Results

Ninety children and adolescents were included in this study (mean age 12.08 ± 13.3 years), Seventy five of them were IDDM patients (36 females and 39 males) with age range from 4.9 to 18.2 years (mean 12.17 ± 3.45 years); a mean duration of diabetes 6.9 years (range from 0.6 to 14 years) and they were on conventional insulin therapy hading two daily subcutaneous injection at a mean dose of 1.0 IU /kg/day (range 0.5 – 2.1 IU/kg/day), and fifteen normal children and adolescents (as a control group); (6 females and 9 males) with age range from 4.9 – 16.7 years (mean 6.95 ± 6.55 years).

The seventy five patients were divided into three groups according to the duration of disease (IDDM). Fifteen normal children were as control (Group D):

Group A : 25 patients had IDDM for less than 5 years.

Group B : 25 patients had IDDM for 5 to 10 years.

Group C : 25 patients had IDDM for more than 10 years.

Group D : 15 normal children and adolescents as controls.

Every one has been checked and examined well before the including for exclusion of urinary tracked infection and macroalbuminuria by clinical examination , repeated urine analysis and test strips. According to Deckert et al (1992), Anderson and Rocchini (1993), Viberti et al (1994), Chiarelli et al (1997) and Shield et al (1995), microalbuminuria was considered positive at AER (Albumin excretion rate) > 20 and < 200 ug/min or ACR > 2.5 – 25mg/mmol.

The analysis of data is presented as follows:

Demographic and anthropometrics data:

- Tables from 16 – 19 are showing the demographic data of the four groups.
- Tables from 20 – 23 are showing the anthropometric data, puberty stages, clinical data and the complications of IDDM of the three

groups.

- Tables 24 and 25 are showing the difference between groups in demographic and anthropometric data.

The mean age in group **A** was 9.5 ± 2.15 years, in group **B** 10.84 ± 1.21 , in group **C** 16.84 ± 1.32 and in group **D** 6.95 ± 6.55. The mean of insulin dose in group **A** was 0.88 ± 0.22, in group **B** 1.148 ± 0.27 and in group **C** 1.28 ± 0.43. The mean of attacks of Diabetic Ketoacidosis in group **A** was 0.24 ± 0.60, in group **B** 1.32 ± 0.99 and in group **C** 2.08 ± 1/47.

The weight and height were plotted according to the percentile charts.(Hamill PVV et al 1979). Puberty stages were divided to five stages for each gender (Tanner JM 1962) . Blood pressure (systole and diastole) percentile were checked and plotted according to the chart(Bethesda MD 1987). There were no evidence of eye puffiness in group A and B, but there were five diabetic patients who developed mild eye puffiness in the morning for 1-2 hours for two to three times per week with spontaneous improvement. There was no history of limited joint movement or evidence of retinopathy in all groups.

There was no significant statistical difference between groups A, B and D (control) as regard age, sex, height, or weight ($p > 0.05$), while group C (diabetic cases > 10 years) was significantly different from the control group in age, height and weight. There was significant between different diabetic groups in age, sex, duration, height, and weight $p < o.o5$ (Table 24).

There was no significant difference between diabetic groups and the control in blood pressure (systole and diastole), but group C diabetics patients had significantly higher blood pressure than the control group. On comparing diabetic groups there was significant difference, there was significant increase in blood pressure in group C than group A ($t = 14.35$, 13.58 for systolic and diastolic blood pressure respectively) (table 25).

Laboratory data:

- Tables from 44 to47 are showing the laboratory results (urine and serum) for all groups
- Tables 26 and figure 2 are showing the comparison between diabetic groups (A,B,C) and control (D) in hemoglobin A1c (HbA1c), fasting blood sugar (FBS), and random blood sugar (RBS). HbA1c, FBS and RBS were showing significant difference $p < 0.01$ in comparison with control in different diabetic groups. There was also significant increase between different diabetic groups A,B, and C (ANOVA- $p < 0.05$) in HbA1c, FBS, and RBS.
- In table 27 the lipid profile (cholesterol and high density lipoprotein) didn't show significant difference in comparing group A (early diabetic) with control, but was significant in group B and C (late diabetic) $p < 0.01$. Between the different diabetic groups, there was significant difference $p < 0.01$.
- Table 28, the prorenin and nitric oxide were significantly different between different diabetic groups and control groups (Figure 4 and 5), but there was no significant difference between different diabetic groups $p > 0.05$. Sialic acid was not in significant difference between early diabetic (group A) and control (Figure 3), but it was in significant increase between late diabetic groups (B and C) $p < 0.01$. Also, SA had significant difference between different diabetic groups $p < o.o5$.
- Table 29 and figures 6 and 7 are showing the comparison between diabetic groups and control in albumin/creatinine ratio (ACR) and N-acetyl-beta-D-glucosaminidase (NAG). ACR and NAG were in significant difference between early diabetic group (A) and late diabetic groups (B,C) with control (D) $p < 0.01$, also there were significant increase between the different diabetic groups $p < o.o5$.
- Table 30 and figures 8,9 : The creatinine was in significant difference between all diabetic groups and control $p < 0.01$, but between

the different diabetic groups was not significant $p > 0.01$. Urea showed only significant difference between late diabetic (group B and C) and control, but there was significant difference between diabetic groups $p < 0.01$.

The correlation tests (Tables 31 to 37 and Figures 10 to 14):

1. Table 31, 32 and 33 showed that ACR was highly significantly correlated with sailic acid, nitric oxide and prorenin in group A (figure 10,11,12) and B, but only correlated with group C. NAG was highly correlated with ACR in group A and significantly correlated in group B and C. HDL was correlated with ACR in group C but cholesterol was highly correlated in group A and not correlated in other groups. Urea and creatinine were not correlated with ACR in different diaberic groups. HbA1c was highly correlated with ACR in group B and correlated with group A and B. FBS was correlated with ACR in group C. RBS was not correlated in group C but correlated in group A and B. SBP and DBS were not correlated in all diabetic groups.
2. Duration was correlated with sailic acid, NAG, RBS, urea, FBS, and HbA1c, but not correlated with the others (Table 34).
3. Table 35, 36, and 37 showed that NAG was the only test in group A correlated with HbA1c but the others (sailic acid, nitric oxide, and prorenin) were not correlated. In group B and C, NAG, sailic acid, nitric oxide, and prorenin were correlated with HbA1c.
4. From the correlation tests and table 43, we suggested that, the NAG can be used as an early tubuler marker with ACR (glomeruler marker) for overt diabetic nephropathy.

* Sensitivity and specificity tests (tables 38 to 42):

It illustrated sensitivity and specificity of laboratory tests (nitric oxide, sailic acid, NAG, pro-renin, and HbA1c) to the albumin/creatinine ratio, FBS, and RBS. These tables showed that NAG had sensitivity 77% and specificity 73%. Nitric oxide had sensitivity 77% and specificity 78%. Sialic acid had sensitivity 59% and specificity 90%. Prorenin had sensitivity 69% and specificity 90%. They can be used in follow up of DN patients.

* Table 43 and Diagrame 1, showed that in group A (early diabetic < 5 years duration of IDDM) seven cases with group I (diabetic patients with significant elevation the level of ACR). There were three cases with high level NAG with group II (with normal level of ACR), and one case with high level of nitric oxide and group II. We can suggest that NAG can be as an early marker for overt DN.

* Tables from 48 to 50 are showing the neurological condition of diabetic patients, Sensory neuropathy (Parasthesia, sensory loss, pinprick, vibration, ankle and knee reflexes), and autonomic neuropathy (week stream of urine, residual urine, palpitation, and postural hypotension). Group A, there was only one case with postural hypotension, this case also was anemic. Group B, there was only one case with postural hypotension and palpitation, but no murmur or other signs. Group C, there were three cases with residual urine and postural hypotension (one of them with peripheral parasthesia), there was also one case with parasthesia.

Table (16) Demographic data of group A :

No.	Age (Year)	Sex	Dur (Year)	Insulin Dose U/kg/day	No. of DKA	FH. DM	FH. HBP	Cons.
1	10	F	4.5	0.6	–	–	–	–
2	6	M	0.9	0.8	–	IDDM	–	–
3	8	M	3.2	0.7	–	–	+	First
4	11	M	2	0.9	–	–	+	First
5	7.4	F	1.9	1	1	–	–	–
6	10.9	F	3.8	1.2	–	NIDDM	–	Second
7	6.5	M	0.8	0.5	–	IDDM	–	First
8	9	F	1	0.8	–	–	–	–
9	8.3	F	2.2	0.9	2	–	–	–
10	12.3	M	4.2	1	–	–	+	–
12	9.5	F	5	0.9	–	IDDM	–	First
13	12.8	F	3.8	1	–	–	–	Second
15	8.5	F	3	0.8	1	–	–	–
17	11.5	F	4	0.6	–	–	–	–
18	8	M	2.5	0.9	–	NIDDM	+	–
19	9.8	M	3.6	1	–	–	–	–
20	6.9	M	4	1.2	–	–	–	–
21	7	M	1	1.3	–	–	–	Second
22	10.2	F	0.6	1.0	2	–	–	–
23	7	F	3.9	0.7	–	–	+	–
24	10	F	4	0.8	–	–	–	–
25	12	M	4.2	0.9	–	–	–	–

Dur = Duration. Ins.= insulin (dose)
DKA = Diabetic Ketoacidosis. FH. HBP = Family history of hypertension.
FH. DM = Family history of diabetes mellitus.
Cons = consanguinity.
IDDM = Insulin dependent diabetes mellitus.
NIDDM = Non- Insulin dependent diabetes mellitus.

