
Results

RESULTS

This study included 54 patients and 15 healthy persons as a control group, who were matched for age and sex, with the patients. They were selected from the attendants of Rheumatology and Rehabilitation Department, Benha University Hospitals.

The 54 patients were diagnosed according to the **ACR** criteria and divided as follows :

- 32 patients had rheumatoid arthritis.
- 12 patients had systemic lupus erythematosus.
- 6 patients had systemic sclerosis.
- 4 patients had dermatomyositis.

RHEUMATOID ARTHRITIS GROUP

This group comprised 32 RA patients according to the ACR (1987) revised criteria. They were 24 females (75%) and 8 males (25%). Their ages ranged between 18 and 60 years with a mean of 36.9 ± 10.6 years.

Clinical features (Table 1):

The 32 patients were 24 non – smoker females and 8 smoker males, the disease duration ranged between 2 and 18 years with a mean of 7.7 ± 4.3 years. The duration of morning stiffness ranged between 20 and 60 minutes with a mean of 35.9 ± 12.3 minutes. By using the visual analouge scale according to ***Berry and Haskisson (1972),*** it was ranged between 2.4 and 6.5 cm with a mean of 4.3 ± 1.3 cm.

According to ***Scott et al. (1984)*** the grip strength ranged between 30 and 180 mmHg with a mean of 98.1 ± 53.2 mmHg, and by using the ***Ritchie et al. (1968)*** as an articular index it was ranged between 3 and 15 joints with a mean of 8.1 ± 3.6 joints. Within our patients, 14 patients had subcutaneous rheumatoid nodule. No other extra-articular manifestations were found.

We classified the functional capacity according to ***Hochberg et al. (1992)*** to 4 grades, 8 patients were classified as grade I, 18 patients as grade II, 6 patients as grade III and no patient in grade IV. By using ***Mallya and Mace (1981)*** for assessment of disease activity, 18 patients were graded according to IDA as grade II and 14 patients as grade III with a mean of the score 2.43 ± 0.5 degrees.

As regards the respiratory symptoms, 16 patients were suffering from dyspnea, 16 patients were suffering from cough, 8 patients had expectoration and 6 had wheezes.

Laboratory findings (Table 1):

The Hb% ranged between 8.3 and 11.8 g/dl with a mean of 9.9 ± 1 g/dl. The 1st hour ESR by the Westergren method ranged between 20 and 80 mm with a mean of 43.3 ± 17.9 mm.

Eighteen patients were + ve for RF by latex test and 6 were +ve for ANA by indirect immunofluorescent technique.

Radiological findings (Table 1) :

According to **Steinbrocker** grading of hand x-ray findings, 10 patients were classified as grade I,14 patients as grade II and 8 patients as grad III.

No abnormal findings were detected in chest x-ray. The HRCT findings will be discussed in detail in (Tables 25, 26).

Drug therapy (Table 1):

All patients were receiving NSAID, 22 patients were receiving steroids in the form of oral prednisolone, 26 were receiving IM methotrexate and 6 were receiving IM gold (as a separate drug or in combination). Ten patients were receiving methotrexate alone, 16 patients were receiving both methotrexate and steroids and 6 patients were treated by gold and steroids (Table 6). No other types of drugs were involved.

Table (1): **Demographic and clinical data of rheumatoid arthritis (RA) patients.**

	Results	Number (N=32)
Age (years)	36.9 ± 10.6	
Sex (female/ male)	75 : 25 %	N = 24 : 8
Smokers %	25%	N = 8
Disease duration (years)	7.7 ± 4.3	
Morning stiffness (min)	35.9 ± 12.3	
Visual analouge scale	4.3 ± 1.3	
Gripe strength	98.1 ± 53.2	
Articular index	8.1 ± 3.6	
Functional capacity grading	Grade I Grade II Grade III Grade IV	N = 8 N = 18 N = 6 N = 0
Rheumatoid nodule %	43.8%	N = 14
Hand x-ray grading	Grade I Grade II Grade III Grade IV	N = 10 N = 14 N = 8 N = 0
Hb%	9.9 ± 1	
ESR 1st hour	43.3 ± 17.9	
+ve R.F	56.3% Titre: 55.5 ± 48.2	N = 18
+ve ANA	9.37% Titre : 1.8 ± 0.7	N = 6
IDA	2.43 ± 0.5	

Treatment		
- NSAID	100%	N = 32
- Steroids	68.8%	N = 22
- Methotrexate	81.3%	N = 26
- Gold.	18.8%	N = 6
Respiratory symptoms		
- Dyspnea	50%	N = 16
- Cough	50%	N = 16
- Expectoration	25%	N = 8
- Wheezes	18.8%	N = 6

N : Number of patients.
Hb : Haemoglobin percent.
ESR : Erythrocyte sedimentation rate.
R.F : Rheumatoid factor.
ANA : Antinuclear antibodies.
IDA : Index of disease activity.
NSAID : Non-steroidal anti-inflammatory drugs.

Pulmonary functions:

Table (2) and Fig. (6) showed comparison of pulmonary function variables between RA patients and controls.

This table exhibited a significant difference in the values of $FEF_{25-75\%}$, TLC, VC and DLCO. Meanwhile a highly significant difference was found in FVC and FEV_1 values.

Comparative studies in RA patients according to some variables Tables (3 – 6):

In (Table 3 and Fig. 7) the RA patients were studied as 2 groups according to sex and in the same time according to smoking as the male patients were all smokers while the female patients were non –smokers.

By studying the pulmonary function results in both groups no significant differences were found, despite the results of pulmonary functions in males were lower in all directions except the FEV_1/FVC ratio. This was not true for the results of HRCT in which showed more involvement in females as regards the ground-glass and linear opacities, bronchiectasis and total score.

Table (4) and Fig. (8) studied the results of pulmonary functions and HRCT on the basis of disease activity. Group I which included 18 patients that classified as grade II (IDA) and group II which included 14 patients that classified as grade III (IDA) were compared together and showed significant difference in the values of FVC, TLC, RV, VC and DLCO, meanwhile significant differences were found in HRCT findings for ground-glass opacities score and the total score.

Another study was done on 3 groups of RA patients according to radiological classification of disease severity (Table 5 and Fig. 9).

This comparison showed significant difference between the 3 groups when comparing FVC, FEF25-75%, DLCO of pulmonary functions and ground-glass opacities of HRCT, while it was highly significant as regards TLC, RV, VC of pulmonary functions and honey combing of HRCT.

Table (6) showed comparison of pulmonary functions and HRCT results in RA patients who were divided according to functional capacity grading into 3 groups. By ANOVA test the 3 groups were compared and the results showed significant differences as regards TLC, RV & VC values. In general look, the values of PFTs specifically showed the best values for most variables in group I and tend to decrease from group II to III where the later showed the least values in comparison to the other 2 groups.

In (Table 7 and Fig. 10) RA studied patients were classified into 3 groups according to drug therapy they were receiving at the time of this study, accordingly comparison was done between those 3 groups towards pulmonary functions and HRCT findings. This comparison resulted in statistical significant differences between the 3 groups as regards VC, DLCO, ground glass opacities, linear opacities and total score.

Correlation coefficient studies within the RA patients:

Table (8) showed correlative study between some clinical and laboratory findings on one side, and pulmonary functions and HRCT

results on the other side. Positive or negative correlations were found when $r \geq 0.35$. These correlations were marked in this table.

Another correlation coefficient study was done as shown in (Table 9) between pulmonary function results and HRCT findings.

The most prominent correlations where in the presence of – ve correlations between the honeycombing as well as the linear opacities on HRCT and the pulmonary functions that indicate a restrictive pattern of pulmonary involvement (FEV_1, TLC, RV, VC and DLCO). Similarly, the correlations of bronchiectasis on HRCT were obvious as regards the obstructive pattern indicators (FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and RV).

Table (2): **Comparison of pulmonary functions between (RA) patients and (control) group.**

	Control (N=15) $\bar{X} \pm SD$	RA (N=32) $\bar{X} \pm SD$	t	p
FVC	92.5 ± 1.7	78.4 ± 10.3	5.1	< 0.001**
FEV_1	90.4 ± 2.2	76.9 ± 9.9	4.9	< 0.001**
FEV_1/FVC	94.3 ± 0.7	90.5 ± 3.4	0.7	> 0.05
$FEF_{25-75\%}$	93.8 ± 1.8	80.5 ± 7.7	2.7	< 0.05*
TLC	94 ± 1.5	87.3 ± 13.4	2.1	< 0.05*
RV	92.3 ± 1.4	84.2 ± 11.8	1.5	> 0.05
VC	90.6 ± 0.8	83.6 ± 11.2	2.6	< 0.05*
DLCO	94.3 ± 1.8	85.6 ± 2.8	2.8	< 0.05*

FVC : Forced vital capacity.
FEV_1 : Forced expiratory volume in one second.
$FEF_{25-75\%}$: Forced expiratory flow
TLC : Total lung capacity.
RV : Residual volume.
VC : Vital capacity.
DLCO : Diffusion capacity for carbon monoxide.

N : Number of subjects.
$\bar{X}$: Mean
SD : Standard deviation
t : t-value
p : Probability * Significance ** Highly significance

Fig. (6): Comparison of pulmonary functions between (RA) patients and (control) group

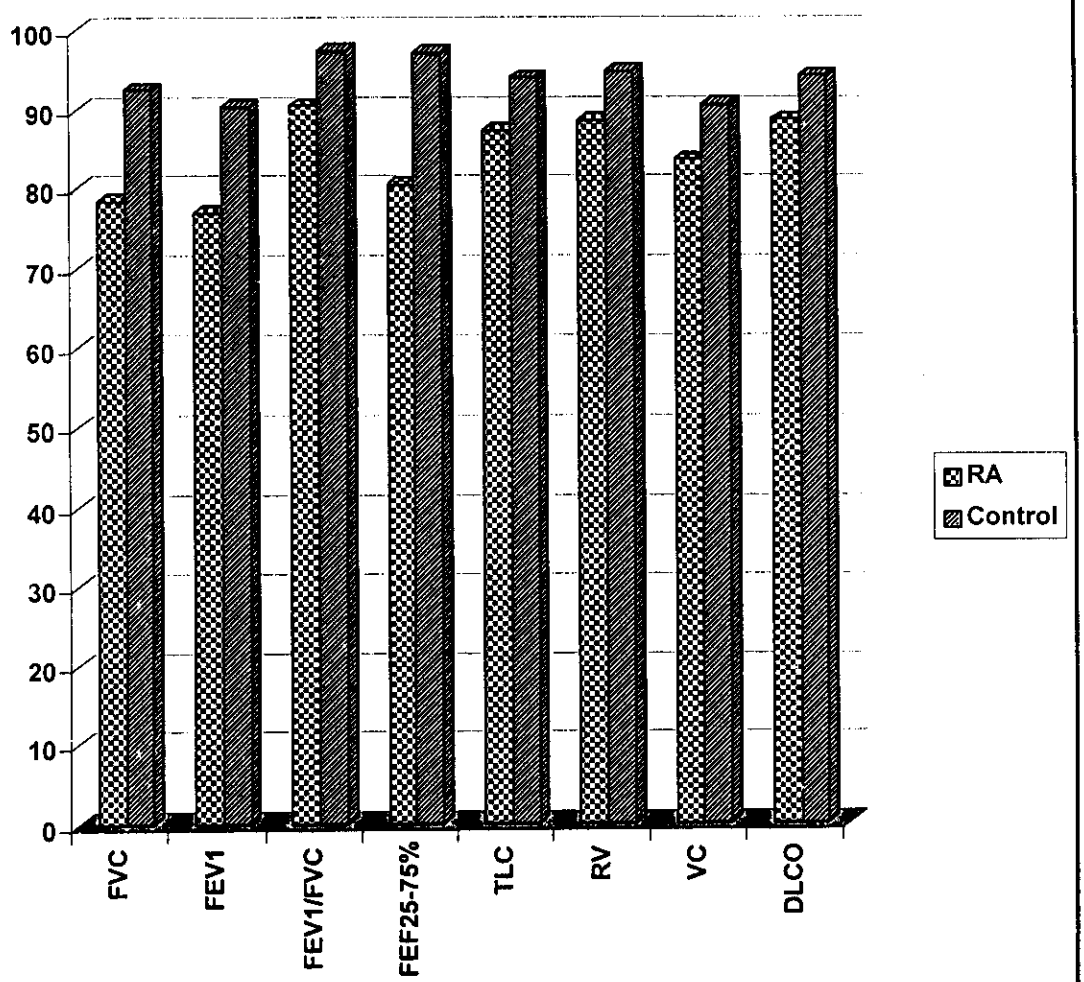


Table (3): **Comparison of pulmonary functions and HRCT results in (RA) patients according to sex and smoking.**

