AIM OF THE WORK

- The aim of this study was to study the relation of dyslipidemia and its relation to insulin sensitivity in patients with thyroid dysfunction.

SUBJECTS AND METHODS

Subjects

The study was conducted on 71 subjects who were randomely selected from the outpatient clinics of internal medicine department, Alexandria University hospitals.

They were divided into three groups. Group 1 as hyperthyroidism (25 patients), group 2 as hypothyroidism (26 patients) and control group (20 subjects) . Subclinical hyperthyroidism and subclinical hypothyroidism were excluded from group 1 and group 2 and compared to control group as subgroup 1 (5 patients) and subgroup 2 (6 patients) respectively. All of the subjects were not taking any medication that affect insulin sensitivity, lipid profile or thyroid function.

Exclusion criteria:

Diabetes and chronic illness as congestive heart failure, renal failure, chronic liver disease and end stage cancer.

Methods

All the subjects of this study were submitted to the following:

1. Through history Taking.
2. Through clinical examination.

Blood pressure and body mass index measurment

3. Routine investigations:

- Fasting and 2 hours post prandial blood glucose.
- Lipid profile (They were done on the auto-analyzer synchron (X5).

  - Total cholesterol: by enzymatic colorimetric method.
  - HDL cholesterol: in this test, the chylomicrons, VLDL and LDL are precipitated by addition of phosphotungestic acid and after centrifugation; the supernatant fluid contains the HDL-c fraction.
  - LDL-Cholesterol : is calculated using the following formula:

$$LDL = Tc - (TG/5 + HDL)$$

  - Triglycerides .

4. Special investigations:

a. Fasting serum insulin:

We measure the insulin sensitivity using the homeostasis model assessment (HOMA) score.[85]

Specimen collection:

After overnight fasting, 7 ml of venous blood were collected by venopuncture, using sterile plastic syringes.

- 2 ml of collected blood were taken in a fluoride-containing tube and then centrifuged and the separated serum was used immediately for the assay of fasting blood glucose level (by glucose oxidase method).
- 5 ml of collected blood were allowed to clot and then centrifuged and the separated serum was divided in to three containers and that were kept frozen and stored at -20 °C for the assay of fasting insulin level and lipid profile (Total cholesterol, HDL and TG).

Measurement of fasting insulin level:

Immunoenzymatic assay was used for the quantitative measurement of human serum insulin.

Principle of the Test:

MEDAENTX INS-EASIA is a salid phase enzyme amplified sensitivity immunoassay.

Performed on micro titer plate. It is based on the oligoclonal system in which several mono clonal antibodies (Mabs) directed against distinct epitopes of insulin are used. The

use of several distinct mabs avoids hyper specificity, allows high sensitive assay with extended standard range and short incubation time.

Standards or samples containing insulin (INS) react with capture antibodies (Mabs 2) labeled with horseradish peroxidase (HRP). After an in incubation period allowing the formation of a sandwich, coat4d mabs 1-INS-Mabs 2-HRP, the micro titer plate is washed to remove unbound enzyme labeled antibodies.

The revelation solution tetra methyl benzydine is added and incubated. The amount of substrate turnover is determined calorimetrically by measuring the absorption which is proportional to the insulin concentration.

Calculation of HoMA-IR:

Inso (micro U/ml) x Gluco (mmol/L)/ 22.5

Where: Inso is fasting plasma insulin concentration.

Gluco is fasting plasma glucose concentration.

With such a method, high HOMA score denote low insulin sensitivity (i.e. insulin resistance)

b. Free T3, free T4 and thyroid stimulating hormone (TSH): [86]

Axsym assay is based on the micro particle enzyme immunoassay (MEIA) Technology.

Sample collection and preparation for analysis:

Serum collected in serum separator tubes was done . Ensure that complete clot formation has taken place prior to centrifugation. Some samples may exhibit increased elotting time. For optimal results, samples should be free of fibrin, red blood cells, or other particulate matter. Patient samples should be mixed and centrifuged after any freeze thaw cycle, or to remove red blood cells, or particulate matter.

Multiple freeze-thaw cycles were avoided. Samples were mixed by low speed vortexing, then centrifuged prior to use to remove particulate matter, and to ensure consistency in the results.

Statistical analysis:

Data were collected, tabulated and statistically analyzed by IBM personal computer microprocessors.

A statistical software pakage "Microsoft" copyright of ecosoft Inc were used.

Two types of statistics was done:

1- Descriptive statistics e.g. mean (X) and standard deviation (SD)
2- Analytic statistics:

- Mean (X) and standard deviation (SD); quantitative data are expressed to measure the central tendency of data and the diversion around the mean.

* Chi-square test (X2); qualitative data expressed in number and percentage and analyzed by applying X2 test to study statistical relation between different variables.

Computed $X2 = \sum (O-E2) /E$

$\sum$ = sum.

E = expected data.

O = observed data.

* F test: is a test of significance for comparison between two quantitative variables with different variance with determination of the least significant difference (LSD) by pair wise comparison between group means.

* Correlation coefficnt test (r–test): is a test of significance for correlation between two quantitative variables. R-test results may be positive correlation or negative correlation.

- P-value < 0.05 was considered statistically significant.
- P-value < 0.001 was considered highly statistically significant.
- P-value > 0.05 was not considered statistically significant.

RESULTS

The mean age of selected groups was 33.94 (SD=7.29) with range (20-52) .Thirty nine percent of the selected groups were males and sixty one were females.

The mean and SD of body mass index were 26.10 and 4.37 respectively, ranging from 17.50 to 39.20 .

The groups were divided into three groups.Group 1 were hyperthyroid (25 patients), group 2 were hypothyroid (26 patients) and control group (20 patients). Subclinical hyperthyroidism (SHE) and subclinical hypothyroidism (SHO) were further analysed seperatly and were compared to control group as subgroup 1 (5 patients) and subgroup 2 (6 patients) respectively.

Laboratory data:

Lipid profile:

a) Total cholesterol:

Total cholesterol in control group ranged between 129- 302 mg/dl with a mean of 192.22 +/- 47.32, In group (1) it ranged between 111-250 with a mean 173.46 +/- 35.6 , In group (2) it ranged between 121-326 with a mean of 201.54 +/- 49.25 , In subgroup (1) it ranged between 111-196 with a mean 158.60 +/- 31.77 , In subgroup (2) itranged between 157-250 with a mean 206.50 +/- 31.11.

There was statistically significant difference found between group (1) and group (2) (p =0.014), similarly there was statistically significant difference between subgroup (1) and subgroup (2) (p= 0.017) as well as between subgroup (1) and control group (p = 0.047) .

Table (5): Comparison between the three studied groups regarding Cholesterol.

	Group I	Group II	Control
Cholert. (up to 200)			
Range	111 – 250	121 - 326	129 – 302
Mean	173.46	201.54	192.22
SD	35.46	49.25	47.32
P1		0.014*	
P2		0.084	
P3		0.269	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

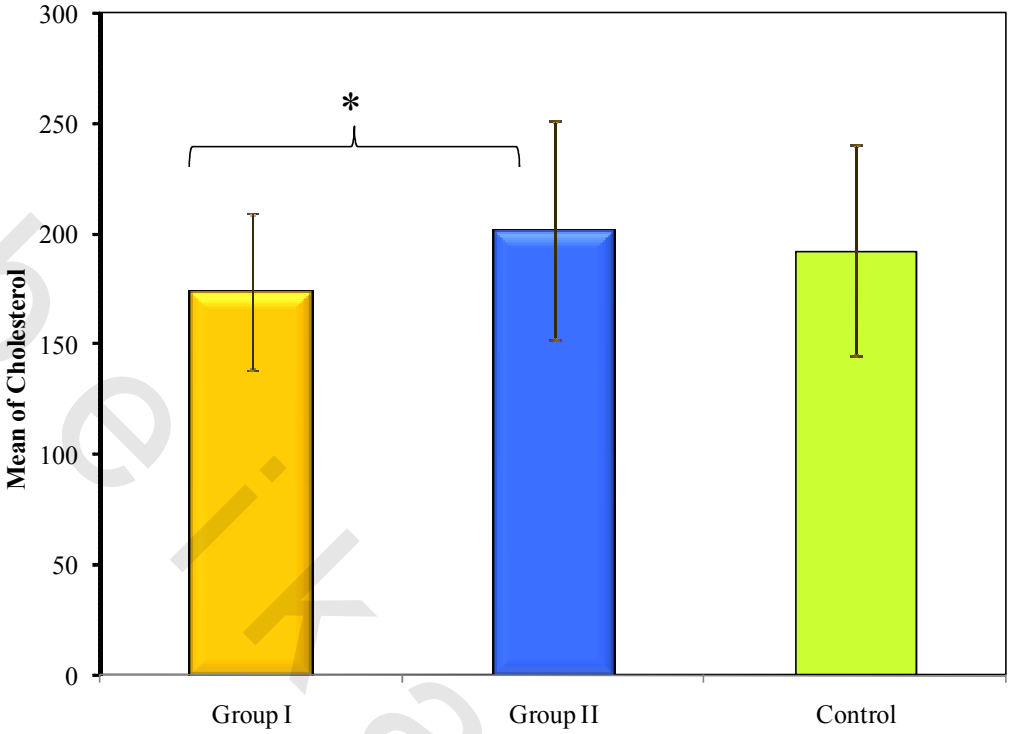

Figure (2): Comparison between the three studied groups regarding Cholesterol.

Table (6): Comparison between the two subgroups regarding Cholesterol.