Table (17) Demographic data of group (B):

No.	Age (year)	Sex	Dur (year)	Insulin Dose U/kg/day	No. of DKA	FH. DM	FH. HBP	Cons.
1	11	M	6	1	1	NIDDM	--	--
2	13.5	F	5.7	1	2	--	--	--
3	9.2	F	6	1	3	--	--	First
4	8.7	F	5.5	1.3	1	--	--	First
5	7.3	M	5	1.6	--	IDDM	--	--
6	8.9	M	6	1	--	IDDM	+	--
7	12	F	6.9	1	1	--	--	--
8	13.6	M	7.2	0.9	1	--	--	--
9	11.5	M	6	1.1	3	NIDDM	--	First
10	8.3	M	5.9	1	--	--	--	Second
11	10.7	F	6.2	1	2	--	--	--
12	14	F	5.1	0.9	1	--	--	--
13	12.6	F	6.3	1.5	--	IDDM	=	--
14	10.7	M	5.2	1.4	2	NIDDM	+	--
15	8	M	5	1.2	2	--	+	--
16	11.5	M	6.5	0.9	2	--	--	--
17	9.9	F	6.9	1	1	--	--	First
18	11.9	M	6.8	1	--	--	--	First
19	13.6	F	7	1.5	--	NIDDM	--	--
20	12.5	M	8.2	2	2	--	--	--
21	6.8	M	5	1.2	1	--	--	--
22	13.3	F	8.9	0.9	3	--	--	--
23	10.5	F	7.2	1.2	2	--	--	--
24	9.3	F	8.2	0.9	1	--	--	--
25	11.7	F	7	1.2	2	--	--	--

Table (18) Demographic data of group C :

No.	Age (year)	Sex	Dur (year)	Insulin Dose U/kg/day	No. of DKA	FH. DM	FH. HBP	Cons.
1	16.5	M	10.2	0.7	1	NIDDM	--	First
2	16.9	F	11	0.9	2	IDDM	--	--
3	15.9	F	10	2	4	IDDM	--	--
4	17.5	M	12.3	1.7	3	NIDDM	+	--
5	15.8	F	11.5	1.2	1	IDDM	--	--
6	14.7	F	12.9	0.8	1	--	--	--
7	15.5	M	10	0.9	2	--	--	Second
8	17.4	M	11.7	1.6	3	--	--	Second
9	18.2	M	13	2.1	5	NIDDM	--	--
10	14.7	F	10.9	1.5	4	--	--	Second
11	14	F	11.8	1.5	3	--	+	--
12	13.9	M	11	1.3	2	-	+	--
13	17.3	F	10.7	0.9	2	IDDM	--	Second
14	18.2	M	11.6	0.6	2	--	--	First
15	17.7	M	13.1	1.7	4	--	--	Second
16	15.5	M	10.2	1.4	--	--	+	--
17	17.9	F	13.3	1.6	4	NIDDM	+	--
18	16.5	F	12.7	0.8	3	--	+	--
19	14.4	F	11	1.2	3	--	--	--
20	15.9	M	10.4	0.8	--	--	--	Second
21	16.3	M	12.9	2	--	--	--	Second
22	14.7	M	11	1.3	--	IDDM	--	First
23	16.2	F	13.4	1.5	1	--	--	--
24	17.5	M	14	0.9	1	--	--	--
25	15.7	F	10	1.1	1	--	--	--

Table (19) Demographic data of group D:

No.	Age (year)	Sex	FH. DM	FH. HBP	Cons.
1	6	M	NIDDM	--	--
2	8.2	M	--	--	--
3	13	M	--	--	--
4	15.5	F	--	+	--
5	4.9	M	--	+	--
6	10	M	IDDM	--	Second
7	11.5	F	--	--	second
8	14.5	F	--	--	First
9	16.7	F	--	+	--
10	6	F	--	--	--
11	9.3	M	--	--	--
12	14	M	--	--	First
13	12.5	M	--	--	--
14	16.7	F	--	--	--
15	15	M	--	--	--

FH. HBP = Family history of hypertension.
FH. DM = Family history of diabetes mellitus.
Cons = consanguinity.
IDDM = Insulin dependent diabetes mellitus.
NIDDM = Non- Insulin dependent diabetes mellitus.

Table (20) Anthropometric measurements, pubertal stages and clinical data of diabetic patients (A):

No.	Wt./ Centile	Ht. / Centile	Pub. stage	SBP / Centile	DBP / Centile	Eye Puffy	LJ M.	R.
1	30/25	130/10	II	100/50	60/50	_	_	_
2	22/50	115/50	I	100/75-50	60/75-50	_	_	_
3	23/25	121/10	I	95/<50	60/50	_	_	_
4	37/50	140/25	I	100/<50	60/<50	_	_	_
5	22/25	117/10	I	105/75	60/50	_	_	_
6	36/50	140/25	II	105/50	65/50	_	_	_
7	23/50	113/10	I	100/75-50	55/<50	_	_	_
8	25/25	126/25	I	105/75-50	60/50	_	_	_
9	26/50	124/50	I	100/50	55/<50	_	_	_
10	37/25	145/25	II	100/<50	60/<50	_	_	_
11	40/25	145/10	II	110/50	60/<50	_	_	_
12	30/50	126/10	I	105/75-50	60/50	_	_	_
13	32/10	147/25	II	105<50	60/<50	_	_	_
14	42/50	152/50	III	110/50	65/<50	_	_	_
15	25/10	122/25	I	100/50	65/75-50	_	_	_
16	28/50	127/25	I	105/75-50	65/50	_	_	_
17	31/10	136/5	II	100<50	60/<50	_	_	_
18	22/10	121/10	I	100/50	60/<50	_	_	_
19	27/25	130/10	I	110/75	60/75-50	_	_	_
20	21/25	114/10	I	100/50	60/50	_	_	_
21	23/50	118/25	I	100/75	60/50	_	_	_
22	25/5	130/10	II	105/75-50	65/50	_	_	_
23	20/25	114/10	I	105/75	60/50	_	_	_
24	28/25	132/25	II	100<50	60/<50	_	_	_
25	31/5	140/10	II	105<50	65/<50	_	_	_

Wt. = weight. Ht. = height. Pub. = Puberty.
SBP. = Systolic blood pressure. DBP. = Diastolic blood pressure.
LJM.= limited joint mobility. R. = Retinopathy.

Table (21) Anthropometric measurements, pubertal stages and clinical data of diabetic patients (B):

No.	Wt./ Centile	Ht. / Centile	Pub. stage	SBP / Centile	DBP/ Centile	Puffy Eye	LJ M.	R.
1	32/25	135/10	I	105/50	60/<50	–	–	–
2	47/50	150/10	III	120/90-50	70/75-50	–	–	–
3	24/10	130/25	I	100/50	55/<50	–	–	–
4	23/25	127/50	I	95/<50	55/<50	–	–	–
5	20/10	117/10	I	105/75	60/75-50	–	–	–
6	28/50	130/50	I	100/50	65/75-50	–	–	–
7	36/25	142/10	II	100/<50	60/<50	–	–	–
8	43/25	150/10	II	115/75-50	60/<50	–	–	–
9	37/50	140/25	II	110/75	70/75	–	–	–
10	19/25	120/10	I	100/50	65/75-50	–	–	–
11	26/5	133/10	I	105/75-50	65/75-50	–	–	–
12	50/50	155/25	IV	120/90-75	70/75-50	–	–	–
13	42/50	155/25	II	105/<50	65/50	–	–	–
14	38/50	137/25	I	105/50	65/50	–	–	–
15	25/50	124/25	I	100/50	65/75-50	–	–	–
16	37/50	140/25	II	110/75-50	65/50	–	–	–
17	25/10	130/10	I	105/75-50	60/50	–	–	–
18	31/10	143/25	I	110/75-50	70/75-50	–	–	–
19	44/25	155/25	III	110/50	60/<50	–	–	–
20	37/25	147/25	II	115/75	70/75-50	–	–	–
21	20/25	113/10	I	95/50	55/<50	–	–	–
22	42/25	155/25	III	115/75-50	70/75-50	–	–	–
23	34/50	135/25	II	105/75-50	65/75-50	–	–	–
24	27/25	127/10	I	11/<50	60/<50	–	–	–
25	30/10	137/5	II	105/50	60/<50	–	–	–

Wt. = weight. Ht. = height. Pub. = Puberty.
SBP. = Systolic blood pressure. DBP. = Diastolic blood pressure.
LJM. = limited joint mobility. R. = Retinopathy.

