shows an increased Cho peak (arrow).

Table (12): NAA/Cr ratio in basal ganglia between SLE patients and healthy controls

NAA/Cr ratio in BG	SLE patients	Healthy Controls
Range	1.03 – 1. 85	1.43 – 2.5
Mean	1.4	1.87
± SD	0.22	0.43
t	3.99	
P-value	< 0.001 (HS)	

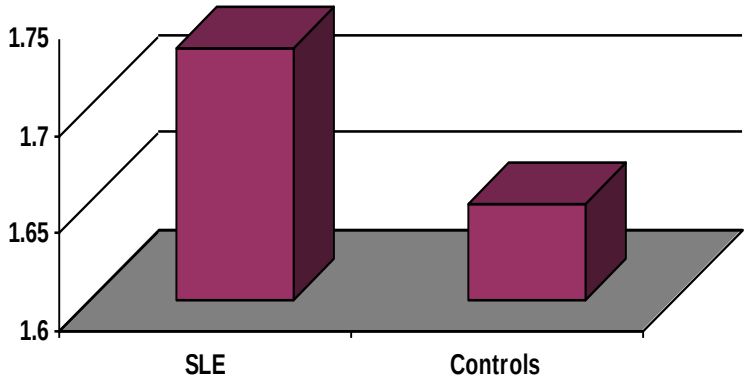
Table (13): NAA/Cr ratio in white matter between SLE patients and healthy controls

NAA/Cr ratio in WM	SLE patients	Healthy controls
Range	1.25 – 4.52	1.43 – 1.9
Mean	1.73	1.65
± SD	0.74	0.18
t	0.33	
P-value	> 0.05 (NS)	



P< 0.001 (HS)

Fig.(11) NAA/Cr ratio in BG between SLE patients and healthy controls



P> 0.05 (NS)

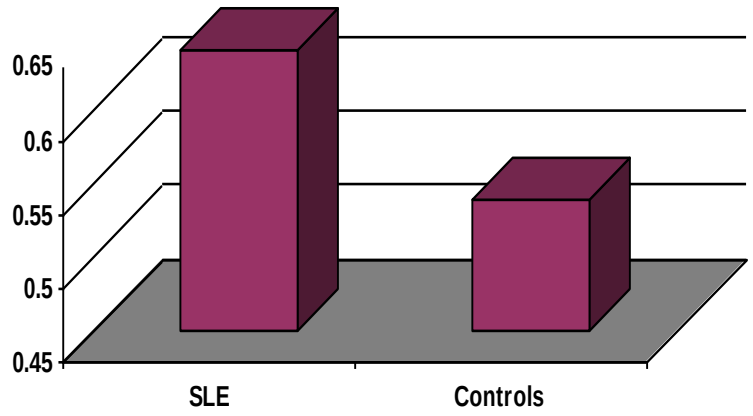
Fig.(12) NAA/Cr ratio in WM between SLE patients and healthy controls

Table (14): Cho/Cr ratio in basal ganglia between SLE patients and healthy controls

Cho/Cr ratio in BG	SLE patients	Healthy controls
Range	0.43 – 0.85	0.45 – 0.61
Mean	0.64	0.54
± SD	0.13	0.07
t	2.26	
P-value	< 0.05 (S)	

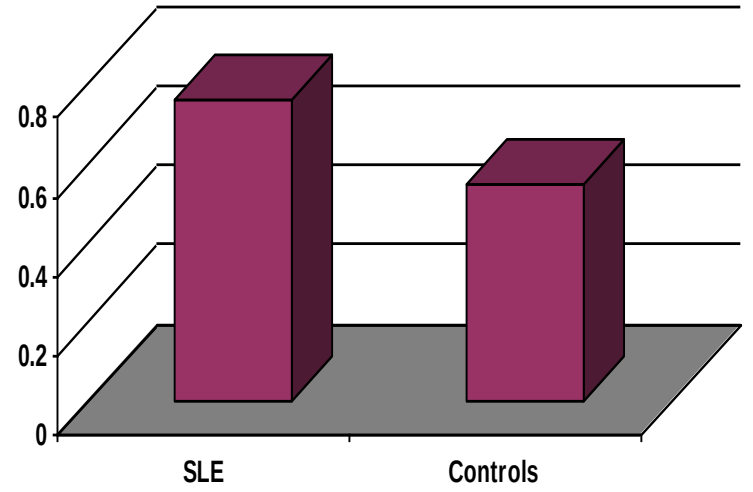
Table (15): Cho/Cr ratio in white matter between SLE patients and healthy controls

Cho/Cr ratio in WM	SLE patients	Healthy controls
Range	0.53 – 1.21	0.45 – 0.61
Mean	0.76	0.55
± SD	0.23	0.06
t	2.8	
P-value	< 0.01 (S)	



P< 0.05 (S)

Fig.(13) Cho/Cr ratio in BG between SLE patients and healthy controls



P< 0.01 (S)

