Results

Personal Data:

1-The age of patients in the current study ranged between 17 and 74 years (mean 52.6 ± 13.32). They included 41 males and 19 females.

2-The age of the patients in group I ranged between 22 and 74 years. The mean age was (52.26 ± 13.3). They were 20 males and 10 females (Tab.1).

3-In group II, the age ranged between 19 and 61. The mean age was (37.7 ± 13.32). They were 8 males and 2 females (Tab.3).

4-In group III, the age ranged between 17 and 63 years. The mean age was (35.65 ± 13.75). They were 13 males and 7 females (Tab.5).

5-Healthy controls (group IV), the age ranged between 28 and 56 years. The mean age was (47.44 ± 12.76). They were 13 males and 7 females.

Clinical findings:

1- Skin affection:

Itching was affecting nine cases (30%) of patients of group I (Tab.7), five of them (16.6%) was associated with skin rashes. The skin lesions were in the form of maculopapular rashes in two patients, vesicles in one patient, papulopustular lesion in one patient, and nodular in one patient.

In group II itching was affecting five cases (50%) of patients (Tab.7), three of them (30%) were associated with skin rashes. Skin rashes were in the form of maculopapular rashes in one patient, maculovesicular lesion in one patient, and nodular lesion in one patient.

In group III itching and skin rashes affected five cases (25%) of patients (Tab.7), the skin rashes affected two patients (10%) only. It was in the form of papulovesicular lesion.

2-Musculoskeletal system affection:

In group I, bone pain affected ten patients (33%), joint pain affected thirteen patients (43.3%), five patients were having joint deformity (16.7%), two patients (6.7%) were having joint inflammation, nine patients (30%) were having limited range of movement in the affected joints, six patients (20%) were having joint crepitus, and three patients (10%) were having muscle wasting (Tab.7).

In group II, bone pain was affecting two patients (20%), joint pain affected four patients (40%), two patients (20%) were having joint deformity, one patient (10%) were having joint inflammation, three patients (30%) were having limited range of movement in the affected joints, two patients (20%) were having joint crepitus, and three patients (30%) were having muscle wasting (Tab.7).

In group III, bone pain affected seven patients (35%), joint pain affected seven patients (35%), two patients (10%) were having joint deformity, three patients (15%) were having joint inflammation, five patients (25%) were having limited range of movement in the affected joints, three patients (15%) were having joint crepitus, and there was not any patient having muscle wasting (Tab.7).

3- Respiratory system affection:

In group I, pleural effusion was affecting one patient (3.3%), chronic bronchitis was affecting two patients (6.7%), pulmonary fibrosis was affecting three patients (10%), and one patient (3.3%) was having nodular lesion detected by plain chest X-ray (Tab.1).

While there was not any patient with respiratory system affection in both group II and III.

4- Neurological system affection:

In group I memory changes affected two patients (6.7%), behavioral changes affected four patients (13.3%), and coordination changes affected two patients (6.7%) (Tab.7).

While there was not any patient with neurological system affection in both group II and III.

Laboratory findings:

1- Silicon:

The mean plasma silicon level in group I was 2588.7 ± 2114.1µg/L. It was significantly higher than that of normal controls (p value less than 0.0001) (Tab. 23 and Fig. 1).

In group II, the mean plasma silicon level in this group was 2413.2 ± 1951.8µg/L. It was significantly higher than that of normal controls (p value less than 0.0002) (Tab. 23 and Fig. 1).

In group III, the mean plasma silicon level in this group was 1457.6 ± 1694.3µg. It was significantly higher than that of normal controls (p value less than 0.02) (Tab. 23 and Fig. 1).

In group IV (normal controls), the mean plasma level of silicon was 540.8± 559.4 µg /l with a relative constancy between different ages. (Tab.23 and Fig.1).

The serum silicon levels were significantly elevated in patients with renal impairment, chronic renal failure on regular hemodialysis, and on conservative measures than in healthy control (P value is less than 0.02, 0.0001, 0.0002 respectively) (Tab.23).

There were not significant differences in serum silicon levels in-patients with chronic renal failure on regular hemodialysis, renal impairment, and those with chronic renal failure on conservative measures (Tab.23).

Serum silicon levels found to be either normal (less than the mean plasma silicon level among the healthy control group"540.8µg/l") or high (more than the mean plasma silicon level among the healthy control group"540.8µg/l"). Serum silicon levels were normal in 10 patients (16.7 %), three patients (10%) in group I, one patient (10%) in group II, and six patients (30%) in group III (Fig.18).

In group I there was insignificant difference, in the serum levels of aluminum in patients with normal silicon (18.4 ± 5.07 µg /l) and those with high silicon (21.73 ± 11.01µg /l), ($p< 0.428$). Serum calcium in patients with normal silicon was (9.30 ± 0.62 mg/dl), while in patients with high silicon was (9.38 ± 1.38 mg/dl), ($p< 0.927$). Corrected calcium in patients with normal silicon was (9.62 ± 0.95 mg/dl), in patients with high silicon was (9.57 ± 1.43 mg/dl), ($p< 0.834$). Serum phosphorus in patients with normal silicon was (5.47 ± 1.91 mg/dl), while in patients with high silicon was (7.35 ± 1.95 mg/dl), ($p< 0.123$) (Tab. 16).

In group II there was only one patient with normal serum silicon level and the other nine patients were having elevated serum silicon level (Tab. 17).

In group III there was insignificant difference, in the serum levels of aluminum in patients with normal silicon (23.95 ± 8.93µg/l) and those with high silicon (20.14 ± 11.35µg /l), ($p< 0.476$). Serum calcium in patients with normal silicon was (8.08± 0.77mg/dl), while in patients with high silicon was (8.95 ± 2.04mg/dl), ($p< 0.329$). Corrected calcium in patients with normal silicon was (8.82 ± 0.82mg/dl), in patients with high silicon was (9.22 ± 2.07mg/dl), ($p< 0.451$). Serum phosphorus in patients

with normal silicon was (5.57 ± 1.21mg/dl), while in patients with high silicon was (5.32 ± 1.04mg/dl), ($p< 0.650$) (Tab. 18).

There was significant difference in the serum parathyroid hormone levels between patients with normal silicon (226.67 ± 201.8 Pg/ml), and those with high silicon (55.3 ± 23.29 Pg/ml) in group I, ($p< 0.001$) (Tab. 16) and in group III silicon level in patients with normal silicon was (784.3 ± 291 Pg/ml) and in those with elevated silicon was (170.6 ± 149.39 Pg/ml) ($P< 0.002$) (Tab. 18).

Regarding the clinical findings:

In group I, skin affection was positive in 33.3% of patients with normal silicon and 29.6% of patients with high silicon ($p< 0.379$). In group II, there was not skin affection in patients with normal silicon while it affected 55.5% of patients with high silicon. In group III, skin affection was positive in 16.7% of patients with normal silicon and 28.6% of patients with high silicon ($p< 0.159$) (Tab. 21).

Bone pain affected 33.3% of patients with normal silicon and 33.3 % of patients with high silicon in group I ($p< 0.13$), and did not affect any patient with normal silicon in group II. In group III, bone pain affected 16.6% of patients with normal silicon and 42.8 % of patients with high silicon ($p< 0.32$) (Tab. 14)

Joint affection was positive in 16.6% of patients with normal silicon in group III while it affected (42.2%) of patients with high silicon in group III ($p< 0.285$). In group I and II there was not joint affection in patients with normal silicon. And the joint affection was associated with elevated silicon levels only in group I (48.15%) and group II (44.5%) (Tab.20).

In group I, the serum silicon level in patients with joint affection was (3479.3 ± 2749.1µg/L), while in patients without joint affection it was

(1907.7 ± 1138.2 µg/L). There was significant difference in the serum silicon levels between patients with joint affection and those without joint affection (p value is less than 0.05) (Tab. 24).

In group II, the serum silicon level in patients with joint affection was (4073 ± 2070.78 µg/L), while in patients without joint affection it was (1306.67 ± 781.5 µg/L). There was significant difference in the serum silicon levels between patients with joint affection and those without joint affection (p value is less than 0.05) (Tab. 24).

In group III, the serum silicon level in patients with joint affection was (2417.8 ± 2532.5 µg/L), while in patients without joint affection it was (940.6 ± 714.9 µg/L). There was not significant difference in the serum silicon levels between patients with joint affection and those without joint affection (p value was 0.06) (Tab. 24).

Regarding the immunological profile:

C-reactive protein, rheumatoid factor, and anti double strand DNA were measured only in patients with high silicon levels in group I and II, while in group III it was measured in one patient with normal silicon level and in six patients with high silicon levels (Patients who have joint complaint).

C-reactive protein was (1.32 ± 1.77 mg/dl) in group I (Tab.16), (1.13 ± 0.78 mg/dl) in group II (Tab.17), (1.43 ± 1.19 mg/dl) in patients with high silicon levels in group III and (1.2 mg/dl) in patient with normal silicon level in group III ($p<0.86$) (Tab.18).

Anti double strand DNA was (63.67 ± 86.18 IU/ml) in group I (Tab.16), (26.8 ± 9.21 IU/ml) in group II (Tab.17), (32.5 ± 39.07 IU/ml) in patients with high silicon levels in group III and (20 IU/ml) in patient with normal silicon level in group III ($p<0.77$) (Tab.18).

Rheumatoid factor was (34 ± 41.6 IU/ml) in group I (Tab.16), (57 ± 57.68 IU/ml) in group II (Tab.17), (46.3 ± 41.85 IU/ml) in patients with high silicon levels in group III and (8 IU/ml) in patient with normal silicon level in group III ($p<0.43$) (Tab.18).

Antinuclear antibody was positive in 38.5% of patients with elevated serum silicon levels in group I, 25% of patients with elevated serum silicon levels in group II, and 33.3% of patients with elevated serum silicon levels in group III. While there was not any patient with normal serum silicon levels developing positive antinuclear antibody (Tab. 19).

2- Aluminum:

The mean plasma aluminum level in group I, was 22.67 ± 9.7µg/L .It was significantly higher than that of control group (p value less than 0.001).

The mean plasma aluminum level in group II, was 18.8 ± 3.5µg/L .It was significantly higher than that of control group (p value less than 0.003).

The mean plasma aluminum level in group III, was 21.2 ± 10.5µg/L .It was significantly higher than that of control group (p value less than 0.008).

While the mean plasma aluminum level in normal healthy control was 13.7 ± 4.1µg/L (Tab.23 and Fig.2)

The serum aluminum levels were significantly elevated in patients with renal impairment, chronic renal failure on regular hemodialysis, and on conservative measures than in healthy control (P value is less than 0.008, 0.001, 0.003 respectively) (Tab.23).

There were not significant differences in serum aluminum levels in-patients with chronic renal failure on regular hemodialysis, renal

impairment, and those with chronic renal failure on conservative measures (Tab.23).

3- **Hematological findings:**

Haemoglobin was 10.57 ± 2.11 gm/dl and hematocrit 33.06 ± 4.8 in group I. In group II, hemoglobin was 9.08 ± 2.21 gm/dl , hematocrit 29.9 ± 6.6, while hemoglobin was 10.25 ± 2.16 gm/dl , hematocrit 31.35 ± 7.47 in group III (Tab.8 and Fig.3 & 4) .

4- **Biochemical findings:**

In group I, the mean serum calcium level was 9.37 ± 1.3 mg/dl (Tab.8 and Fig.5), corrected calcium was 9.57 ± 1.37mg/dl (Tab.8 and Fig.6) phosphorus was 7.16 ± 1.9 mg/dl (Tab.8 and Fig.7), alkaline phosphatase was 560.8 ± 908.3 u/dl (Tab.8 and Fig.8), S.G.O.T was 17.4 ± 9.6 u/dl (Tab.8 and Fig.9), S.G.P.T was 21.4 ± 17 u/dl (Tab.8 and Fig.10), serum albumin was 3.74 ± 0.35 gm% (Tab.8 and Fig.11).

In group II, the mean serum calcium level was 8.34 ± 1.56 mg/dl, corrected calcium was 8.41 ± 1.81 mg/dl, phosphorus was 7.19 ± 3.7 mg/dl , alkaline phosphatase was 144.9 ± 129.1 u/dl ,S.G.O.T was 21.2 ± 12.7 u/dl ,S.G.P.T was 15.5 ± 7.2 u/dl , serum albumin was 3.91 ± 0.66 gm% (Tab.8).

In group III, The mean serum calcium level was 8.68 ± 1.78 mg/dl, corrected calcium was 9.1 ± 1.77 mg/dl, phosphorus was 5.39 ± 1.06 mg/dl, alkaline phosphatase was 132.6 ± 154.5 u/dl, S.G.O.T was 30.8 ± 22.4 u/dl, S.G.P.T was 28.7 ± 38.3 u/dl, serum albumin was 3.48 ± 0.87 gm% (Tab.8).

5- Parathyroid hormone:

Parathyroid hormone was 110.76 ± 184.06 Pg/ml in group I, and was 235.1 ± 386.2 Pg/ml in group II, while it was 354.75 ± 347.5 Pg/ml in group III (Tab.8 and Fig.12)

6- Serological Findings:

I- Autoimmune profile that has been performed for the 13 patients with joint complaint in group I revealed the following:

a-Anti-nuclear antibodies: was positive in five patients (38.5 %) and negative in eight patients (61.5 %) (Tab.9 and Fig.13).

b-Anti-double strand D.N.A: was positive in six patients (46.2%) and negative in seven patients (53.8%)) (Tab.10 and Fig.14).

c-Rheumatoid factor: was positive in seven patients (53.8%) and negative in six patients (46.2%) (Tab.11 and Fig.15).

d-E.S.R: was elevated in ten patients (76.9 %) and normal in three patients (23.1 %) (Tab. 13 and Fig.17).

e-C-reactive protein: was positive in seven patients (53.8 %) and negative in six patients (46.2 %) (Tab. 12 and Fig.16).

II- In group II, autoimmune profile that has been performed for the four patients with joint complaint revealed the following:

a- Anti-nuclear antibodies: was positive in one patient (25%) and negative in three patients (75%).

b-Anti-double strand D.N.A: was negative in 3 patients (75%) and was positive in one patient (25%).

c- Rheumatoid factor: was positive in two patients (50%) and negative in two patients (50%).

d-E.S.R: was elevated in four patients (100 %).

e- C-reactive protein: was positive in two patients (50%) and negative in two patients (50%).

III- In group III, the autoimmune profile that has been performed for the 7 patients with joint complaint revealed the following:

a- Anti-nuclear antibodies: was positive in two patients (28.6%) and negative in five patients (71.4%).

b- Anti-double strand D.N.A: was negative in six patients (85.7%) and positive in one patient (14.3%).

d- Rheumatoid factor: was positive in four patients (57.1%) and negative in three patients (42.9%).

e- E.S.R: was elevated in seven patients (100%).

f- C-reactive protein: was positive in five patients (71.4%) and negative in two patients (28.6%).

7- Urine analysis:

Urine has been investigated for presence of albuminuria in-patients of group III, it revealed albuminuria in eight patients (40%) (2.91 ± 1.56 gm), while 12 patients (60%) were not albuminuric.

There was insignificant difference between albuminuric patients with normal serum silicon levels (3.77 ± 1.46 gm) and those with elevated serum silicon levels (2.4 ± 1.99 gm) ($p < 0.405$) (Tab. 18).

Correlation between plasma silicon levels and laboratory findings:

Standard regression analysis was done to study correlation between silicon and the following parameters (Tab.20):

- There was negative but insignificant correlation between silicon and age in group I (r = -0.19), and group II (r = -0.43). While in group III it was positive insignificant correlation (r = 0.15)

- There was negative but insignificant correlation between silicon and aluminum in group I (r = - 0.11) and group III (r = - 0.32). While in group II it was positive and insignificant (r = 0.32) (Fig.19).

