ISSN: 0975-3583,0976-2833 VOL15, ISSUE 1, 2024

Original Research Paper

"A STUDY ON CORRELATION OF BMI (BODY MASS INDEX) TO DIABETES MELLITUS, HYPERTENSION & DYSLIPIDEMIA IN A TERTIARY CARE HOSPITAL"

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ABSTRACT:

Background: In populations of poor countries, urbanisation is linked to a higher prevalence of obesity. Urbanisation causes fundamental changes in lifestyle such as less physical activity, more calorie-dense food consumption, and psychosocial stress. This causes weight gain & obesity which leads to the development of hypertension, increased LDL cholesterol, decreased HDL cholesterol, and diabetes.

Objective: To study the relation of Body Mass Index to diabetes mellitus, hypertension, and dyslipidaemia (triglyceride, total cholesterol, HDL cholesterol and LDL cholesterol).

MATERIAL & METHODS: Study Design: A prospective hospital based observational study. **Study area:** Department of General Medicine, Gayatri Vidya Parishad Institute of Health Care & Medical Technology. **Study Period:** 6 months. **Study population**: In patients and out patients of diabetes mellitus (type 1 & 2) or hypertension or dyslipidaemia coming to Department of General Medicine. **Sample size:** By using simple random method, 110 patients were selected, among which 20 patients had type1 DM, 30 patients had type2 DM, 30 were hypertensive and 30 patients had dyslipidaemia. **Sampling method:** Simple random technique. **Ethical consideration:** Institutional Ethical committee permission was taken prior to the

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 1, 2024

commencement of the study. **Study tools and Data collection procedure:** Measurement of height, weight and calculating BMI from it as per WHO recommendations. Fasting serum lipid profiles: total Cholesterol, HDL-cholesterol and triglyceride measurements were performed by using standard enzymatic techniques. LDL- cholesterol was calculated by using formula of Friedewald et al. Venous plasma glucose was measured by glucose oxidase method. Blood pressure measurement: As mentioned in measurement protocol. **Statistical Method:** By using simple random sampling method 110 patients were selected. Comparison of various parameters among normal weight, overweight and obesity were performed with diabetes mellitus, hypertension and dyslipidemia by T- test. Analysis of covariance was performed to allow for potential confounding factors like age, sex, number. Data were analyzed by T- test and correlation coefficient. A p- value <0.05 was considered as statistically significant.

Results: There was a statistically significant elevation of total cholesterol levels when compared between normal weight (216.33±45.12) and obesity (306.66±96.6) group. ($t=2.92$, $p<0.05$). There was elevation of total cholesterol levels when compared between overweight (245.55±59.2) and obesity (306.66±96.6) group. However, the difference was statistically not significant ($t=1.30$, $p>0.05$, $r = 0.47$).

Conclusion: Significantly increased triglyceride and decreased HDL-C levels were observed in overweight and obese patients. As BMI increased, there was increased risk of developing elevated triglyceride levels and decreased HDL-C levels. Significantly increased levels of total cholesterol and LDL-C were observed only in obese dyslipidemic group.

Keywords: BODY MASS INDEX**,** dyslipidemic group, elevated triglyceride levels and decreased HDL-C levels

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INTRODUCTION:

In populations of poor countries, urbanisation is linked to a higher prevalence of obesity. Urbanisation causes fundamental changes in life style such as less physical activity, more calorie-dense food consumption, and psychosocial stress.[1] This causes weight gain & obesity which leads to the development of hypertension, increased LDL cholesterol, decreased HDL cholesterol, and diabetes.[2]

The American Heart Association and other organisations should include obesity as a significant modifiable cardiovascular risk factor, according to a large prospective study like the Framingham Heart Study.[3] Insulin resistance, obstructive sleep apnea, and coronary atherosclerosis are three conditions that obesity may worsen.[4.] Obesity is a chronic condition that increases the risk of developing a number of illnesses, including heart disease, gall bladder disease, and some types of cancer. These illnesses can lower quality of life and even cause death.[5]

Studies and reviews have shown that the prevalence of hypertension, diabetes, elevated LDL cholesterol, lowered HDL cholesterol, and the metabolic syndrome has increased among India's urban population.[6] In the last two to three decades, obesity prevalence has increased

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 1, 2024

significantly, quickly emerging as the most significant public health issue in the majority of industrialised nations.

In developed nations, 10% to 20% of children and adolescents and 20% to 40% of adults are obese. India's obesity epidemic, which now affects 5% of the population is reaching epidemic proportions. India is continuing the upward trend in obesity seen in other developing nations.