Fig.(14) Cho/Cr ratio in WM between SLE patients and healthy controls

Table (16): Basal ganglia NAA/Cr ratio in patients with and without neuropsychiatric manifestation

NAA/Cr in BG	NPSLE patients	Without NPSLE
Range	1.03 – 1.58	1.06 – 1.85
Mean	1.33	1.43
± SD	0.21	0.22
t	0.94	
P-value	> 0.05 (NS)	

Table (17): White matter NAA/Cr ratio in patients with and without neuropsychiatric manifestation

NAA/Cr in WM	NPSLE patients	Without NPSLE
Range	1.25 – 1.61	1.34 – 4.52
Mean	1.44	1.85
± SD	0.16	0.86
t	1.14	
P-value	> 0.05 (NS)	

Table (18): Basal ganglia Cho/Cr ratio in patients with and without neuropsychiatric manifestation

Cho/Cr in BG	NPSLE patients	Without NPSLE
Range	0.59 – 0.85	0.43 – 0.85
Mean	0.69	0.62
± SD	0.099	0.13
t	1.17	
P-value	> 0.05 (NS)	

Table (19): White matter Cho/Cr ratio in patients with and without neuropsychiatric manifestation

Cho/Cr in WM	NPSLE patients	Without NPSLE
Range	0.55 – 1.07	0.53 – 1.21
Mean	0.77	0.75
± SD	0.2	0.25
t	0.17	
P-value	> 0.05 (NS)	

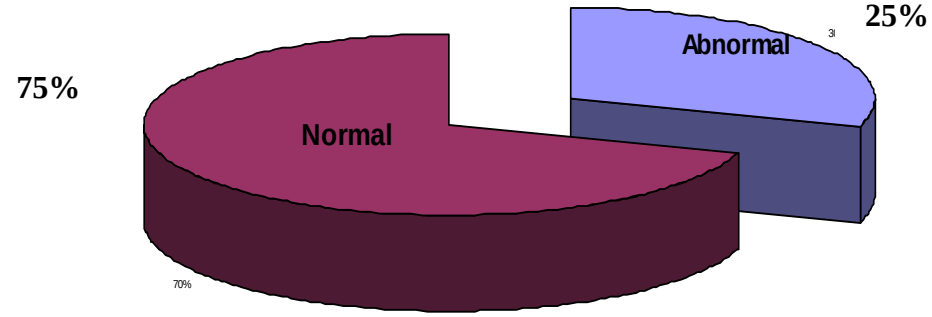


Fig.(15) Abnormal MRI in SLE patients .

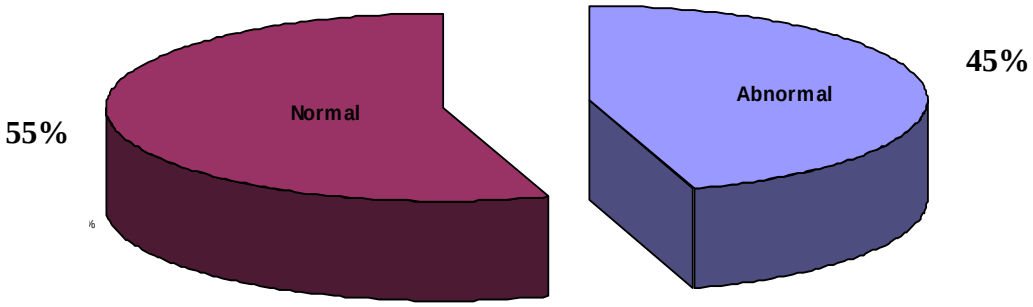


Fig.(16) Abnormal MRS in SLE patients .

Table (20): MRS abnormal cases in relation to disease activity in patients with and without neuropsychiatric manifestation

Grade	NPSLE (n=6)	Without NPSLE (n=14)	X^2	p-value
Mild	0%	15%	5.8	< 0.05 (S)
Moderate	20%	5%		
Severe	5%	0%		

Table (21): MRI abnormal cases in relation to disease activity in patients with and without neuropsychiatric manifestation

Grade	NPSLE (n=6)	Without NPSLE (n=14)	X^2	p-value
Mild	0%	5%	2.63	> 0.05 (NS)
Moderate	10%	5%		
Severe	5%	0%		