- There was insignificant correlation between silicon and calcium in group I (r = 0.19), and group II (r = 0.24). While in group III it was negative and non significant (r = -0.24) (Fig.20).

- There was insignificant correlation between silicon and corrected calcium in group I (r = 0.23), and group II (r = 0.24). While in group III it was negative and non significant (r = -0.32).

- There was insignificant correlation between silicon and phosphorous in group I (r = 0.03), group II (r = 0.37) and in group III (r = 0.04) (Fig.21).

- There was negative but insignificant correlation between silicon and alkaline phosphatase in group I (r = -0.16), and group II (r = -0.13). While in group III it was positive and non significant (r = 0.30).

- There was negative and insignificant correlation between silicon and serum GOT in group I (r = -0.18), and group III (r = -0.14). While in group II it was positive and non significant (r = 0.03).

- There was negative and insignificant correlation between silicon and serum GPT in group I (r = -0.26), and group III (r = -0.15). While in group II it was positive and non significant (r = 0.29).

- There was negative but insignificant correlation between silicon and serum albumin in group I (r = -0.21), and group II (r = -0.11). While in group III it was positive and non significant (r = 0.21).

- There was negative significant correlation between silicon and parathormon hormone in group I (r = -0.79), group II (r = -0.93) and group III (r = -0.53) (Fig. 22).

- There was insignificant correlation between silicon and hemoglobin in group I (r = 0.21), and group II (r = 0.33). While in group III it was negative and non significant (r = -0.26).

- There was insignificant correlation between silicon and hematocrit in group I (r = 0.13), and group II (r = 0.32). While in group III it was negative and non significant (r = - 0.26).

- There was insignificant correlation between silicon and creatinine in group III (r = 0.02). While it was negative and non significant in group I (r = - 0.15), and group II (r = - 0.46).

- There was significant correlation between silicon and antinuclear antibody in group I (r = 0.80), group II (r = 0.66). While it was insignificant in group III (r = 0.16).

- There was insignificant correlation between silicon and C-reactive protein in group I (r = 0.26) and group II (r = 0.25). While it was negative and non significant in group III (r = - 0.17),

- There was negative insignificant correlation between silicon and anti double strand DNA in group I (r = - 0.14) and group III (r = -0.06). While it was positive and non significant in group II (r = 0.38).

- There was negative insignificant correlation between silicon and rheumatoid factor in group I (r = - 0.36). While it was positive and non significant in group II (r = 0.01) and group III (r = 0.15).

- There was significant correlation between silicon and Joint affection in group I (r = 0.55), group II (r = 0.75), and group III (r = 0.56) (Fig. 23).

- There was non significant correlation between silicon and skin affection in group I (r = 0.20), group II (r = 0.27), and group III (r = 0.18).

Tab.1:Clinical findings in group I

No.	age	sex	itcing	skin rash	bone pain	joint pain	deformity	inflammation	limited range of movement	joint crepitus	muscle wasting	memory changes	behavior changes	coordination changes	motor affection	respiratory examination
1	58	M	n		n	n	n	n	n	n	n	n	n	n	n	
2	46	M	n		n	n	n	n	n	n	n	n	n	n	n	
3	69	M	n		n	y	n	n	y	n	y	n	n	n	n	PE+ I
4	54	M	n		y	y	y	n	n	n	n	n	n	n	n	
5	41	F	n		n	y	n	n	n	n	n	n	n	n	n	
6	74	M	y	y	n	y	y	n	y	y	n	n	n	n	n	
7	62	M	n		n	n	n	n	n	n	n	n	y	n	n	
8	55	M	n		y	n	n	n	y	y	n	n	n	n	n	
9	68	F	y	y	y	n	n	n	n	n	y	n	n	n	n	NL
10	49	M	n	y	y	n	y	n	y	y	n	y	n	n	n	F
11	56	F	y		n	n	n	n	n	n	n	n	n	n	n	
12	27	F	y		n	n	n	n	y	n	n	n	n	n	n	
13	48	M	n		n	n	n	n	n	n	n	n	y	n	n	
14	66	M	n		n	n	n	n	n	n	n	y	y	y	n	
15	34	M	n	y	n	n	n	n	n	n	n	n	n	n	n	
16	42	F	n		n	n	n	n	n	n	n	n	n	n	n	
17	45	M	y		n	y	n	n	n	n	n	n	n	n	n	
18	49	M	y		n	y	n	n	y	n	y	n	n	n	n	
19	53	M	n		n	y	y	n	n	y	n	n	n	n	n	F
20	69	M	y		n	n	n	n	n	n	n	n	n	y	n	
21	47	M	n		n	n	n	n	n	n	n	n	n	n	n	
22	61	M	n	y	y	y	n	y	y	y	n	n	n	n	n	I
23	52	M	n		y	y	n	n	n	n	n	n	n	n	n	
24	68	M	y		n	y	n	n	y	y	n	n	n	n	n	
25	59	F	n		y	y	n	y	y	n	n	n	n	n	n	
26	57	F	n		y	n	n	n	n	n	n	n	y	n	n	
27	22	F	n		y	y	n	n	n	n	n	n	n	n	n	
28	65	M	n		n	n	n	n	n	n	n	n	n	n	n	
29	45	F	n		n	n	y	n	n	n	n	n	n	n	n	
30	27	F	y		y	y	n	n	n	n	n	n	n	n	n	F

F= pulm.fibrosis
NL= nodular lesion
PE= pleural effusion
I = chronic bronchitis

n = no
y = yes

Tab. 2 : Laboratory findings in group I

No.	creatinine (mg/dl)	Silicon (µg/L)	Alluminium (µg/L)	calcium (mg/dl)	corrected calcium (mg/dl)	phosphorous (mg/dl)	alkaline phosphatase (IU/L)	GOT (IU/L)	GPT (IU/L)	albumin (gm%)	PTH (Pg/ml)	hemoglobin (gm/dl)	hematocrit (vol%)	ESR (mm/hr)	CRP (mg/dl) (n. < .5)	antinuclear antibodies	anti- ds DNA (IU/ml)	rheumatoid factor (IU/ml) (n. < 8)
1	11.6	1401	28.4	6.9	6.9	7.4	399	24	44	4	65	10.2	32					
2	12.5	1295	18.3	7.5	8.14	6.5	594	16	41	3.2	74	8.5	27					
3	9.4	4123	30.1	9.4	9.72	6.6	528	44	32	3.6	30	12.6	37	23/25	< 0.5	Posit.	46 (BL)	< 8
4	10.7	3749	23.6	9.2	9.28	2.5	188	12	18	3.9	40	8.1	26			Posit.		
5	8.4	1220	26	8.2	8.04	9.8	732	9	21	4.2	78	14	41	45/87	1.3	Neg.	29 (Neg.)	116
6	13.6	1657	29.3	11.8	11.704	8.2	159	10	11	4.12	26	12.2	37	14/28	< 0.5	Neg.	47 BL	85
7	7.5	1121	25.4	13.5	13.74	6.9	183	30	11	3.7	76	9	30					
8	14.1	2336	11.6	9.1	9.5	4.9	205	13	16	3.5	51	9.3	32					
9	12.5	156	24.2	9.5	10.22	3.3	373	38	86	3.1	850	9.5	33	13/22	0.7		332	112
10	14.6	3626	34.2	11.3	11.86	7.7	211	12	18	3.3	38	8.2	28	28/65	1.7		21	< 8
11	8	3802	24.4	9.2	9.68	6.9	208	11	10	3.4	36	8.9	31					
12	11.3	2396	BDL	8.2	8.36	7.3	3510	11	8	3.8	49	8.2	26					
13	15.4	3294	19.3	7.9	7.82	10.2	325	10	16	4.1	31	12.1	36					
14	12.7	1115	24.8	9.5	9.5	9.2	139	8	8	4	80	12	37					
15	9.3	345	16.2	9.8	10.12	6.2	4158	20	28	3.6	460	10.5	34					
16	9.2	1336	22.7	9.6	9.84	6.2	359	14	7	3.7	82	10.8	34					
17	13	2616	26	9.5	9.66	12.5	663	28	17	3.8	58	9.2	29			Neg.		
18	12.5	7335	37.5	10.4	10.48	7.4	481	12	17	3.9	13	17.3	46	60/96	0.6	Posit.	104	< 8
19	14.8	3711	24.7	9.8	9.88	5.5	442	13	17	3.9	33	12.5	39	43/82	< 0.5	Neg.	19.1	24
20	14.7	217	14.8	8.6	8.52	6.9	133	12	15	4.1	570	12.4	36					
21	9.4	1254	48.2	8.3	8.94	6.3	167	11	19	3.2	61	8.9	27					
22	12.8	2548	26	9.7	9.86	6.7	252	23	18	3.8	50	10.7	34	25/54	< 0.5	Neg.	19.5	32
23	14.8	1207	8.5	8.2	8.04	8.7	444	17	10	4.2	74	9.4	30	32/58	1.8	Neg.	108	< 8
24	11	6197	12.6	10.1	10.1	8.6	111	17	8	4	22	11.7	36	30/65	7	Posit.	22	16
25	10.4	2394	6.13	9	9.32	5.9	301	8	13	3.6	63	10.2	32	17/40	1.1	Neg.	35	24
26	13.8	1587	29.7	10.6	10.84	10.2	296	37	54	3.7	92	9.1	31					
27	9.4	1475	26.4	8.3	8.22	6.2	482	22	19	4.1	77	10.5	33	15/36	< 0.5	Neg.	27.1	< 8
28	15.2	1146	11.3	9.26	8.94	6.7	188	10	9	4.4	86	9.1	30					
29	9.9	3421	BDL	8.76	9.32	6.5	248	23	40	3.3	39	13.6	41					
30	8.5	9583	4.6	10.1	10.82	6.9	346	8	11	3.1	16	8.6	27	13/27	< 0.5	Posit.	18	< 8

BDL = below detection limit (< 5 µg/L)

Tab. 3 : Clinical findings in group II

No.	age	sex	itcing	skin lesion	bone pain	joint pain	deformity	inflammation	limited range of movement	joint crepitus	muscle wasting	memory changes	behavior changes	coordination changes	neurological examination	respiratory examination
31	47	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
32	22	M	n	n	n	y	n	n	y	n	y	n	n	n	n	n
33	51	M	y	y	n	n	n	n	y	n	y	n	n	n	n	n
34	19	F	y	y	n	y	y	n	y	y	y	n	n	n	n	n
35	55	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
36	19	M	y	n	n	n	n	n	n	n	n	n	n	n	n	n
37	38	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
38	38	F	y	n	n	n	n	n	n	n	n	n	n	n	n	n
39	61	M	y	y	y	y	y	y	y	y	y	n	n	n	n	n
40	27	M	n	n	y	y	y	n	n	n	n	n	n	n	n	n

Tab. 4 : Laboratory findings in group II

No.	creatinine (mg/dl)	Silicon (µg/L)	Alluminium (µg/L)	calcium (mg/dl)	corrected calcium (mg/dl)	phosphorous (mg/dl)	alkaline phosphatase (IU/L)	GOT (IU/L)	GPT (IU/L)	albumin (gm%)	PTH (Pg/ml)	hemoglobin (gm/dl)	hematocrit (vol%)	ESR (mm/hr)	CRP (mg/dl) (n. < .5)	antinuclear antibodies	anti- ds DNA (IU/ml)	rheumatoid factor (IU/ml) (n. < 8)
31	5.7	2396	23.7	10.2	11.24	6.1	94.2	19	7	3	79	13.5	43					
32	6.9	1740	19.8	7.8	7.8	5.5	71	22	6	4	120	6.5	20	25/51	1.4	Neg.	27.6	< 8
33	5.6	895	14.8	9.4	9.08	3.1	47	54	22	4	216	7.6	25					
34	4.8	6154	22.6	6.8	6.64	17	63	28	27	4	31	8	28	22/50	2.1	Posit.	25.1	< 8
35	6.8	254	20	5.9	5.1	5.1	315	18	21	5	1280	7.7	26					
36	4.2	1336	14.8	7.9	8.38	5.8	93.2	10	17	3	66	9.5	32					
37	6.5	1994	17.9	8.8	8.72	9.2	185	12	20	4	56	9.2	31					
38	5.2	965	13.2	8.1	8.1	6.7	53	14	8	4	420	8.3	29					
39	5.3	2962	21.5	7.4	8.12	6.5	431	13	10	3	65	8.1	27	59/92	< 0.5	Neg.	14.6	116
40	4.8	5436	19.7	11.1	10.94	6.9	97	22	17	4	18	12.4	38	14/31	< 0.5	Neg.	37	97

Tab. 5 : Clinical findings in group III

No.	age	sex	itcing	skin lesion	bone pain	joint pain	deformity	inflammation	limited range of movement	joint crepitus	muscle wasting	memory changes	behavior changes	coordination changes	neurological examination	respiratory examination
41	25	M	n	n	y	y	n	y	y	n	n	n	n	n	n	n
42	39	M	n	n	n	n	n	n	y	n	n	n	n	n	n	n
43	45	M	n	n	y	y	n	n	n	y	n	n	n	n	n	n
44	18	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
45	19	M	y	y	y	y	y	y	y	y	n	n	n	n	n	n
46	55	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
47	32	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
48	54	M	n	n	y	y	n	n	n	n	n	n	n	n	n	n
49	24	M	y	n	n	n	n	n	n	n	n	n	n	n	n	n
50	47	M	n	n	y	y	n	n	n	n	n	n	n	n	n	n
51	41	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
52	34	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
53	36	M	y	n	y	y	n	y	y	y	n	n	n	n	n	n
54	41	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
55	17	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n
56	22	M	y	y	y	y	y	n	y	n	n	n	n	n	n	n
57	46	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
58	38	M	n	n	n	n	n	n	n	n	n	n	n	n	n	n
59	63	M	y	n	n	n	n	n	n	n	n	n	n	n	n	n
60	17	F	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Tab. 6 : Laboratory findings in group III

No.	creatinine (mg/dl)	Silicon (µg/L)	Alluminium (µg/L)	calcium (mg/dl)	corrected calcium (mg/dl)	phosphorous (mg/dl)	alkaline phosphatase (IU/L)	GOT (IU/L)	GPT (IU/L)	albumin (gm%)	PTH (Pg/ml)	hemoglobin (gm/dl)	hematocrit (vol%)	ESR (mm/hr)	CRP (mg/dl) (n. < .5)	antinuclear antibodies	anti- ds DNA (IU/ml)	rheumatoid factor (IU/ml) (n. < 8)	albuminuria (gm)
41	3.3	1758	22	7.8	8.92	5.3	84.2	44	28	2.6	136	8.8	27	24/53	1	Neg.	112	105	1.3
42	2.7	2212	26	7.9	7.66	4.3	267	13.7	12.1	4.3	260	8.4	26						-
43	1.65	345	28	8.4	8.32	6.6	66.1	33	26	4.1	1076	13.1	39	96/119	1.2	Neg.	20	< 8	-
44	2.7	1164	9	9.2	10.8	7.6	724	88	41	2	82	12.7	36						0.8
45	1.8	965	23.7	9.4	9	5.2	95.7	12	11	4.5	180	10.4	33	38/69	0.8	Neg.	15.7	< 8	-
46	3.6	536	17.9	7.4	7.48	4	61	19	4	3.9	361	8.9	28						-
47	1.9	384	29.4	8.12	9.32	4.9	77	66	90	2.5	612	10.5	33						4.7
48	3.8	4680	16	7.6	8.08	6.1	156	18	13	3.4	74	9	28	121/150	2.4	Posit.	21	78	6.3
49	1.6	287	17.9	9.4	9.56	4.6	150	81	170	3.8	1045	12.7	37						-
50	3.19	1358	22.8	10.1	9.62	4.9	84	26	23	4.6	55	12.5	36	14/36	< 0.5	Posit.	14	64	-
51	2.39	1248	11	8.3	8.54	5.2	80	20	18	3.7	63	8.4	25						-
52	1.8	645	51	7.2	7.92	4.1	78	33	19	3.1	210	7.7	21						1.6
53	2.16	7146	14.3	7.3	7.22	5.3	285	26	30	4.1	70	7.7	22	47/85	< 0.5	Neg.	19.3	19	-
54	3.96	175	37	7.84	8.72	6.9	51.2	13	6.9	2.9	980	8.9	27						4.9
55	3.71	1245	8	8.4	8.8	6.7	65.3	26.6	10.5	3.5	85	12.9	38						2
56	3.39	673	29	15.4	15.72	4.1	65	9.6	5.1	3.6	511	10.1	31	43/93	3.4	Neg.	13	< 8	-
57	1.53	2418	7.1	8.4	8.72	5.6	111	29	13	3.6	20	13.4	40						-
58	2.46	245	13.5	7.3	9.54	6.4	29	15	13	1.2	632	8.2	25						1.7
59	3.6	743	19	9.1	8.86	4.1	82	25	33	4.3	455	13.1	39						-
60	2.8	926	23.1	9.2	9.28	6	42	19	7.5	3.9	188	7.6	21						-