	SubGroup I	SubGroup II	Control
Cholert. (up to 200)			
Range	111 – 196	157 - 250	129 – 302
Mean	158.60	206.50	192.22
SD	31.77	31.11	47.32
P1	0.017*		
P2	0.047*		
P3	0.207		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

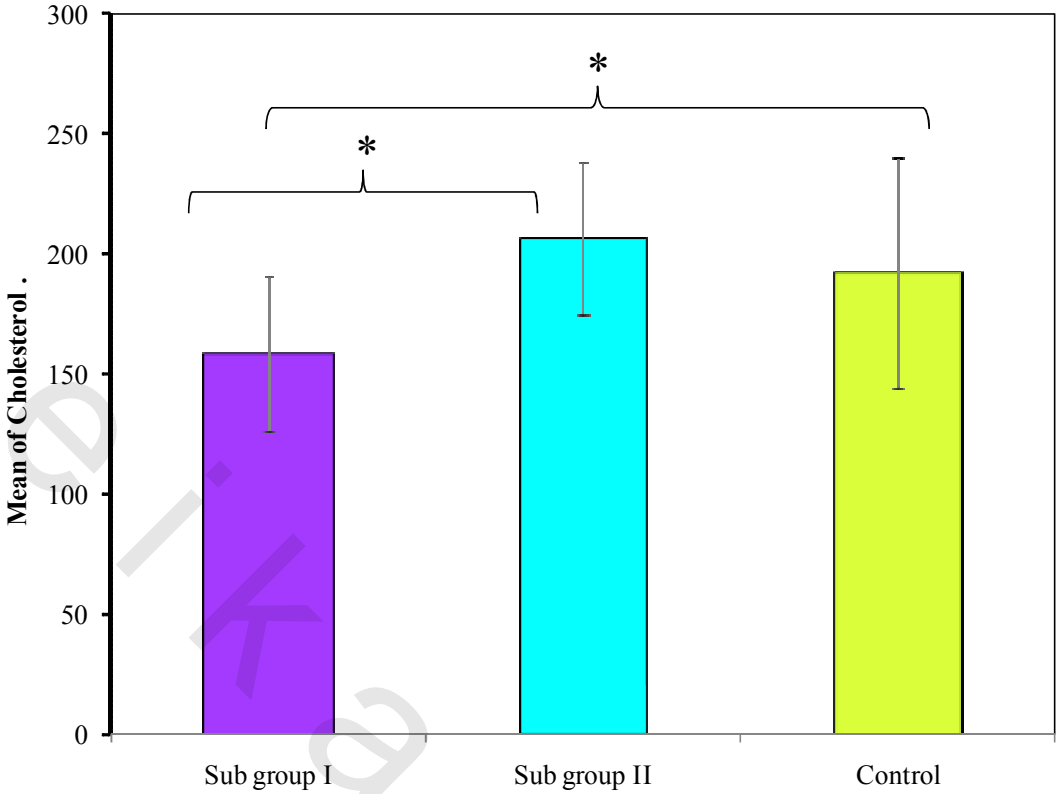

Figure (3): Comparison between the two subgroups regarding Cholesterol.

b) LDL:

LDL in the control group ranged between 63-180 mg/dl with mean of 120.44 +/- 38.37, In group (1) it ranged between 31-165 with mean 107.29 +/- 33.46, In group (2) it ranged between 65-254 with mean 134.67 +/- 40.98, In subgroup (1) it ranged between 70 -136 with mean 99.60 +/- 28.80 and in subgroup (2) it ranged between 106-160 with mean 137.17 +/- 20.16.

There was statistically significant difference found between group (1) and group (2) (p= 0.007), similarly there was statistically significant difference between subgroup (1) and subgroup (2)(p =0.022)

Table (7): Comparison between the three studied groups regarding LDL

	Group I	Group II	Control
LDL (up to 130)			
Range	31 - 165	65 - 254	63 – 180
Mean	107.29	134.67	120.44
SD	33.46	40.98	38.37
P_1		0.007*	
P_2		0.127	
p_3		0.128	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

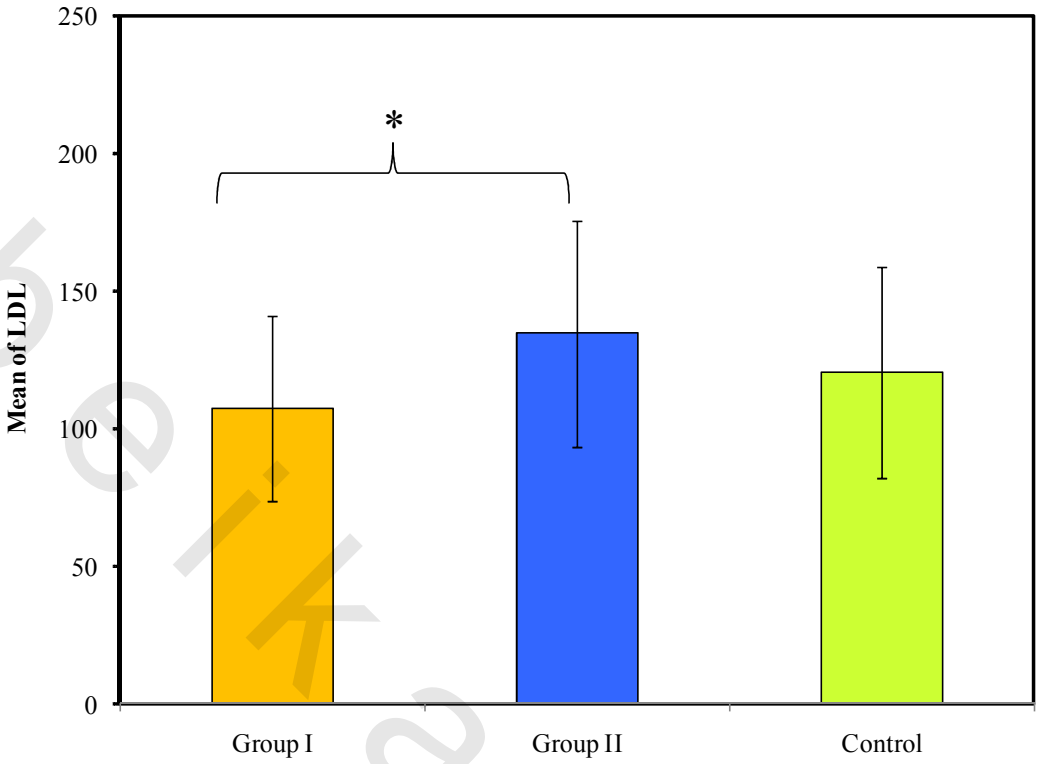

Figure (4): Comparison between the three studied groups regarding LDL

Table (8): Comparison between the two subgroups regarding LDL

	SubGroup I	SubGroup II	Control
LDL (up to 130)			
Range	70 – 136	106 - 160	63 – 180
Mean	99.60	137.17	120.44
SD	28.80	20.16	38.37
P_1		0.022*	
P_2		0.110	
p_3		0.095	

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

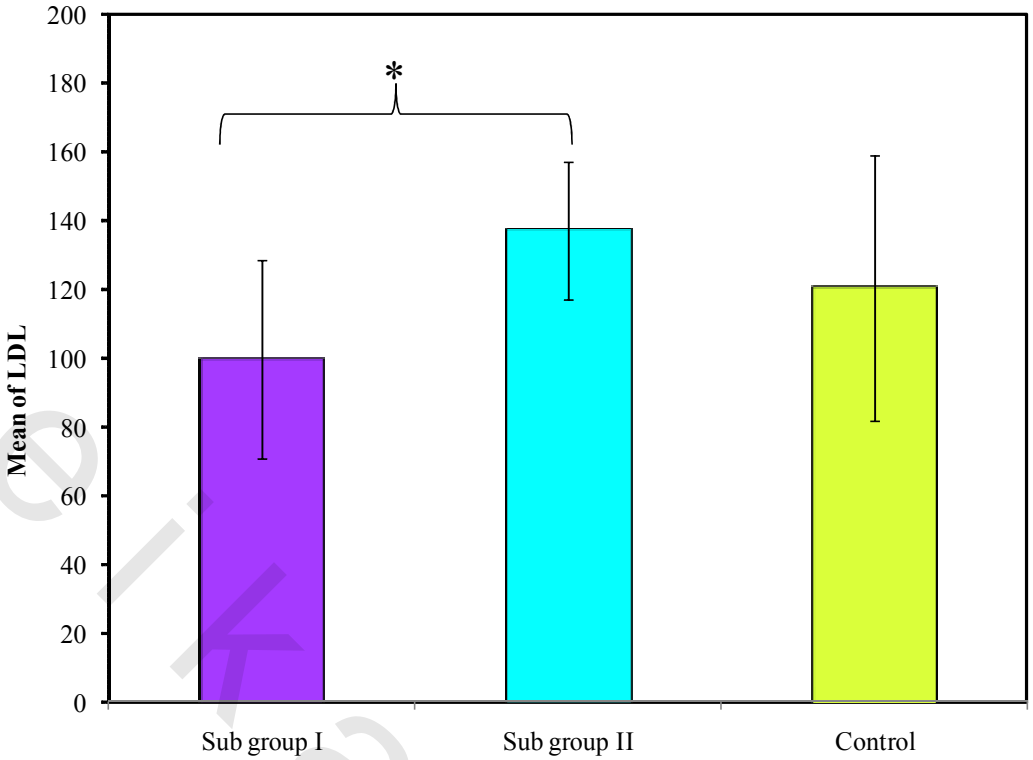

Figure (5): Comparison between the two subgroups regarding LDL.

c) Triglycerides:

Triglycrides in the control group ranged between 76-200 mg/dl with mean of 134.83 +/- 44.51, In group (1) it ranged between 61-300 with mean 120.92 +/- 54.57, In group (2) it ranged between 66-280 with mean 132.63 +/- 66.98, In subgroup (1) it ranged between 61-116 with mean 92.40 +/- 20.22 , In subgroup (2) it ranged between 66-280 with mean 137.17 +/- 83.73.

In this study there was statistically significant difference found between control group and subgroup (1) (p= 0.004).

Table (9): Comparison between the three studied groups regarding T.Gs.

	Group I	Group II	Control
T.Gs. (40-160)			
Range	61 - 300	66 - 280	76 – 200
Mean	120.92	132.63	134.83
SD	54.57	66.98	44.51
P_1	0.255		
P_2	0.184		
p_3	0.449		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

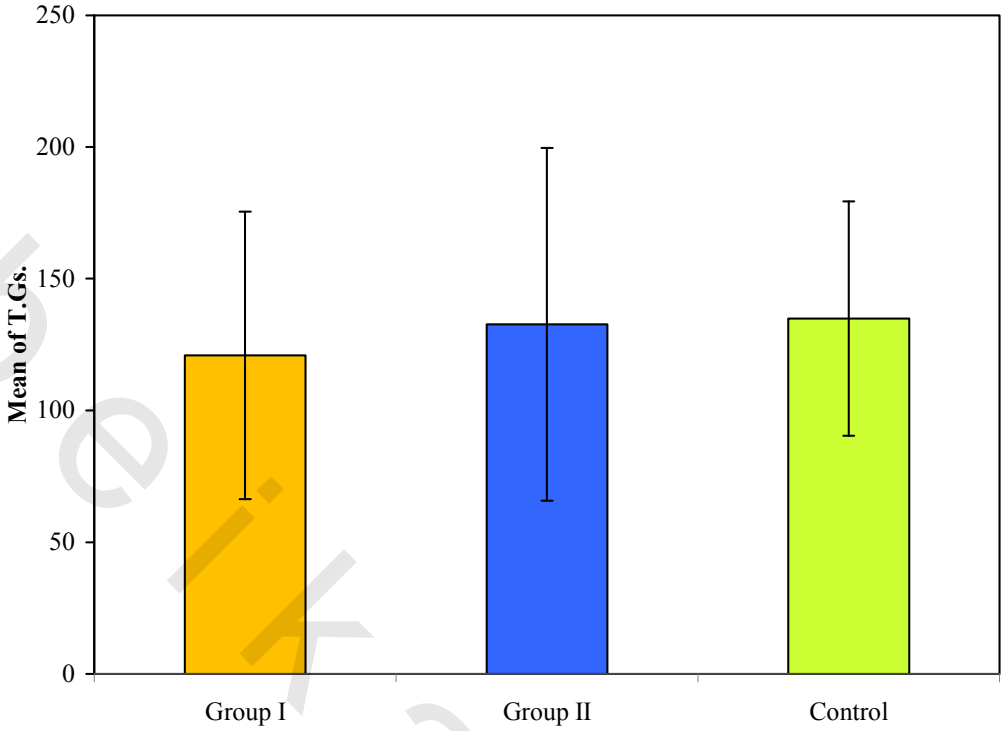

Figure (6): Comparison between the three studied groups regarding T.Gs.