		Males (smokers) (N = 8)	Females (non-smokers) (N = 24)	t	p
		$\bar{X} \pm SD$	$\bar{X} \pm SD$		
PFTs	FVC	73.4 ± 14.7	80.1 ± 8.5	1.1	> 0.05
	FEV_1	72.2 ± 14.2	78.5 ± 8.2	1.1	> 0.05
	FEV_1/FVC	98.5 ± 0.5	96.4 ± 5.3	0.8	> 0.05
	$FEF_{25-75\%}$	79 ± 7.2	81.1 ± 8.1	0.5	> 0.05
	TLC	85.5 ± 18.3	87.9 ± 12.3	0.3	> 0.05
	RV	86.2 ± 19.8	89.3 ± 11.4	0.4	> 0.05
	VC	86.1 ± 19.7	86.9 ± 12.1	0.4	> 0.05
	DLCO	87 ± 5.5	89.2 ± 2.5	1.2	> 0.05
HRCT	GG	8.8 ± 6.3	11.8 ± 6.7	0.7	> 0.05
	LO	3.5 ± 4	3.7 ± 4.2	0.1	> 0.05
	HC	2 ± 2.4	1.4 ± 2.4	0.4	> 0.05
	BCT	4 ± 6.2	5.3 ± 7.8	0.3	> 0.05
	Total score	18.3 ± 11.3	22.4 ± 12.1	0.6	> 0.05

PFTs : Pulmonary function tests.
HRCT : High – resolution CT.
GG : Ground – glass opacities
LO : Linear opacities
HC : Honeycombing
BCT : Bronchiectasis.

N : Number of subjects.
$\bar{X}$: Mean.
SD : Standard deviation.
t : t-value.
p : Probability.

Fig. (7) : Comparison of pulmonary functions and HRCT results in RA patietns according to sex and smoking

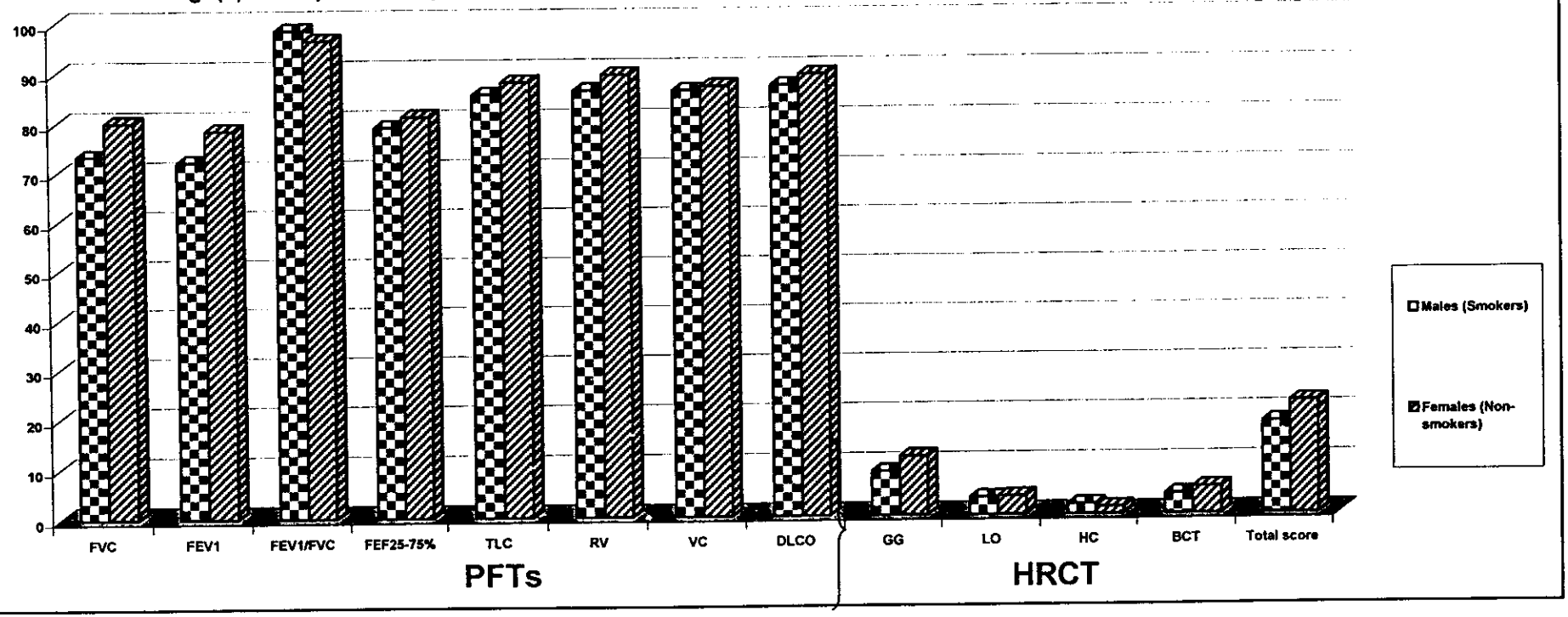


Table (4): **Comparison of pulmonary functions and HRCT results in (RA) patients according to disease activity.**

	Group I (N=18) $\bar{X} \pm SD$	Group II (N=14) $\bar{X} \pm SD$	t	p
FVC	82.4 ± 6.4	73.3 ± 12.4	2	< 0.05*
FEV_1	79.9 ± 6.1	73.4 ± 13	1.3	> 0.05
FEV_1/FVC	95.7 ± 6	98.4 ± 0.5	1.2	> 0.05
$FEF_{25-75\%}$	80.1 ± 7.1	81.2 ± 9	0.3	> 0.05
TLC	93.1 ± 10.6	79.8 ± 13.4	2.2	< 0.05*
RV	95 ± 10.2	80.5 ± 12.6	2.5	< 0.05*
VC	92.2 ± 11.2	80.2 ± 12.8	2.4	< 0.05*
DLCO	89.9 ± 2.6	87.1 ± 3.8	1.7	< 0.05*
GG	10.4 ± 6.3	11.7 ± 7.2	1.4	< 0.05*
LO	2.9 ± 3.1	4.2 ± 4.1	0.7	> 0.05
HC	0	1.6 ± 2.3	0.5	> 0.05
BCT	4.7 ± 4.2	5.9 ± 10.1	0.3	> 0.05
Total score	19.3 ± 8.8	29.4 ± 15	2.7	< 0.05*

Group I : Grade II (IDA)
Group II : Grade III (IDA)

N : Number of subjects.
$\bar{X}$: Mean.
SD : Standard deviation.
t : t-value.
P : Probability. * Significance.

Fig. (8): Comparison of pulmonary functions and HRCT results in (RA) patietns according to disease activity

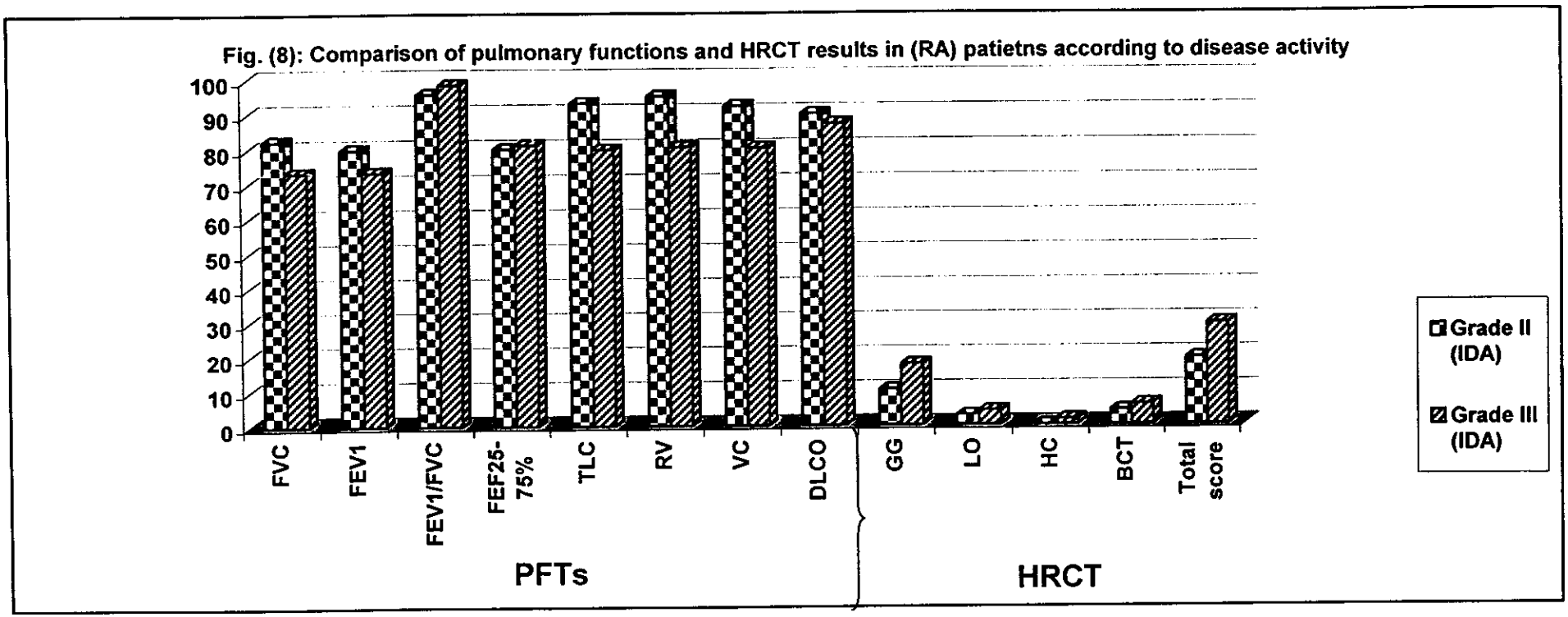


Table (5):**Comparison of pulmonary functions and HRCT results in (RA) patients according to radiological grading of disease severity.**

	Group I (N = 10)	Group II (N = 14)	Group III (N = 8)	F	P
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$		
FVC	85.2 ± 4.5	79.1 ± 8.2	68.8 ± 12.8	4	< 0.05*
FEV_1	83.5 ± 5.2	76.7 ± 7.4	69.3 ± 13.8	2.9	>0.05
FEV_1/FVC	96 ± 6.4	96.7 ± 4.8	98.5 ± 0.6	0.32	>0.05
$FEF_{25-75\%}$	75.5 ± 8.24	80.6 ± 7.5	86.7 ± 1.3	3	< 0.05*
TLC	99.1 ± 3.2	87.7 ± 12.2	71.6 ± 4.3	11	<0.001**
RV	100.7 ± 2.8	87.8 ± 13	74.8 ± 4.2	8.8	<0.001**
VC	97.3 ± 3.5	85.6 ± 11.3	72.6 ± 3.1	12	<0.001**
DLCO	90.5 ± 0.8	89 ± 3.6	85.7 ± 3.6	2.8	< 0.05*
GG	5.2 ± 5.7	13.3 ± 4.3	14.1 ± 6.8	4.1	< 0.05*
LO	2 ± 4.5	4 ± 3.7	5 ± 4.4	0.6	>0.05
HC	0	0.9 ± 1.5	4.8 ± 2.1	14.2	<0.001**
BCT	7.6 ± 6.1	3.1 ± 5.1	5.8 ± 11.5	0.6	>0.05
Total score	14.8 ± 8.7	21.3 ± 6.3	29.8 ± 18.4	2.1	>0.05

Group I : Grade I radiological severity.
Group II : Grade II radiological severity.
Group III : Grade III radiological severity.