The prevalence of Hypertension is between 10 and 20 %.[7] In India, prevalence rates for males and females in urban areas are 59.9 and 69.9 per 1000, respectively, and 35.5 and 35.9 per 1000 for males and females in rural areas.[8] By 2025, 1.56 billion adults are expected to have hypertension, up from the 2000 estimate of 1 billion.[9] From 10 to 73% of people had dyslipidaemia overall. In metropolitan New Delhi, hypertriglyceridemia was more common in 73% of obese patients compared to 61% of non-obese subjects. Asian Indian migrants and urban Asian Indian residents of India had the highest serum triglyceride levels.[7]

Hence the present study was undertaken to study the relation of Body Mass Index to diabetes mellitus type 1 & 2, hypertension, and dyslipidaemia (triglyceride, total cholesterol, HDL cholesterol and LDL cholesterol).

Objective: To study the relation of Body Mass Index to diabetes mellitus type 1 & 2, hypertension, and dyslipidaemia (triglyceride, total cholesterol, HDL cholesterol and LDL cholesterol).

MATERIAL & METHODS:

Study Design: A prospective hospital based observational study.

Study area: Department of General Medicine, Gayatri Vidya Parishad Institute of Health Care & Medical Technology.

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Study Period: 6 months.

Study population: In patients and out patients of diabetes mellitus (type 1 & 2) or hypertension or dyslipidaemia coming to Department of General Medicine.

Sample size: By using simple random method, 110 patients were selected, in that 20 patients were type1 DM, 30 patients were type2 DM, 30 were hypertensive and 30 patients had dyslipidaemia.

Sampling method: Simple random technique.

Inclusion Criteria:

• Age group: >13yrs

• Diabetes mellitus (both type1 and type2) confirmed by, random blood sugar, fasting blood sugar, 2hr post glucose and past history of diabetes mellitus on oral hypoglycaemic or on injectable insulin. Either newly detected or detected with in past 1yr.

• Systemic hypertension detected by auscultatory method of blood pressure measurement or known hypertensive on anti hypertensives. Either newly detected or detected with in past 1yr.

• Dyslipidaemia detected by serum triglyceride, total cholesterol, HDL- cholesterol, LDL-cholesterol levels (Either single or multiple lipid profile abnormality). Either detected newly or within past 1yr by known reports.

Exclusion criteria:

• Age group ≤13yrs

• Patients with hypertension, diabetes mellitus and dyslipidaemia diagnosed more than 1yr ago.

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Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure: Measurement of height, weight and calculating BMI from it as per WHO recommendations. Fasting serum lipid profiles: total Cholesterol, HDL-cholesterol and triglyceride measurements were performed by using standard enzymatic techniques. LDL- cholesterol was calculated by using formula of Friedewald et al. Venous plasma glucose was measured by glucose oxidase method. Blood pressure measurement: As mentioned in measurement protocol.

Measurement Protocols

1. Height: It was measured against a vertical board with an attached metric rule and a horizontal headboard was brought in contact with uppermost point on the head. It was recorded bare-foot, with person standing on a flat surface and weight distributed evenly on both feet, heels together and the head positioned so that the line of vision is perpendicular to the body. The arms were hanging freely by the sides, and the head, back, buttocks, and heels were in contact with vertical board. The individual was asked to inhale deeply and maintained a full erect position. Top –most point on the head with sufficient pressure to compress the hair was taken as height to the nearest of 0.1 cm.

2. Weight: Weight was recorded without footwear with light clothes worn on body, standing straight on the centre of weighing machine with body weight evenly distributed between both feet by the ISI certified weighing machine to the nearest of 100 gm.

3. Body Mass Index: Calculated as weight (kg)/ height2 (mt).

Systolic blood pressure (SBP) = at the appearance of Korotkoff first sound (Phase I)

Diastolic blood pressure (DBP) = At the disappearance of Korotkoff sound (Phase V)

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Statistical Method: By using simple random sampling method 110 patients were selected. Comparison of various parameters among normal weight, overweight and obesity were performed with diabetes mellitus, hypertension and dyslipidemia by T- test. Analysis of covariance was performed to allow for potential confounding factors like age, sex, number. Data were analyzed by T- test and correlation coefficient. A p- value <0.05 was considered as statistically significant.

OBSERVATIONS & RESULTS:

In our study 110 patients were selected, out of them 20 patients had type1 DM, 30 had type2 DM, 30 had systemic hypertension and 30 had dyslipidaemia.