Table (22) Anthropometric measurements, pubertal stages and clinical data of diabetic matients (C):

No.	Wt./ Centile	Ht. / Centile	Pub. stage	SBP / Centile	DBP / Centile	Puffy Eye	LJ M.	R.
1	55/25-10	165/10	IV	120/50	70/50	–	–	–
2	54/50-25	155/10	IV	115/75-50	75/75	–	–	–
3	50/25	163/50	III	110/50	70/75-50	–	–	–
4	57/25	173/25	IV	125/75-50	70/50	–	–	–
5	45/10	157/25	IV	120/75	75/75	–	–	–
6	47/25	155/25-10	II	120/75	75/75	+	–	–
7	53/25	160/10	III	115/50	70/75-50	–	–	–
8	55/10-5	170/25-10	IV	125/75-50	70/50	–	–	–
9	59/10	170/25-10	IV	130/75	70/50	–	–	–
10	43/10	157/25	III	120/75	70/75-50	–	–	–
11	45/25	155/25	IV	125/90	75/75	–	–	–
12	38/10	150/10	III	135/ > 95	85/ > 95	+	–	–
13	53/25	156/10	IV	120/75-50	75/75	–	–	–
14	63/25	167/10	IV	120/50	70/50	–	–	–
15	53/5	167/10	IV	125/75-50	70/50	–	–	–
16	47/10	155/10	IV	125/75	70/75-50	–	–	–
17	53/25	158/25	IV	120/75	75/75	+	–	–
18	53/25	155/10	IV	125/90-95	85/95	–	–	–
19	43/10	157/25	III	115/75-50	70/75-50	–	–	–
20	57/25	167/10	III	130/90-75	70/75-50	–	–	–
21	55/25-10	165/10	III	120/50	70/50	+	–	–
22	47/25	155/10	II	115/50	70/75-50	–	–	–
23	47/25-10	157/25	IV	135/ > 95	85/95	+	–	–
24	57/10	167/10	IV	120/50	70/50	–	–	–
25	45/10	155/25-10	IV	125/90-95	80/90-95	–	–	–

Wt. = weight. Ht. = height. Pub. = Puberty.
SBP. = Systolic blood pressure. DBP. = Diastolic blood pressure.
LJM.= limited joint mobility. R. = Retinopathy.

Table (23) Anthropometric measurements, pubertal stage and clinical data of group (D):

No.	Wt./ Centile	Ht. / Centile	Pub. stage	SBP , Centile	DBP., Centile	Puffy Eye	LJ M.	R.
1	20/50	117/50	I	100/75-50	60/50	–	–	–
2	27/75	125/25	I	100/50	65/75-50	–	–	–
3	45/50	150/25	II	110/50	65/<50	–	–	–
4	50/25	157/25	III	120/75	70/75-50	–	–	–
5	17/75	107/25	I	95/50	55/<50	–	–	–
6	32/50	134/25	I	105/75-50	65/50	–	–	–
7	35/25	143/25	II	105/50	60/<50	–	–	–
8	46/25	153/10	III	120/75	65/<50	–	–	–
9	56/50	163/50	IV	115/75-50	70/75-50	–	–	–
10	20/50	112/25	I	100/75-50	55/<50	–	–	–
11	27/50	130/25	II	100/50	65/75-50	–	–	–
12	40/10	157/25	III	115/75-50	65/50	–	–	–
13	43/50	147/25	III	100/50	65/50	–	–	–
14	51/25	153/25	IV	120/75	70/75-50	–	–	–
15	52/25	160/10	III	115/75-50	65/<50	–	–	–

Wt. = weight. Ht. = height. Pub. = Puberty.
SBP. = Systolic blood pressure. DBP. = Diastolic blood pressure.
LJM.= limited joint mobility. R. = Retinopathy.

Table (24) Difference between groups in demographic data, weight and height:

Variables	Group N= 25	Group B N = 25	Group C N = 25	Group D N = 15	Test of significance
Age in years X ± SD	9.5 ± 2.15	10.84 ± 2.1	16.84 ± 1.32 *	6.95 ± 6.55	F = 7.13 P < 0.05
Duration of Diabetes (y)	2.99 ± 1.34	6.39 ± 1.05	11.62 ± 1.24 *	———	F = 9.02 P < 0.01
Gender male female	40% 60%	40% 60%	48% 52%	60% 40%	X2 = 3.76 P < 0.05
Height in cm X ± SD	129 ±11.51	137.08 ± 12.28	160.44 ± 6.29 *	140.53 ± 18.44	F = 6.83 P < 0.05
Weight in kg X ± SD	18.64 ± 6.24	32.68 ± 8.93	59.96 ± 6.08 *	37.4 ± 12.94	F = 5.94 P < 0.05

* = Significant difference p < 0.01 in comparison to the control group D.
F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (25) The comparison of systolic and diastolic blood pressure in different studied groups:

Blood pressure MmHg	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Systolic	102.8 ± 3.84	102.64 ± 20.28	120.6 ± 4.86 *	108 ± 8.82	F= 3.99 P < 0.05
Diastolic	60.8 ± 2.77	63.36 ± 4.93	71.4 ± 2.71 *	64± 4.71	F=4.67 P < 0.05

* = Significant difference p < 0.01 in comparison to the control group D.
F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (26) The comparison of Glycated Hb, FBS, and RBS in different studied groups:

Investigation	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Haemoglobin A1c - %	8.29 ± 1.69 *	10.33 ± 1.60 *	9.86 ± 1.16 *	5.85 ± 1.13	F=11.42 P < 0.001
Fasting blood sugar- mg/dl	181.36 ±54.4 *	165.88 ± 34.22 *	241.72 ± 42.05 *	78.27 ± 12.62	F = 20.41 P < 0.001
Random blood sugar- mg/dl	246.76 ±74.2 *	252.28 ± 59.63 *	317.76 ± 39.43 *	96.53 ± 11.46	F = 11.01 P < 0.001

* = Significant difference $p < 0.01$ in comparison to the control group D.

F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (27) The comparison of serum lipid profile in different studied groups:

Investigation	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Serum cholesterol mg/dl	91.64 ± 11.14	114.6 ± 14.9 *	156.4 ± 32.13 *	82.87 ± 10.36	F=58.65 P < 0.001
High density lipoprotein mg/dl	29.92 ± 9.38	37.84 ± 9.55 *	31.64 ± 7.18 *	23.87 ± 6.2	F = 5.64 P < 0.01

* = Significant difference $p < 0.01$ in comparison to the control group D.

F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (28) The comparison of serum Sialic acid, Prorenin, and Nitric oxide in different studied groups :

Investigation	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Sialic acid mmol/L	51.3 ± 14.93	55.25 ± 15.1 *	64.32 ± 22.09 *	46.37 ± 8.05	F = 3.42 P < 0.05
Prorenin Pg/ml	2.43 ± 1.25 *	2.78 ± 1.38 *	2.65 ± 1.31 *	1.87 ± 0.35	F = 0.46 P > 0.05
Nitric oxide µmol/L	24.92 ± 15.09 *	28.67 ±15.66 *	33.06 ± 15.62 *	13.63 ± 5.52	F = 1.75 P > 0.05

* = Significant difference $p < 0.01$ in comparison to the control group D.

F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (29) The comparison of urinary albumin/ creatinine ratio, and N-acetyl-beta-D-glucosaminidase in different studied groups :

Investigation	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Albumin/creatinine ratio- mg/mmol	0.18 ± 0.08 *	0.2 ± 0.1 *	0.22 ± 0.1 *	0.11 ± 0.03	F= 3.53 P < 0.05
N-acetyl-beta –D-glucosaminidase U/g	15.47 ±8.5 *	18.81 ± 11.47 *	19.96 ± 11.43 *	7.77 ± 2.18	F=3.77 P < 0.05

* = Significant difference $p < 0.01$ in comparison to the control group D.

F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (30) The comparison of serum urea and creatinine in different studied groups:

Test	Group A No.=25	Group B No.=25	Group C No.=25	Group D No.=25	Test of Significance
Serum urea mg/dl	19.28 ± 7.88	25.40 ±7.39 *	29.2 ± 7.69 *	12.6 ± 3.79	F= 10.57 P < 0.001
Serum creatinine mg/dl	0.76 ± 0.04 *	0.85 ± 0.04 *	0.82 ± 0.05 *	0.67 ± 0.04	F= 1.09 P > 0.05

* = Significant difference p < 0.01 in comparison to the control group (D).

F = (0r ANOVA) to test difference between diabetic groups A,B,C.

Table (31) Correlation between albumin/creatinine ratio (ACR) and other studied parameters in group A (early diabetics):

Correlation	Coefficient of correlation r	Significance
Albumin/creatinine with:		
sailic acid.	0.86	HS
Nitric oxide.	0.85	HS
Pro-renine.	0.83	HS
NAG.	0.78	HS
Cholesterol	0.6	HS
RBS.	0.33	S
Urea.	0.11	NS
Creatinine	0.04	NS
FBS.	0.14	NS
HbA1c.	0.34	S
HDL.	0.33	S
SBP	0.15	NS
DBP	0.17	NS

HS = highly significant.
S = significant.
NS = not significant.