$\underline{N}$: Number of patients.
$\bar{X}$: Mean.
SD : Standard deviation.
F : F-value.
P : Probability. * Significance. ** Highly significance

Fig. (9): Comparison of pulmonary functions and HRCT results in (RA) patients according to radiological grading of disease severity

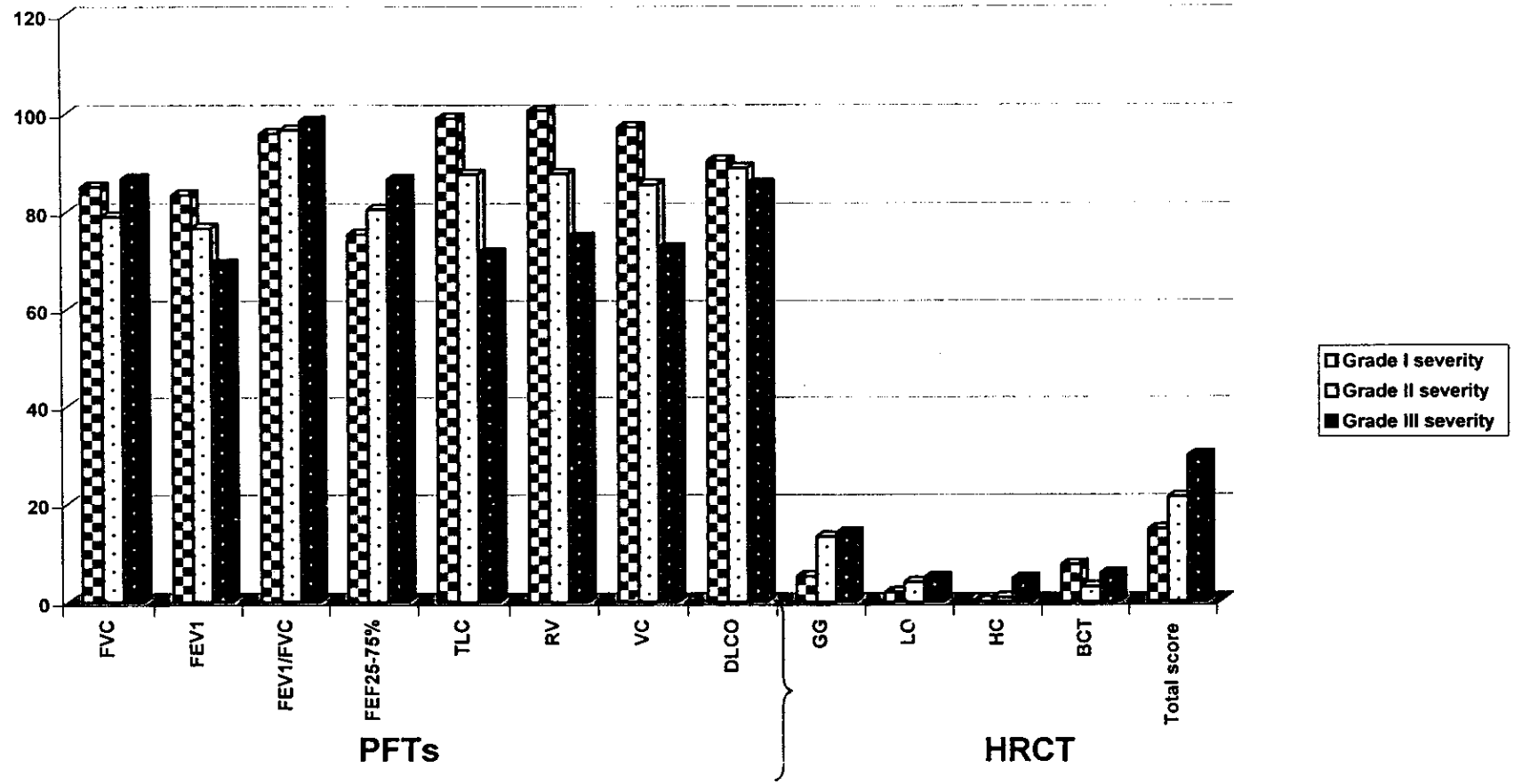


Table (6): **Comparison of pulmonary functions and HRCT results in (RA) patients according to functional capacity grading.**

	Group I (N=8)	Group II (N=18)	Group III (N=6)	F	P
	$\overline{X} \pm SD$	$\overline{X} \pm SD$	$\overline{X} \pm SD$		
FVC	87.2 ± 0.9	76.8 ± 9	71.6 ± 15.3	2.7	> 0.05
FEV_1	82.8 ± 5.9	76.1 ± 8.6	71.7 ± 16.5	1.2	>0.05
FEV_1/FVC	95.2 ± 7.2	97.1 ± 4.2	98.4 ± 0.7	0.4	>0.05
$FEF_{25-75\%}$	75.5 ± 9.5	80.6 ± 6.8	87.2 ± 1.4	2.4	> 0.05
TLC	98.9 ± 3.6	87.1 ± 13	72.2 ± 6	5.4	<0.05*
RV	100.5 ± 3.2	87.5 ± 13.4	75.9 ± 5.6	4.5	<0.05*
VC	93.6 ± 1.8	86.9 ± 12.8	73.4 ± 5.2	4.3	<0.05*
DLCO	90.6 ± 0.8	88.8 ± 13.3	85.5 ± 4.4	2.4	> 0.05
GG	13.3 ± 4.7	14 ± 4.4	12.3 ± 6.8	2.3	> 0.05
LO	0	4.9 ± 4.2	4.7 ± 4	2.6	>0.05
HC	0	1.6 ± 2.4	3.3 ± 2.9	2	>0.05
BCT	8.8 ± 6.4	5.3 ± 8	0	1.4	>0.05
Total score	12 ± 7	25.9 ± 12.5	20.3 ± 7.6	1.6	>0.05

Group I : Grade I functional capacity.
Group II : Grade II functional capacity .
Group III : Grade III functional capacity .

N : Number of patients.
$\overline{X}$: Mean.
SD : Standard deviation.
F : F-value.
P : Probability. * Significance.

Table (7): **Comparison of pulmonary functions and HRCT results in (RA) patients according to treatment.**

	Group I (N = 10)	Group II (N = 16)	Group III (N = 6)	F	P
	$\overline{X} \pm SD$	$\overline{X} \pm SD$	$\overline{X} \pm SD$		
FVC	71.5 ± 13	80.8 ± 8.3	83.4 ± 6.1	1.9	> 0.05
FEV_1	71.7 ± 13.4	78.3 ± 8.2	82 ± 4.9	1.2	> 0.05
FEV_1/FVC	98.6 ± 0.7	96.6 ± 5	94.8 ± 7.7	0.6	> 0.05
$FEF_{25-75\%}$	80.7 ± 6.9	80.7 ± 9	79.8 ± 8.3	0.02	> 0.05
TLC	82.3 ± 16.1	87 ± 13	96.5 ± 6.1	1.1	> 0.05
RV	81.4 ± 14.8	89.4 ± 12.7	98.5 ± 4.3	1.8	> 0.05
VC	80.6 ± 13.1	86.2 ± 11.4	94.2 ± 3.1	0.9	<0.05*
DLCO	80.9 ± 4.7	85 ± 2.6	94.6 ± 1.6	0.7	<0.05*
GG	13 ± 4.5	127 ± 4.5	9.1 ± 8.1	0.6	<0.05*
LO	3.4 ± 4.8	3 ± 3.5	5.7 ± 5.1	0.5	<0.05*
HC	2.6 ± 1.8	1.5 ± 2.8	0	1.2	> 0.05
BCT	6 ± 10	5.4 ± 6.8	3.3 ± 3.5	0.1	> 0.05
Total score	25 ± 17.1	22.6 ± 10	18.1 ± 5.9	0.5	<0.05*

Group I : Methotrexate treatment.
Group II : Methotrexate and steroids.
Group III : Gold and steroids.

N : Number of subjects.
$\overline{X}$: Mean.
SD : Standard deviation.
F : F-value.
p : Probability. * Significance.

Fig. (10): Comparison of pulmonary functions and HRCT results in (RA) patients according to treatment

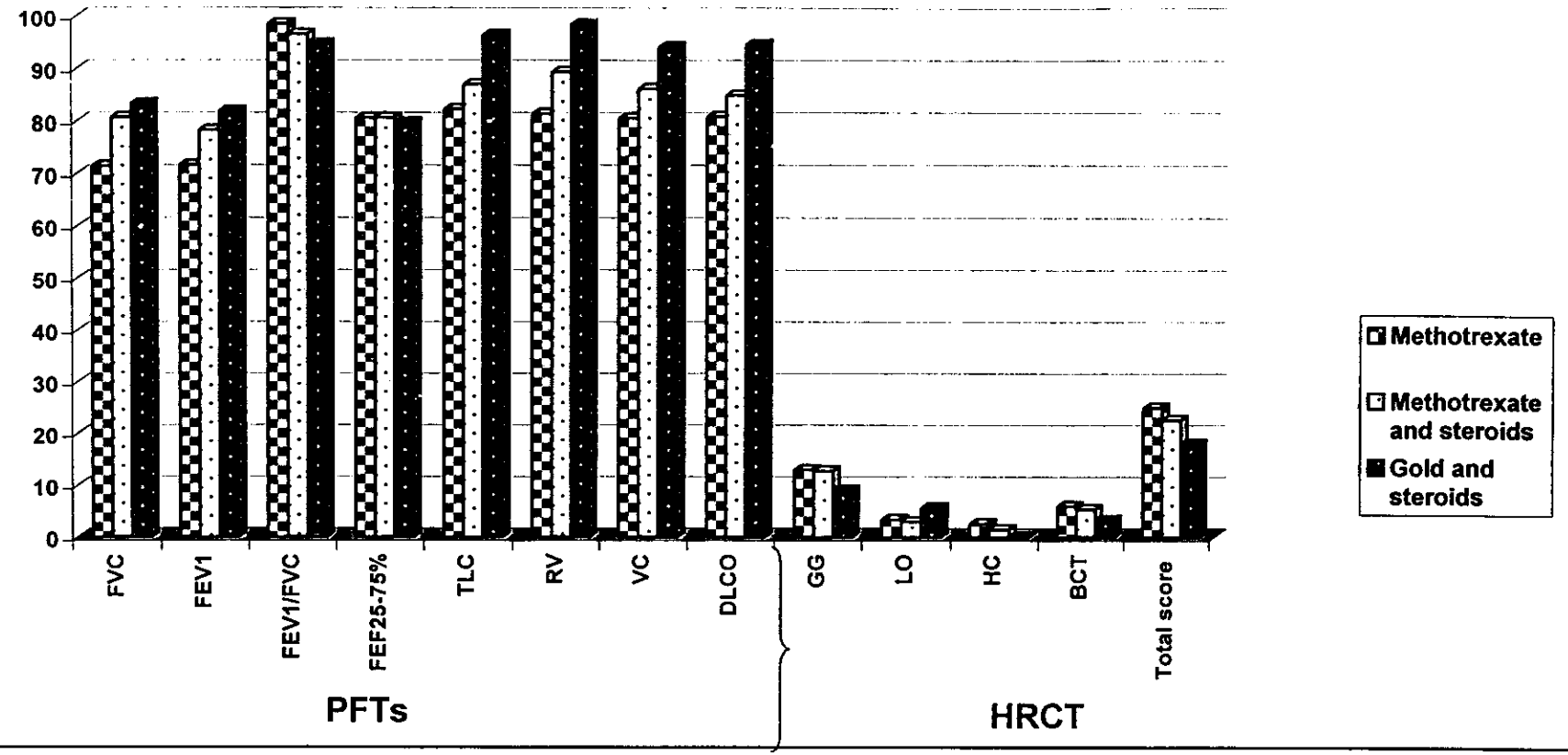


Table (8): **Correlative coefficient study of clinical and laboratory data with pulmonary functions and HRCT results in (RA) patients.**