Table 1: Showing age distribution of Type1 DM, Type2 DM, hypertension and dyslipidemia

Age(years)	Type1DM	Type2 DM	Hypertension	Dyslipidemia
15-25	18 (90%)	0	0	0
26-35	2(10%)	0	6(20%)	5(16%)
36-45	0	8 (26%)	9(30%)	11(37%)
46-55	0	10 (33%)	9(30%)	10(33%)
56-65	0	10(34%)	6(20%)	4(13%)
>65	0	2 (7%)	0	0
Total	20(100%)	30 (100%)	30(100%)	30(100%)

In our study 20 patients had type1 DM, out of them 18(90%) patients were between 15-25 years and 2(10%) patients were between 26-35 years. 30 patients had type 2 DM. All patients were above 35 years. Most patients 20(67%) were between 46-65 years. 30 patients had systemic

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hypertension. Patients age ranged from 26- 65 years. 30 patients had dyslipidaemia. Patients age ranged from 26-65 years.

Table 2: Showing sex distribution of Type1DM, Type2DM, hypertension and dyslipidemic patients

	Type1DM	Type2 DM	Hypertension	Dyslipidemia
Male	9 (45%)	24 (80%)	23 (77%)	22 (73%)
Female	11(55%)	6 (20%)	7 (23%)	8 (27%)
Total	20	30	30	30

In our study group of 20 type1 DM patients, 9(45%) were males and 11(55%) were females. In our study group of 30 type2 DM patients, 24(80%) were males and 6(20%) were females. In our study group of 30 hypertensive patients 23(77%) were males and 7(23%) were females. In our study group of 30 dyslipidaemia patients 22(73%) were males and 8(27%) were females.

Table 3: Showing BMI distribution in study population

BMI	Type1 DM	Type2 DM	Hypertension	Dyslipidemia
<18.5	11 (55%)	0	0	0
18.5- 24.9	9 (45%)	6 (20%)	7 (23%)	6 (20%)
25- 29.9	0	19 (63%)	19 (63%)	18 (60%)
≥ 30	0	5 (17%)	4 (13%)	6 (20%)
Total	20	30	30	30
Mean ± SD	18.22±2.23	26.98± 2.1	26.71±3.75	27.52± 3.43

In our study of 20 type1 DM patients 11(55%) were underweight and 9(45%) were normal weight. In our study of 30 type2 DM patients 6(20%) were normal weight, 19(63%) were overweight and 5(17%) were obese. In our study of 30 hypertensive patients 7(23%) were normal weight, 19(63%) were overweight and 4(13%) were obese. In our study of 30

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dyslipidaemia patients 6(20%) were normal weight, 18(60%) were overweight and 6(20%) were obese.

Table 4: Showing comparison of mean values of systolic blood pressure between different BMI groups

SBP (mm Hg)	<18.5	18.5-24.9	25-29.9	≥ 30
<130	0	2 (7%)	3 (10%)	0
130-139	0	3 (10%)	3 (10%)	0
140-159	0	2 (7%)	5 (17%)	0
160-179	0	0	2 (7%)	2 (7%)
≥ 180	0	0	6 (20%)	2 (7%)
Total	0	7 (23%)	19 (63%)	4 (14%)
Mean± SD	0	130.57±8.39	152.62±19.24	174.5±5.5
Inference		Significant	Significant	Significant

In our study of 30 patients with hypertension elevated SBP was observed in 2(7%) patients with normal weight, 13(44%) patients with overweight and 4(14%) patients with obesity. Mean SBP in normal weight group was 130.57±8.39, in overweight group it was 152.62±19.24 and in obese group it was 174.5±5.5. There was a statistically significant elevation in SBP when compared between normal weight (130.57±8.39) and overweight (152.62±19.24) group ($t = 4.06$, $p < 0.01$). There was a statistically significant elevation in SBP when compared between normal weight (130.57±8.39) and obesity (174.5±5.5) group, ($t = 7.2$, $p < 0.001$). There was a statistically significant elevation in SBP when compared between overweight (152.62±19.24) and obesity (174.5±5.5) group, ($t = 4.21$, $p < 0.01$, $r = 0.90$).