Table (32)Correlation between ACR and other parameters in group B:

Correlation	Coefficient of correlation r	Significance
ACR:		
Sialic acid	0.69	HS
Nitric oxide	0.6	HS
Prorenin	0.17	HS
NAG	0.4	S
FBS	0.23	NS
Urea	0.01	NS
Creatinine	0.03	NS
RBS	0.37	S
HbA1c	0.74	HS
Cholesterol	0.26	NS
HDL	0.21	NS

Table (33)Correlation between ACR and other parameters in group C:

Correlation	Coefficient of correlation r	Significance
ACR:		
Sialic acid	0.49	S
Nitric oxide	0.57	S
Prorenin	0.32	S
NAG	0.45	S
FBS	0.4	S
Urea	0.28	NS
Creatinine	0.07	NS
RBS	0.01	NS
HbA1c	0.65	S
Cholesterol	0.05	NS
HDL	0.38	S

Table (34) Correlation between duration and other studied parameters in all studied groups:

Correlation	Coefficient of correlation r	Significance
Duration of diabetes with:		
- sialic acid.	0.29	S
- Nitric oxide.	0.12	NS
- Prorenin.	0.07	NS
- NAG.	0.44	S
- Cholesterol.	0.36	S
- RBS.	0.44	S
- Urea.	0.47	S
- Creatinine.	0.1	NS
- FBS.	0.45	S
- HbA1c.	0.25	S
- HDL.	0.39	S
- SBP.	0.05	NS
- DBP.	0.18	NS
- Alb/creat	0.12	NS

Table (35) Correlation between HbA1c and other studied parameters in group A:

Correlation	Coefficient of correlation r	Significance
HbA1c with		
- sialic acid	0.16	NS
- Nitric oxide	0.06	NS
- NAG	0.37	S
- Prorenin	0.31	NS
- SBP	0.04	NS
- DBP	0.3	NS

Table (36) Correlation between HbA1c and other parameters in group B:

Correlation	Coefficient of correlation r	Significance
HbA1c:		
Sialic acid	0.61	HS
Nitric oxide	0.69	HS
Prorenin	0.78	HS
NAG	0.64	HS

Table (37) Correlation between HbA1c and other parameters in groupC:

Correlation	Coefficient of correlation r	Significance
HbA1c:		
Sialic acid	0.62	HS
Nitric oxide	0.69	HS
Prorenin	0.62	HS
NAG	0.54	S

Table (38) Sensitivity and specificity of Nitric oxide test in relation to Albumin/creatinine ratio, RBS, and FBS:

Nitric Oxide (cut-off level)	FBS >100	FBS <100	RBS >111	RBS <111	ACR > 0.18	ACR <0.18
>22.2	40	1	40	1	30	11
<22.2	33	16	34	15	9	40
Sensitivity	55%		54%		77%	
Specificity	94%		94%		78%	

Table (39) Sensitivity and specificity of Sialic acid test in relation to Albumin/creatinine ratio, RBS, and FBS:

Sialic acid (cut-off level)	FBS >100	FBS <100	RBS >111	RBS <111	ACR > 0.18	ACR <0.18
> 60.2	28	0	27	1	23	5
< 60.2	45	17	47	15	16	46
Sensitivity	38%		36%		59%	
Specificity	100%		94%		90%	

Table (40) sensitivity and specificity of Prorenin test in relation to Albumin/creatinine ratio, RBS, and FBS:

Prorenin (cut-off level)	FBS >100	FBS <100	RBS >111	RBS <111	ACR > 0.18	ACR <0.18
> 2.46	31	1	31	1	27	5
< 2.46	42	17	43	15	12	46
Sensitivity	42%		42%		69%	
Specificity	94%		94%		90%	

Table (41) sensitivity and specificity of N-acetyl-beta-D-glucosaminidase test in relation to Albumin/creatinine ratio, RBS, and FBS:

N-acetyl-beta-D-glucosaminidase (cut-off level)	FBS		RBS		ACR	
	>100	<100	>111	<111	> 0.18	<0.18
> 12.3	44	0	43	1	30	9
< 12.3	29	17	31	15	14	37
Sensitivity	60%		58%		77%	
Specificity	100%		94%		73%	

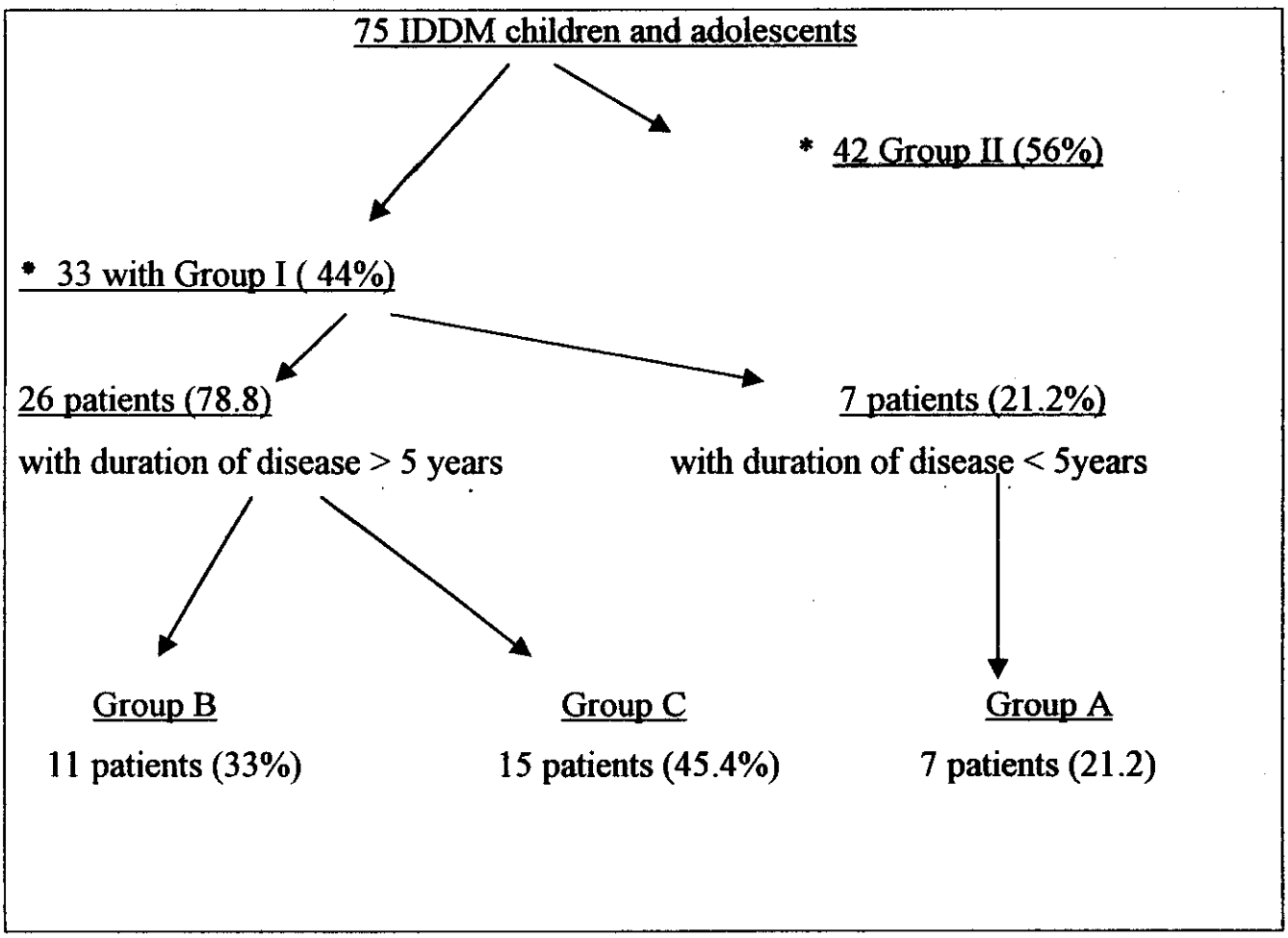
Table (42) sensitivity and specificity of HbA1c test in relation to Albumin/creatinine ratio, RBS, and FBS:

HbA1c (cut-off level)	FBS		RBS		ACR	
	>100	<100	>111	<111	> 0.18	<0.18
> 7.5	62	2	63	1	34	21
< 7.5	11	15	11	15	5	30
Sensitivity	85%		85%		87%	
Specificity	88%		94%		59%	

Table (43)Early detection of microalbuminuria by different methods in group A:

Test	Cut-off level	No. of detected cases >cut-off level (with normal level of ACR)
Nitric Oxide	22.2	1 (4%)
Sailic Acid	60.2	0
Prorenin	2.46	0
N-acetyl-beta-D-glucosamindase	12.3	3 (12%)

Diagram (1) the percentage of ACR in diabetic patients:



Group I : diabetic patients with significant increase in ACR level.

Group II: diabetic patients with normal level of ACR.

Fig. (2) HbA1c in different studied groups:

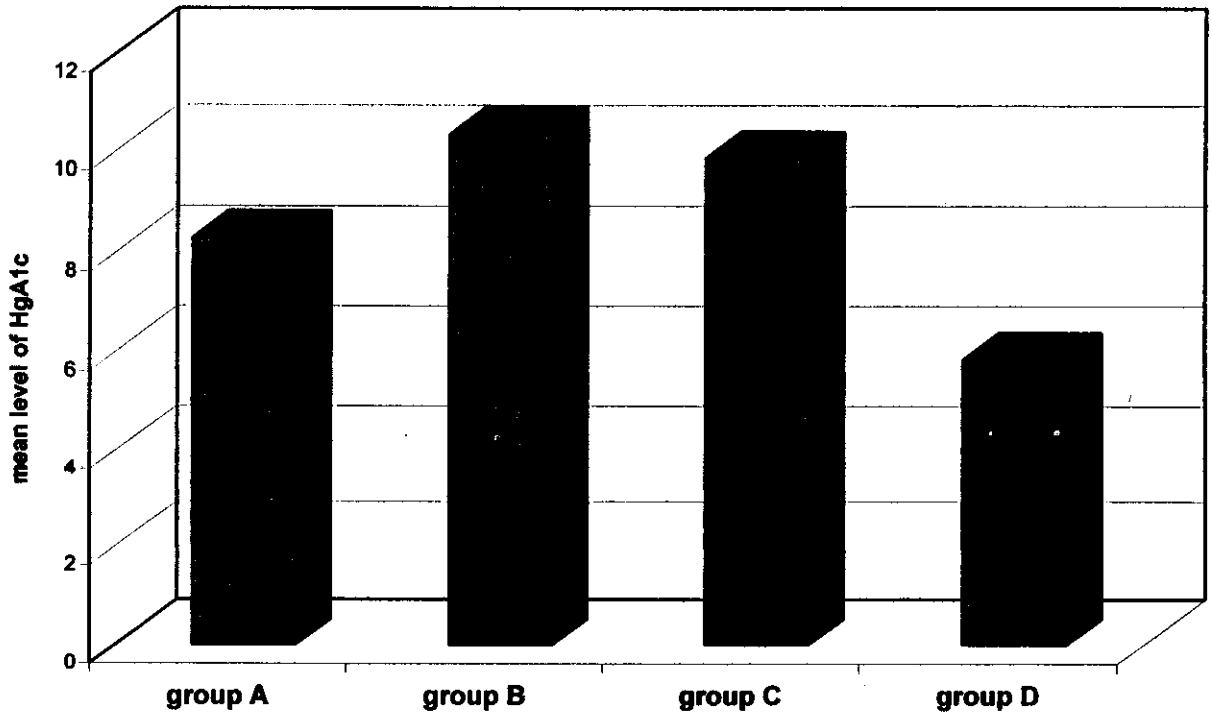


Fig. (3) Serum Sailic Acid (SA) in different studied groups:

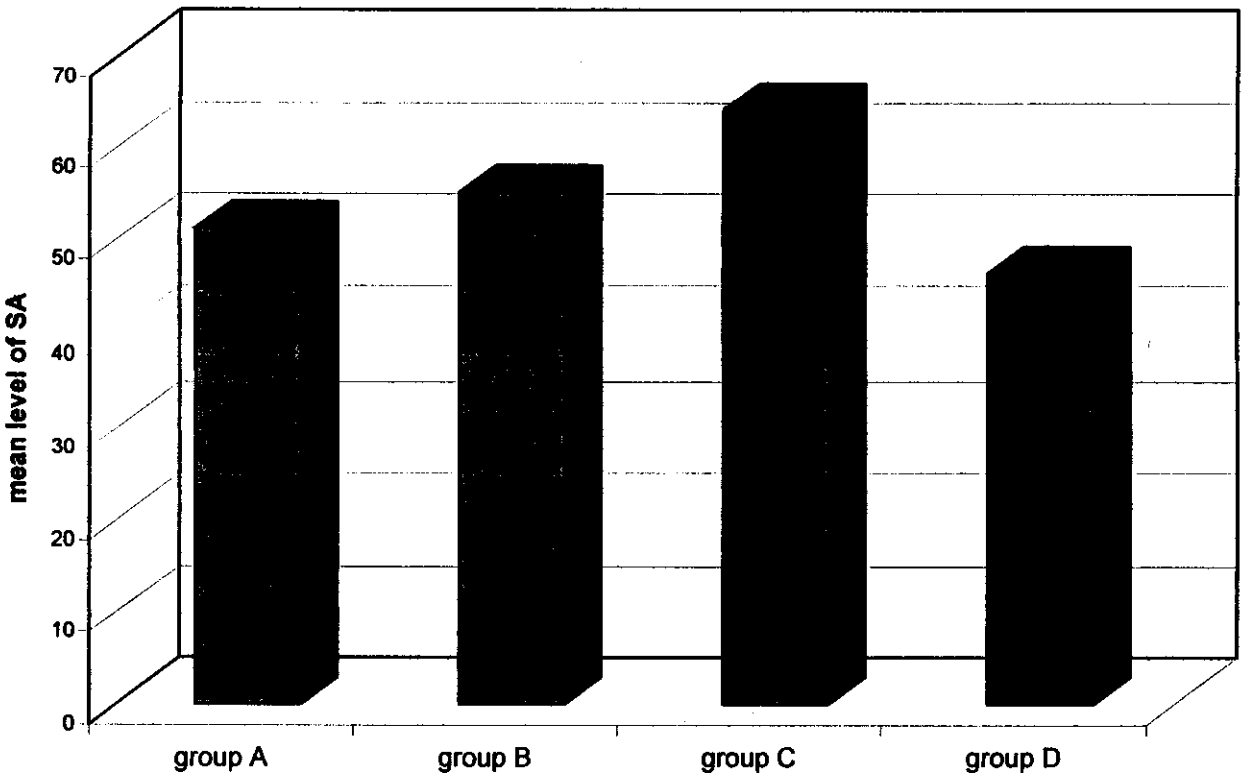


Fig. (4) Serum Prorinin (PRO) in different studied groups:

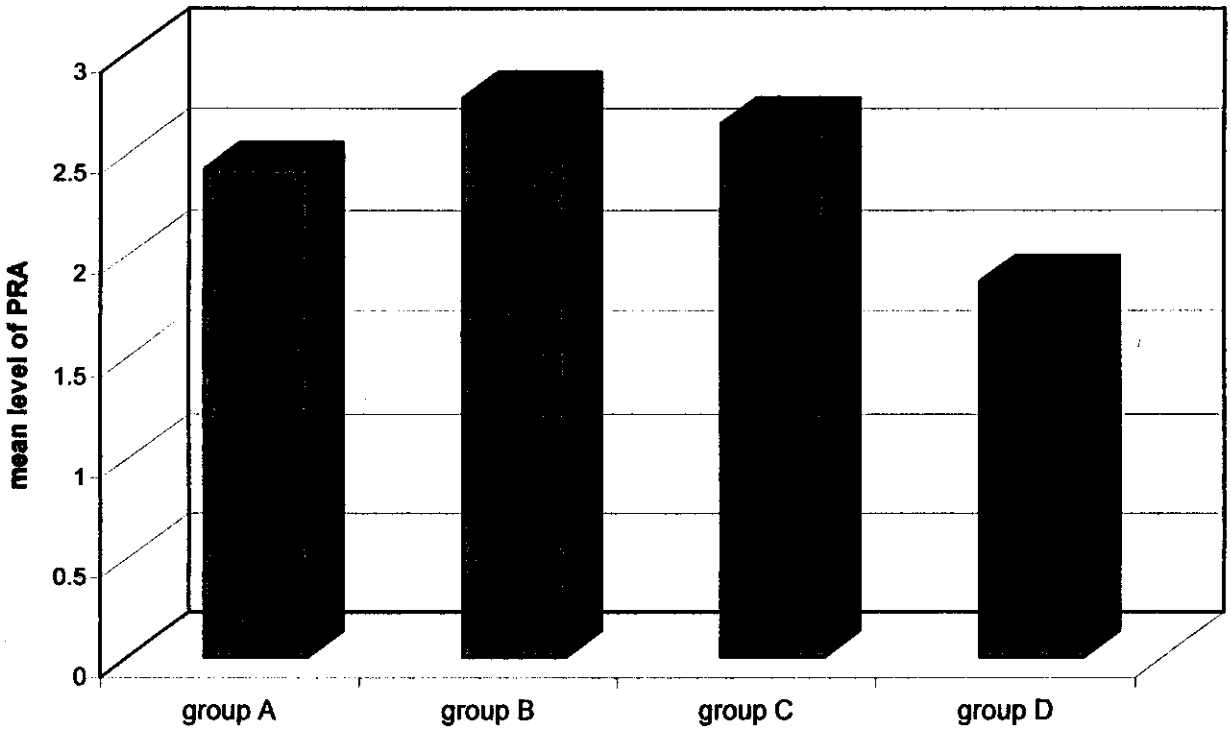


Fig. (5) Serum Nitric Oxide (NO) in different studied groups:

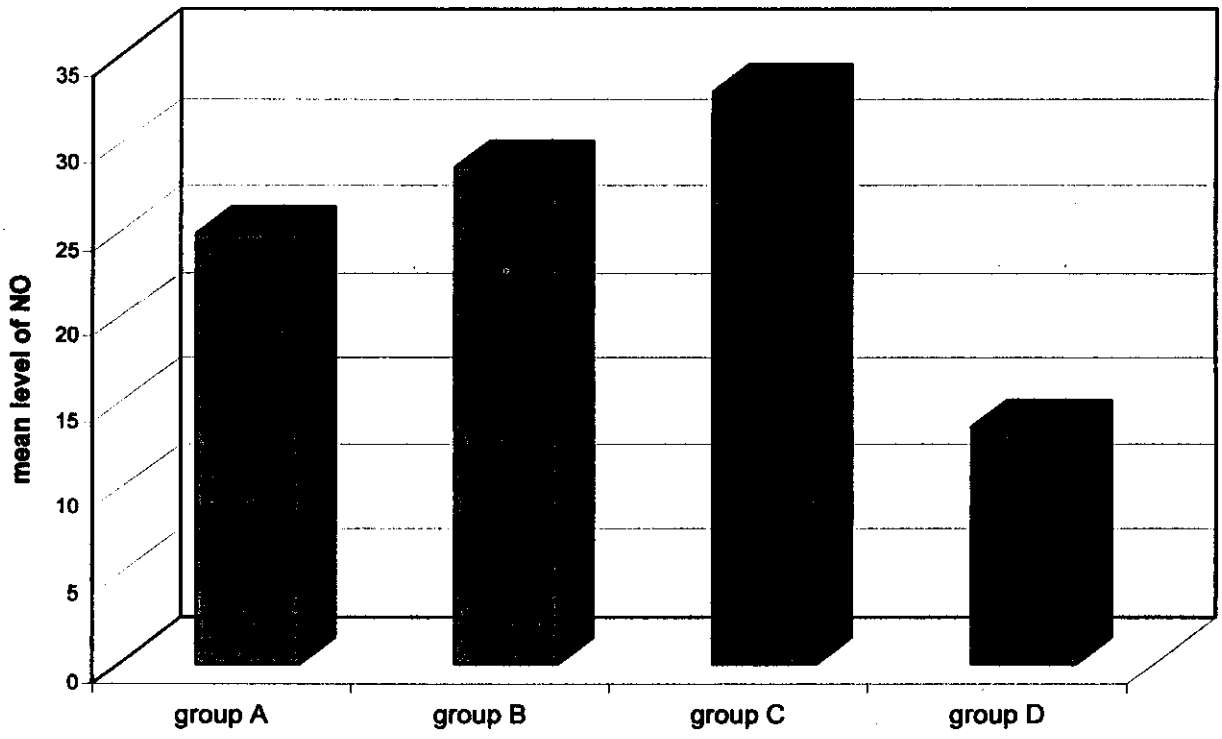


Fig.(6) ACR in different studied groups:

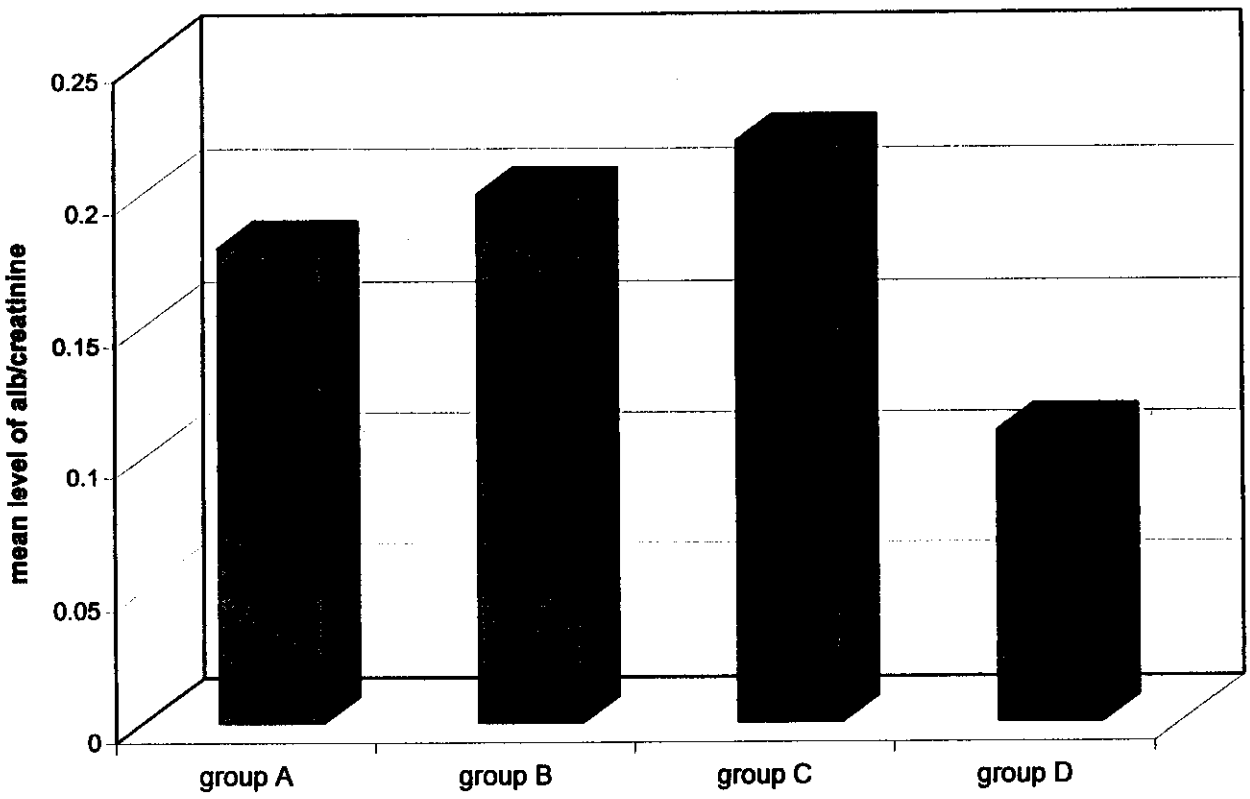


Fig.(7) NAG in different studied groups:

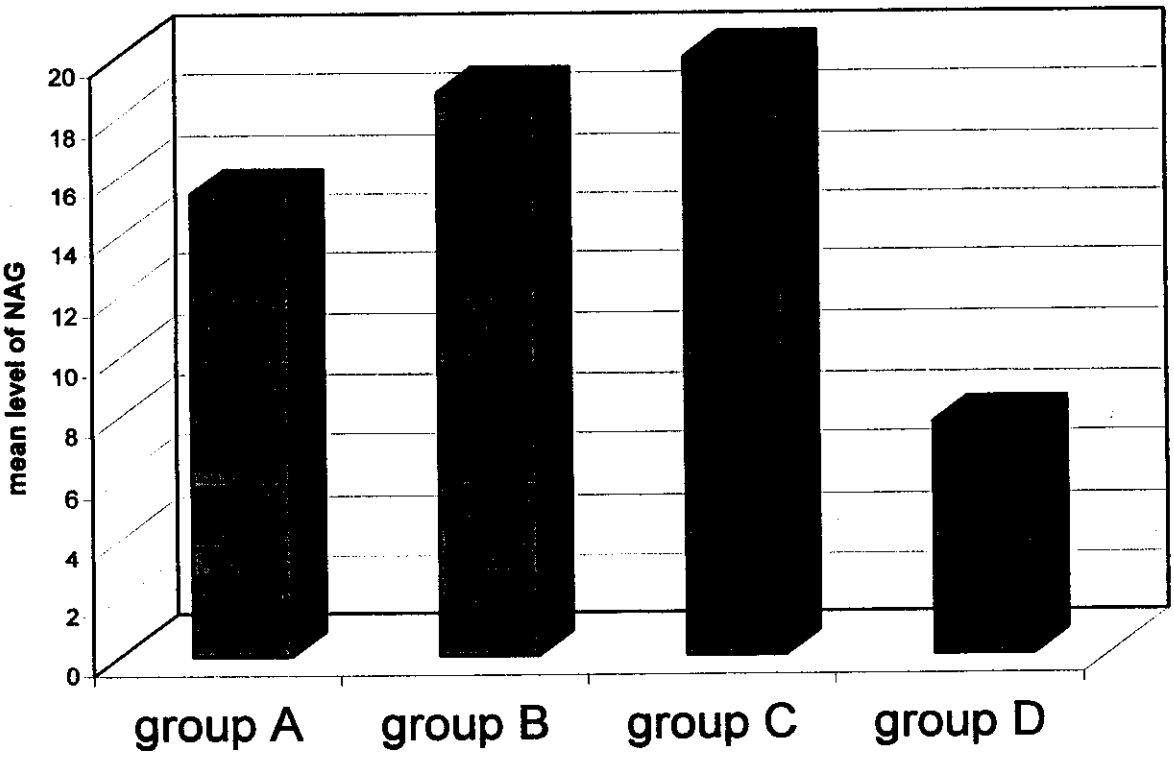


Fig.(8) serum Urea in different studied groups:

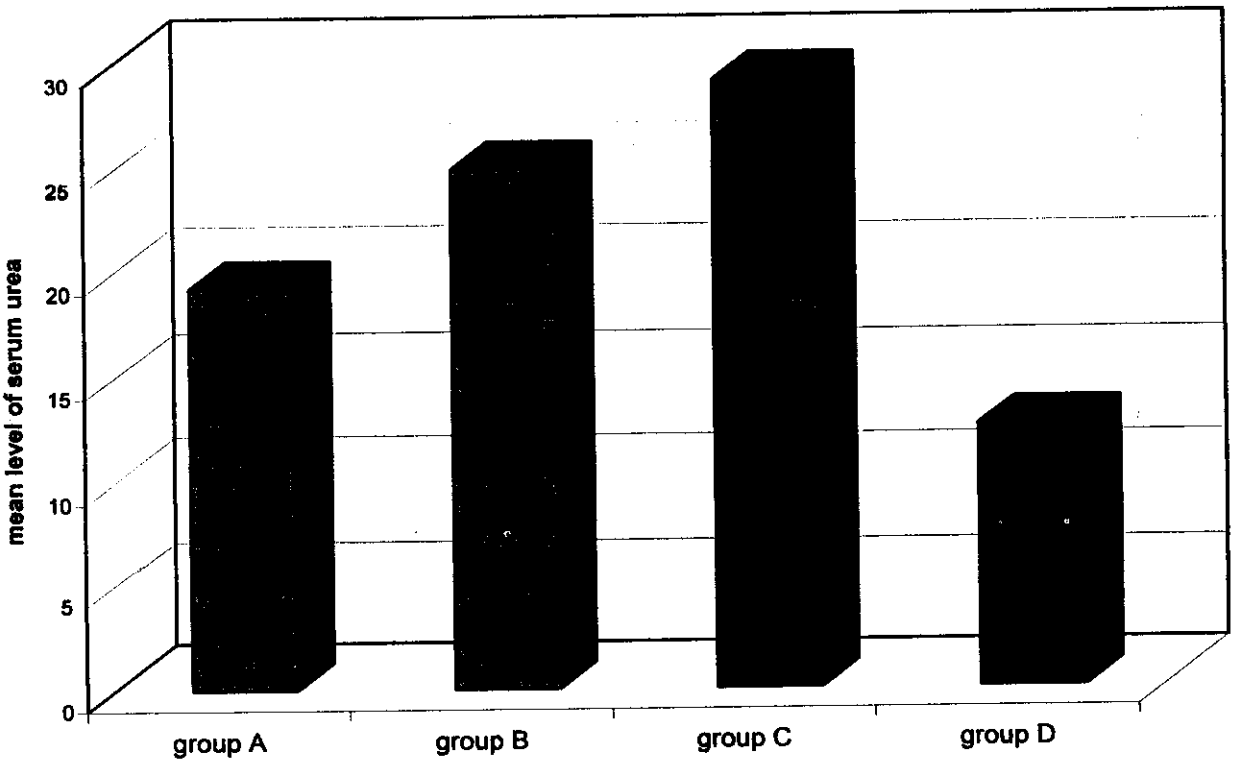


Fig.(9) serum Creatinine in different studied groups:

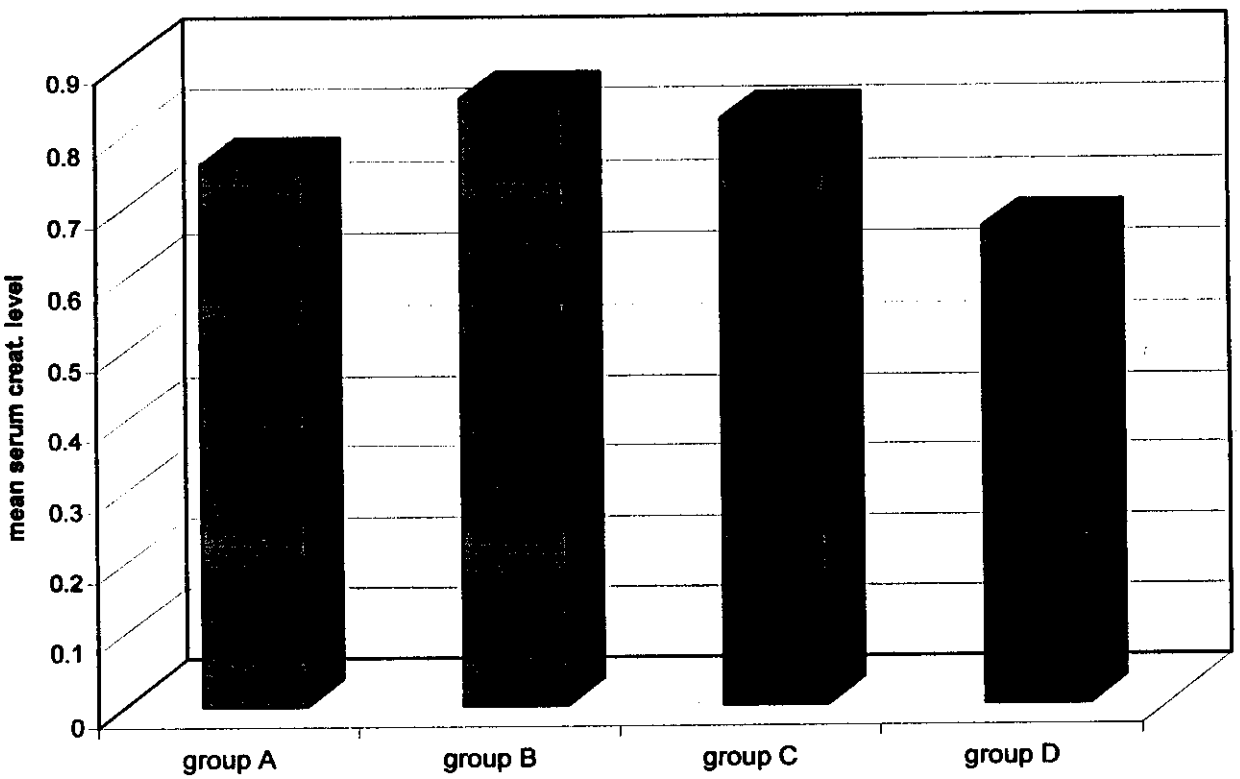


Fig.(10) Correlation between nitric oxide (NO) and albumin/creatinine ratio in group A:

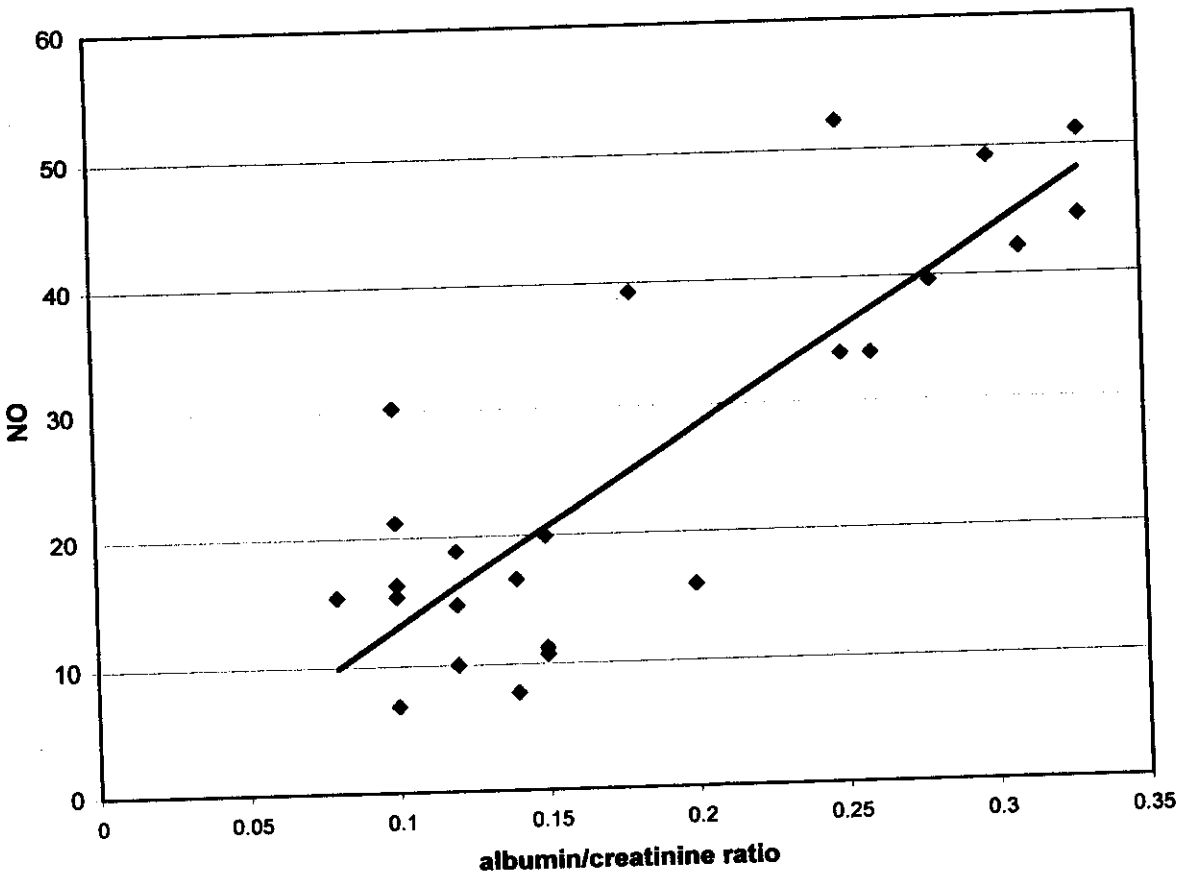


Fig.(11) Correlation between serum sailic acid (SA) and albumin/creatinine ratio in group A (early diabetics):