	Age	Disease duration	Morning stiffness	Visual analogue scale	Grip strength	Articular index	Hb%	ESR	RF	ANA
FVC	-0.22	-0.25	-0.19	-0.22	0.30	-0.29	0.21	-0.29	-0.41*	-0.19
FEV_1	-0.26	-0.2	-0.18	-0.43*	0.18	-0.42*	0.22	-0.45*	-0.52*	-0.26
FEV_1/FVC	-0.3	-0.33	-0.35	-0.35*	0.17	0.18	0.19	-0.07	-0.12	-0.2
$FEF_{25-75\%}$	-0.36*	-0.61*	-0.16	-0.35*	0.2	-0.57*	0.23	-0.28	-0.19	-0.2
TLC	-0.29	-0.2	-0.31	-0.22	0.28	-0.17	0.1	-0.29	-0.13	-0.18
RV	-0.28	-0.26	-0.2	-0.23	0.27	-0.18	0.16	-0.3	-0.1	-0.19
VC	-0.28	-0.3	-0.21	-0.3	0.32	-0.18	0.18	-0.2	-0.09	-0.22
DLCO	-0.31	-0.29	-0.19	-0.3	0.3	-0.22	0.38*	-0.44*	-0.35*	-0.1
GG	0.36*	0.36*	0.42*	0.3	-0.25	0.33	-0.25	0.37*	0.4*	0.25
LO	0.35	0.36*	0.51*	0.35*	-0.23	0.39*	-0.23	0.09	0.39*	0.4*
HC	0.29	0.25	0.18	0.16	-0.27	0.25	-0.2	0.18	0.3	0.3
BCT	0.4*	0.29	0.33	0.23	-0.28	0.36*	-0.42*	0.43*	0.26	0.31
Total score	0.28	0.22	0.29	0.3	-0.2	0.29	-0.25	0.27	0.31	0.26

* Significant correlation where r(critical value) = 0.35

Table (9): **Correlative coefficient study between pulmonary functions and HRCT results in (RA) patients.**

	Ground glass opacities	Linear opacities	Honey combing	Bronchi-ectasis	Total score
FVC	-0.18	-0.33	-0.34	-0.53*	-0.22
FEV_1	-0.18	-0.35*	-0.43*	-0.58*	-0.27
FEV_1/FVC	0.19	0.27	0.43*	-0.45*	-0.33
$FEF_{25-75\%}$	-0.26	-0.22	-0.23	-0.45*	-0.3
TLC	-0.3	-0.43*	-0.54*	-0.17	-0.34
RV	-0.31	-0.44*	-0.37*	0.35*	-0.28
VC	-0.24	-0.42*	-0.58*	-0.21	-0.28
DLCO	-0. 35*	-0.27	-0.44*	-0.26	-0.3

* Significant correlation where r (critical value) = 0.35

SYSTEMIC LUPUS ERYTHEMATOSUS GROUP

This group included 12 patients according to the ACR (1982) revised criteria. They were 11 females (91.5%) and 1 male (8.5%). Their ages ranged between 18 and 40 years with a mean of 26.5 ± 7.4 years.

Clinical features (Table 10):

One female patient plus the male patient were smokers. The disease duration ranged between 1 and 10 years with a mean of 4.3 ± 2.8 years.

The number of painful joints ranged between 2 and 8 joints with a mean of 4.4 ± 1.8 joints. The functional capacity grading divided the patients into 3 patients as grade I, 4 patients as grade II and 5 patients as grade III.

Laboratory and radiologic findings (Table 10):

The Hb% ranged between 7.8 and 10.5 g/dl with a mean of 9.3 ± 0.8 g/dl. The 1st hour ESR tested by Westergren method ranged between 30 and 80 mm with a mean of 42.3 ± 15.8 mm. The ANA by indirect immunofluorescent technique were detected in all patients and + ve R.F. by latex test in 3 patients.

The respiratory symptoms were detected as 8 patients had dyspnea, 5 patients had cough and 2 patients had expectoration.

No abnormal radiological findings were detected in both hand and chest x-ray. HRCT findings will be discussed in detail in (Tables 25, 26).

Drug therapy (Table 10):

All patients were receiving NSAID. Nine patients were treated by steroids, 9 were treated by azathioprine and 2 patients were receiving cyclophosphamide therapy.

Pulmonary functions:

Table (11) and Fig. (11) showed comparative study of the pulmonary functions between the SLE patients and the control group. This exhibited significant differences as regards $FEF_{25-75\%}$, TLC, R.V and DLCO values. A highly significant difference, as regards FVC, FEV1 and VC values were also present.

*Table(10):*Demographic and clinical data of systemic lupus erythematosus (SLE) patients.

	Results	Number (N = 12)
Age (years)	26.5 ± 7.4	
Sex (female/ male)	91.5 : 8.5%	N = 11:1
Smokers %	16.7	N = 2
Disease duration (years)	4.3 ± 2.8	
Number of painful joints	4.4 ± 1.8	
Functional capacity grading	Grade I Grade II Grade III Grade IV	N = 3 N = 4 N = 5 N = 0
Hb %	9.3 ± 0.8	
ESR 1st hour	42.3 ± 15.8	
+ve R.F	25%	N = 3
+ve ANA	100%	N = 12
Treatment - NSAI - Steroids - Azathioprine - Cyclophosphamide	 100% 75% 75% 16.5%	 N = 12 N = 9 N = 9 N = 2
Respiratory symptoms - Dyspnea - Cough - Expectoration - Wheezes	 66.7% 83.3% 33.3% 0%	 N = 8 N = 5 N = 2 N = 0

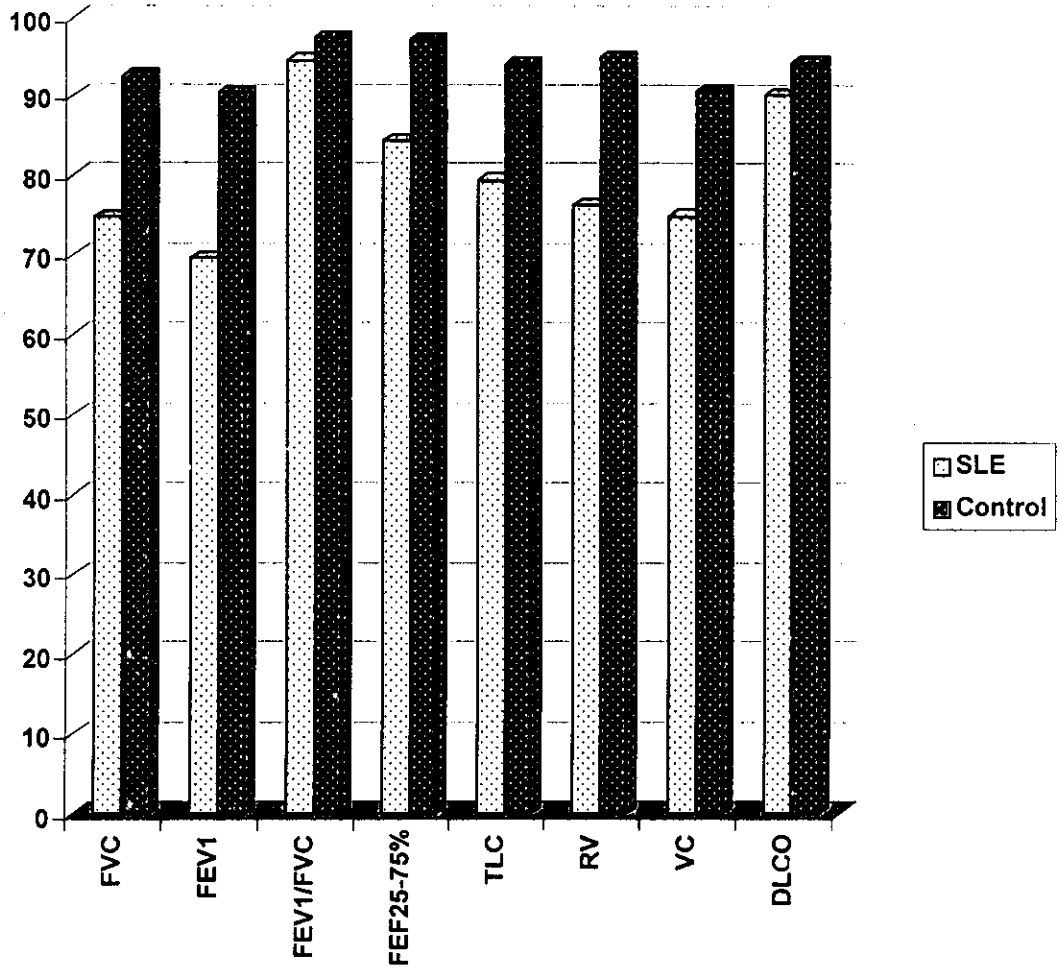
N : Number of patients.

Table (11): **Comparison of pulmonary functions between (SLE) patients and (control) group.**

	Control (N=15) $\bar{X} \pm SD$	SLE (N=12) $\bar{X} \pm SD$	T	p
FVC	92.5 ± 1.7	74.7 ± 1.7	3.9	< 0.001**
FEV_1	90.4 ± 2.2	69.6 ± 2.1	4.9	< 0.001**
FEV_1/FVC	94.3 ± 0.7	93.9 ± 0.9	1.5	> 0.05
$FEF_{25-75\%}$	93.8 ± 1.8	84.3 ± 2.4	2.4	< 0.05*
TLC	94 ± 1.5	79.4 ± 1.5	3.8	< 0.05*
RV	92.3 ± 1.4	76.2 ± 1.7	2.6	< 0.05*
VC	90.6 ± 0.8	74.8 ± 1.6	3.7	< 0.001**
DLCO	94.3 ± 1.8	79.4 ± 1.8	3.1	< 0.05*

N : Number of subjects.
$\bar{X}$: Mean
SD : Standard deviation
t : t-value
p : Probability * Significance ** Highly significance

Fig. (11): Comparison of pulmonary functions between (SLE) patients and (control) group.



* Correlative coefficient studies between some data in SLE patients :

Table (12) showed correlative study between some clinical and laboratory data on one side and pulmonary functions and HRCT results on the other side. There were significant correlations between some clinical parameters and pulmonary functions rather than HRCT findings. Positive or negative correlations depended on the r-value which were shown in (Table 12) in detail.

Table (13) showed significant correlations when we compared pulmonary functions with HRCT, specially the total score of the HRCT which gave multiple correlations with the variables of PFTs as shown in that table.