Table (10): Comparison between the two subgroups regarding T.Gs.

	SubGroup I	SubGroup II	Control
T.Gs. (40-160)			
Range	61 - 116	66 - 280	76 – 200
Mean	92.40	137.17	134.83
SD	20.22	83.73	44.51
P_1	0.127		
P_2	0.004^*		
p_3	0.475		

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

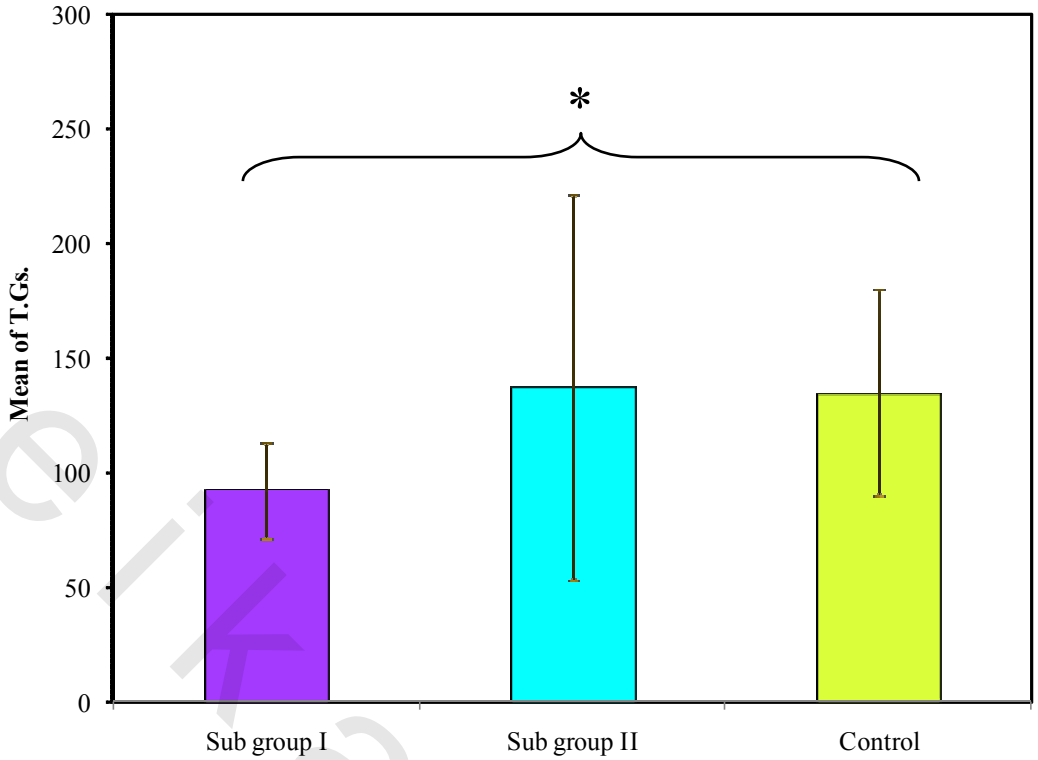

Figure (7): Comparison between the two subgroups regarding T.Gs.

d) HDL:

HDL in the control group ranged between 30-65 mg/dl with mean of 47.72 +/- 11.93, In group (1) it ranged between 23-70 with mean 45.46 +/- 13.06 , In group (2) it ranged between 26-65 with mean 54.42 +/- 8.93, In subgroup (1) it ranged between 29-52 with mean 40.60 +/- 9.56 , In subgroup (2) IT ranged between 38-62 with mean 45.83 +/- 9.

There was no statistically significant difference between control group and other groups.

Table (11): Comparison between the three studied groups regarding HDL.

	Group I	Group II	Control
HDL (35-75)			
Range	23 - 70	29 - 65	30 – 65
Mean	45.46	45.42	47.72
SD	13.06	8.93	11.93
P_1		0.495	
P_2		0.281	
p_3		0.248	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

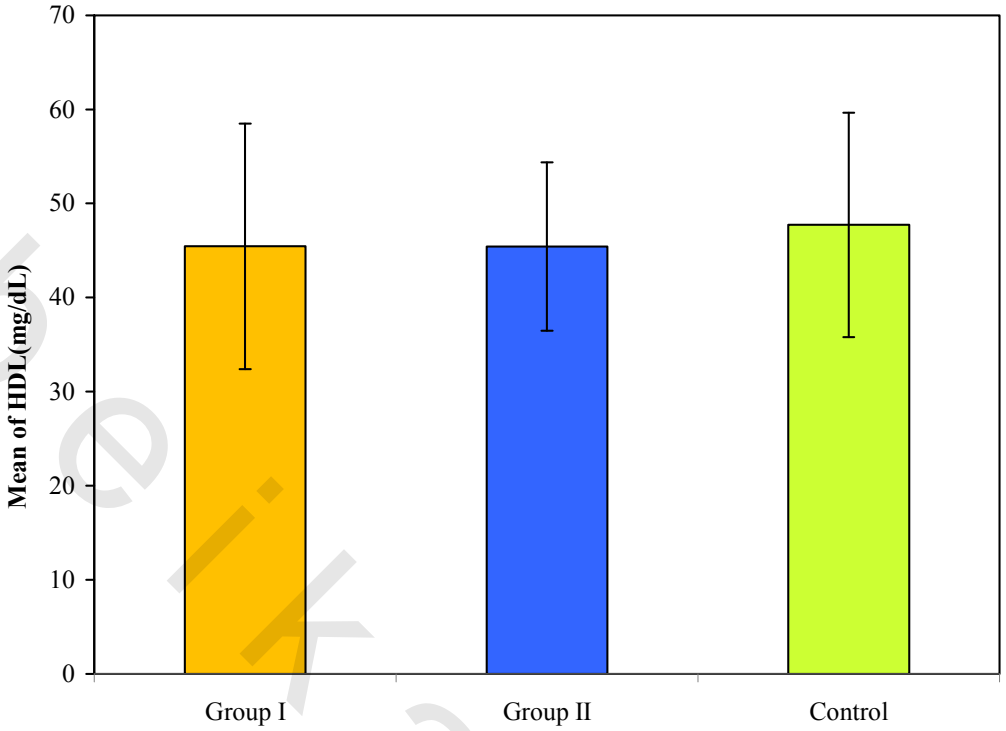

Figure (8): Comparison between the three studied groups regarding HDL

Table (12): Comparison between the two subgroups regarding HDL.

	SubGroup I	SubGroup II	Control
HDL (35-75)			
Range	29 - 52	38 - 62	30 – 65
Mean	40.60	45.83	47.72
SD	9.56	9.00	11.93
P_1	0.189		
P_2	0.101		
p_3	0.345		

p_1: p value for comparing between subgroup I and group II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

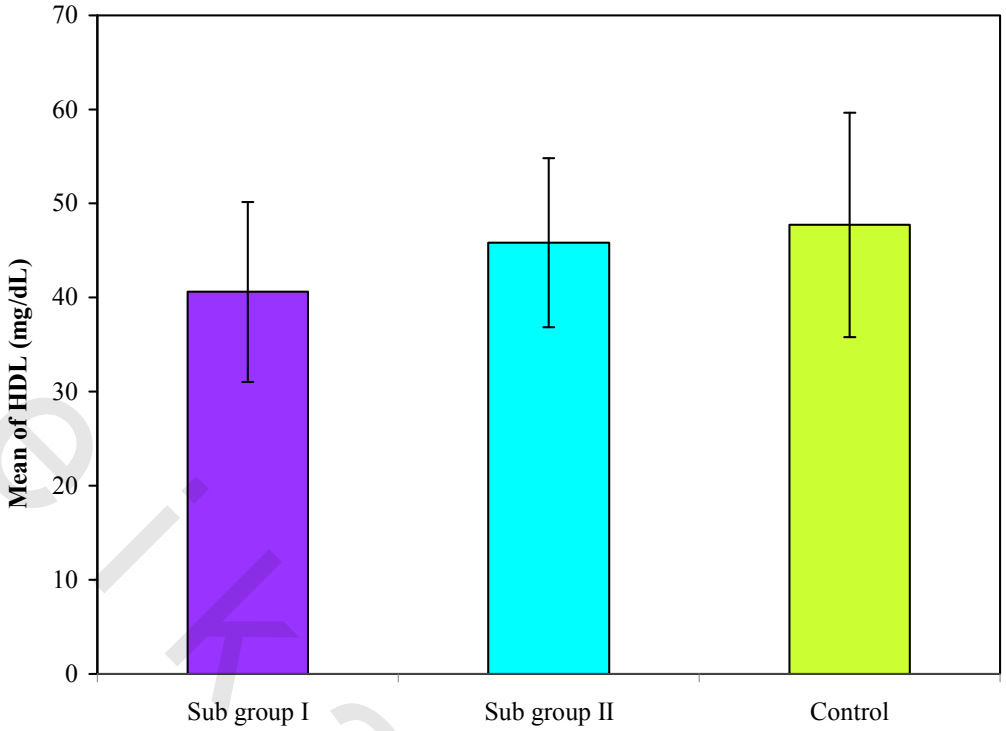

Figure (9): Comparison between the two subgroups regarding HDL

e) Fasting insulin level:

Fasting insulin level in the control group ranged between 6.5-34.4 mg/dl with mean of 15.42 +/- 7, in group (1) ranged between 5-61 with mean 17.23 +/- 12.05, in group (2) ranged between 4.5-61 with mean 17.23 +/- 12.34, in subgroup (1) ranged between 5-17 with mean 9.70 +/- 4.89 , in subgroup (2) ranged between 8-31 with mean 16 +/- 8.29.

There was statistically significant difference found between control group and subgroup (1)(p =0.033) .