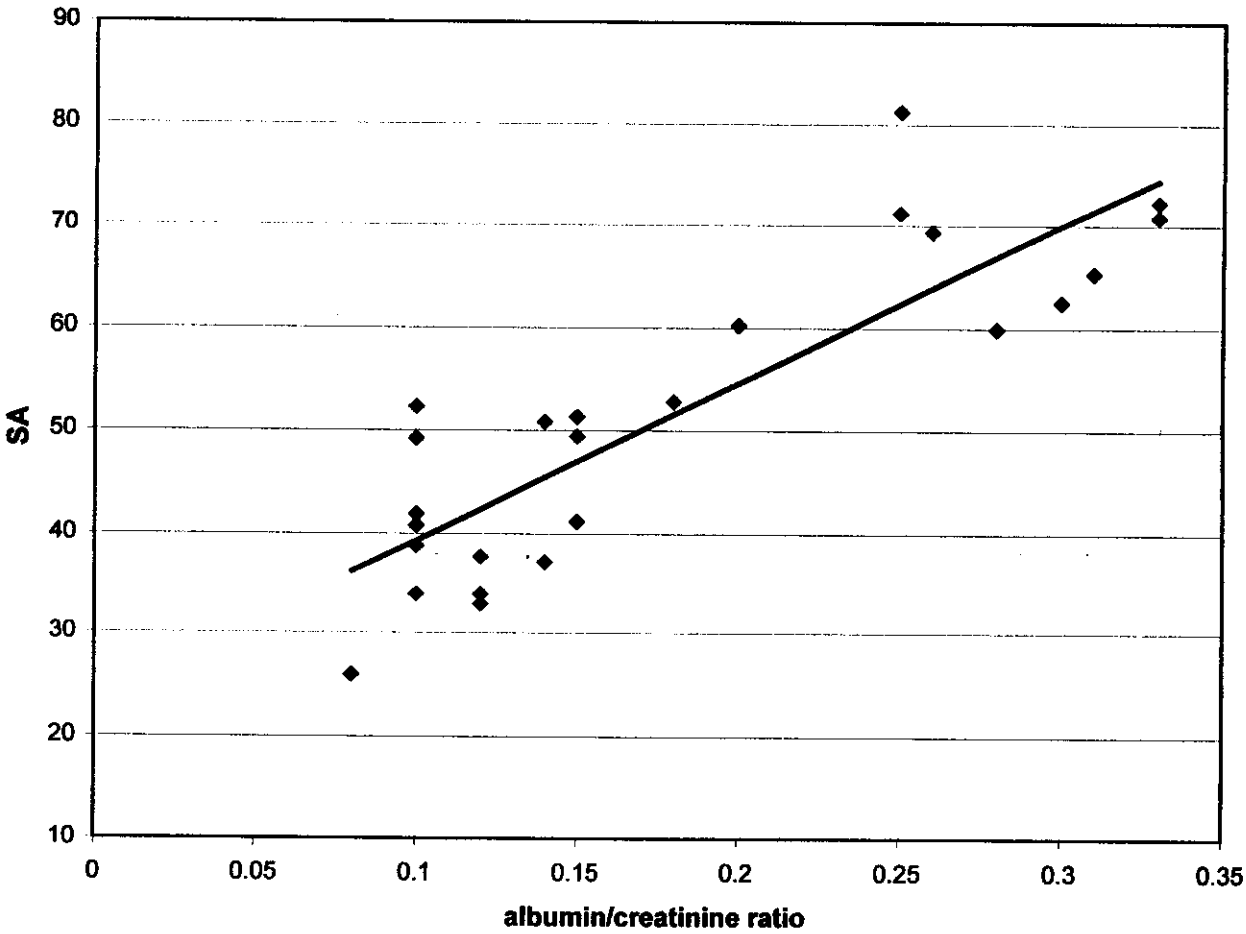


Fig.(12) : Correlation between prorenine level (PRO) and albumin /creatinine ratio in group A (early diabetics)

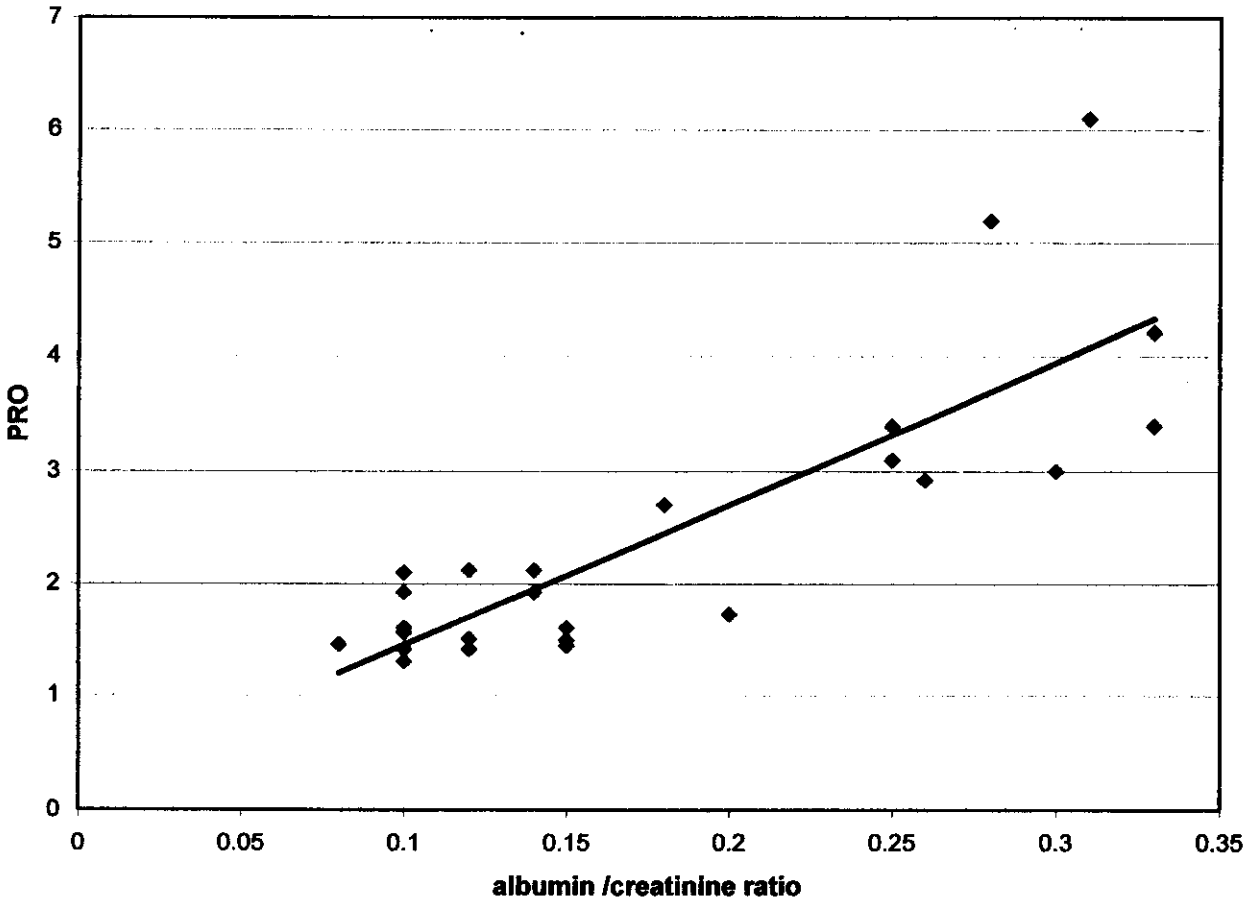


Fig.(13) : Correlation between NAG and albumin creatinine ratio in group A (early diabetics)

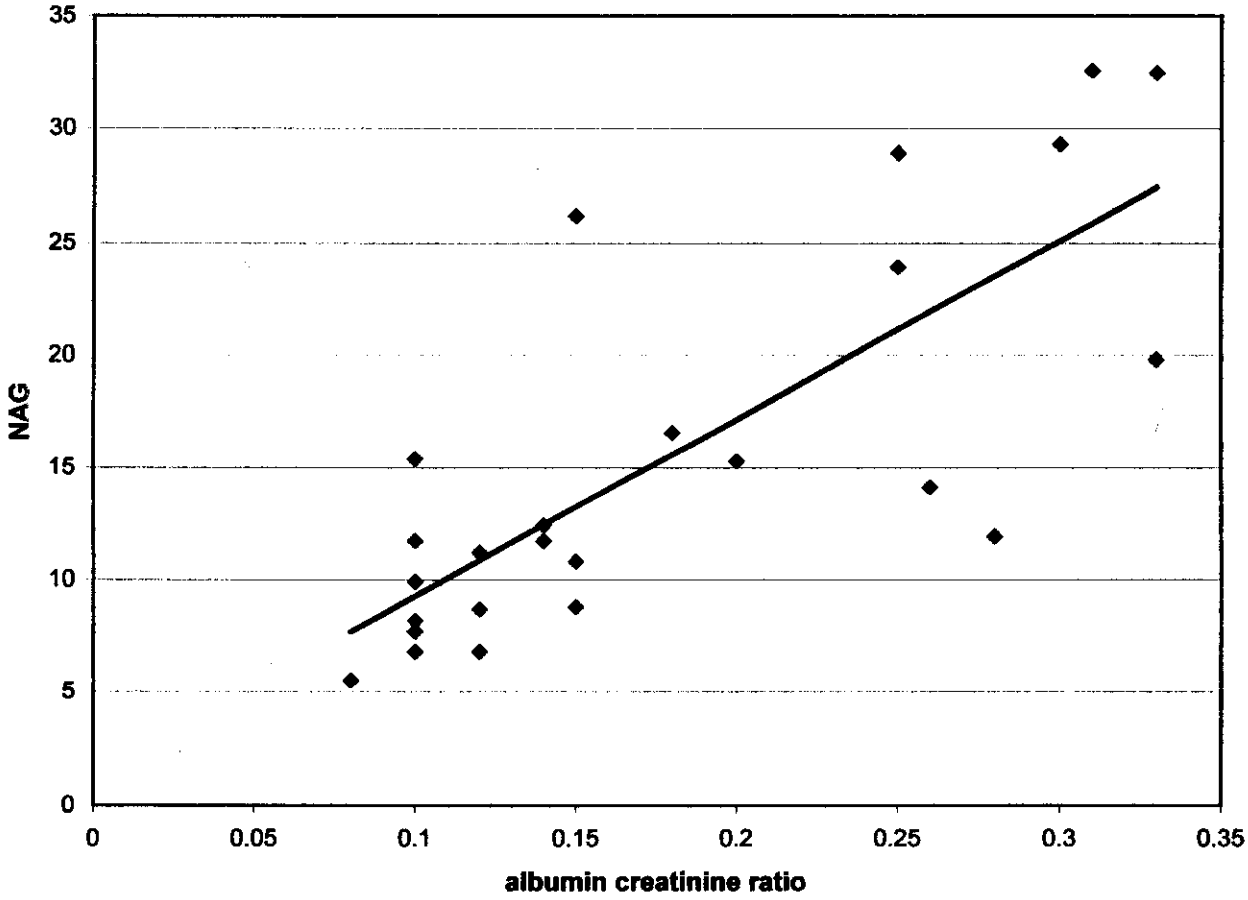


Fig.(14) : Correlation between HBA1C and albumin creatinine ratio in group A (early diabetics)