Table (12): **Correlative coefficient study of clinical and laboratory data with pulmonary functions and HRCT results in (SLE) patients.**

	Age	Disease duration	No. of painful joints	Hb%	ESR	ANA
FVC	-0.5*	-0.49*	-0.33	0.21	-0.49*	-0.33
FEV_1	-0.49*	-0.26	-0.44	0.49*	-0.58*	-0.35
FEV_1/FVC	0.23	0.21	0.12	0.22	0.21	-0.21
$FEF_{25-75\%}$	0.16	0.15	-0.43	0.36	-0.41	-0.32
TLC	-0.49*	-0.22	-0.32	0.41	-0.46	-0.28
RV	- 0.21	-0.25	-0.51*	0.33	-0.44	-0.35
VC	-0.49*	-0.11	-0.31	0.39	-0.49*	-0.36
DLCO	-0.57*	-0.32	-0.49*	0.33	-0.51*	-0.22
GG	0.33	0.53*	0.23	-0.17	0.25	0.16
LO	0.42	0.54*	0.24	-0.24	0.16	0.28
HC	0.36	0.24	0.21	-0.22	0.21	0.22
BCT	0.22	0.57*	0.11	-0.11	0.22	0.23
Total score	0.54*	0.49*	0.23	-0.16	0.18	0.16

* Significant correlation where r (critical value) = 0.49

Table (13): **Correlative coefficient study between pulmonary functions and HRCT results in (SLE) patients.**

	Ground glass opacities	Linear opacities	Honey combing	Bronchi-ectasis	Total score
FVC	-0.63*	-0.48	-0.28	0.21	-0.67*
FEV_1	-0.41	-0.46	-0.27	0.23	-0.65*
FEV_1/FVC	0.26	0.33	0.21	-0.18	-0.49*
$FEF_{25-75\%}$	-0.32	-0.23	-0.18	-0.49*	-0.53*
TLC	-0.41	-0.28	-0.23	-0.33	-0.56*
RV	-0.59*	-0.27	-0.33	0.33	-0.49*
VC	-0.67*	-0.21	-0.62*	-0.32	-0.58*
DLCO	-0.48	-0.29	-0.58*	-0.48	-0.45

* Significant correlation where r (critical value) = 0.49

SYSTEMIC SCLEROSIS GROUP

This group comprised 6 patients diagnosed according to ACR criteria for PSS. They were 5 females (66.7%) and 1 male (33.3%). Their ages ranged between 34 and 50 years with a mean of 40.2 ± 5.6 years.

Clinical and laboratory features (Table 14):

One female patient and the male patient were smokers. The disease duration ranged between 4 and 7 years with a mean of 5.2 ± 1.2 years. Number of painful joints were ranged between 4 and 6 joints with a mean of 5.2 ± 1 joints.

According to functional capacity grading, no patient was classified as grade I or IV, 4 patients were classified as grade II and 2 patients as grade III.

All patients had have dyspnea, 5 patients were suffering from cough, 2 patients with expectoration and no patient was having wheezes.

The Hb% ranged between 8.5 and 9.5 g/dl with a mean of 9.01 ± 0.3 g/dl, while the 1st hour ESR ranged between 30 and 50 mm with a mean of 39.2 ± 7.4 mm.

Half of the patients had +ve R.F and all of them had +ve ANA.

Table (14): **Demographic and clinical data of systemic sclerosis (PSS) patients.**

	Results	Number (N = 6)
Age (years)	40.2 ± 5.6	
Sex (female / male %)	66.7 : 33.3	N = 5 : 1
Smokers %	33.3	N = 2
Disease duration (years)	5.2 ± 1.2	
Number of painful joints.	5.2 ± 1	
Functional capacity grading	Grade I Grade II Grade III Grade IV	N = 0 N = 4 N = 2 N = 0
Hb%	9.01 ± 0.3	
ESR 1st hour	39.2 ± 7.4	
+ ve R.F.	50% Titre 96 ± 37	N = 3
+ ve ANA	100% Titre 1.8 ± 0.5	N = 6
Respiratory symptoms		
Dyspnea	100%	N = 6
Cough	83.3%	N = 5
Expectoration	33.3%	N = 2
Wheezes	0%	N = 0

N : Number of patients.

Radiological findings :

No abnormal findings were detected in hands and chest x-ray HRCT results will be discussed in (Tables 25,26) in detail.

Pulmonary functions:

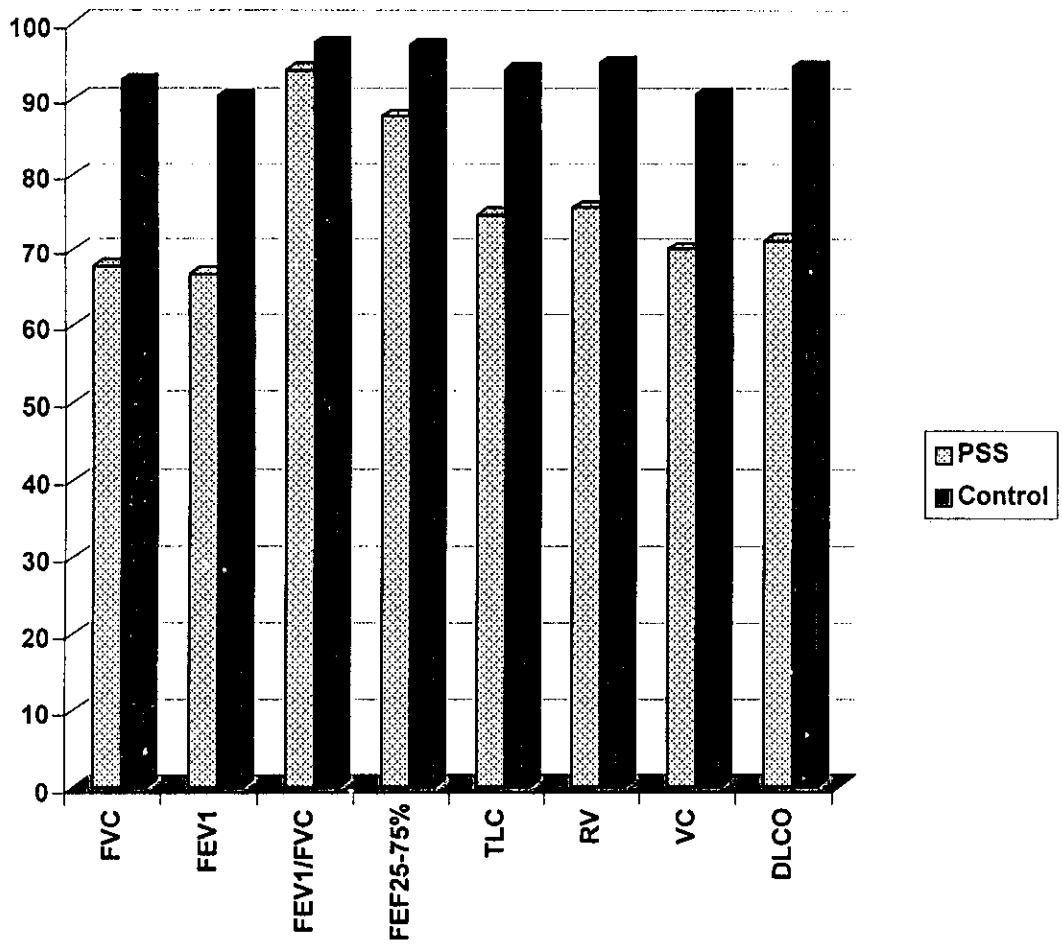
In (Table 15 and Fig. 12) comparison of pulmonary functions was done between patients and control. Its results showed highly significant differences in all pulmonary function variables except FEV_1/FVE which did not exhibit any significant difference.

Table (15): **Comparison of pulmonary functions between (PSS) patients and (control) group.**

	Control (N=15)	PSS (N=6)	t	P
	$\overline{X} \pm SD$	$\overline{X} \pm SD$		
FVC	92.5 ± 1.7	67.9 ± 6.2	14.1	< 0.001**
FEV1	90.4 ± 2.2	70.1 ± 6.3	12.6	< 0.001**
FEV1/FVC	94.3 ± 0.7	93.9 ± 0.4	2	> 0.05
FEF25-75%	93.8 ± 1.8	87.8 ± 1.1	7.1	< 0.001**
TLC	94 ± 1.5	74.7 ± 3.9	12.4	< 0.001**
RV	92.3 ± 1.4	73.3 ± 3.4	11.9	< 0.001**
V.C	90.6 ± 0.8	66.8 ± 2.1	12.5	< 0.001**
DLCO	94.3 ± 1.8	71.3 ± 3.9	13.2	< 0.001**

N : Number of subjects.
$\overline{X}$: Mean
SD : Standard deviation
t : t. value
P : Probability ** Highly significance.

Fig. (12) : Comparison of pulmonary functions between (PSS) patients and (control) group.



Correlative coefficient studies within PSS group :

Two correlation studies within the PSS group were performed. The 1st one which was shown in (Table 16) showed correlation significances, either positive or negative according to the r-value, between data of pulmonary functions and HRCT on one side, and data of clinical and laboratory variables on the other side. The most obvious correlations were that between disease duration and FVC, VC as well as DLCO which were significant +ve correlation showed that the decline and, consequently correlation, was detected in early years of the disease. Other significant correlations either + ve or – ve were marked in this table.

The second correlative study was shown in (Table 17) and was between variables of pulmonary functions and HRCT in PSS patients. The most prominent significant correlations were between honey combing with most of the parameters of restrictive impairment, and between ground-glass opacities with DLCO as well as VC, the latter is the first indicator of restrictive pattern, consequently the total score showed significant correlations with almost all variables of PFTs.

In (Table 18) significant difference was shown between D-penicillamine intake and two variables of PFTS. No significant difference with the other variables was predicted.

Table (16): **Correlative coefficient study of clinical and laboratory data with pulmonary functions and HRCT results in (PSS) patients.**

	Age	Disease duration	No. of painful joints	Hb%	ESR	ANA
FVC	-0.72	0.87*	-0.69	0.68	-0.85*	-0.4
FEV1	-0.72	-0.53	-0.64	0.71	-0.71	-0.39
FEV1/FVC	-0.53	0.47	0.62	0.63	0.63	0.32
FEF25-75%	-0.45	-0.49	-0.56	-0.49	-0.72	-0.43
TLC	-0.61	-0.55	-0.53	0.56	-0.71	-0.48
RV	-0.63	-0.54	-0.46	0.5	-0.72	-0.49
VC	-0.47	0.78*	-0.44	0.7	-0.91*	-0.62
DLCO	-0.35	0.91*	-0.53	0.61	-0.42	-0.49
GG	0.82*	0.8*	-0.71	-0.63	0.58	0.51
LO	0.72	0.8*	-0.65	-0.67	0.41	0.49
HC	0.82*	0.93*	0.53	-0.72	0.49	0.37
BCT	0.26	0.41	0.73*	-0.71	0.7	0.53
Total score	0.77*	0.86*	0.61	-0.69	0.94*	0.45

* Significant correlation where r(critical value) = 0.73

Table (17): **Correlative coefficient study between pulmonary functions and HRCT results in (PSS) patients.**

	Ground-glass opacities	Linear opacities	Honeycombing	Bronchiectasis	Total score
FVC	-0.62	-0.6	-0.72	0.51	-0.9*
FEV1	-0.71	-0.93*	-0.81*	0.47	-0.96*
FEV1/FVC	0.61	0.54	0.69	-0.46	0.96*
FEF25-75%	-0.6	-0.51	-0.43	-0.52	-0.72*
TLC	-0.62	-0.5	-0.91*	-0.68	-0.95*
RV	-0.72	-0.7	-0.82*	-0.63	-0.73*
VC	-1.02*	-0.72	-0.97*	-0.71	-0.95*
DLCO	-0.92*	-0.54	-0.84*	-0.61	- 1*

* Significant correlation where r (critical value) = 0.73

Table (18): **Chi-square test study between D-penicillamine therapy and pulmonary functions.**

	D-Penicillamine therapy
$FEF_{25-75\%}$	Significant (P = 0.04)
DLCO	Significant (P = 0.04)

DERMATOMYOSITIS GROUP

This group included 4 patients diagnosed according to ACR criteria. They were 3 females and 1 male. Their ages ranged between 20 and 40 years with a mean of 28.5 ± 8.7 years.