Table (7): Clinical data in patients groups

Clinical data	Group I		Group II		Group III		P
	No	%	No	%	No	%	
Itching	9	30	5	50	5	25	NS
skin rash	5	16.6	3	30	2	10	NS
Bone pain	10	33.3	2	20	7	35	NS
Joint affection	13	43.3	4	40	7	35	NS
Inflammation	2	6.7	1	10	3	15	NS
Limitation of movement	9	30	3	30	5	25	NS
Joint crepitus	6	20	2	20	3	15	NS
Deformity	5	16.7	2	20	2	10	NS
Muscle wasting	3	10	3	30	0	0	0.03
Memory changes	2	6.7	0	0	0	0	NS
Behavior changes	4	13.3	0	0	0	0	NS
Coordination changes	2	6.7	0	0	0	0	NS

Tab. 8: Laboratory findings in different groups

	Group I		Group II		Group III		Group IV	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Silicon (µg/L)	2588.767	2114.161	2413.2	1951.809	1457.65	1694.359	540.85	559.4805
Alluminum (µg/L)	22.67	9.73	18.8	3.54589	21.285	10.59902	13.72	4.13
Calcium (mg/dl)	9.374	1.317114	8.34	1.569289	8.688	1.784629		
corrected calcium (mg/dl)	9.5788	1.374769	8.412	1.813436	9.104	1.770169		
phosphorous (mg/dl)	7.16	1.995961	7.19	3.773431	5.395	1.065969		
alk. Phosphatase (IU/L)	560.8333	908.3617	144.94	129.1562	132.675	154.5862		
GOT (IU/L)	17.43333	9.672868	21.2	12.76976	30.845	22.40316		
GPT (IU/L)	21.4	17.01034	15.5	7.291548	28.705	38.31654		
Albumin (gm%)	3.744	0.357593	3.91	0.669079	3.48	0.875154		
hematocrit (vol%)	33.06667	4.89851	29.9	6.607235	31.35	7.478214		
PTH (Pg/ml)	110.76	184.06	235.1	386.2	354.7	347.5		
Hb%	10.57667	2.117038	9.08	2.217005	10.25	2.161262		

Table 9

Antinuclear antibodies in different groups

			Antinuclear antibody		Total
			Negative	Positive	
GROUP	1	Count	8	5	13
		%	61.50%	38.50%	100.00%
	2	Count	3	1	4
		%	75.00%	25.00%	100.00%
	3	Count	5	2	7
		%	71.40%	28.60%	100.00%

Table 10

Anti-double strand DNA study in different

			anti-ds_DNA		Total
			Negative	Positive	
GROUP	1	Count	7	6	13
		%	53.80%	46.20%	100.00%
	2	Count	3	1	4
		%	75.00%	25.00%	100.00%
	3	Count	6	1	7
		%	85.70%	14.30%	100.00%

Table 11

Rheumatoid factor study in different groups

			rheumatoid_factor		Total
			Negative	Positive	
GROUP	1	Count	6	7	13
		%	46.20%	53.80%	100.00%
	2	Count	2	2	4
		%	50.00%	50.00%	100.00%
	3	Count	3	4	7
		%	42.90%	57.10%	100.00%

Table 12

C- reactive protein study in different groups

			CRP		Total
			Negative	Positive	
GROUP	1	Count	6	7	13
		%	46.20%	53.80%	100.00%
	2	Count	2	2	4
		%	50.00%	50.00%	100.00%
	3	Count	2	5	7
		%	28.60%	71.40%	100.00%

Table 13: ESR study in different groups

			ESR		Total
			Negative	Positive	
GROUP	1	Count	3	10	13
		%	23.10%	76.90%	100.00%
	2	Count		4	4
		%		100.00%	100.00%
	3	Count		7	7
		%		100.00%	100.00%

Tab 14

Bone pain in different groups

group	normal silicon	high silicon	P value
I	33.30%	33.30%	0.13
II	0	22.20%	
III	16.60%	42.8	0.32

Tab 15

Muscle wasting in different groups

group	normal silicon	high silicon	P value
I	33.30%	7.40%	0.26
II	0	33.30%	
III	0%	0	

Tab. 16: Laboratory data in patients with normal and elevated silicon in group I

Group I	High silicon			Normal silicon			p
	N	Mean	SD	N	Mean	SD	
Alluminium (µg/L)	27	21.73	11.01	3	18.40	5.07	0.428
Calcium (mg/dl)	27	9.38	1.38	3	9.30	0.62	0.927
phosphorous (mg/dl)	27	7.35	1.95	3	5.47	1.91	0.123
PTH (Pg/ml)	27	53.33	23.29	3	226.67	201.80	0.001
corrected calcium (mg/dl)	27	9.57	1.43	3	9.62	0.95	0.843
Rheumatoid factor (IU/ml)	13	34.00	41.68	0			
C-reactive protein (mg/d)l	13	1.32	1.77	0			
Anti ds DNA (IU/ml)	13	63.67	86.18	0			

Tab. 17: Laboratory data in patients with normal and elevated silicon in group II

Group II	High silicon			Normal silicon	
	N	Mean	SD	N	Mean
Alluminium (µg/L)	9	18.67	3.73	1	20.00
Calcium (mg/dl)	9	8.61	1.39	1	5.90
phosphorous (mg/dl)	9	7.42	3.93	1	5.10
PTH (Pg/ml)	9	119.00	127.11	1	1280.00
corrected calcium (mg/dl)	9	8.78	1.48	1	5.10
Rheumatoid factor (IU/ml)	4	57.00	57.68	0	
C-reactive protein (mg/d)l	4	1.13	0.78	0	
Anti ds DNA (IU/ml)	4	26.80	9.21	0	

Tab. 18: Laboratory data in patients with normal and elevated silicon in group III

Group III	High silicon			Normal silicon			
	N	Mean	SD	N	Mean	SD	p
Alluminium (µg/L)	14	20.14	11.35	6	23.95	8.93	0.476
Calcium (mg/dl)	14	8.95	2.04	6	8.08	0.77	0.329
phosphorous (mg/dl)	14	5.32	1.04	6	5.57	1.21	0.650
PTH (Pg/ml)	14	170.64	149.39	6	784.33	291.00	0.002
corrected calcium (mg/dl)	14	9.22	2.07	6	8.82	0.82	0.451
Albuminuria (gm/24 h urine	5	2.40	1.99	3	3.77	1.46	0.405
Rheumatoid factor (IU/ml)	6	46.30	41.85	1	8		0.435
C-reactive protein (mg/d)l	6	1.43	1.19	1	1.2		0.864
Anti ds DNA (IU/ml)	6	32.50	39.07	1	20		0.77

Tab. 19 Antinuclear antibody in patients with normal and elevated silicon levels in different groups

			Silicon level				P
			Normal ≤ 540.8		High > 540.8		
			No	%	No	%	
Antinuclear antibody	G1	Negative	0	0%	8	61.50%	
		Positive	0	0%	5	38.50%	
	G2	Negative	0	0%	3	75%	
		Positive	0	0%	1	25%	
	G3	Negative	1	100.00%	4	66.60%	0.573
		Positive	0	0%	2	33.30%	

Tab. 20: Joint affection in patients with normal and elevated silicon levels in different groups

			Silicon level				P
			Normal ≤ 540.8		High > 540.8		
			No	%	No	%	
Joint Affection	G1	Negative	3	100%	14	51.85%	
		Positive	0	0%	13	48.15%	
	G2	Negative	1	100%	5	55.50%	
		Positive	0	0%	4	44.50%	
	G3	Negative	5	83.33%	8	57.10%	
		Positive	1	16.66%	6	42.20%	0.285

Tab. 21: Skin affection in patients with normal and elevated silicon levels in different groups

			Silicon level				P
			Normal ≤ 540.8		High > 540.8		
			No	%	No	%	
Skin lesion	G1	Negative	2	66.60%	19	70.33%	0.379
		Positive	1	33.30%	8	29.66%	
	G2	Negative	1	100%	4	44.5%	
		Positive	0	0%	5	55.5%	
	G3	Negative	5	83.30%	10	71.40%	0.159
		Positive	1	16.70%	4	28.60%	

Tab. 22:Correlation between serum silicon levels and clinical& laboratory data in different groups:

	Group I			Group II			Group III		
	Pearson Correlation (r)	Sig. (2-tailed) P value	N	Pearson Correlation (r)	Sig. (2-tailed) P value	N	Pearson Correlation (r)	Sig. (2-tailed) P value	N
Silicon / Age	-0.19	0.31	30	-0.43	0.22	10	0.15	0.52	20
Silicon / Aluminum	-0.11	0.56	30	0.32	0.10	10	-0.32	0.17	20
Silicon / Calcium	0.19	0.31	30	0.24	0.50	10	-0.24	0.31	20
Silicon / Corrected calcium	0.23	0.23	30	0.24	0.50	10	-0.32	0.16	20
Silicon / Phosphorous	0.03	0.88	30	0.37	0.02	10	0.04	0.88	20
Silicon / Alkaline phosphatase	-0.16	0.39	30	-0.13	0.72	10	0.30	0.20	20
Silicon / GOT	-0.18	0.33	30	0.03	0.94	10	-0.14	0.54	20
Silicon / GPT	-0.26	0.16	30	0.29	0.42	10	-0.15	0.53	20
Silicon / Albumin	-0.21	0.26	30	-0.11	0.76	10	0.21	0.37	20
Silicon / PTH	-0.79	0.12	30	-0.93	0.92	10	-0.56	0.58	19
Silicon / Hemoglobin	0.21	0.26	30	0.33	0.35	10	-0.26	0.28	20
Silicon / Hematocrit	0.13	0.50	30	0.32	0.37	10	-0.26	0.27	20
Silicon /ANA	0.80	0.09	30	0.66	0.13	10	0.16	0.19	20
Silicon / Anti-ds DNA	-0.14	0.31	30	0.38	0.27	10	-0.06	0.47	20
Silicon /C-reactive protein	0.26	0.66	30	0.25	0.28	10	-0.17	0.26	20
Silicon / Rheumatoid factor	-0.36	0.64	30	0.01	0.91	10	0.15	0.87	20
Silicon / Creatinine	-0.15	0.42	30	-0.46	0.18	10	0.02	0.95	20
Silicon / Albuminuria							0.09	0.72	20
Silicon/ Joint affection	0.55	0.37	30	0.75	0.16	10	0.56	0.49	20
Silicon/ Muscle wasting	0.18	0.21	30	0.32	0.01	10	0.09	0.27	20
Silicon/ Bone pain	0.11	0.34	30	0.26	0.13	10	0.41	0.16	20
Silicon/ Skin lesion	0.27	0.65	30	0.27	0.46	10	0.19	0.94	20
Silicon/ Neurological affection	0.31	0.12	30						

Table (23): Silicon & Aluminum levels in patients & controls

Comparison		Silicon (µg/L)			Aluminum (µg/L)		
		Mean	SD	P	Mean	SD	P
Group	1	2588.7	2114.1	0.0001	22.67	9.7	0.001
	4	540.8	559.4		13.7	4.1	
Group	2	2413.2	1951.8	0.0002	18.8	3.5	0.003
	4	540.8	559.4		13.7	4.1	
Group	3	1457.6	1694.3	0.02	21.2	10.5	0.008
	4	540.8	559.4		13.7	4.1	
Group	1	2588.7	2114.1	NS	22.6	9.7	NS
	2	2413.2	1951.8		18.8	3.5	
Group	1	2588.7	2114.1	NS	22.6	9.7	NS
	3	1457.6	1694.3		21.2	10.5	
Group	2	2413.2	1951.8	NS	18.8	3.5	NS
	3	1457.6	1694.3		21.2	10.5	

Table 24

Relation between silicon level and joint affection

GROUP	Arthrpopathic			Non arthropathic			p
	N	Mean	SD	N	Mean	SD	
1	13	3479	2749	17	1908	1138	0.041
2	4	4073	2071	6	1307	782	0.016
3	7	2418	2533	13	941	715	0.061

Fig 1: Comparison between serum silicon levels in different groups (µg/L)

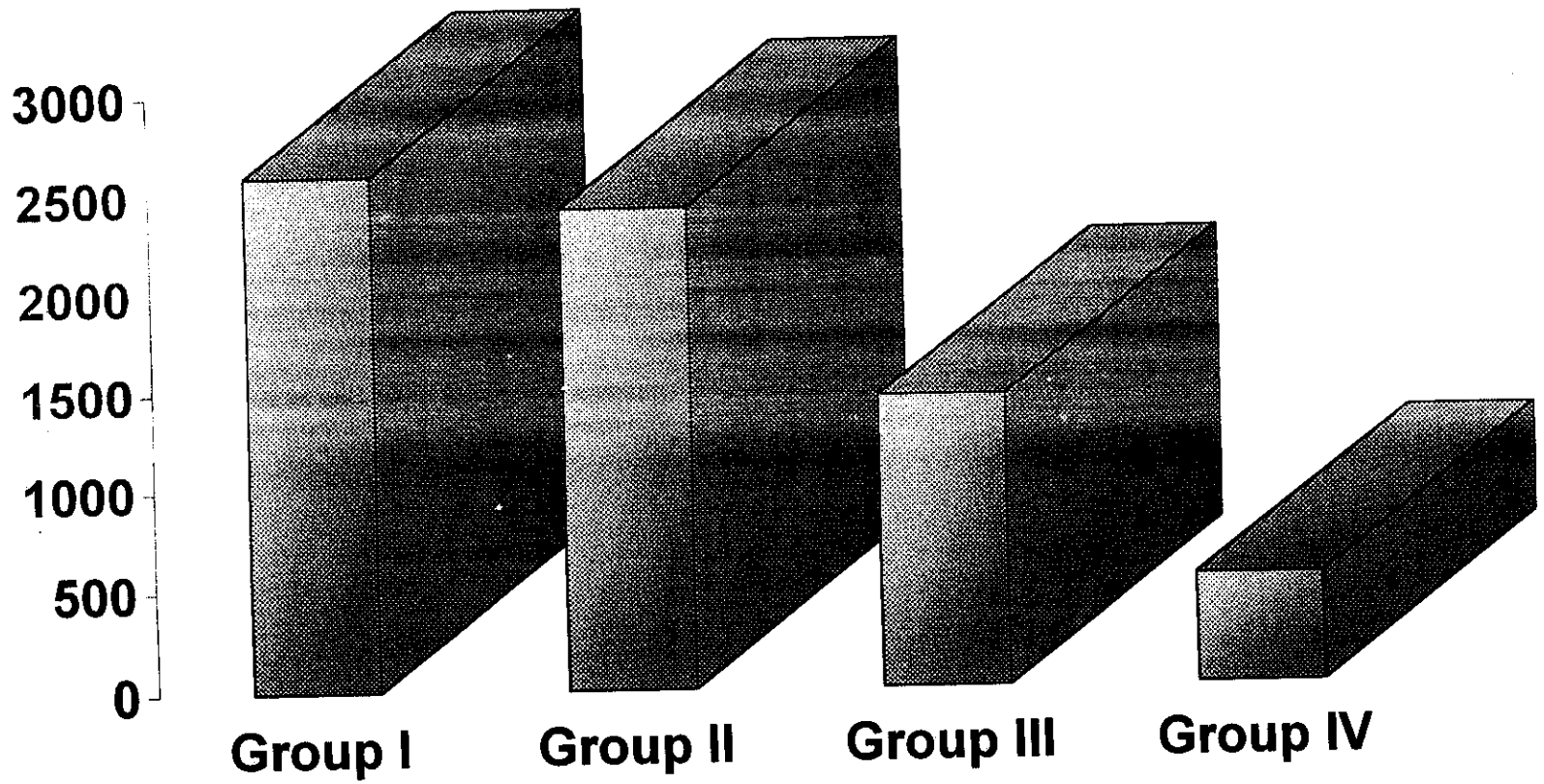

Fig 2: Comparison between serum aluminum levels in different groups (µg/L)