Table 5: Showing comparison of mean values of diastolic blood pressure between different BMI groups

DBP (mmHg)	<18.5	18.5-24.9	25-29.9	≥ 30
< 80	0	2 (7%)	2 (7%)	0

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80-89	0	3 (10%)	3 (10%)	0
90-99	0	2 (7%)	4 (13%)	0
100-109	0	0	3 (10%)	1 (3%)
≥ 110	0	0	7 (23%)	3 (10%)
Total	0	7 (24%)	19(63%)	4 (13%)
Mean± SD	0	81.14±6.4	99.36±18.85	104±16.67

In our study group of 30 hypertensive patients elevated DBP was observed in 2 (7%) patients with normal weight, 14 (46%) patients with overweight and 4 (13%) patients with obesity. Mean DBP in normal weight group was 81.14±6.4, in overweight group it was 99.36±18.85 and in obese group it was 104±16.67. There was a statistically significant elevation in DBP when compared between normal weight 81.14±6.4) and overweight (99.36±18.85) group, ($t = 3.69$, $p<0.01$). There was a statistically significant elevation in DBP when compared between normal weight (81.14±6.4) and obese (104±16.67) group, ($t = 3.7$, $p<0.001$). There was a statistically significant elevation in DBP when compared between overweight (99.36±18.85) and obese (104±16.67) group, ($t = 2.52$, $p< 0.01$, $r = 0.94$).

Table 6: Showing comparison of mean values of Type 1 diabetes mellitus between different BMI groups

BMI	RBS(mg/dl)	FBS(mg/dl)	PPBS(mg/dl)
<18.5	337.27±125.57	179.72±53	265.72±74.62
18.5-24.9	397.6±96.59	207.33±47.56	238.76±34.63
25-29.9	0	0	0
≥30	0	0	0
t- test	1.21	1.22	1.04
p- value	> 0.05	> 0.05	> 0.05
Inference	Not significant	Not significant	Not significant

In our study of 20 Type1 DM patients, all patients were in underweight and normal weight group. Mean RBS, FBS and PPBS in underweight group was 337.27±125.57, 179.72±53 and 265.72±74.62 respectively and in normal weight group it was 397.6±96.59, 207.33±47.56 and

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238.76±34.63 respectively. Since p- > 0.05, hence there was no statistically significant difference between underweight and normal weight groups.

Table 7: Showing comparison of mean values of Type 2 diabetes mellitus between different BMI groups

BMI	No of cases	RBS(mg/dl)	FBS(mg/dl)	PPBS(mg/dl)
<18.5	0	0	0	0
18.5-24.9	6(20%)	188.0±47.67	150.66±22.92	190.16±14.91
25-29.9	19(63%)	264.6±72.2	178.9±32.2	232.72±31.3
≥30	5(17%)	335.2±75.2	201±12.0	270.6±29.8

Mean RBS, FBS and PPBS in normal weight group was 188.0±47.67, 150.66±22.92 and 190.16±14.91 respectively. Mean RBS, FBS and PPBS in overweight group was 264.6±72.2, 178.9±32.2 and 232.72±31.3 respectively. Mean RBS, FBS and PPBS in obese group was 335.2±75.2, 201±12.0 and 270.6±29.8 respectively. There was a statistically significant elevation in RBS, when compared between normal weight (188.0±47.67) and overweight (264.6±72.2) group, ($t = 3.01$, $p<0.001$)

There was a statistically significant elevation in RBS, when compared between normal weight (188.0±47.67), and obese (335.2±75.2) group, ($t = 3.7$, $p<0.01$). There was a statistically significant elevation in RBS when compared between overweight (264.6±72.2) and obese (335.2±75.2) group, ($t = 1.89$, $p<0.05$, $r = 0.98$). There was a statistically significant elevation in FBS, when compared between normal weight (150.66±22.92), and overweight (178.9±32.2) group, ($t = 2.37$, $p<0.025$)

There was a statistically significant elevation in FBS, when compared between normal weight (150.66±22.92), and obese (201±12.0) group, ($t = 4.73$, $p<0.01$). There was a statistically significant elevation in FBS, when compared between overweight (178.9±32.2), and obese (201±12.0) group, ($t = 2.46$, $p<0.025$, $r = 0.95$). There was a statistically significant elevation

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in PPBS, when compared between normal weight (190.16±14.91), and overweight (232.72±31.34.53) group, (t= 4.53, p<0.001).

There was a statistically significant elevation in PPBS, when compared between normal weight (190.16±14.91), and obese (270.6±29.8) group, (t = 5.48, p<0.01). There was a statistically significant elevation in PPBS, when compared between overweight ((232.72±31.34.53)), and obese (270.6±29.8) group, (t = 2.56, p<0.01, r = 0.95).