Clinical findings (Table 19):

The male patient was smoker and the female patients were non-smokers. Disease duration ranged between 1 and 5 years with a mean of 3 ± 1.8 years. The number of painful joints ranged between 5 and 6 joints with a mean of 5.8 ± 0.5 joints. According to functional capacity, 3 patients were classified as group II and 1 patient as group III.

Three patients were suffering from dyspnea and 1 patient were suffering from wheezes, no other chest symptoms was found.

Laboratory and Radiological findings (Table 19):

The Hb% ranged between 9.3 and 10.3 g/dl with a mean of 9.9 ± 0.4 g/dl. By Westergren method the 1st hour ESR values ranged between 35 and 50 mm with a mean of 45 ± 7.1 mm. One patient was RF +ve by latex test, and by indirect immunofluorescent technique 3 patients were +ve for ANA.

No radiological findings were observed in hands or chest x-ray. The HRCT data will be discussed in (Tables 25, 26).

In (Table 20) we compared the pulmonary functions between DM patients and control. There were significant differences as regards $FEF_{25-75\%}$ and RV, while there were highly significant differences as regards FVC, FEV_1, TLC, VC and DLCO results.

Correlation coefficient study was studied in (Table 21), it showed the correlation between pulmonary functions and HRCT results in DM patients. The +ve and –ve correlations were shown in the table.

Table (19): **Demographic and clinical data of dermatomyositis (DM) patients.**

	Results	Number (N = 6)
Age (years)	28.5 ± 8.7	
Sex (female / male %)	75 : 25%	N = 3 :1
Smokers %	25%	N = 1
Disease duration (years)	3 ± 1.8	
Number of painful joints	5.8 ± 0.5	
Functional capacity grading	Grade I Grade II Grade III Grade IV	N = 0 N = 3 N =1 N = 0
Hb%	9.9 ± 0.4	
ESR 1st hour	45 ± 7.1	
+ ve R.F.	25%	N = 1
+ ve ANA	75% Titre 1.3 ± 0.5	N = 3
Respiratory symptoms **- Dyspnea** **- Cough** **- Expectoration** **- Wheezes**	 75% 0% 0% 25%	 N = 3 N = 0 N = 0 N = 1

N : Number of patients

Table (20): **Comparison of pulmonary functions between (DM) patients and (control) group.**

	Control (N = 15)	DM (N = 4)	t	P
	$\overline{X} \pm SD$	$\overline{X} \pm SD$		
FVC	92.5 ± 1.7	77.3 ± 8.2	6.9	< 0.001**
FEV1	90.4 ± 2.2	74.7 ± 7.1	7.6	< 0.001**
FEV1/FVC	94.3 ± 0.7	96.8 ± 2.8	0.5	> 0.05
FEF25-75%	93.8 ± 1.8	87.4 ± 1.9	3.1	< 0.05*
TLC	94 ± 1.5	81.1 ± 8.6	4.2	< 0.001**
RV	92.3 ± 1.4	80.3 ± 4.8	3.6	< 0.05*
V.C	90.6 ± 0.8	73.3 ± 6.8	7.8	< 0.001**
DLCO	94.3 ± 1.8	78.6 ± 8.5	6.2	< 0.001**

N : Number of subjects.
$\overline{X}$: Mean
SD : Standard deviation
t : t- value
P : Probability * Significance ** Highly significance.

Table (21): **Correlative coefficient study between pulmonary functions and HRCT results in (DM) patients.**

	Ground glass opacities	Linear opacities	Honeycombing	Bronchiectasis	Total score
FVC	- 0.93*	- 0.97*	- 1*	- 0.51	- 0.95*
FEV1	- 0.73	- 0.85	- 0.9	- 0.45	- 0.94*
FEV1/FVC	0.78	0.88	0.66	- 0.4	0.9
FEF25-75%	- 0.84	- 0.77	0.7	- 0.5	- 0.85
TLC	- 0.96*	- 1*	- 0.92*	- 0.44	- 0.97*
RV	- 0.91	- 0.67	- 0.54	- 0.73	- 0.91
VC	- 0.94*	- 0.93*	- 0.96*	- 0.63	- 0.97*
DLCO	- 0.97*	- 0.95*	- 0.92*	- 0.55	- 0.91

- Significant correlation where r (critical value) = 0.92

- **Statistical study between the studied groups according to variable data:**

Table (22) and Figs. (13, 14) by chi-square test study the respiratory symptoms found in the studied patients were comparisoned, the most frequent symptom was dyspnea as it presented by the highest percentage in all disease, the next frequent symptom was cough, then was expectoration and lastly was wheezes which showed the least frequency. There was significant difference only as regard the cough presenting symptom.

The results of pulmonary function variables between the different groups of patients as well as the control group were studied in (Table 23). It showed highly significant differences in all those variables except the FEV_1/FVC ratio which showed no significant difference. The order of arrangement from highest to lowest values in each variable was as follow:

FVC : Control, RA, DM, SLE and PSS.

FEV_1 : Control, RA, RM, SLE and PSS.

FEV_1/FVC : Control, DM, SLE, PSS and RA.

$FEF_{25-75\%}$: Control, PSS, DM, SLE and RA.

TLC : Control, RA, DM, SLE and PSS.

RV : Control, RA, DM, SLE and PSS.

VC : Control, RA, SLE, DM and PSS.

DLCO : Control, SLE, RA, DM and PSS.

Table (24) and Fig. (15) showed classification of the pattern of pulmonary affection according to the results of pulmonary functions into three patterns : restrictive, obstructive or combined.

As regard the HRCT findings, each lung was divided into 3 zones, the involvement of each zone in every disease by the variable pattern of findings was studied and discussed in (Table 25) as cephalo-caudal distribution. The most frequent HRCT abnormalities that detected in our study were : ground glass opacities, linear opacities, honeycombing and bronchiectasis. The order and percentage of involvement for every finding was shown in the table.

The score of HRCT findings then studied in (Table 26 and Fig. 16). It showed significant difference as regard the total score and highly significant differences as regards linear opacities and honey combing.

Table (22): **Chi-square test study of respiratory symptoms in the studied patients.**

	RA (N = 32)		SLE (N = 12)		PSS (N = 6)		DM (N = 4)		X^2	P
	N	%	N	%	N	%	N	%		
Dyspnea	16	50	8	66.7	6	100	3	75	5.04	>0.05
Cough	16	50	4	33.3	5	83.3	0	0	7.7	<0.05*
Expectoration	8	25	2	16.7	2	33.3	0	0	1.9	>0.05
Wheezes	6	18.8	2	16.7	0	0	2	50	4.03	>0.05

N : Number of patients .
% : Percentage of involvement.
X^2 : Chi-square value.
P : Probability * Significance

Fig. (13) : Chi-square test study of respiratory symptoms in the studied patients

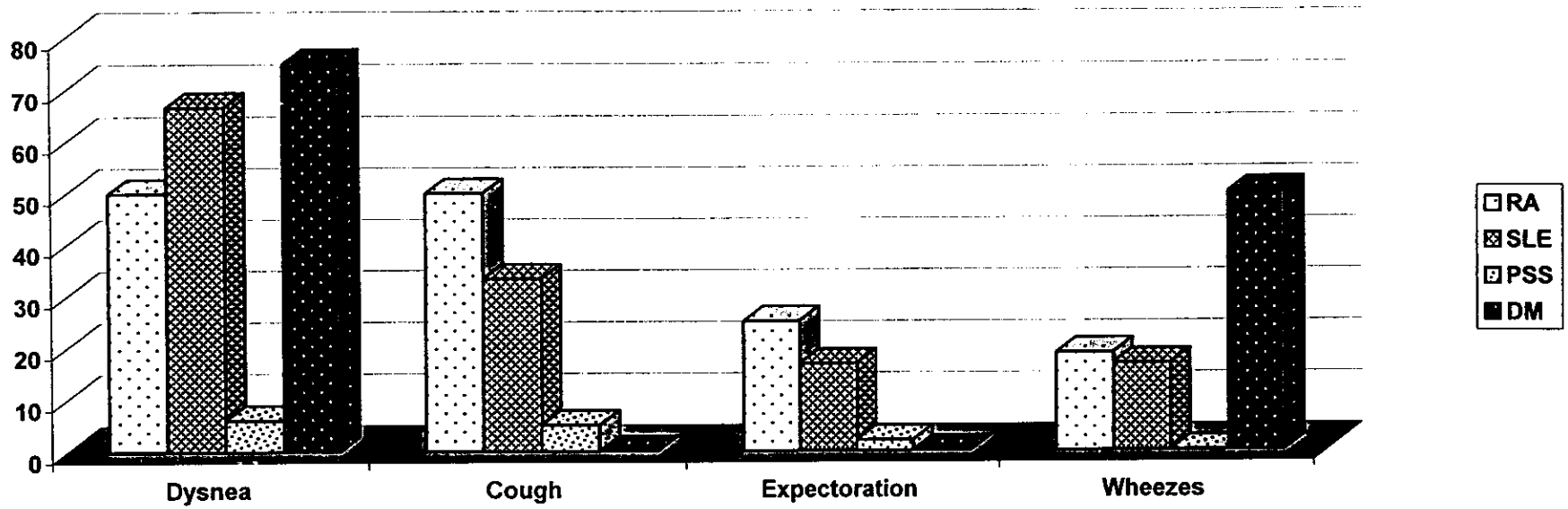


Fig. (14): Prevalence of dysnea in the studied patients

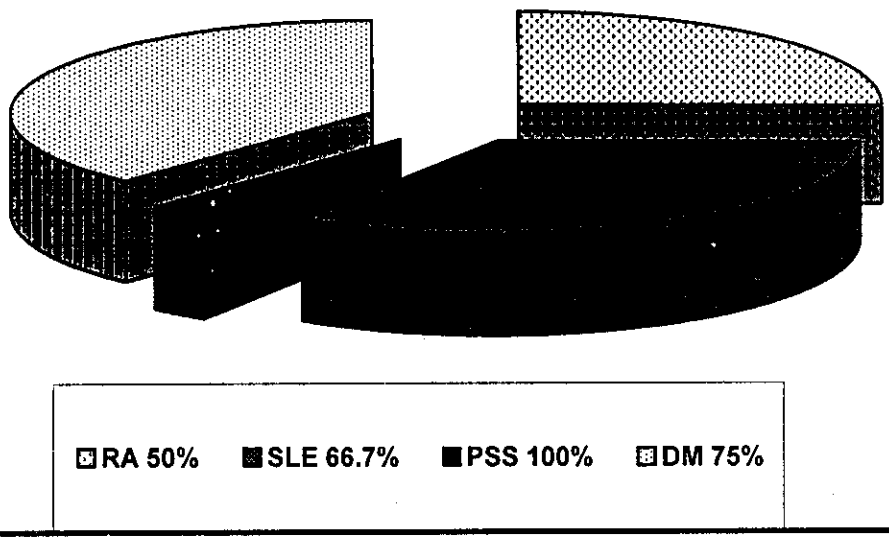


Table (23): **Comparison of pulmonary functions results in the studied groups.**

	RA (N=32)	SLE (N=12)	PSS (N=6)	DM (N=4)	Control (N=15)	F	P
	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD		
FVC	78.4 ±10.3	74.7 ± 4.6	67.9 ± 6.2	77.3 ± 8.2	92.5 ±1.7	15.9	<0.001**
FEV_1	76.9 ± 9.9	69.6 ± 4.8	66.8 ± 6.3	74.7 ± 7.1	90.4 ± 2.2	16.4	<0.001**
FEV_1/FVC	90.5 ± 4.6	94.6 ± 1.9	93.9 ± 0.4	96.8 ± 2.8	97.8 ± 1.5	1.2	>0.05
$FEF_{25-75\%}$	80.5 ± 7.7	84.3 ± 8.9	87.8 ± 1.1	87.4 ± 1.9	97.2 ± 2.4	16.2	<0.001**
TLC	87.3± 13.4	79.4 ± 5.7	74.7 ± 3.9	81.1 ± 9.9	94 ± 1.5	7.9	<0.001**
RV	88.5±13.3	76.2± 10.1	75.6 ± 4.4	83.3 ± 5.1	94.9 ± 1.7	7.8	<0.001**
VC	83.6± 10.2	74.8 ± 4.8	70.1 ± 3.8	73.3 ± 4.2	90.6 ± 2.3	15.6	<0.001**
DLCO	88.7 ±3.4	90.1 ± 2.2	71.3 ± 3.9	82.5 ± 4.4	94.3 ± 1.8	19.5	<0.001**

N : Number of subjects.
$\bar{X}$: Mean
SD : Standard deviation
F : F. value
P : Probability ** Highly significance.