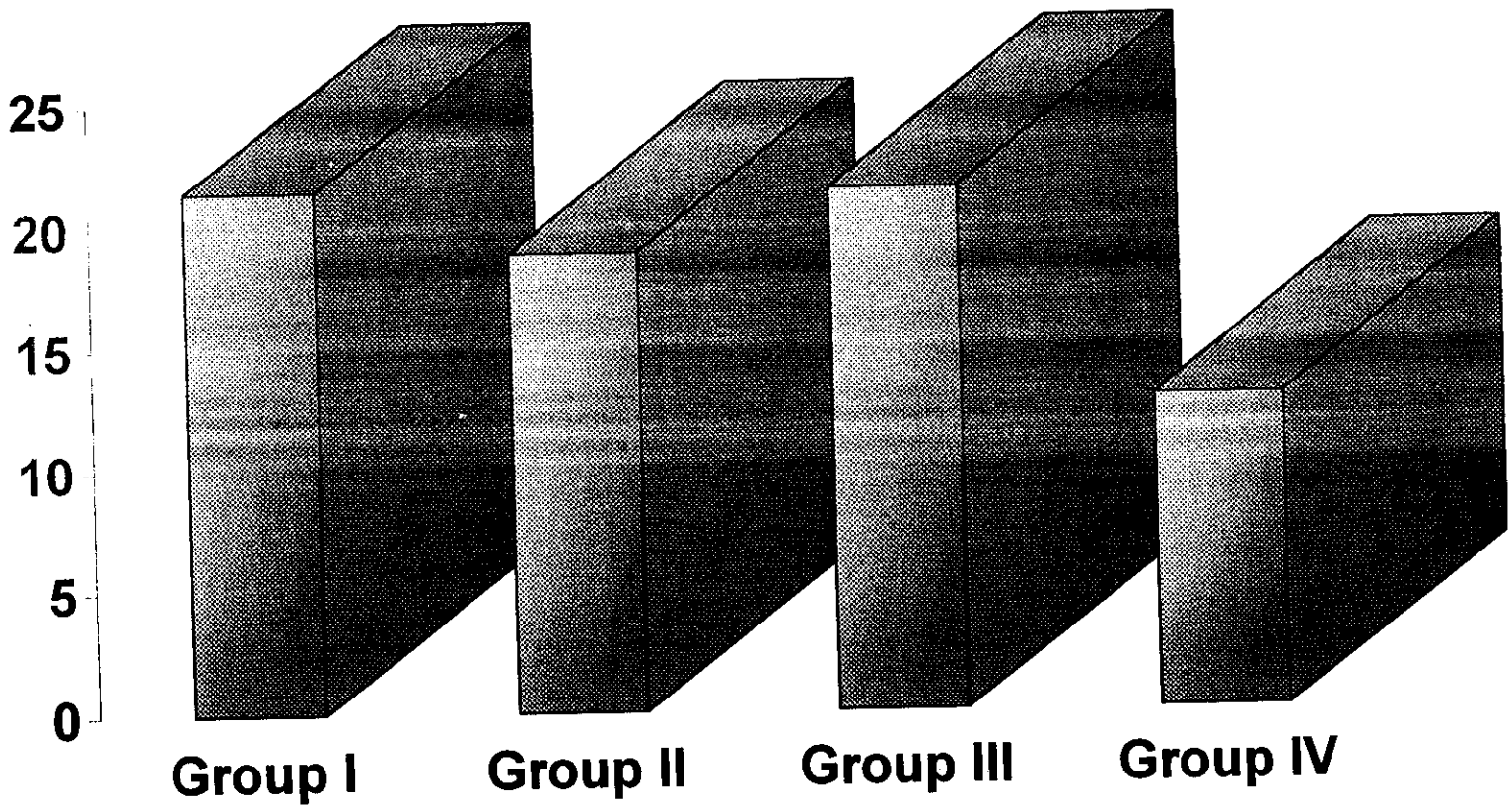

Fig 3: Comparison between hemoglobin levels in different groups (%)

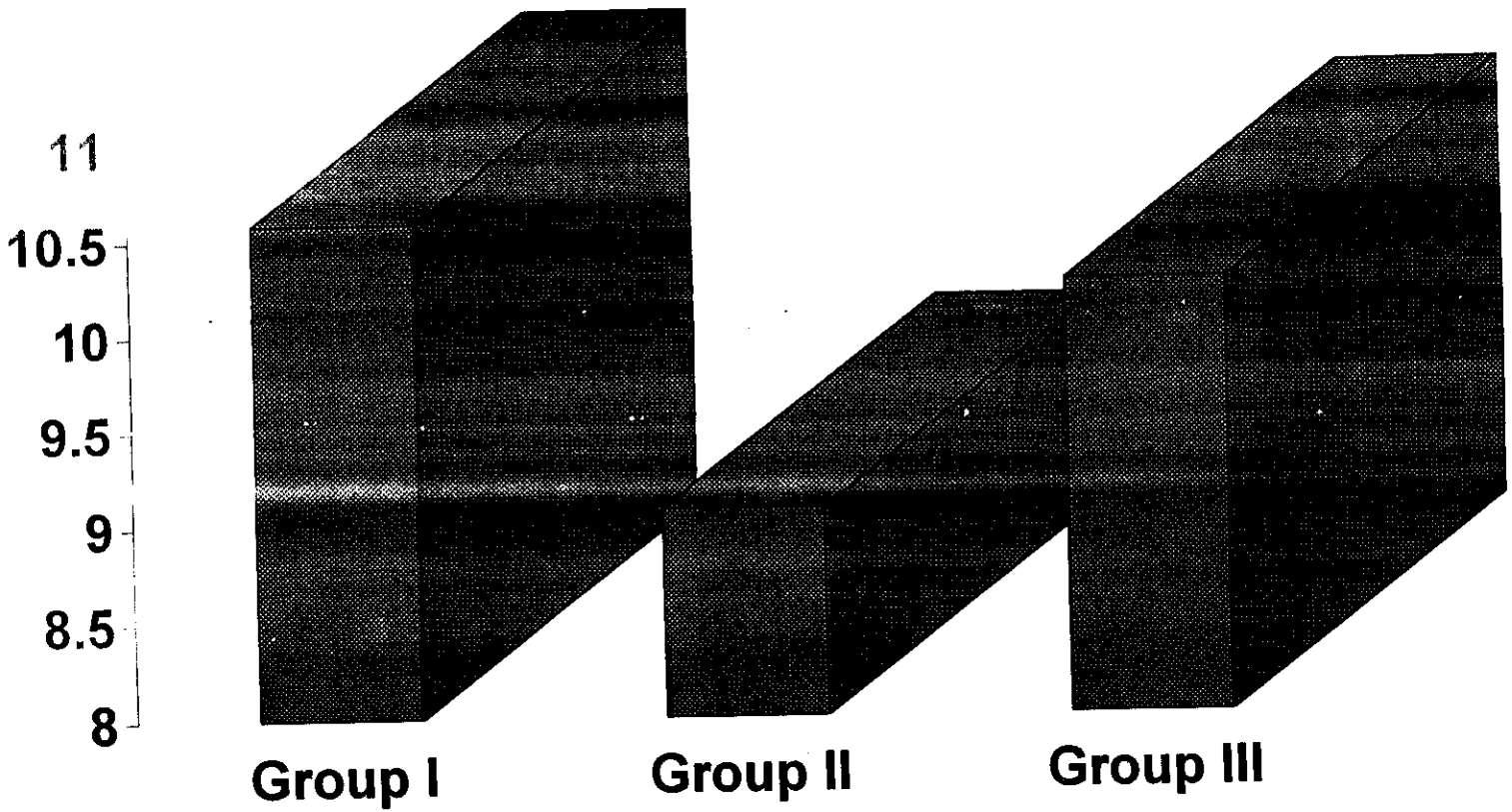

Fig 4: Comparison between hematocrit levels in different groups (vol%)

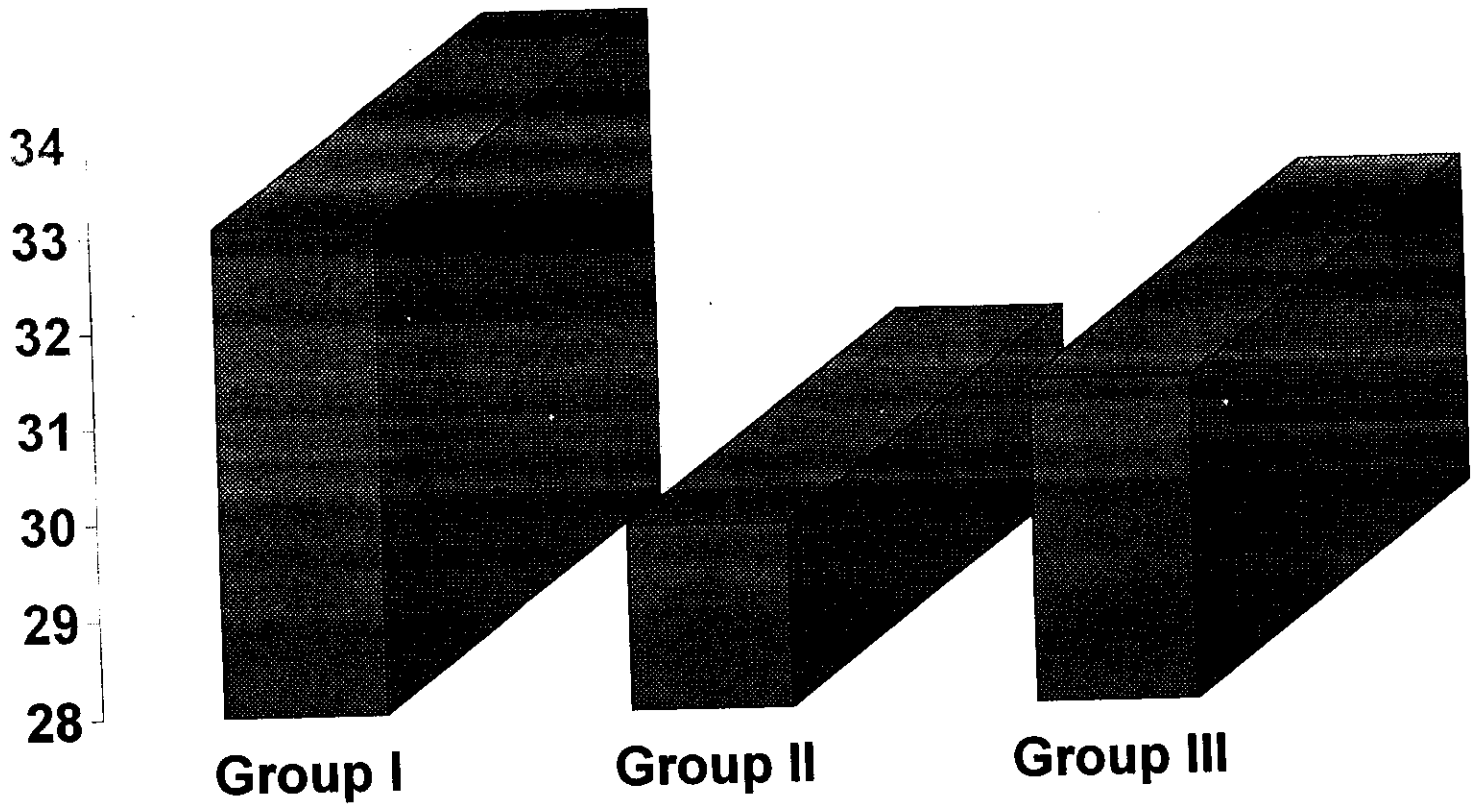

Fig 5: Comparison between serum calcium levels in different groups (mg/dl)

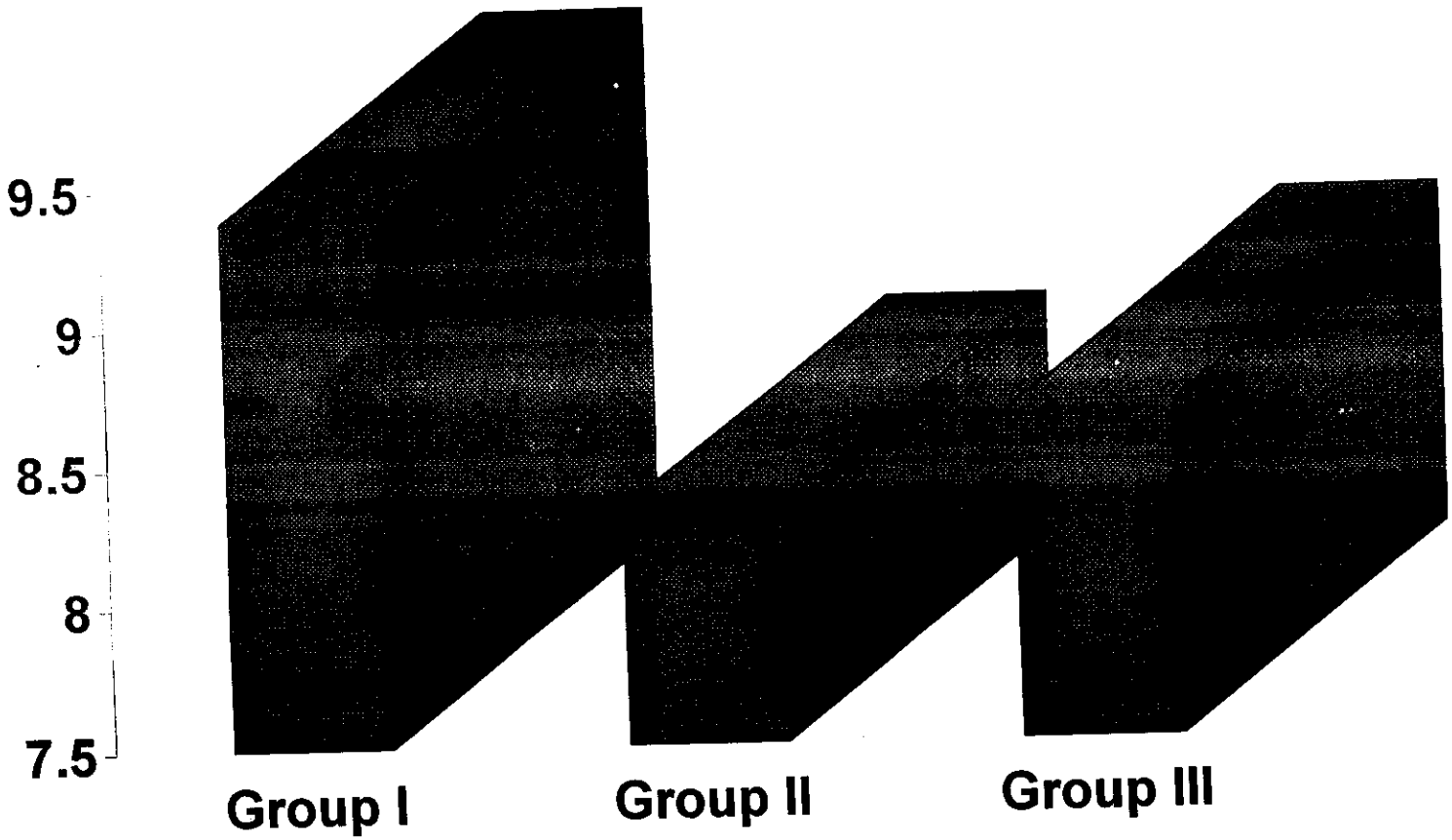

Fig 6: Comparison between corrected serum calcium levels in different groups (mg/dl)