Table (13): Comparison between the three studied groups regarding F.insulin level

	Group I	Group II	Control
F.Insulin			
Range	5 - 61	4.5 - 61	6.5 - 34.4
Mean	17.23	17.23	15.42
SD	12.05	12.34	7.00
P_1		0.500	
P_2		0.273	
p_3		0.276	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

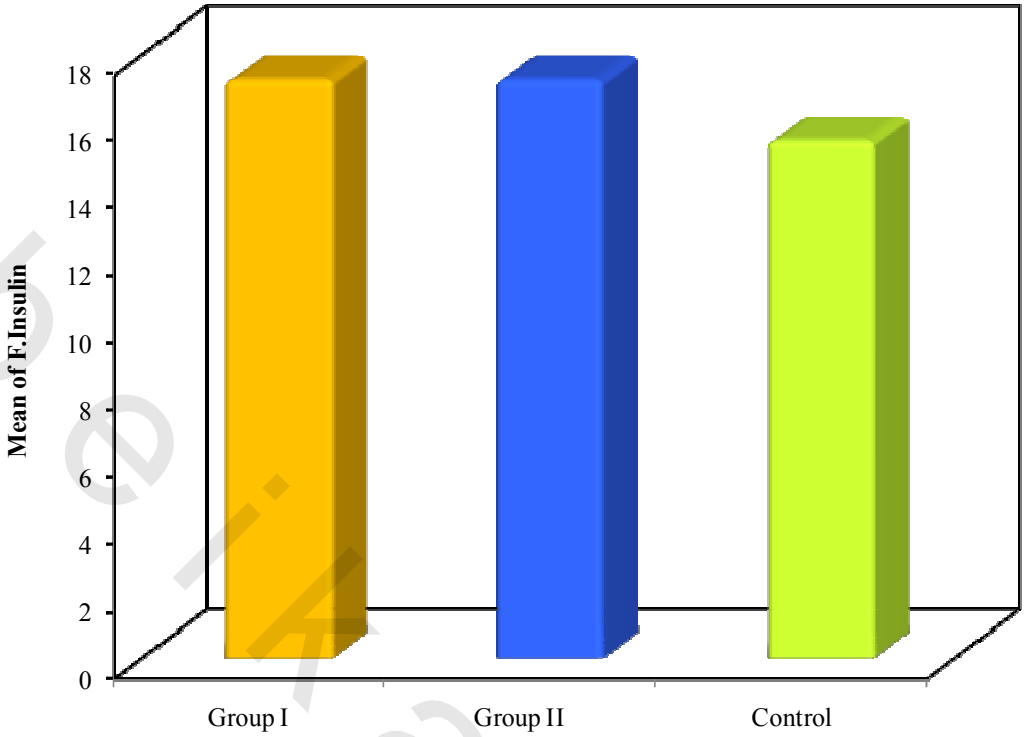

Figure (10): Comparison between the three studied groups regarding F.insulin

Table (14): Comparison between the two subgroups regarding F.Insulin (2-25 mg/dl)

	SubGroup I	SubGroup II	Control
F.Insulin (2-25)			
Range	5 - 17	8 - 31	6.5 - 34.4
Mean	9.70	16.00	15.42
SD	4.89	8.29	7.00
P_1		0.078	
P_2		0.033*	
p_3		0.441	

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

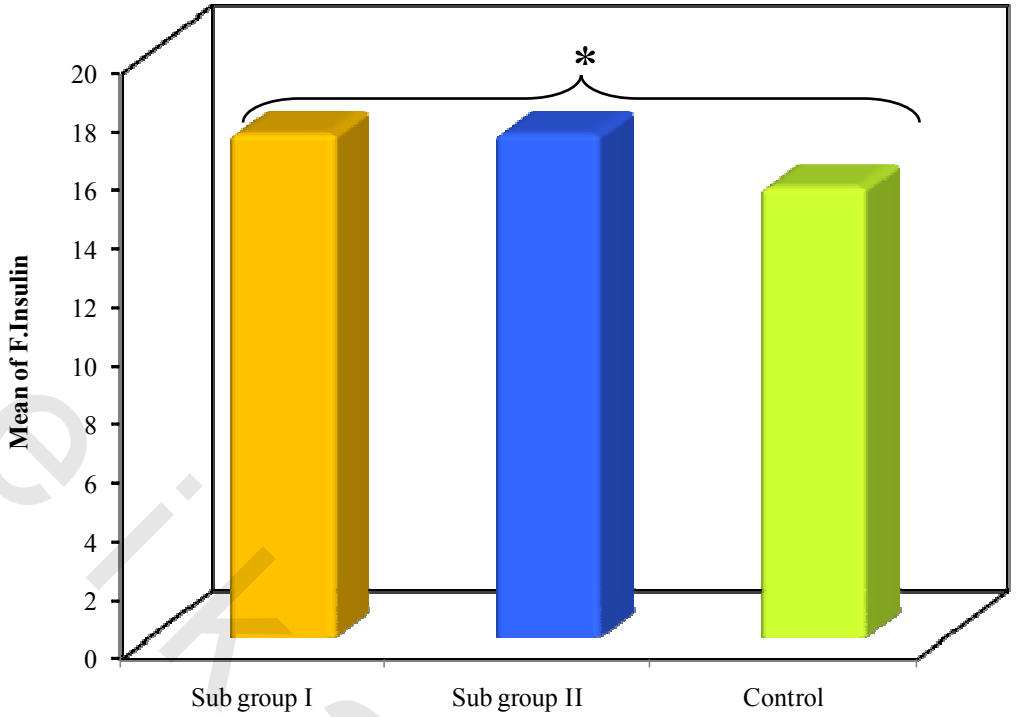

Figure (11): Comparison between the two subgroups regarding F.Insulin

e) Insulin resistance:

Insulin resistance in the control group ranged between 1.2-6.2 with mean of 2.98 +/- 1.42, In group (1) it ranged between 0.4-16.2 with mean 4.04 +/- 3.22, In group (2) it ranged between 0.7-16.1 with mean 3.93 +/- 3.24, In subgroup (1) it ranged between 0.4-3.8 with mean 2.12 +/- 1.49, In subgroup (2) it ranged between 1.6-5.2 with mean 3.23 +/- 1.25.

The study revealed no statistically significant difference between control group and other groups.

Table (15): Comparison between the three studied groups regarding Insulin resistance.

	Group I	Group II	Control
Insulin resistance			
Range	0.4 - 16.2	0.7 - 16.1	1.2 - 6.2
Mean	4.04	3.93	2.98
SD	3.21	3.24	1.42
P_1	0.454		
P_2	0.079		
p_3	0.103		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

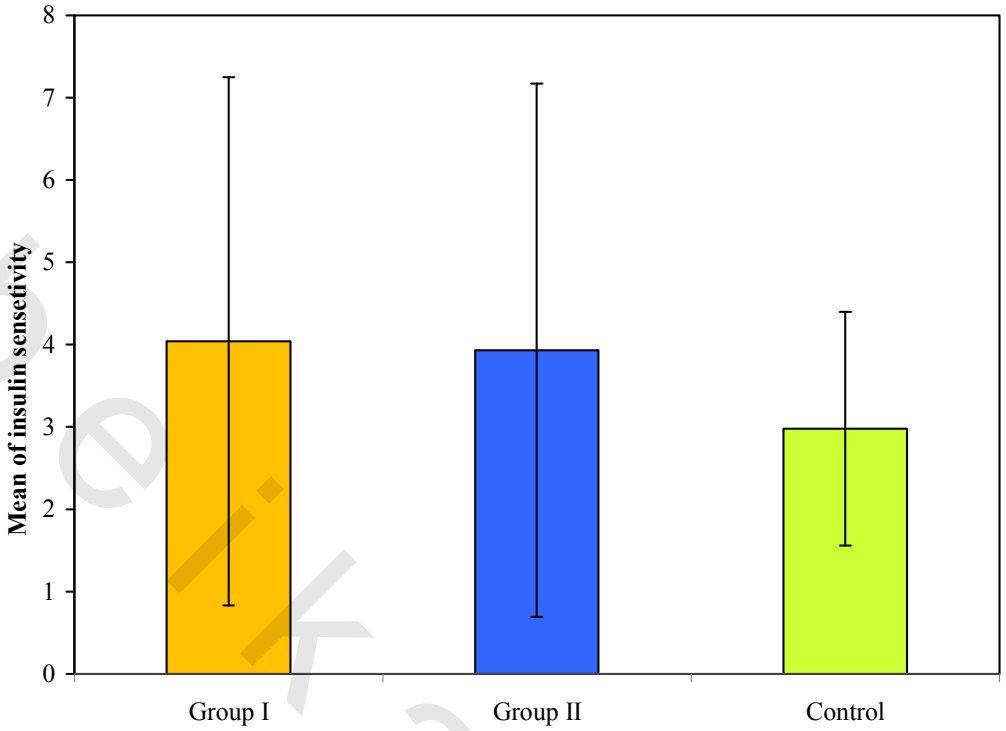

Figure (12): Comparison between the three studied groups regarding Insulin resistance.

Table (16): Comparison between the two subgroups regarding Insulin resistance.

	SubGroup I	SubGroup II	Control
Insulin resistance			
Range	0.4 - 3.8	1.6 - 5.2	1.2 - 6.2
Mean	2.12	3.23	2.98
SD	1.49	1.25	1.42
P_1	0.111		
P_2	0.146		
p_3	0.343		

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

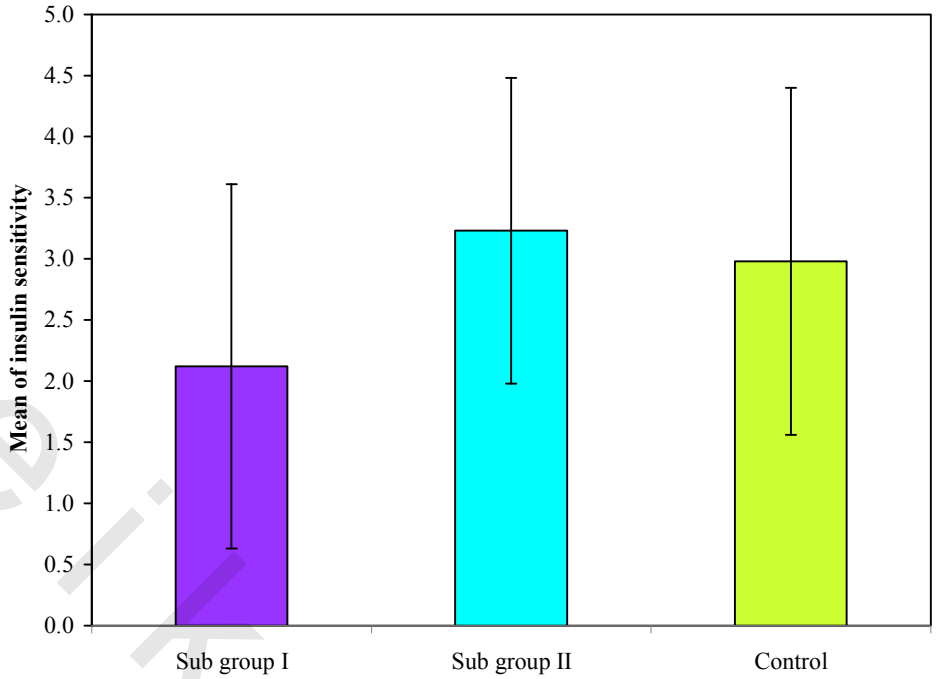

Figure (13): Comparison between the two subgroups regarding insulin resistance.

f) Fasting blood glucose (FBG):

FBG in the control group ranged between 55-105 mg/dl with mean of 79.78 +/- 15.27, In group (1) it ranged between 36-129 with mean 92.54 +/- 19.78, In group (2) it ranged between 69-126 with mean 90.58 +/- 14.14, In subgroup (1) it ranged between 36-120 with mean 83.40 +/- 30.41 , In subgroup (2) it ranged between 69-102 with mean 86.50 +/- 11.71.

There was statistically significant difference found between control group and group (1) (p= 0.012), and between control group and group (2)(p = 0.012).

Table (17): Comparison between the three studied groups regarding F.B.G.