Table (24): **Distribution of the studied patients according to PFTs pattern of impairment.**

	Restrictive Impairment		Obstructive Impairment		Combined impairment	
	N	%	N	%	N	%
RA (32)	14	43.75%	12	37.5%	6	18.75%
SLE (12)	7	58.3%	3	25%	2	16.7%
PSS (6)	6	100%	0	0	0	0
DM (4)	3	75%	1	25%	0	0

N : Number of patients
% : Percentage of involvement.

Fig (15) : Distribution of the studied patients according to PFTs pattern of impairment

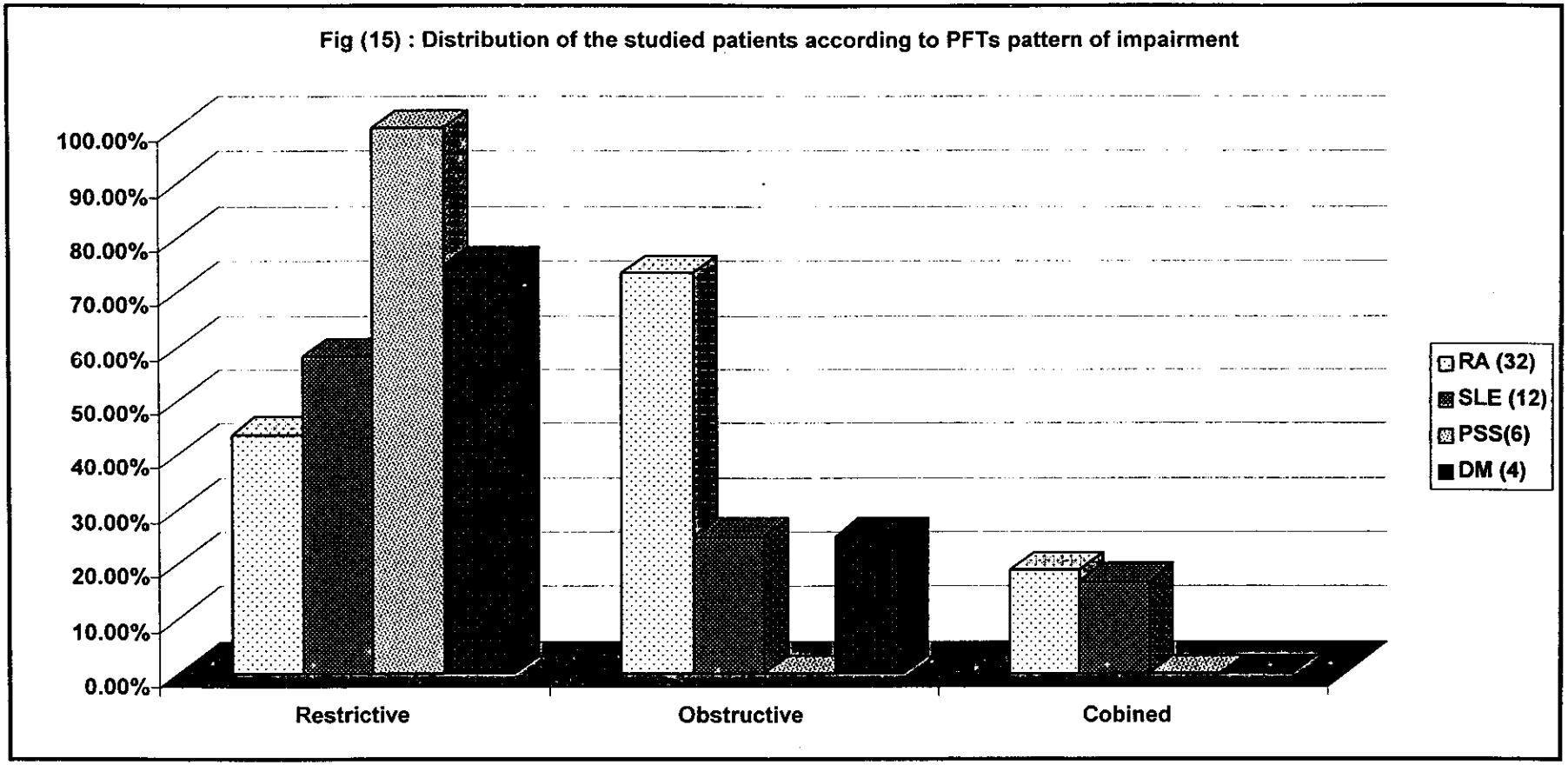


Table (25): **Cephalo-caudal distribution of pulmonary abnormalities in the studies patients on HRCT.**

Group		Ground glass opacities						Linear opacities						Honycombing						Bronchiectasis					
		Right			Left			Right			Left			Right			Left			Right			Left		
		U	M	L	U	M	L	U	M	L	U	M	L	U	M	L	U	M	L	U	M	L	U	M	L
RA	N	6	26	28	8	26	28	4	12	12	4	12	12	2	6	4	2	8	10	6	12	14	6	12	14
(32)	%	18.8	81.3	86.5	25	81.3	87.5	12.5	37.5	37.5	12.5	37.5	37.5	6.3	18.8	12.5	6.3	25	31.3	18.8	37.5	43.8	18.8	37.5	43.8
SLE	N	6	11	11	6	11	11	2	4	5	1	5	5	0	0	3	0	0	5	0	3	6	0	2	5
(12)	%	50	91.7	91.7	50	91.7	91.7	16.7	33.3	41.7	8.3	41.7	41.7	0	0	25	0	0	41.7	0	25	50	0	16.7	41.7
PSS	N	3	6	6	3	6	6	0	5	5	0	5	5	0	1	6	0	0	6	0	1	0	0	1	0
(6)	%	50	100	100	50	100	100	0	83.3	83.8	0	83.3	83.3	0	16.7	100	0	0	100	0	16.7	0	0	16.7	0
DM	N	3	4	4	4	4	4	2	4	4	3	4	4	0	0	2	0	2	1	0	0	0	0	0	0
(4)	%	75	100	100	100	100	100	50	100	100	75	100	100	0	0	50	0	50	25	0	0	0	0	0	0

N : Number of subjects.
% : Percentage of involvement.

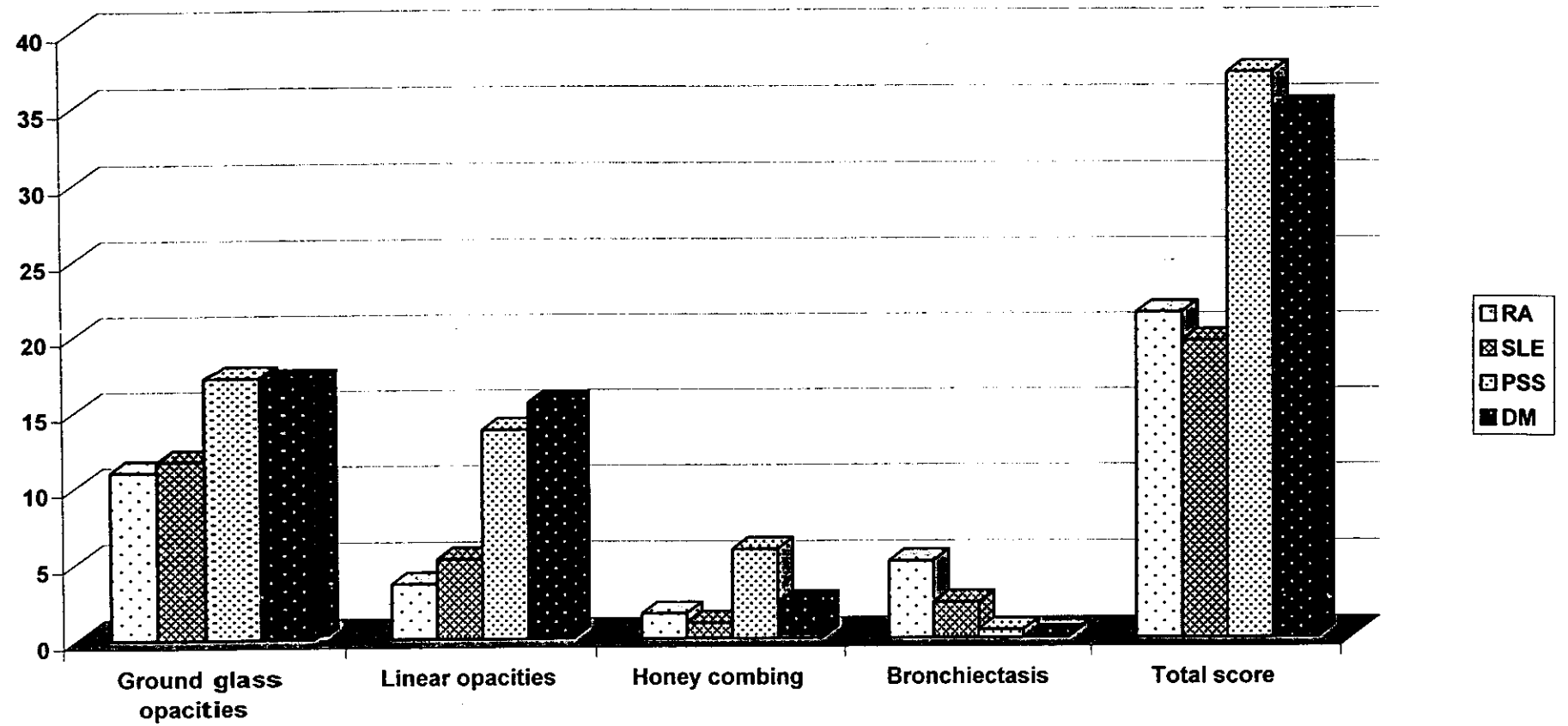
U (Upper zone): From lung apex to the top of the aortic arch.
M (Middle zone): From aortic arch to the right inferior pulmonary vein.
L (Lower zone): From inferior pulmonary vein to the most caudal extent.