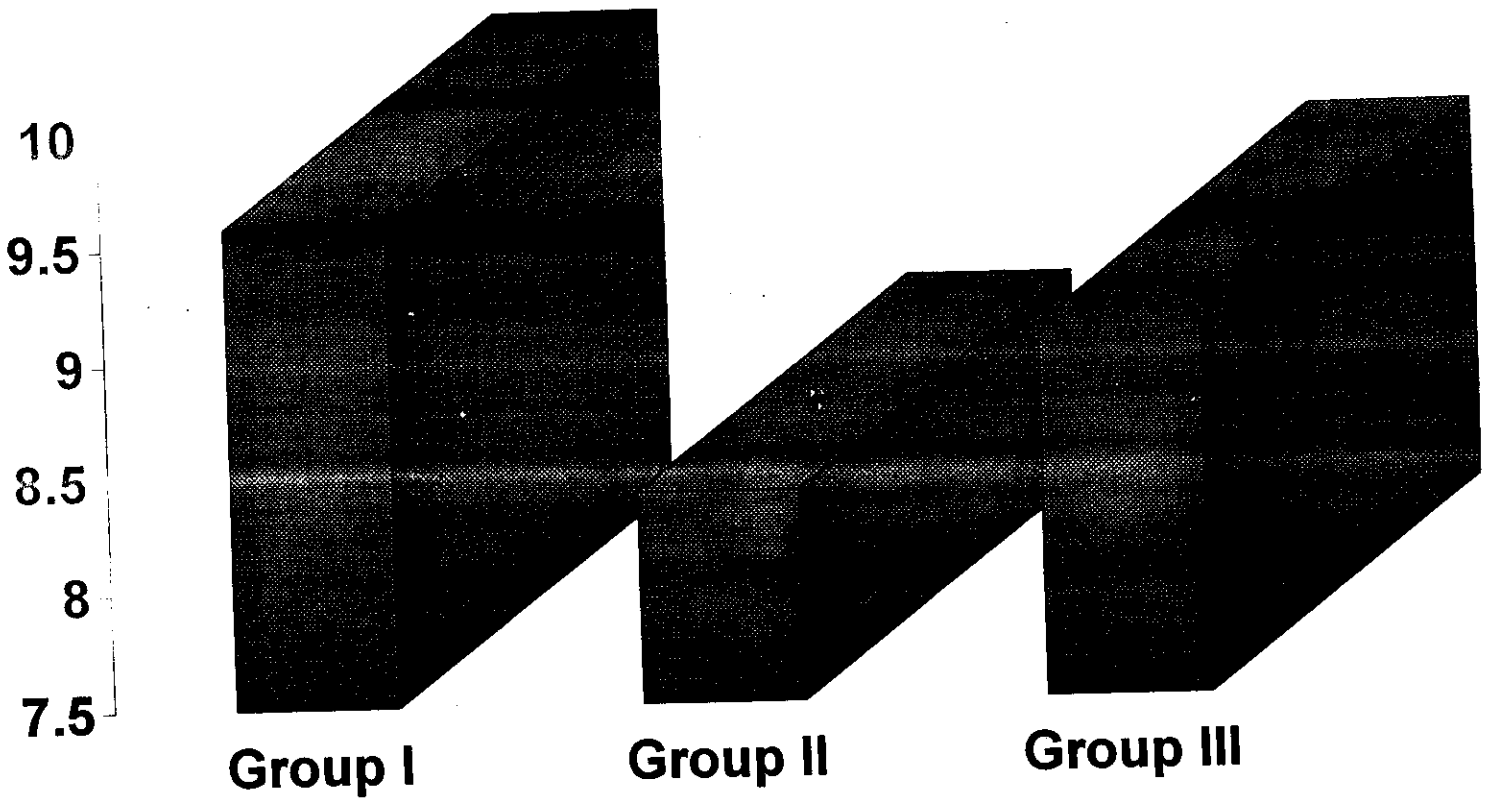

Fig 7: Comparison between serum phosphorous levels in different groups (mg/dl)

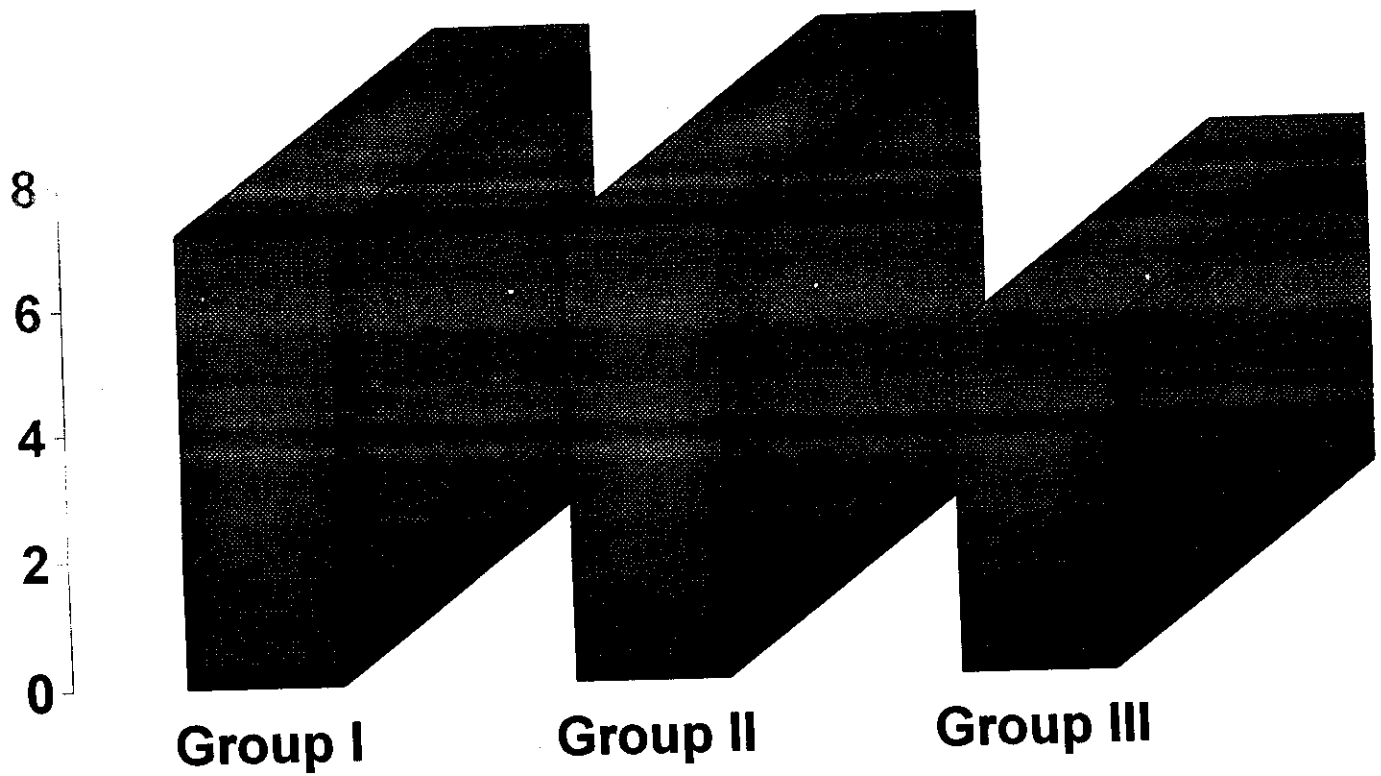

Fig 8: Comparison between serum alkaline phosphatase levels in different groups (IU/L)

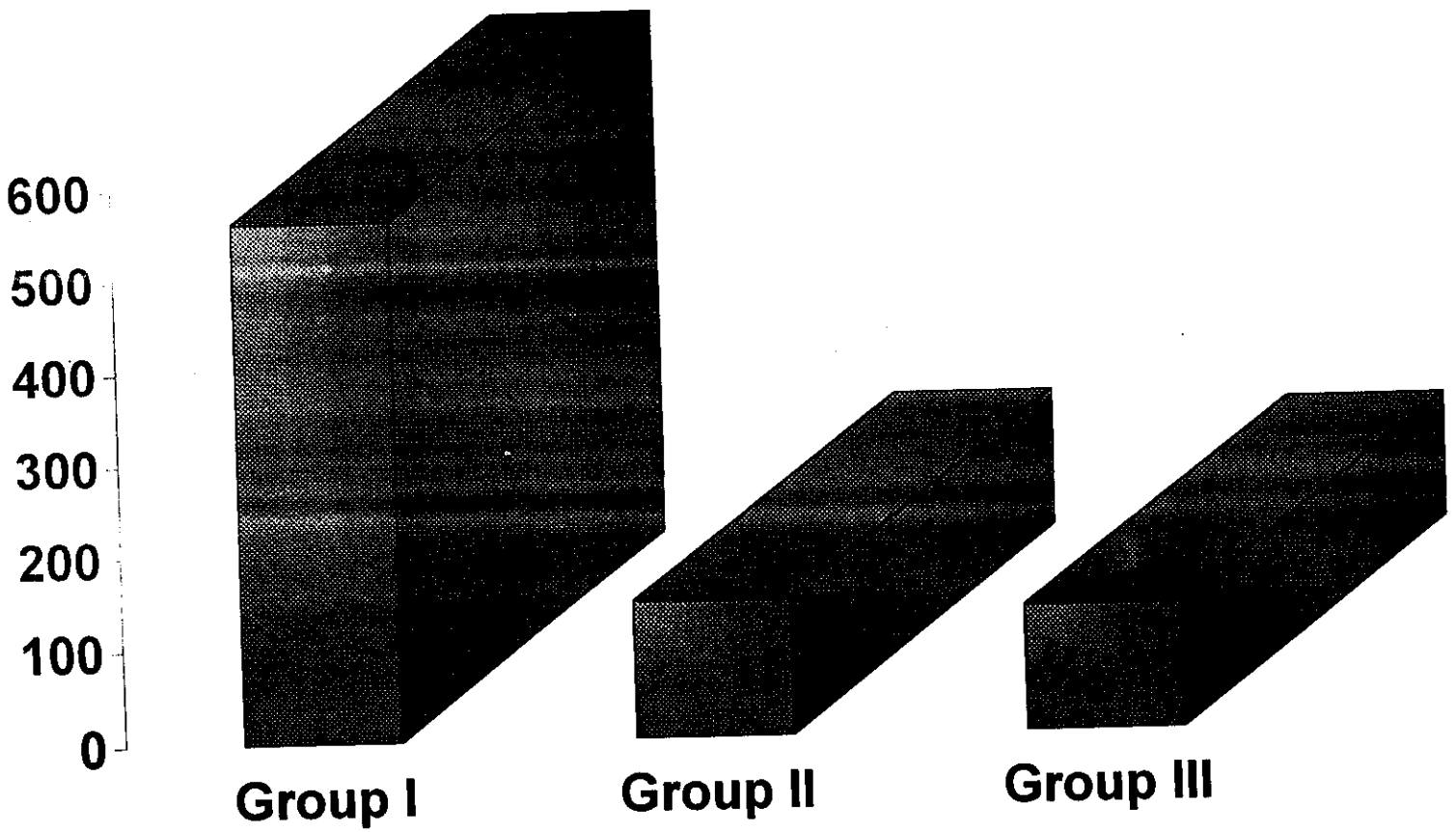

Fig 9: Comparison between serum GOT levels in different groups (IU/L)

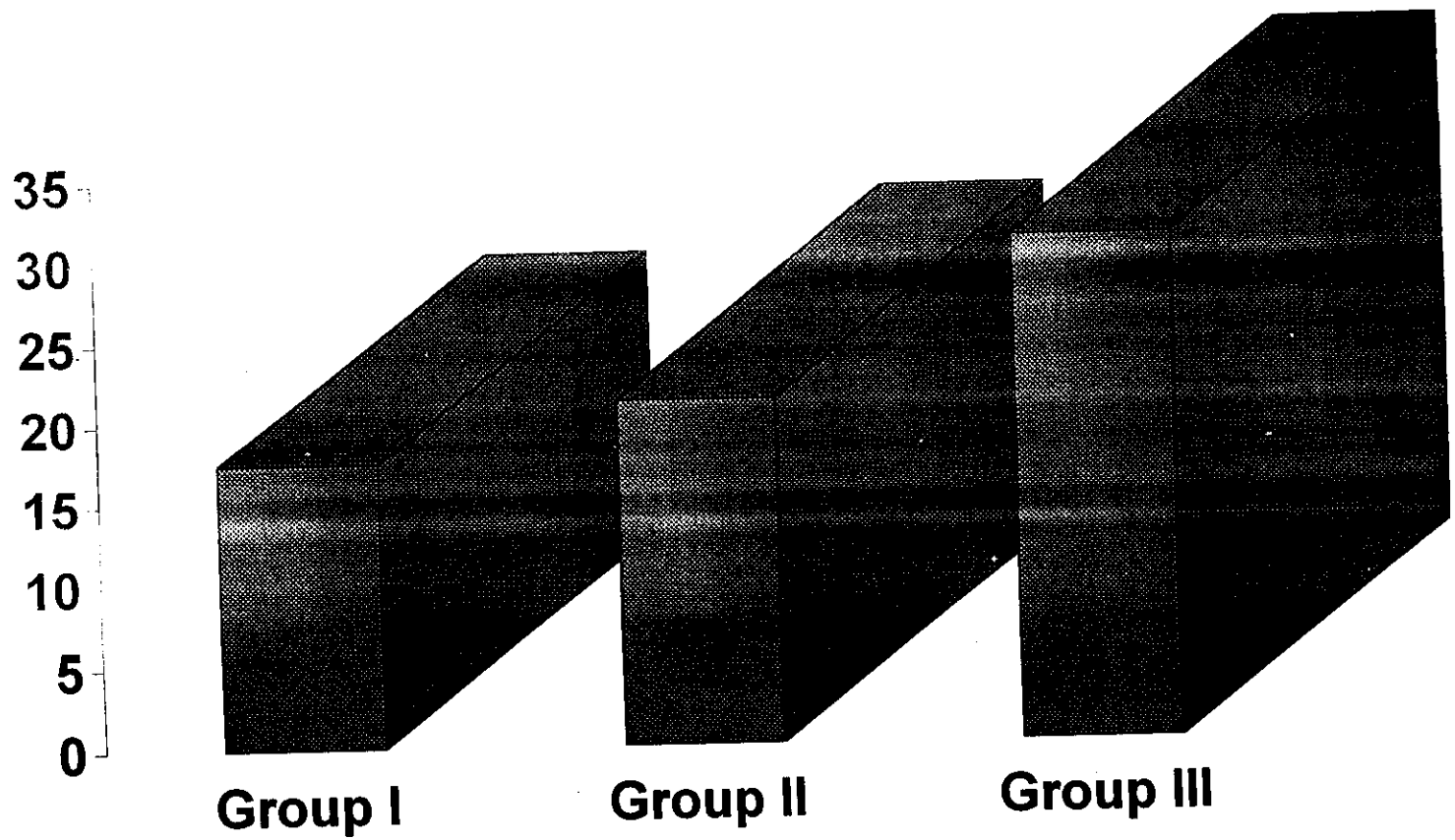

Fig 10: Comparison between serum GPT levels in different groups (IU/L)