	Group I	Group II	Control
F.B.G			
Range	36 - 129	69 - 126	55 - 105
Mean	92.54	90.58	79.78
SD	19.78	14.14	15.27
P_1	0.348		
P_2	0.012*		
p_3	0.012*		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

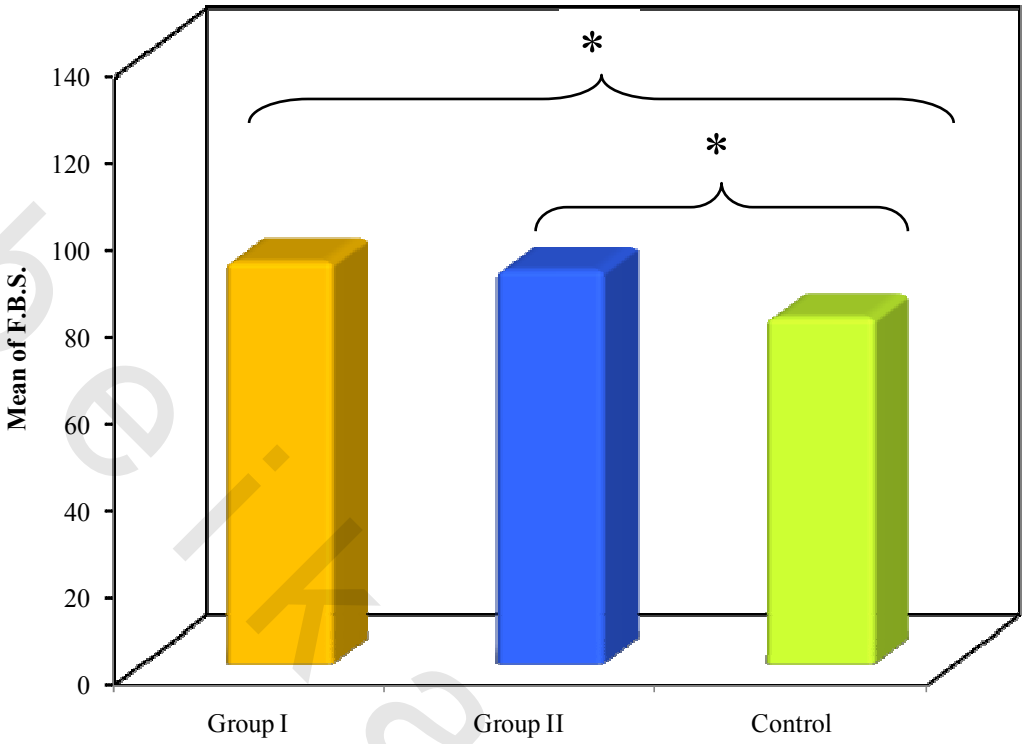

Figure (14): Comparison between the three studied groups regarding F.B.G.

Table (18): Comparison between the two subgroups regarding F.B.G

	SubGroup I	SubGroup II	Control
F.B.G			
Range	36 - 120	69 - 102	55 - 105
Mean	83.40	86.50	79.78
SD	30.41	11.71	15.27
P_1	0.419		
P_2	0.404		
p_3	0.142		

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

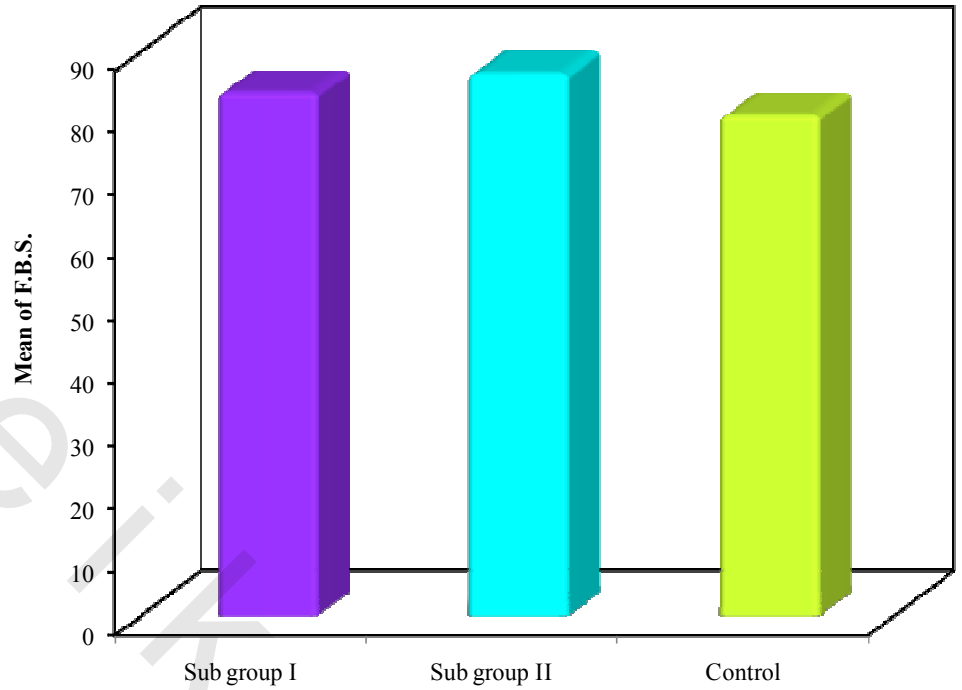

Figure (15): Comparison between the two subgroups regarding F.B.G.

h) Postprandial blood glucose (PPG) :

P.P.G in the control group ranged between 110-185 mg/dl with mean of 161.83 +/- 17.47, In group (1) it ranged between 130-200 with mean 136.38 +/- 15.73, In group (2) it ranged between 150-210 with mean 173.67 +/- 14.23, In subgroup (1) it ranged between 140-200 with mean 165 +/- 22.91 , In subgroup (2) it ranged between 162-210 with mean 182.33 +/- 16.42.

There was statistically significant difference found between control group and group (2)(p= 0.013) and between control group and subgroup (2) (p =0.014), similarly there was statistically significant difference found between group (1) and control group (p =0.011).

Table (19): Comparison between the three studied groups regarding P.P.G.

	Group I	Group II	Control
P.P.G			
Range	130 - 200	150 - 210	110 - 185
Mean	163.38	173.67	161.83
SD	15.73	14.23	17.47
P_1	0.011*		
P_2	0.385		
p_3	0.013*		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

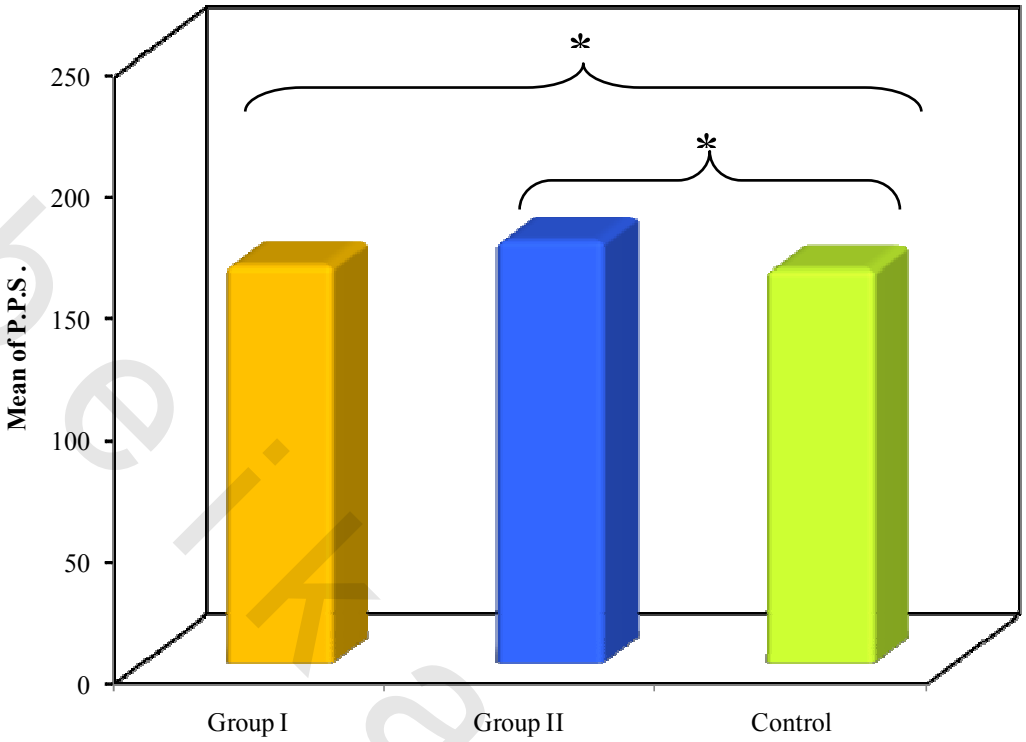

Figure (16): Comparison between the three studied groups regarding P.P.G.

Table (20): Comparison between the two subgroups regarding P.P.G

	SubGroup I	SubGroup II	Control
P.P.G			
Range	140 - 200	162 - 210	110 - 185
Mean	165.00	182.33	161.83
SD	22.91	16.42	17.47
P_1	0.100		
P_2	0.393		
p_3	0.014*		

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

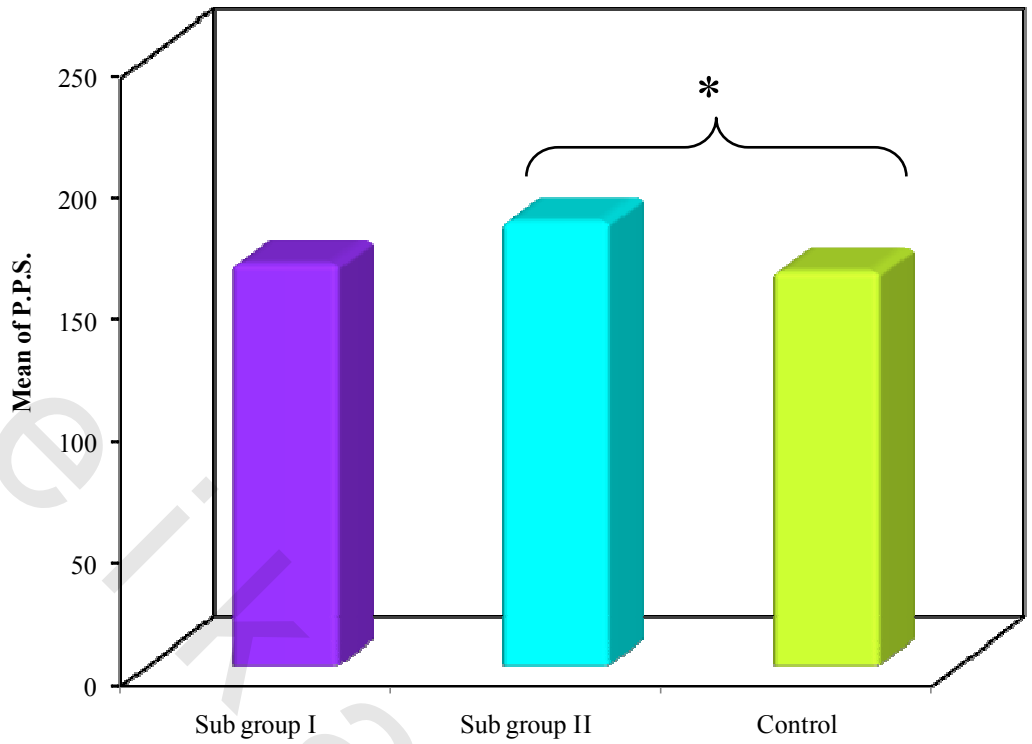

Figure (17): Comparison between the two subgroups regarding P.P.G.

i) Hb A1C:

HbA1C in the control group ranged between 4.1-6.1 with mean of 5.09 +/- 0.63, In group (1) it ranged between 3.5-6.5 with mean 5.07 +/- 0.77, In group (2) it ranged between 4-6.3 with mean 5.13 +/- 0.7, In subgroup (1) it ranged between 3.5-6.5 with mean 5.18 +/- 1.12 , In subgroup (2) it ranged between 4.4-6.3 with mean 5.28 +/- 0.81.