Table (26): **Comparison of scores of HRCT abnormalities in the studied patients.**

Group	RA (N=32) $\bar{X}$ ± SD	SLE (N=12) $\bar{X}$ ± SD	PSS (N=6) $\bar{X}$ ± SD	DM (N=4) $\bar{X}$ ± SD	F	P
Ground-glass opacities	11 ± 6.5	11.7 ± 6.4	17.2±3.7	17 ± 3.6	2.4	>0.05
Linear opacities	3.6 ± 4	5.2 ± 6.3	13.7 ± 7.5	15.5 ± 6.4	8.1	<0.001**
Honeycombing	1.6 ± 2.3	1 ± 1.3	5.8 ± 2.7	2.3 ± 0.5	8.5	<0.001**
Bronchiectasis	5 ± 7.2	2.3 ± 2.6	0.5 ± 1.2	0	1.9	>0.05
Total score	21.4 ±11.7	19.5± 10.7	37.2± 11.5	34.8 ±10.1	4.9	<0.05*

N : Number of subjects.
$\bar{X}$: Mean
SD : Standard deviation
F : F. value
P : Probability * Significance ** Highly significance.

Fig. (16) : Comparison of scores scores of HRCT abnormalities in the studied patients



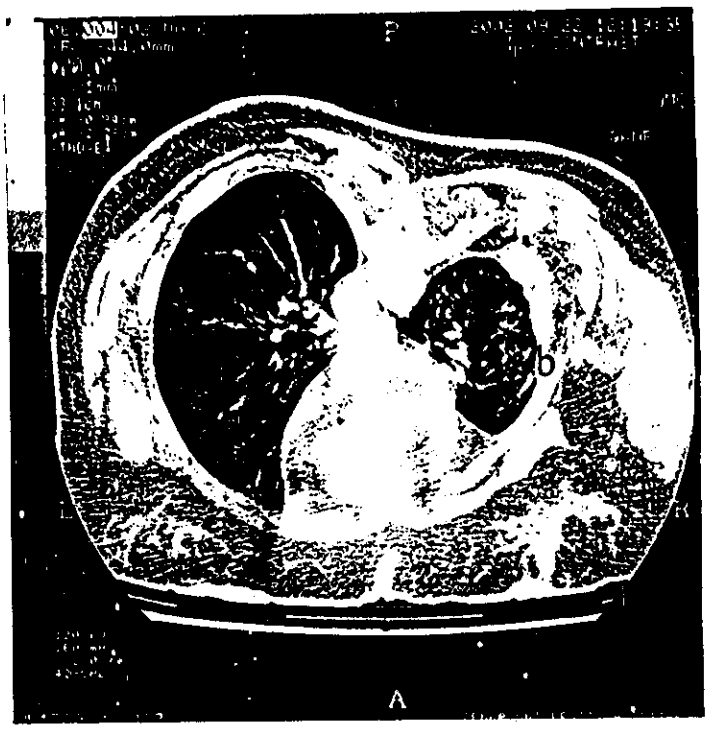


Photo. (1): HRCT lung shows:

a- Gound-glass opacities in the middle and upper zones of both lungs.

b- Right sided pleural thickening and fibrosis.

Photo. (2): **HRCT lung shows:**

a- Ground-glass opacities in the middle zone of both lungs

b- Linear opacities in the middle zone of both lungs.

c- Mild bronchiectasis in the middle zone of right lung.

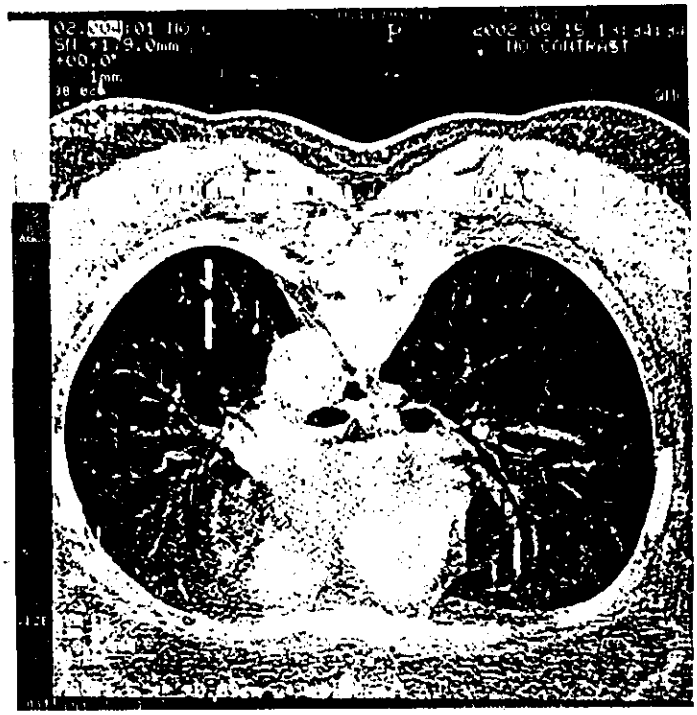


photo. (3): **HRCT lung shows:**

a- Ground-glass opacities in the middle zone of both lungs

b- Mild bronchiectasis in the middle zone of right lung.

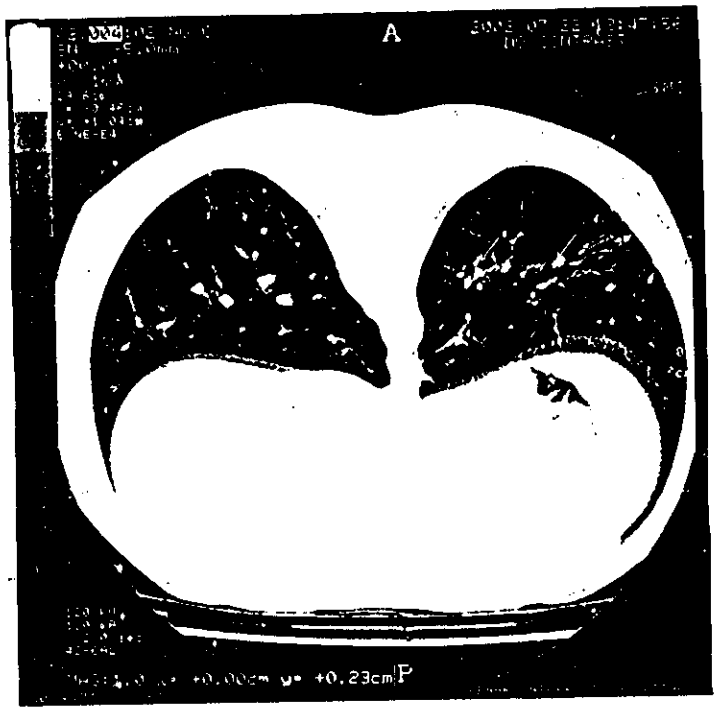


photo. (4): **HRCT lung shows :**

a- Linear opacities in the lower zone of left lung.

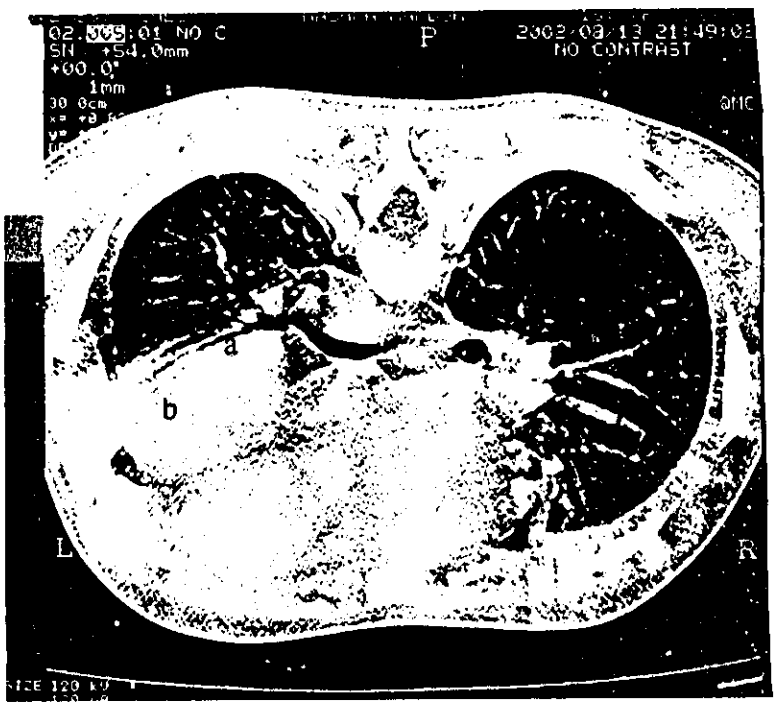


Photo. (5): **HRCT lung shows.**
a- Mild bronchiectasis in the lower zone of left lung.

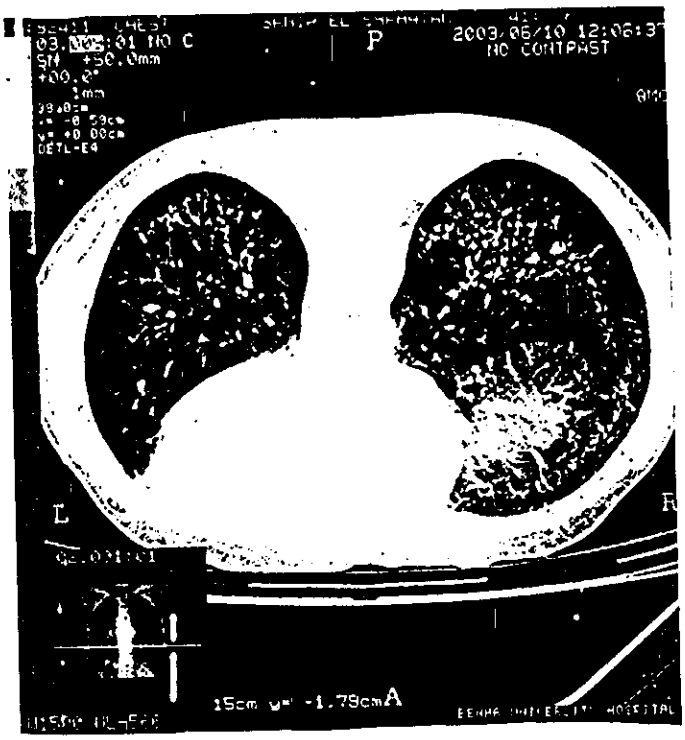


Photo. (6): **HRCT lung shows:**

a- Bilateral, basal, subpleural honeycombing

b- Linear opacities in the lower zone of right lung.

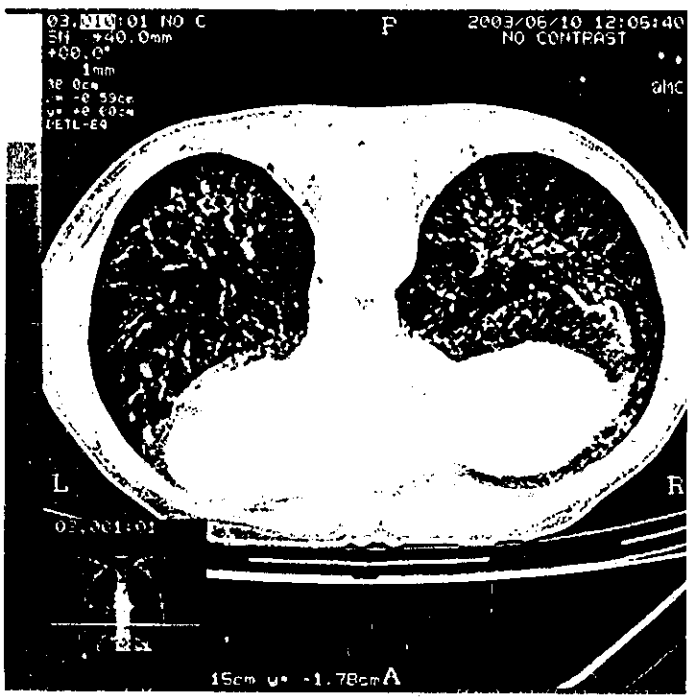


Photo. (7): HRCT lung shows:
a – Bilateral, basal, subpleural honeycombing.