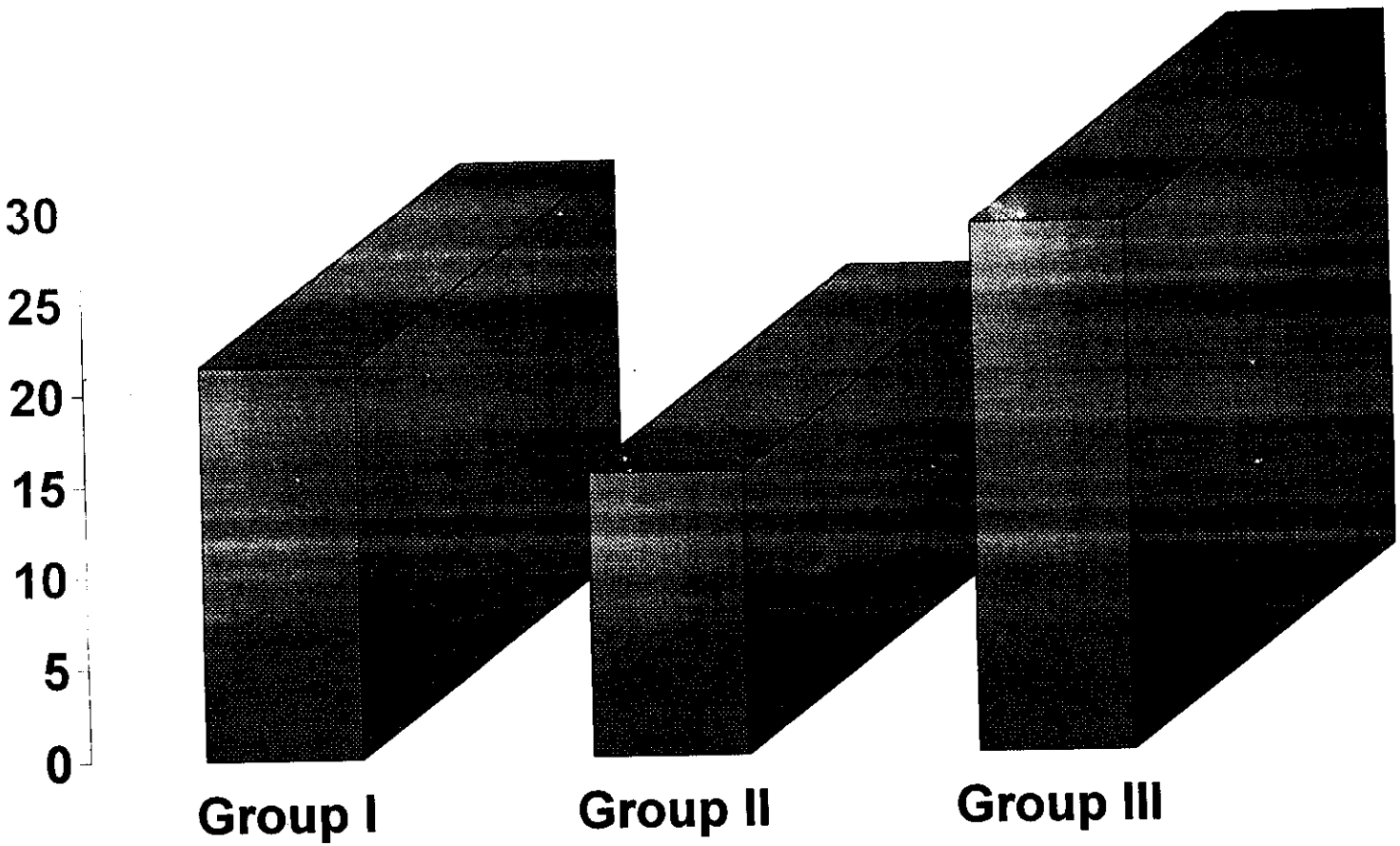

Fig 11: Comparison between serum albumin levels in different groups (gm%)

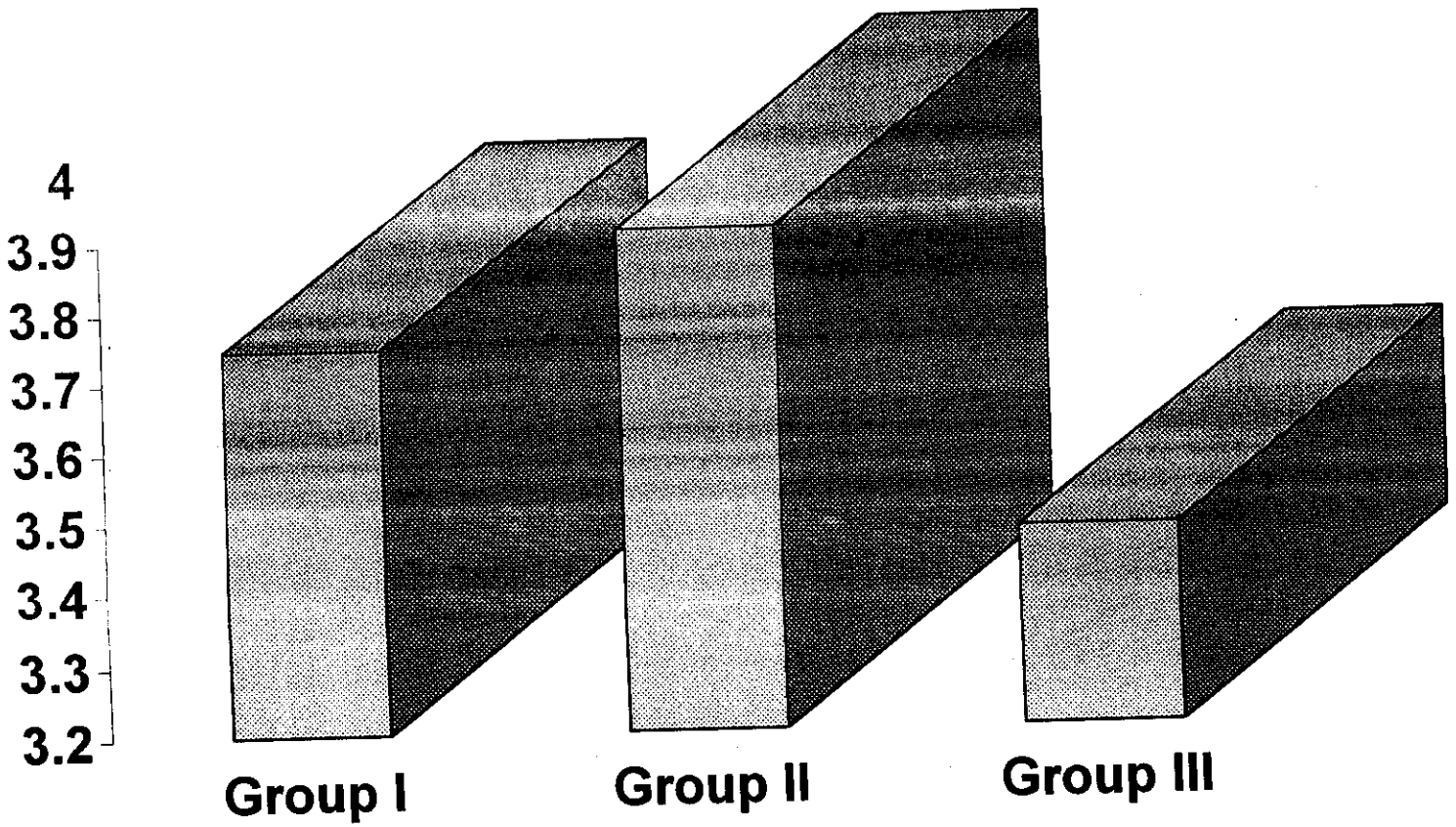

Fig 12: Comparison between parathormon levels in different groups (pg/ml)

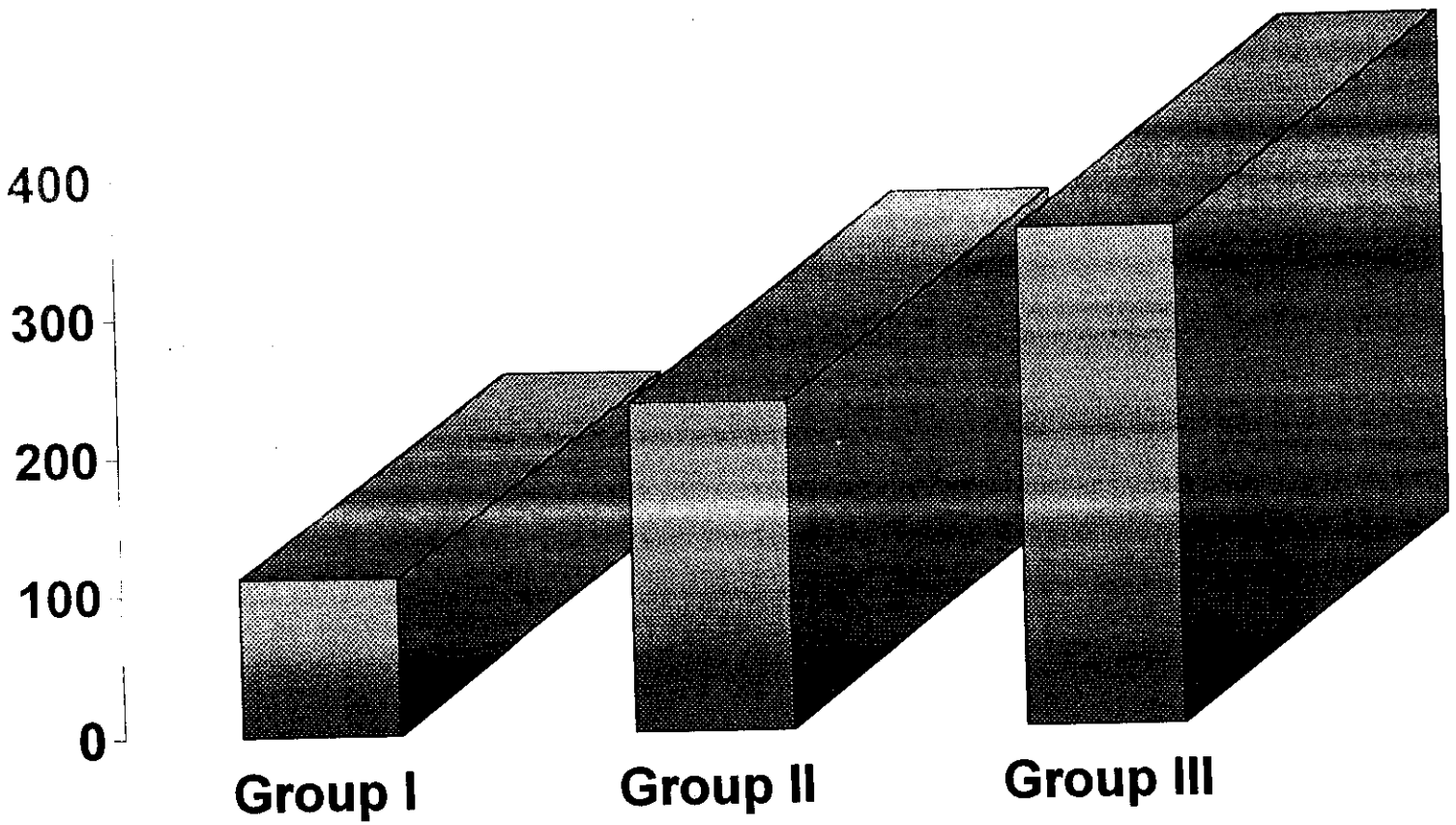

Fig. 13

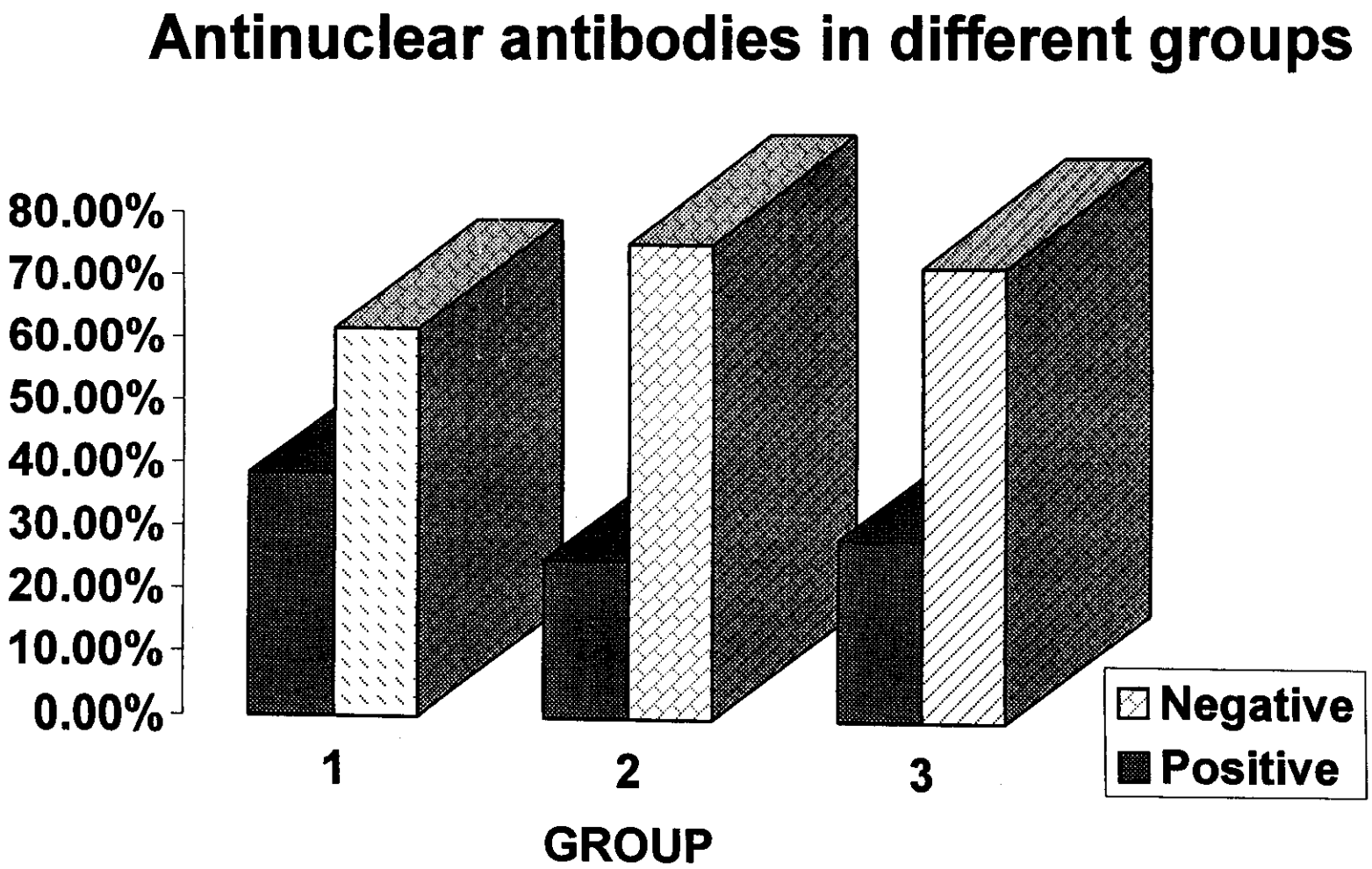
Antinuclear antibodies in different groups
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1
2
3
GROUP
Negative
Positive