There was no statistically significant difference between control group and other groups.

Table (21): Comparison between the three studied groups regarding HbA1C

	Group I	Group II	Control
HbA1C (4-6%)			
Range	3.5 - 6.5	4 - 6.3	4.1 - 6.1
Mean	5.07	5.13	5.09
SD	0.77	0.70	0.63
P_1	0.393		
P_2	0.460		
p_3	0.431		

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

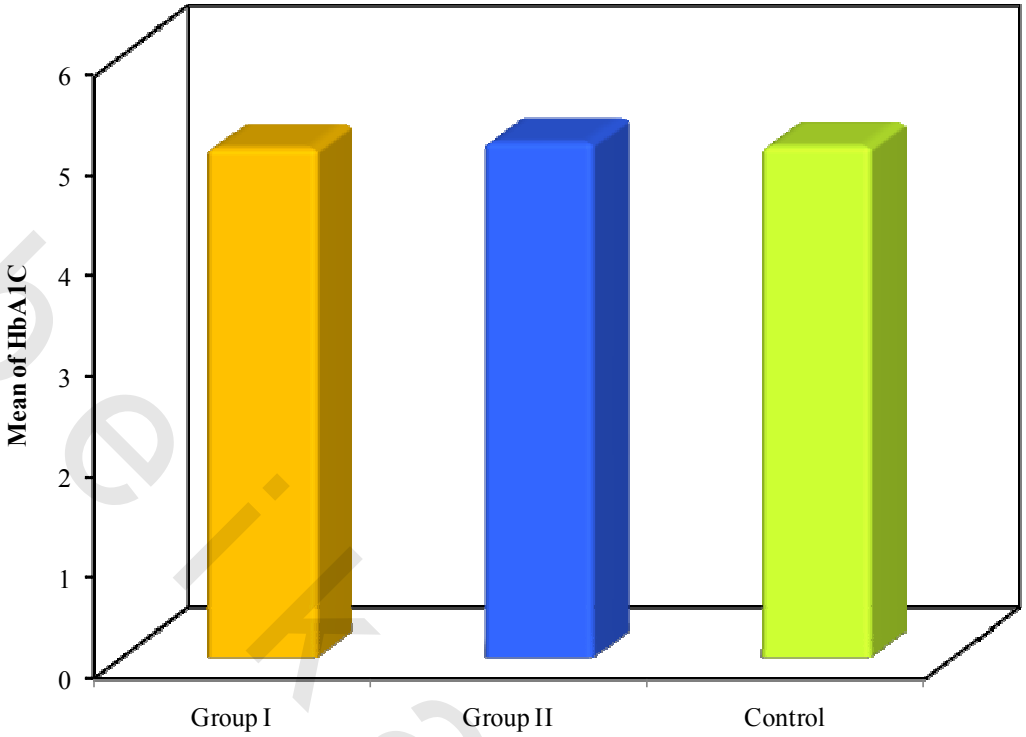

Figure (18): Comparison between the three studied groups regarding HbA1C

Table (22): Comparison between the two subgroups regarding HbA1C

	SubGroup I	SubGroup II	Control
HbA1C (4-6%)			
Range	3.5 - 6.5	4.4 - 6.3	4.1 - 6.1
Mean	5.18	5.28	5.09
SD	1.12	0.81	0.63
P_1	0.434		
P_2	0.434		
p_3	0.304		

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

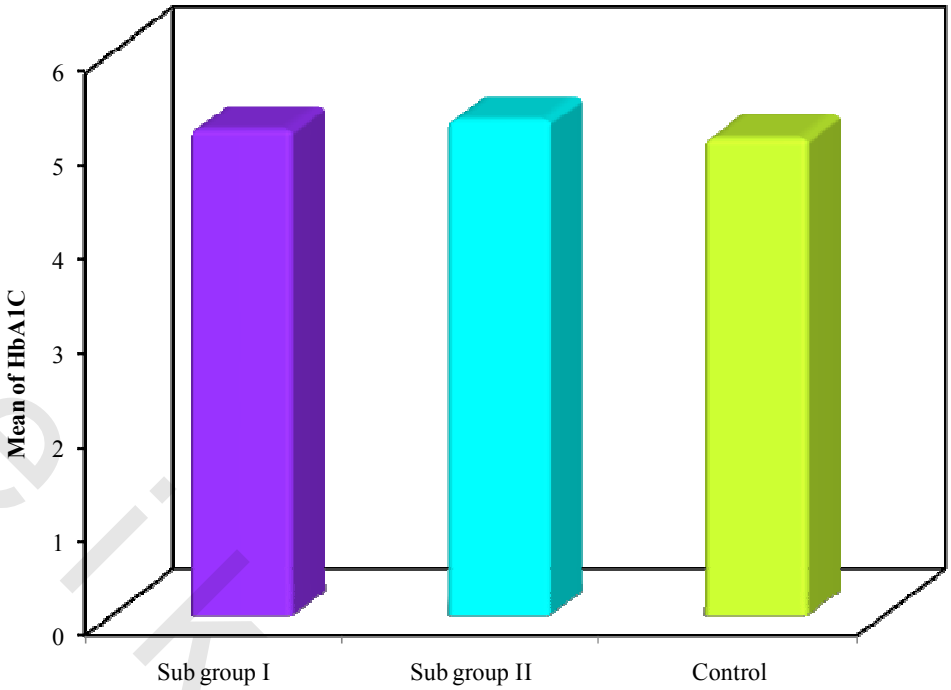

Figure (19): Comparison between the two subgroups regarding HbA1C

i) Systolic blood pressure:

SBP in the control group ranged between 100-150 mmHg with mean of 124.72 +/- 16.13, In group (1) it ranged between 90-140 with mean 116.04 +/- 13.35, In group (2) it ranged between 110-155 with mean 132.50 +/- 11.61, In subgroup (1) it ranged between 100-120 with mean 110 +/- 7.07, In subgroup (2) it ranged between 130-140 with mean 134.17 +/- 4.92.

There was statistically significant difference found between control group and group (1), group (2) , subgroup (1) and subgroup (2)(p =0.036, 0.046, 0.004, 0.019) respectively

In this study there was statistically significant difference between group (1) and group (2) (p= 0.000) and between subgroup (1) and subgroup (2) (p = 0.000)

Table (23): Comparison between the three studied groups regarding SBP

	Group I	Group II	Control
SBP			
Range	90 - 140	110 - 155	100 - 150
Mean	116.04	132.50	124.72
SD	13.35	11.61	16.13
P_1		0.000*	
P_2		0.036*	
p_3		0.046*	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

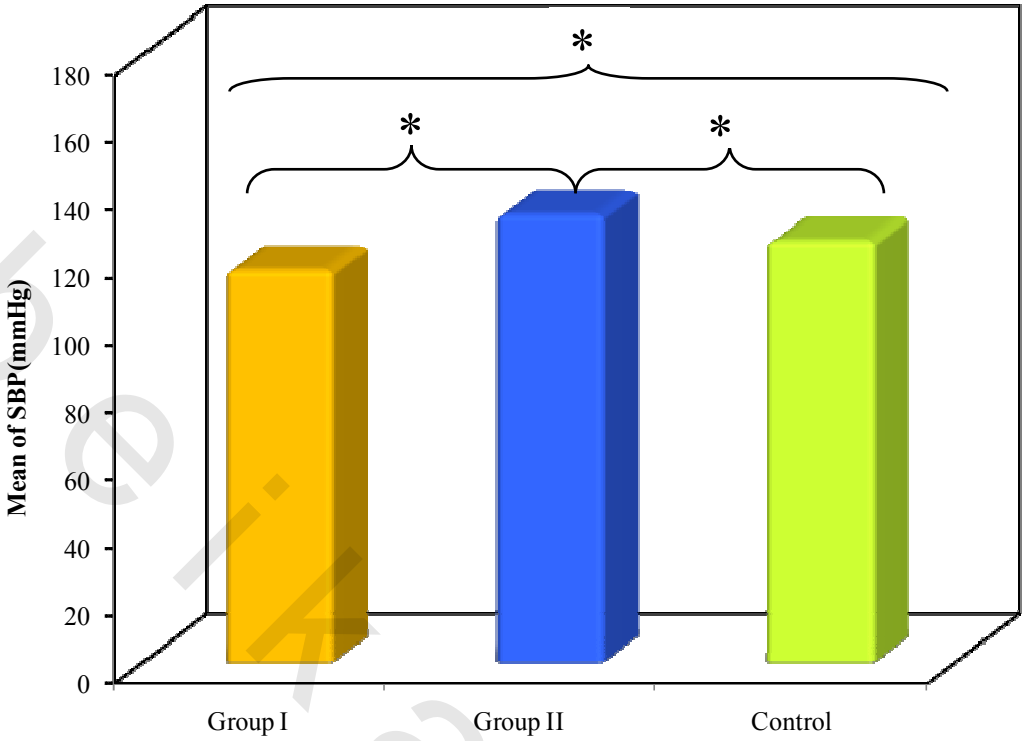

Figure (20): Comparison between the three studied groups regarding SBP

Table (24): Comparison between the two subgroups regarding SBP

	SubGroup I	SubGroup II	Control
SBP			
Range	100 - 120	130 - 140	100 - 150
Mean	110.00	134.17	124.72
SD	7.07	4.92	16.13
P_1		0.000*	
P_2		0.004*	
p_3		0.019*	