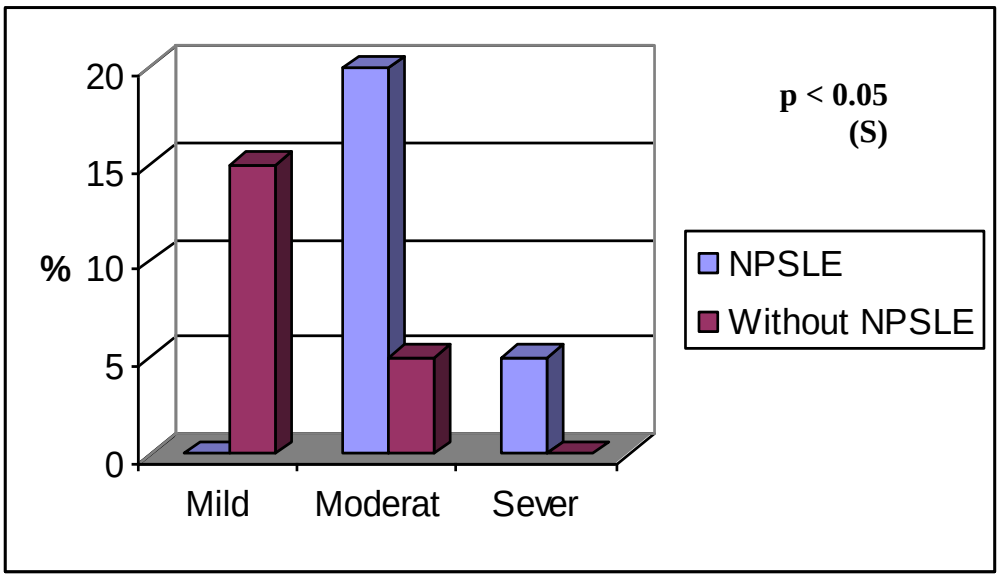


Fig.(17): MRS abnormal cases in relation to disease activity

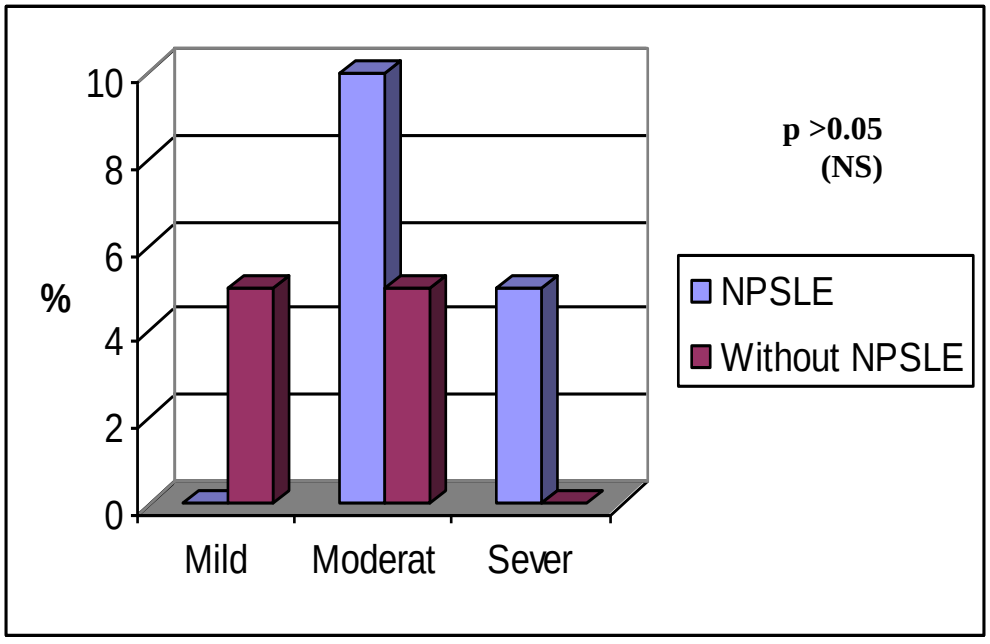


Fig.(18): MRI abnormal cases in relation to disease activity

Table (22): Correlation between MRI and MRS findings in patients with neuropsychiatric manifestation

Variables	MRI		MRS	
	r	P-value	r	P-value
Age	0.23	> 0.05 (NS)	0.23	> 0.05 (NS)
Sex	0.68	< 0.05 (S)	0.37	> 0.05 (NS)
Disease duration	0.099	> 0.05 (NS)	- 0.09	> 0.05 (NS)
Disease activity	0.78	< 0.05 (S)	0.63	< 0.05 (S)
ESR	0.31	> 0.05 (NS)	0.49	> 0.05 (NS)
Anti DNA Ab	0.26	> 0.05 (NS)	0.14	> 0.05 (NS)
Anti cardiolipin Ab	- 0.11	> 0.05 (NS)	0.21	> 0.05 (NS)
MRI	-	-	0.55	< 0.05 (S)
MRS	0.55	< 0.05 (S)	-	-

Table (23): Correlation between MRI and MRS findings in patients without neuropsychiatric manifestation

Variables	MRI		MRS	
	r	**P-value**	**r**	**P-value**
Age	0.27	> 0.05 (NS)	- 0.42	> 0.05 (NS)
Sex	-	-	-	-
Disease duration	0	-	0	-
Disease activity	0.62	< 0.05 (S)	0.66	< 0.05 (S)
ESR	0.46	> 0.05 (NS)	0.15	> 0.05 (NS)
Anti DNA Ab	0.25	> 0.05 (NS)	- 0.5	> 0.05 (NS)
Anti cardiolipin Ab	0.25	> 0.05 (NS)	- 0.5	> 0.05 (NS)
MRI	-	-	0.25	< 0.05 (NS)
MRS	- 0.5	< 0.05 (NS)	-	-