Fig. 14

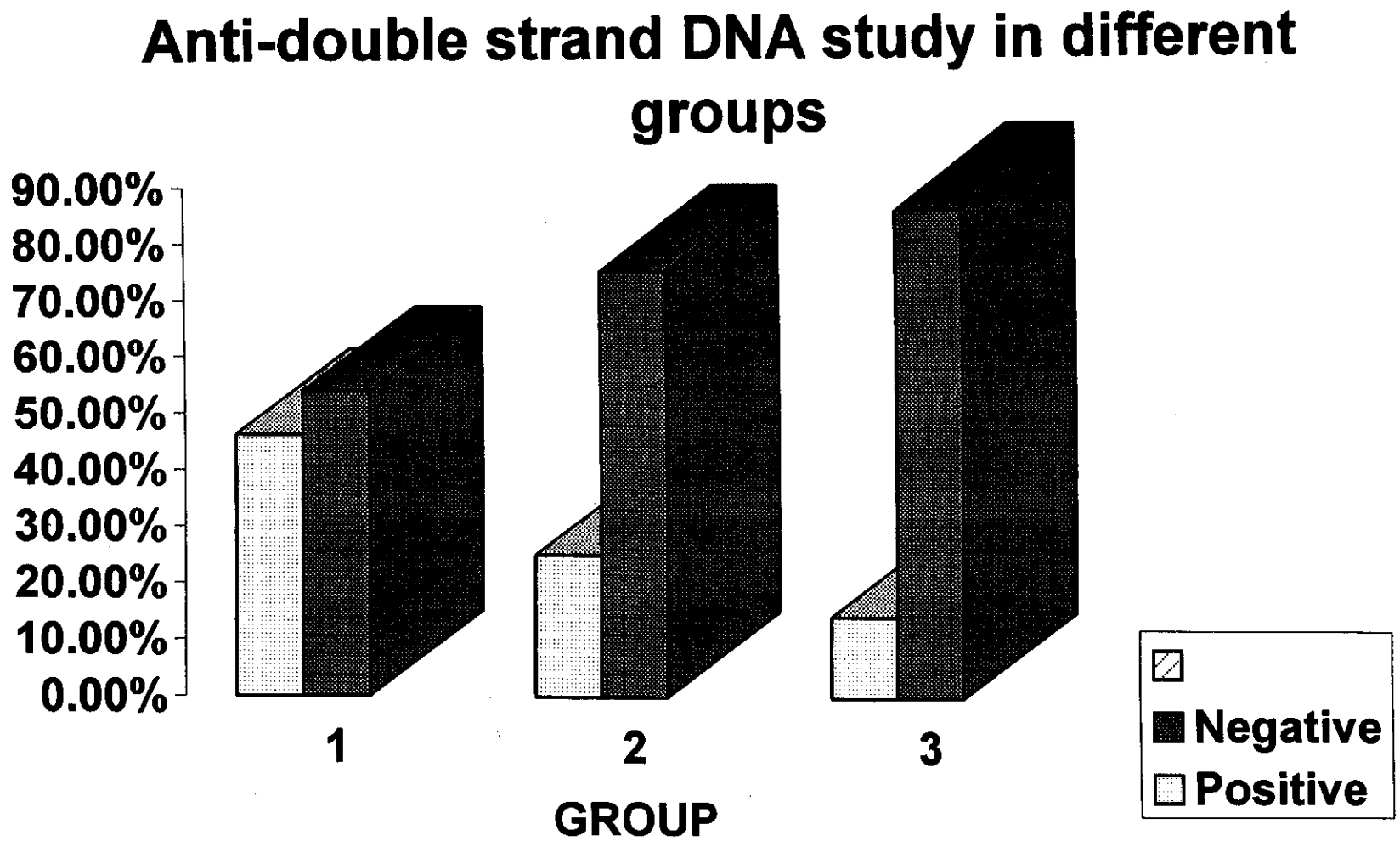
Anti-double strand DNA study in different groups
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1
2
3
GROUP
Negative
Positive

Fig. 15

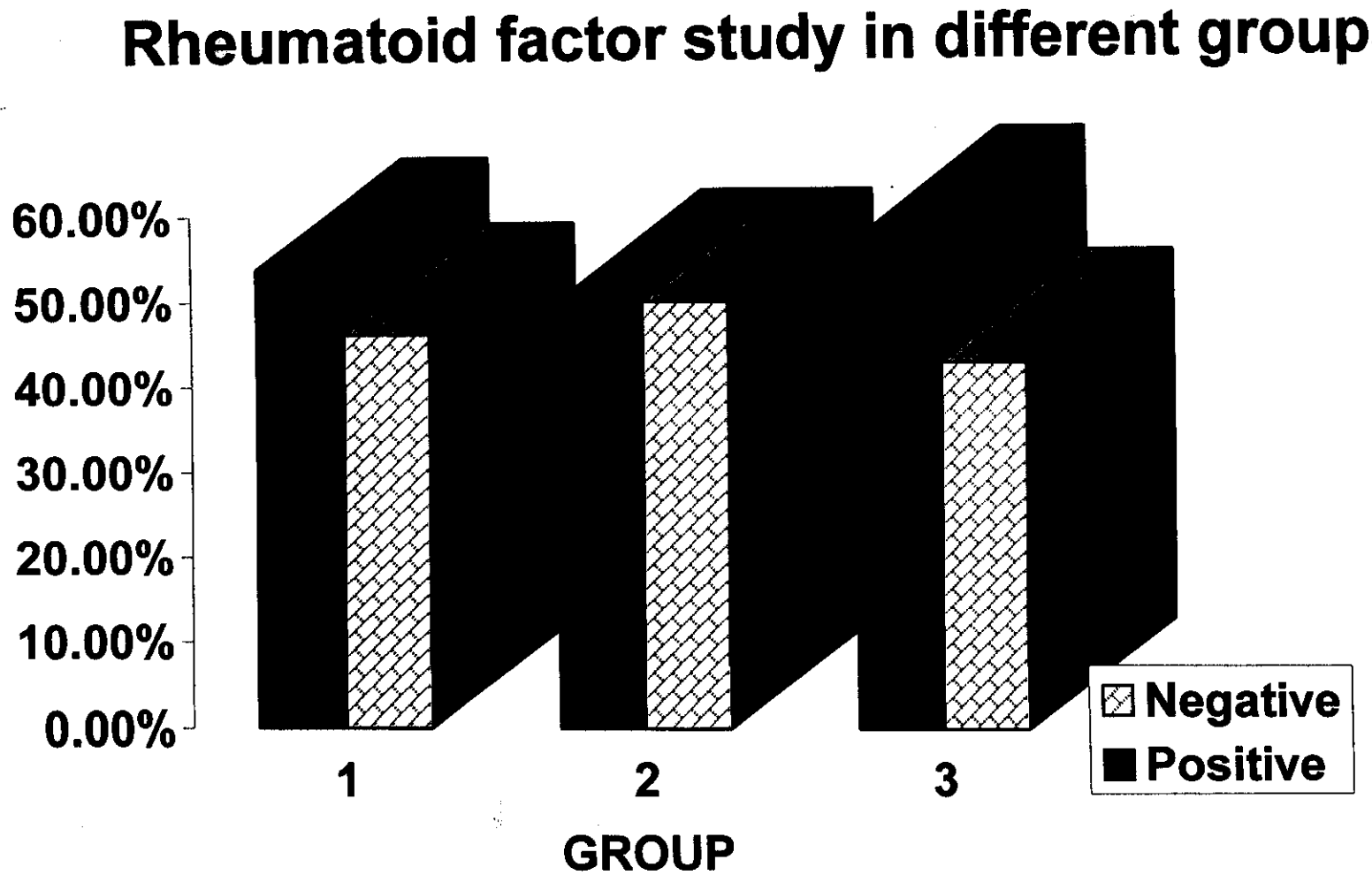
Rheumatoid factor study in different groups
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1
2
3
GROUP
Negative
Positive

Fig. 16

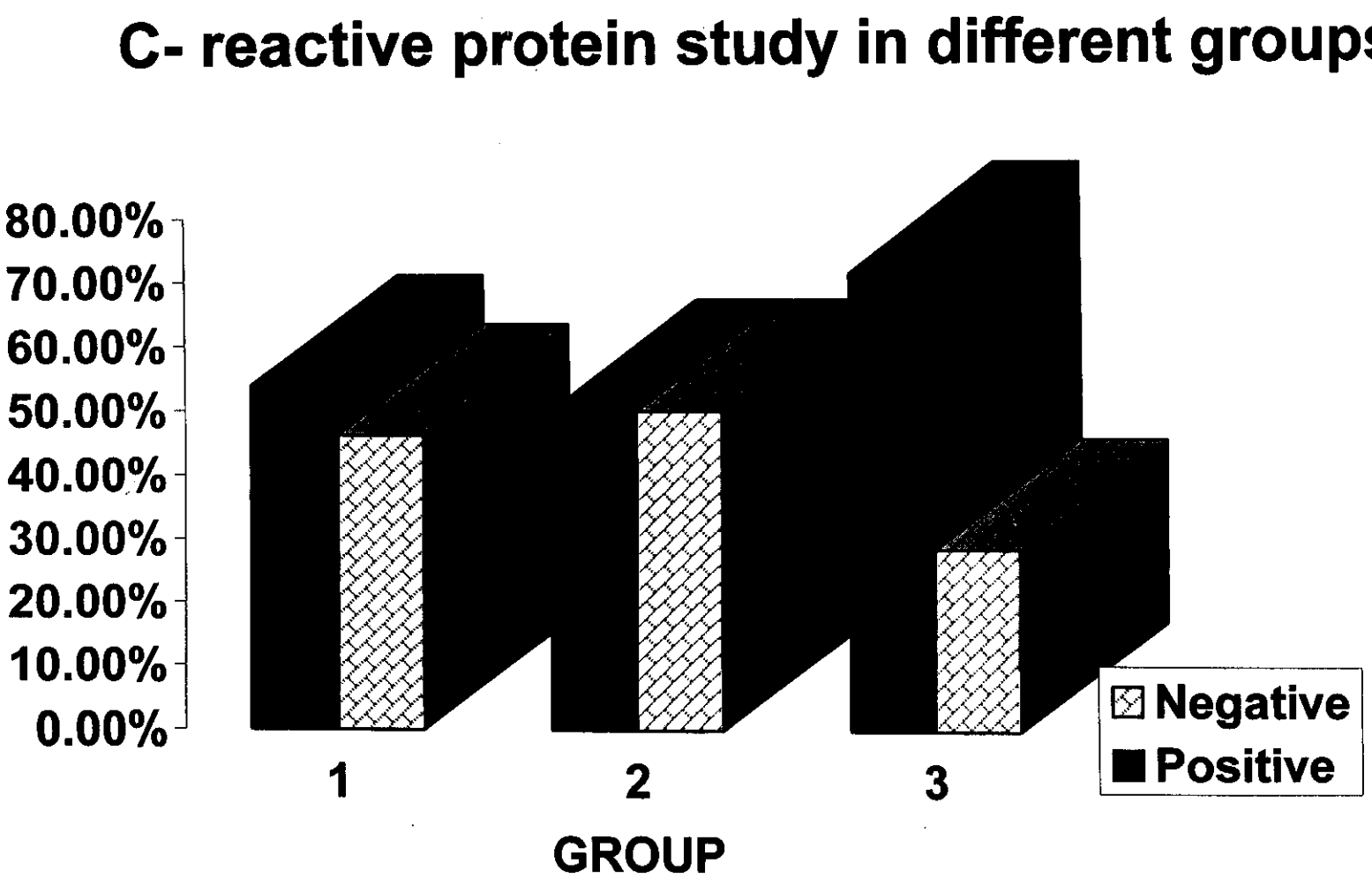
C- reactive protein study in different groups
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1
2
3
GROUP
Negative
Positive