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

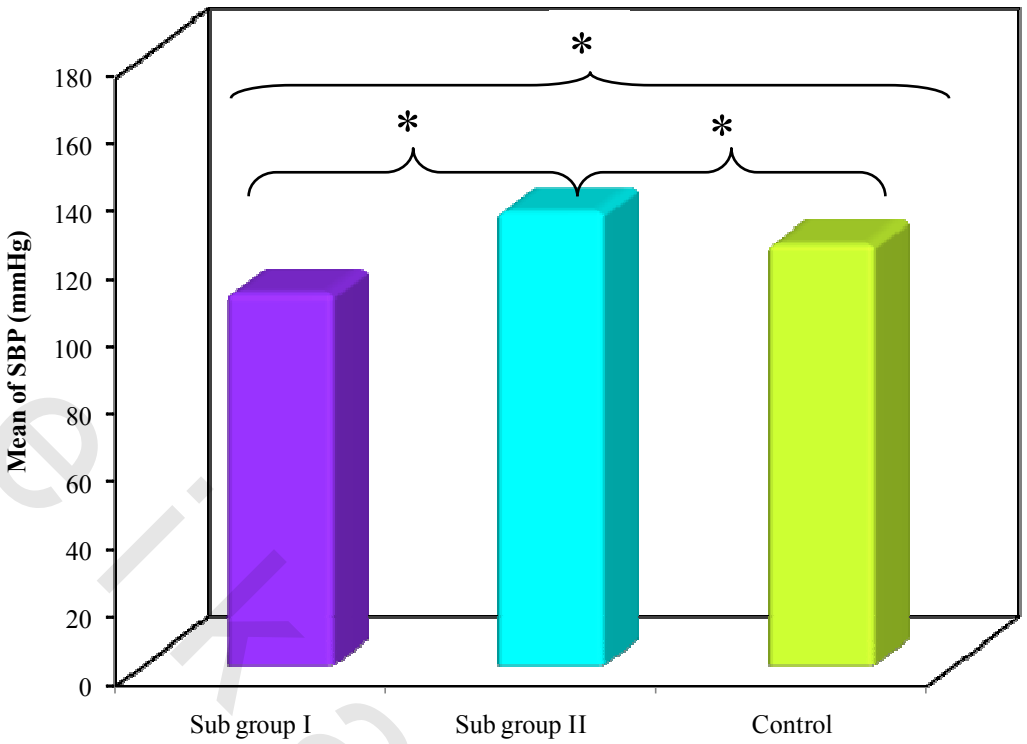

Figure (21): Comparison between the two subgroups regarding SBP

K) Diastolic blood pressure:

DBP in the control group ranged between 60-90 mmHg with mean of 73.33 +/- 9.07,In group (1) it ranged between 60-85 with mean 72.08 +/- 7.79, In group (2) it ranged between 60-90 with mean 81.25 +/- 8.88, In subgroup (1) it ranged between 60-80 with mean 70 +/- 10 , In subgroup (2) it ranged between 85-90 with mean 89.17 +/- 2.04.

There was statistically significant difference found between control group and group (2) (P= 0.004) as well as between control group and subgroup (2)(p = 0.000).

There was statistically significant difference found between group (1) and group(2) (p= 0.000) ,and between subgroup (1) and subgroup (2) as (p = 0.006)

Table (25): Comparison between the three studied groups regarding DBP

	Group I	Group II	Control
DBP			
Range	60 - 85	60 - 90	60 - 90
Mean	72.08	81.25	73.33
SD	7.79	8.88	9.07
P_1		0.000*	
P_2		0.321	
p_3		0.004*	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

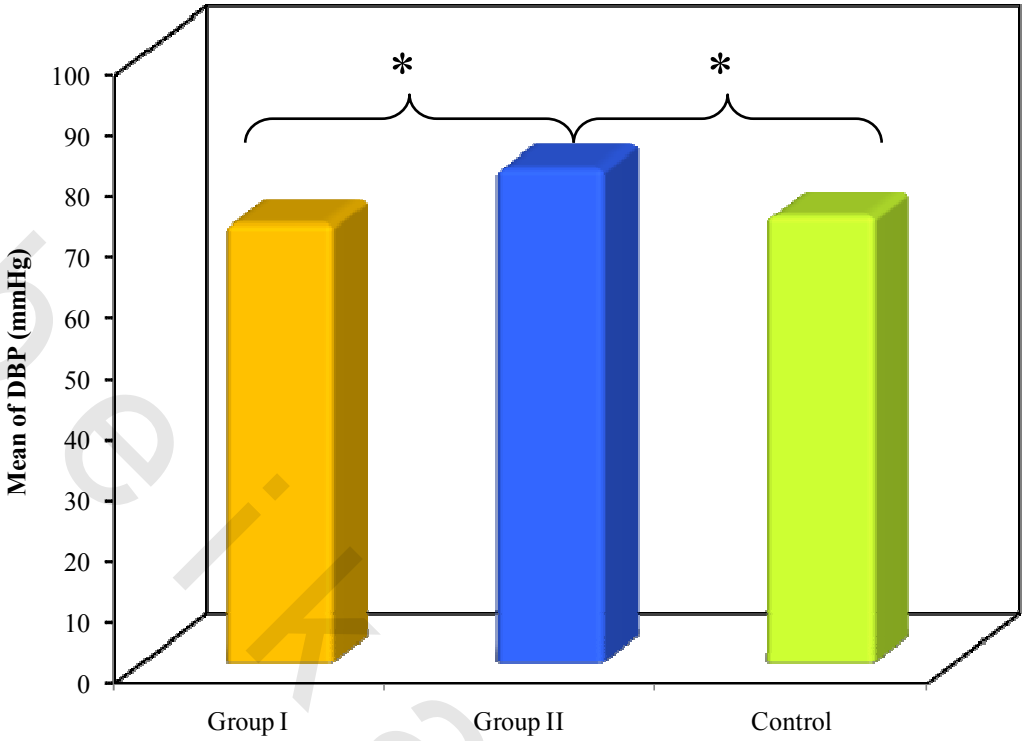

Figure (22): Comparison between the three studied groups regarding DBP

Table (26): Comparison between the two subgroups regarding DBP

	SubGroup I	SubGroup II	Control
DBS			
Range	60 - 80	85 - 90	60 - 90
Mean	70.00	89.17	73.33
SD	10.00	2.04	9.07
P_1		0.006*	
P_2		0.263	
p_3		0.000*	

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

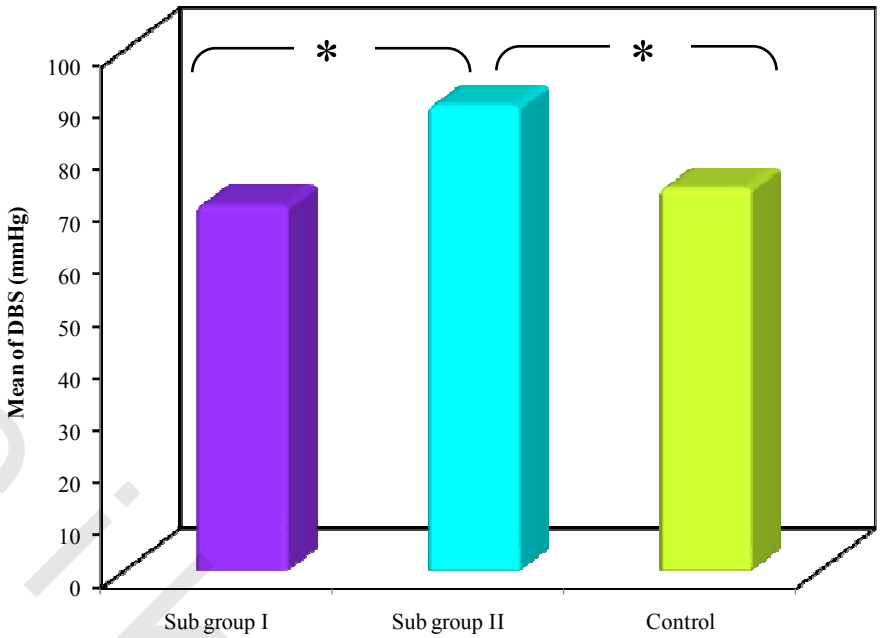

Figure (23): Comparison between the two subgroups regarding DBP

I) BMI:

BMI in the control group ranged between 19.5-39.2 with mean of 26.88 +/- 4.27, In group (1) it ranged between 15.1-26 with mean 22.02 +/- 2.82, In group (2) it ranged between 24.8-36.5 with mean 29.18 +/- 3.30, In subgroup (1) it ranged between 22.2-25 with mean 23.82 +/- 1.12 , In subgroup (2) it ranged between 26.5-28.5 with mean 27.33 +/- 0.82.

There was statistically significant difference found between control group and group (1) (p= 0.000) , and between control group and group (2) (p= 0.033) , and between control group and subgroup (1)(p = 0.006) .

There was statistically significant difference found between group (1) and group(2)(p = 0.000).

There was statistically significant difference found between subgroup (1) and subgroup(2)(p = 0.000).

Table (27): Comparison between the three studied groups regarding BMI

	Group I	Group II	Control
BMI			
Range	15.1 - 26	24.8 - 36.5	19.5 - 39.2
Mean	22.02	29.18	26.88
SD	2.82	3.30	4.27
P_1		0.000*	
P_2		0.000*	
p_3		0.033*	

p_1: p value for comparing between group I and group II
p_2: p value for comparing between group I and control
p_3: p value for comparing between group II and control

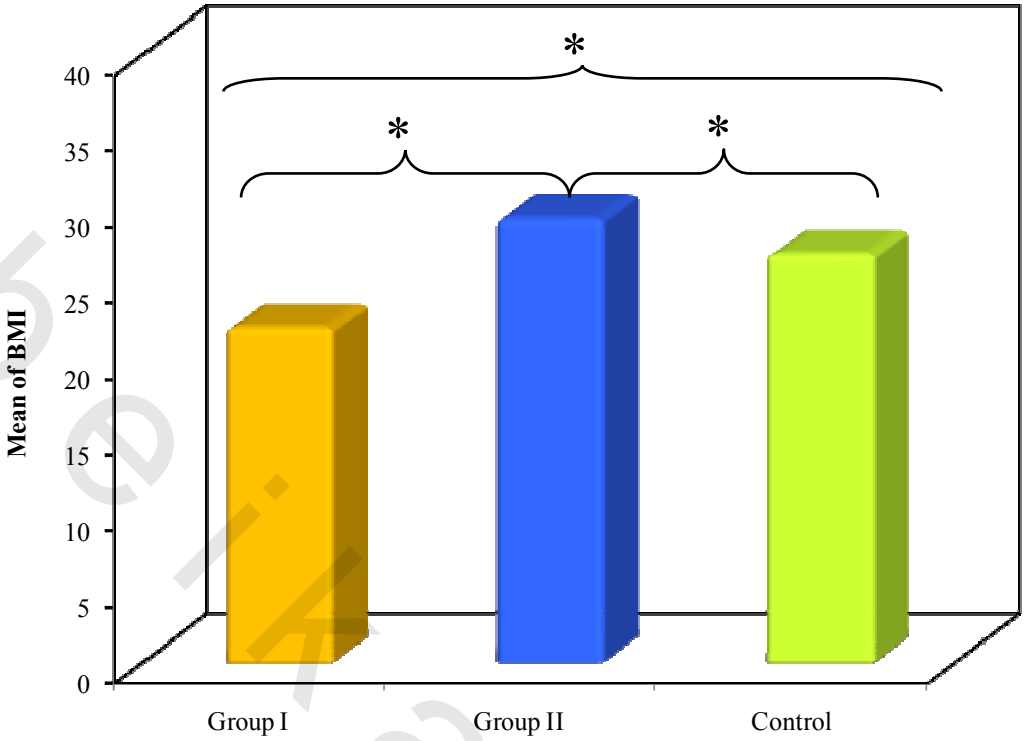

Figure (24): Comparison between the three studied groups regarding BMI

Table (28): Comparison between the two subgroups regarding BMI

	SubGroup I	SubGroup II	Control
BMI			
Range	22.2 - 25	26.5 - 28.5	19.5 - 39.2
Mean	23.82	27.33	26.88
SD	1.12	0.82	4.27
P_1		0.000*	
P_2		0.006*	
p_3		0.336	

p_1: p value for comparing between subgroup I and subgroup II
p_2: p value for comparing between subgroup I and control
p_3: p value for comparing between subgroup II and control