Fig.18: Silicon levels in different groups

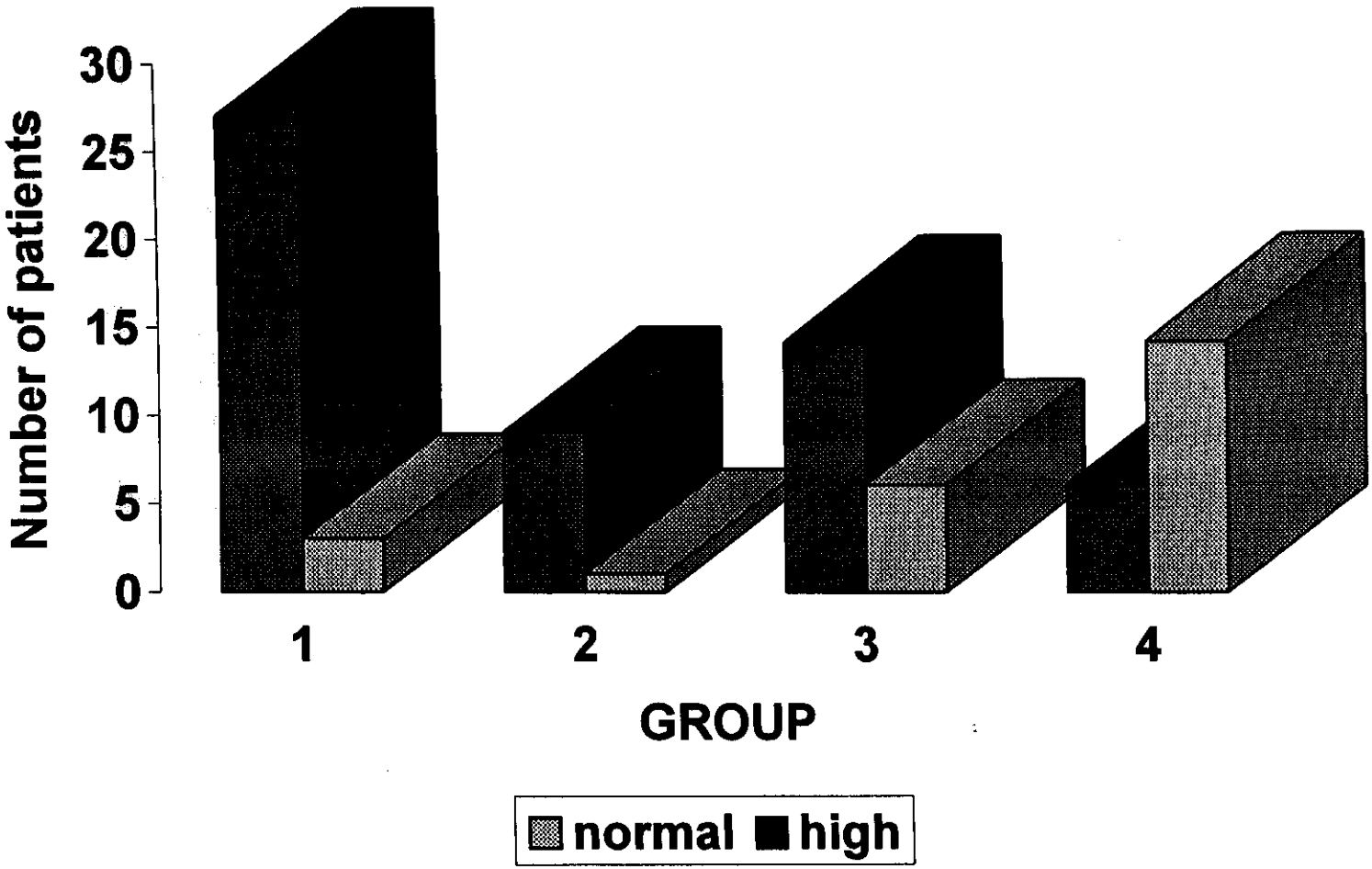

Fig. 19: Correlation between serum silicon and aluminum

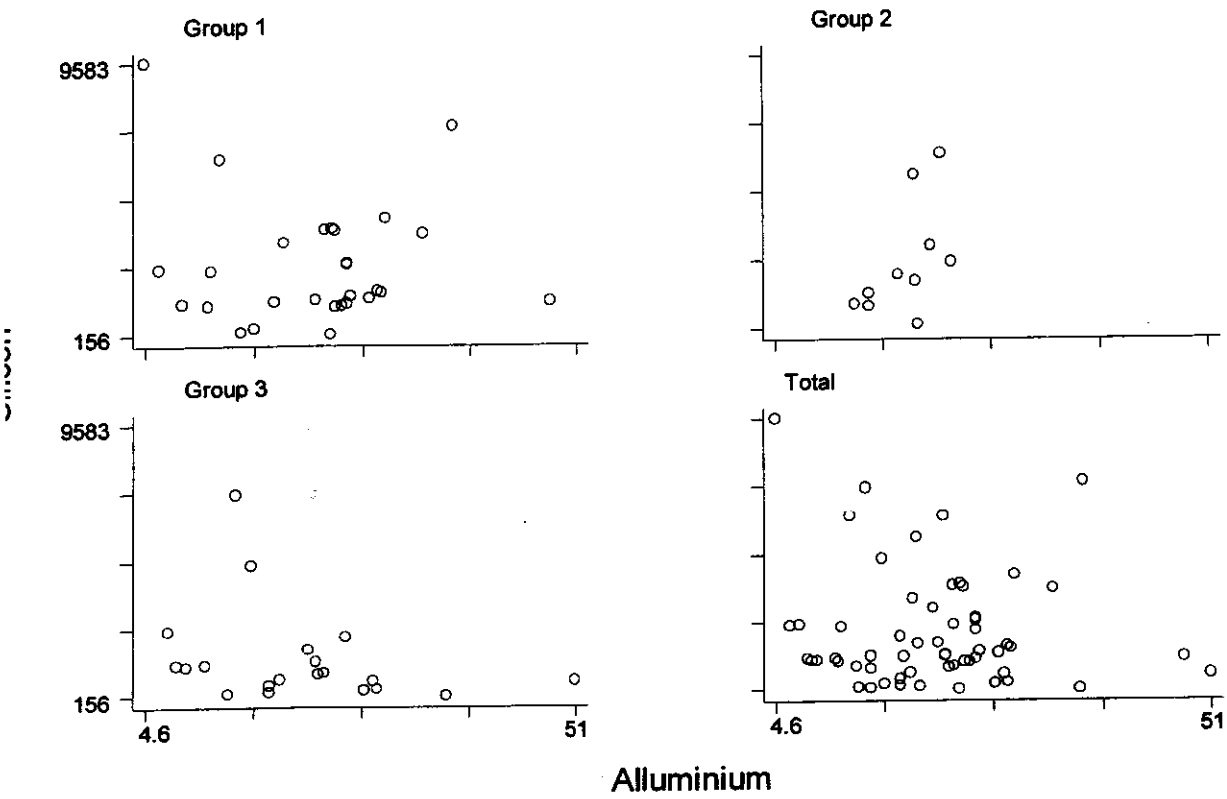

Fig. 20: Correlation between serum silicon and calcium

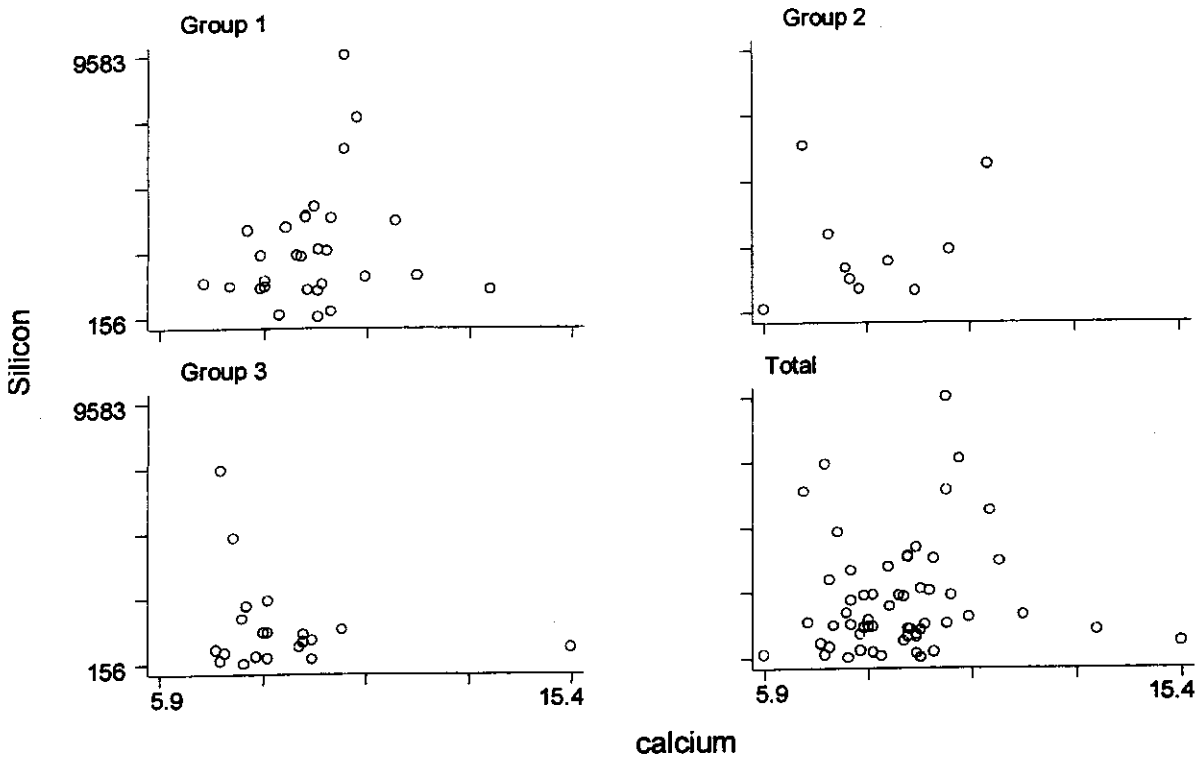

Fig. 21: Correlation between serum silicon and phosphorous

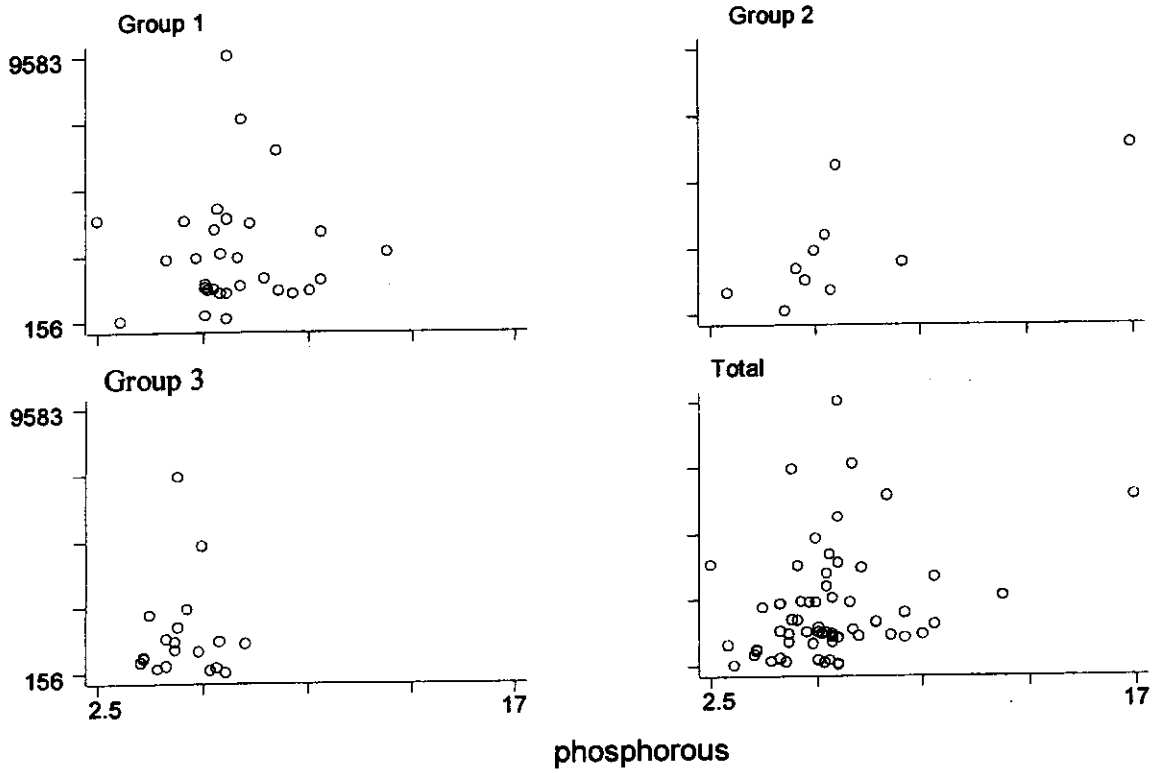

Fig. 22: Correlation between serum silicon and PTH

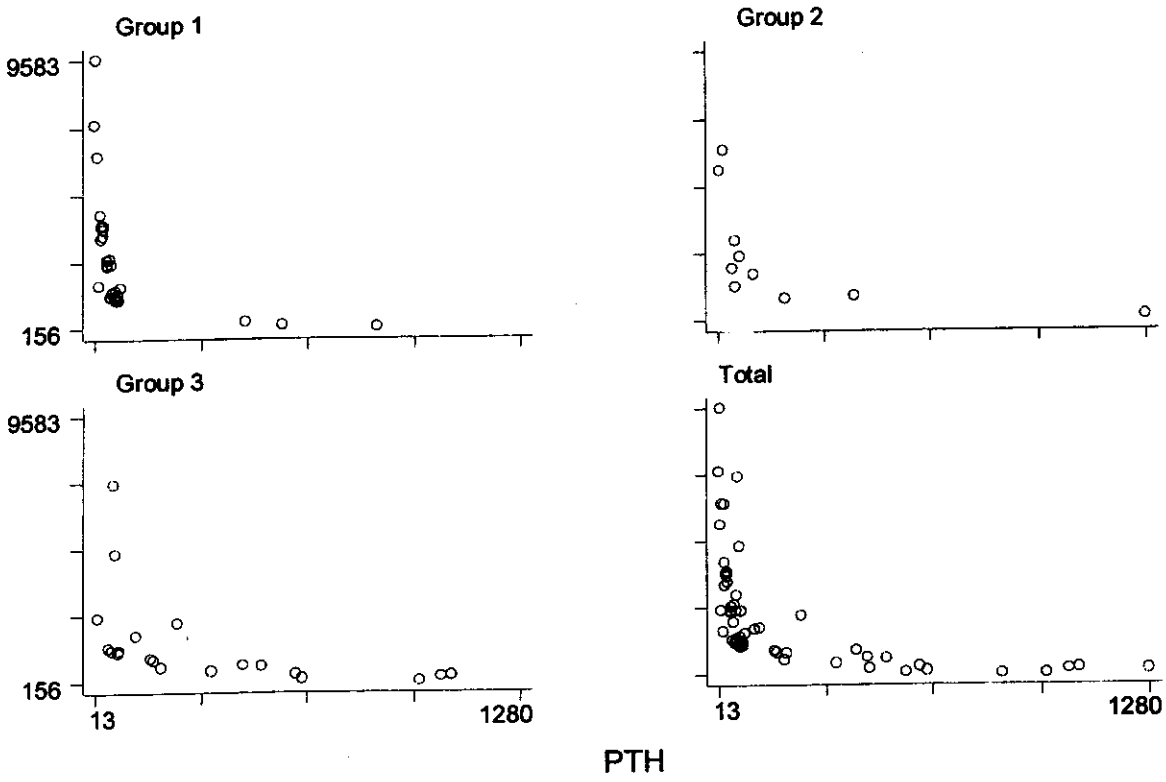

Fig. 23: Correlation between serum silicon and Joint pain

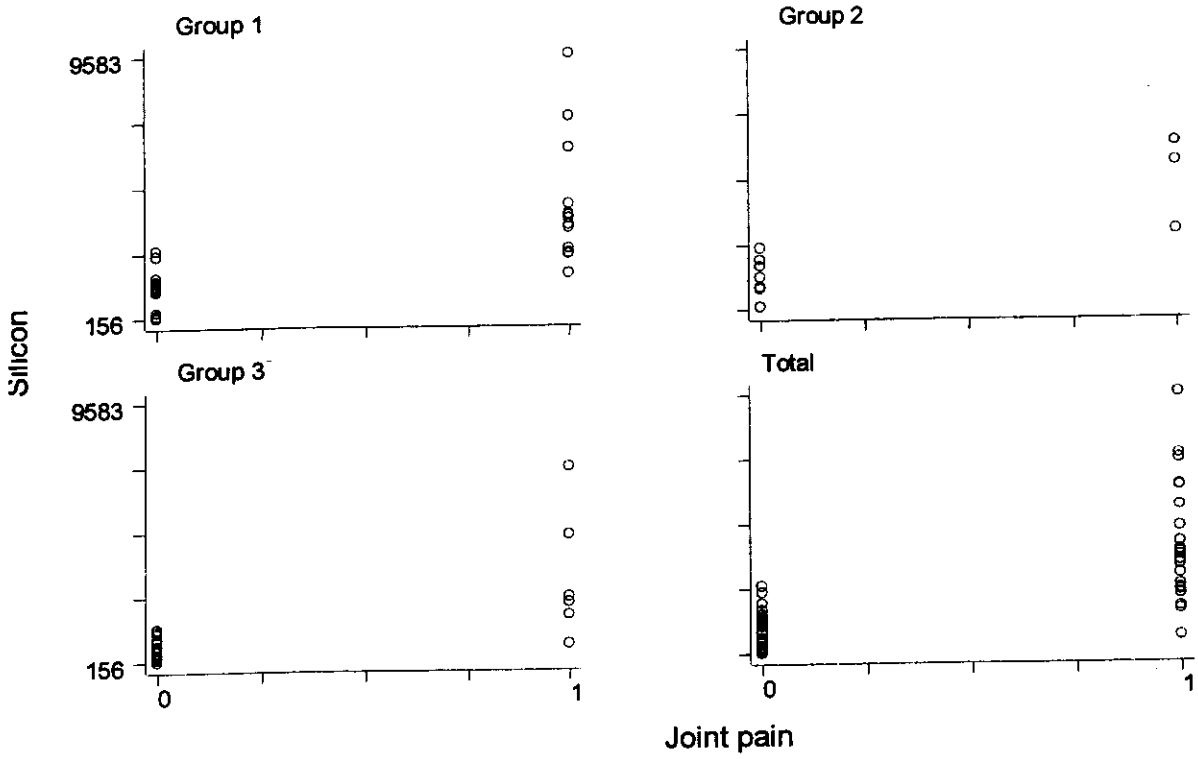

Fig. 24: Correlation between serum silicon and albuminuria