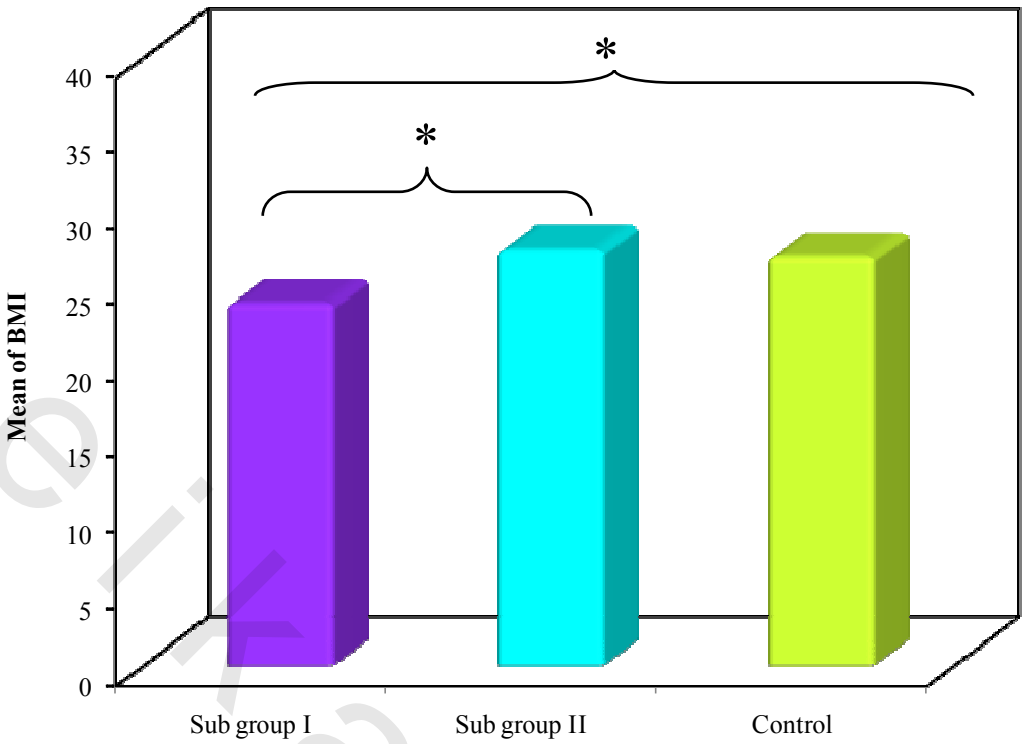

Figure (25): Comparison between the two subgroups regarding BMI

Correlation between TSH , lipid profile and insulin sensitivity

In group (1):

Table (29) there is positive correlation between TSH and LDL as r= 0.476 and statistically significant (p= 0.019) .

Table (29): Correlation between TSH with lipid profile and insulin sensitivity in group 1

	TSH	
	r	**p**
LDL	0.476*	0.019
HDL	0.124	0.564
TGs	0.011	0.959
Cholesterol	0.318	0.129
Insulin sensitivity	0.100	0.641

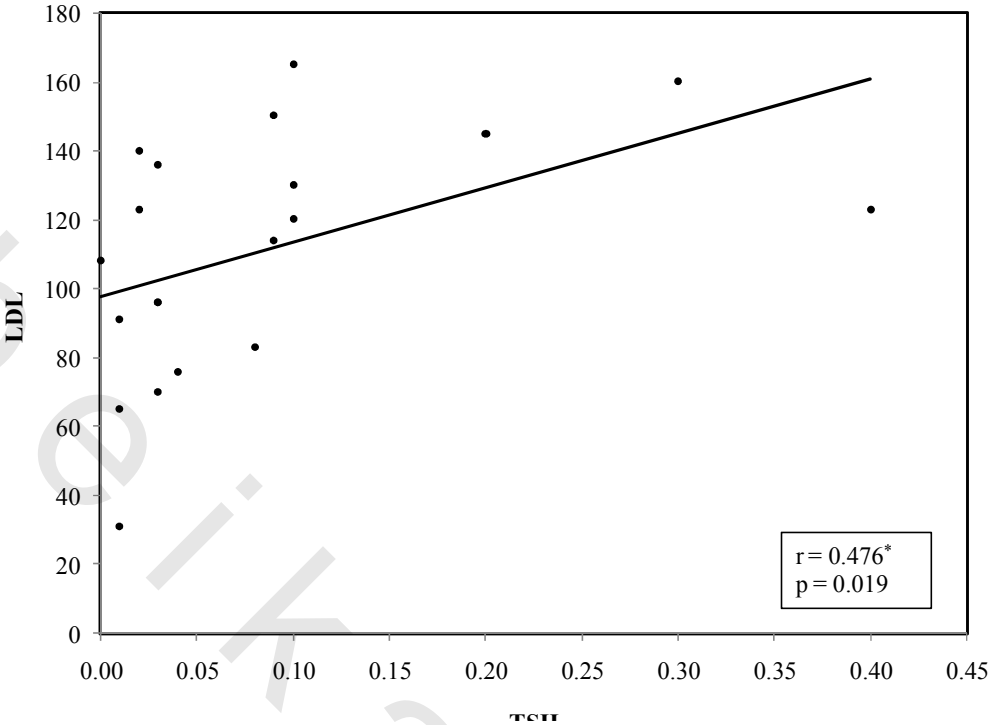

Figure (26): Correlation between TSH with LDL in group I

In group (2): Table (30)

There is correlation between TSH and LDL as r= 0.639 and statistically significant ($p < 0.001$).

There is correlation between TSH and Cholesterol as r= 0.511 and statistically significant (p= 0.006) .

Table (30): Correlation between TSH with lipid profile and insulin sensitivity in group (2)

	TSH	
	R	**p**
LDL	0.639*	<0.001
HDL	-0.079	0.696
TGs	0.252	0.205
Cholesterol	0.511*	0.006
Insulin sensitivity	-0.210	0.293

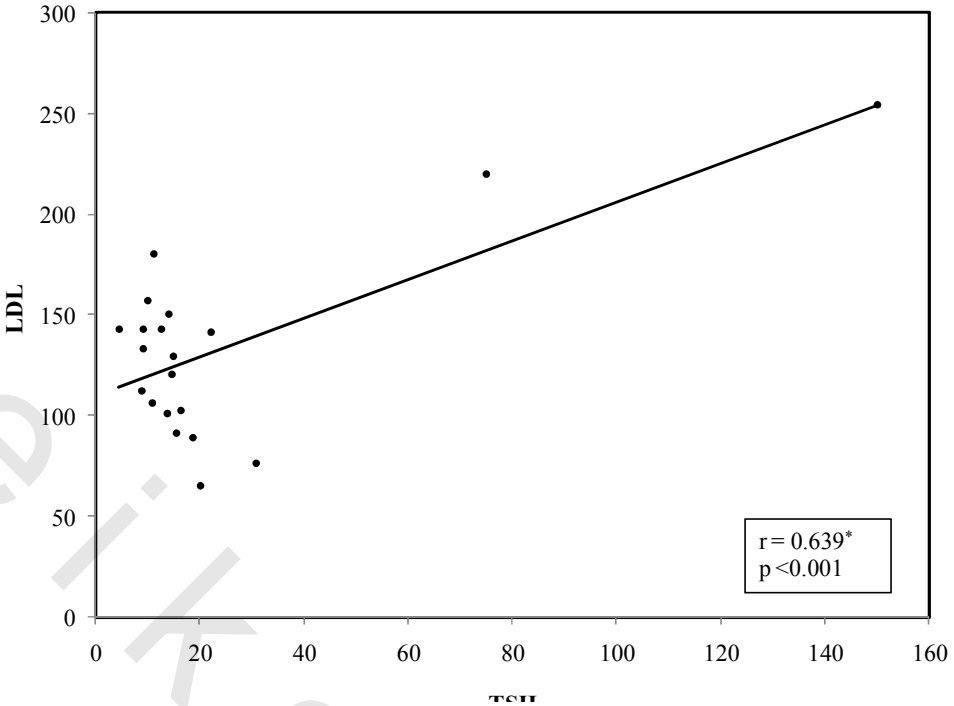

Figure (27): Correlation between TSH with LDL in group II

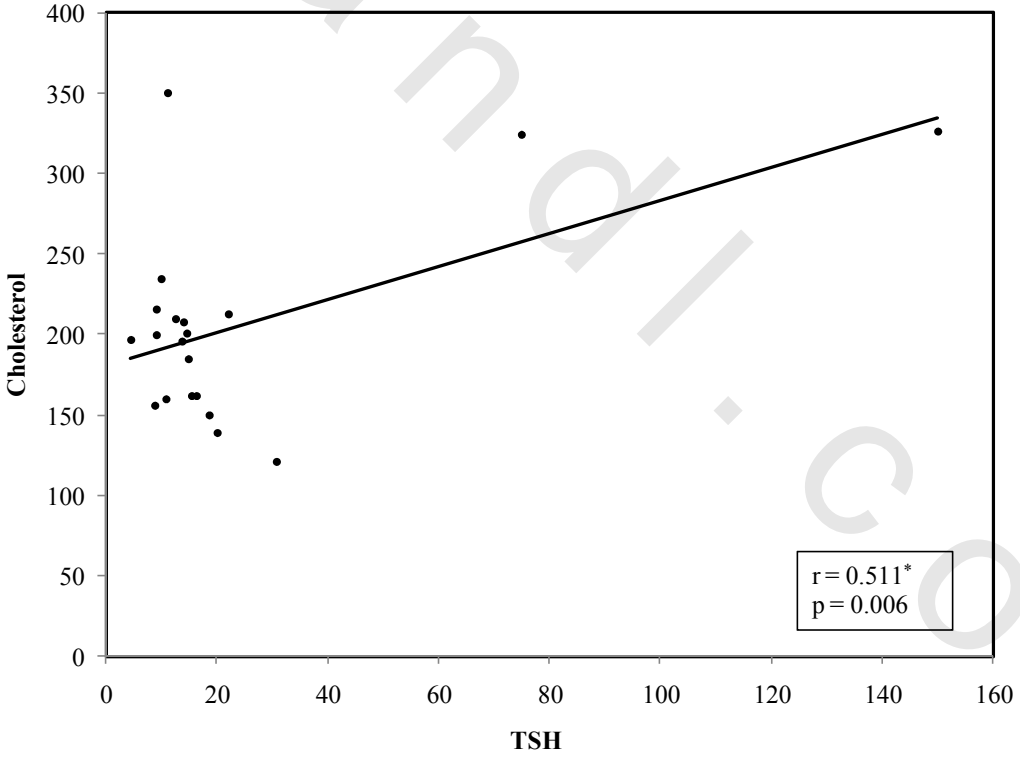

Figure (28): Correlation between TSH with cholesterol in group II