Table 8: Showing comparison of mean values of HDL-Cholesterol between different BMI groups

HDL(mg/dl)	<18.5	18.5-24.9	25-29.9	≥30
<40	0	3 (10%)	17 (58%)	6 (20%)
40-60	0	3 (10%)	1 (3%)	0
>60	0	0	0	0
Total	0	6 (20%)	18 (60%)	6 (20%)
Mean ± SD	0	39±2.1	37.25±1.23	34.83±2.1

In our study of 30 dyslipidaemia patients, decreased HDL-cholesterol was observed in 3(10%) patients with normal weight, 17(58%) patients with overweight and 6(20%) patients with obesity. Mean HDL-cholesterol in normal weight group was 39±2.1, in overweight group it was 37.25±1.23 and in obese group it was 34.83±2.1. There was statistically significant decreased HDL-Cholesterol level when compared between normal weight (39±2.1) and overweight (37.25±1.23) group, (t = 1.94, p<0.05).

There was statistically significant decreased HDL-Cholesterol level when compared between normal weight (39±2.1) and obese (34.83±2.1) group, (t = 4.9, p<0.01). There was statistically significant decreased HDL-Cholesterol level when compared between overweight (37.25±1.23) and obese (34.83±2.1) group, (t = 2.67, p<0.01, r = -0.99).

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In our study group of 30 dyslipidaemia patients, elevated cholesterol was observed in 4(13%) patients with normal weight, 14(47%) patients with overweight and 6(20%) patients with obesity. Mean total cholesterol in normal weight group was 216.33±45.12, in overweight group it was 245.55±59.2 and in obese group it was 306.66±96.6. There was elevation of total cholesterol levels when compared between normal weight (216.33±45.12) and overweight (245.55±59.2) group. However, the difference was statistically not significant ($t=1.22$, $p>0.05$). There was a statistically significant elevation of total cholesterol levels when compared between normal weight (216.33±45.12) and obesity (306.66±96.6) group. ($t=2.92$, $p<0.05$). There was elevation of total cholesterol levels when compared between overweight (245.55±59.2) and obesity (306.66±96.6) group. However, the difference was statistically not significant ($t=1.30$, $p>0.05$, $r = 0.47$).

In our study of 30 dyslipidaemia patients, elevated triglyceride level was observed in 4(14%) patients with normal weight, 14(47%) patients with overweight and 6(20%) patients with obesity. Mean triglyceride in normal weight group was 164±35.2, in overweight group it was 216.22±75.14 and in obese group it was 389.33±95.4. There was a statistically significant elevation of triglyceride levels when compared between normal weight (164±35.2) and overweight (216.22±75.14) group, ($t = 2.29$, $p< 0.025$). There was a statistically significant elevation of triglyceride levels when compared between normal weight (164±35.2) and obese (389.33±95.4) group, ($t = 7.6$, $p< 0.001$). There was a statistically significant elevation of triglyceride levels when compared between overweight (216.22±75.14) and obese (389.33±95.4) group, ($t = 4.06$, $p< 0.05$ $r = 0.947$).

Table 9: Showing comparison of mean values of LDL-Cholesterol between different BMI groups

LDL(mg/dl)	<18.5	18.5-24.9	25-29.9	≥30
<100	0	1 (3%)	0	0

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100-129	0	1 (3%)	2 (7%)	1 (3%)
130-159	0	2 (7%)	3 (10%)	0
160-189	0	1 (3%)	8 (27%)	2 (7%)
≥190	0	1 (3%)	5 (17%)	3 (10%)
Total	0	6 (20%)	18 (60%)	6 (20%)
Mean± SD	0	145.83±42.8	172.55±36.62	215.33±52.4

In our study of 30 dyslipidaemia patients, elevated LDL-cholesterol was observed in 4 (13%) patients with normal weight, 16 (54%) patients with overweight and 5 (17%) patients with obesity. Mean LDL-cholesterol in normal weight group was 145.83±42.8, in overweight group it was 172.55±36.62 and in obese group it was 215.33±52.4. There was elevation of LDL-cholesterol levels when compared between normal weight (145.83±42.8) and overweight (172.55±36.62) group.

However, the difference was statistically not significant ($t=1.37$, $p = 0.10$). There was statistically significant elevation of LDL-cholesterol levels when compared between normal weight 145.83±42.8) and obesity (215.33±52.4) group. ($t=3.56$, $p< 0.01$). There was elevation of LDL-cholesterol levels when compared between overweight (172.55±36.62) and obesity (215.33±52.4) group. However, the difference was statistically not significant ($t=1.75$, $p> 0.05$, $r = 0.822$).

DISCUSSION:

The present study was undertaken to examine the major risk factors for atherosclerotic cardiovascular diseases like Diabetes Mellitus, hypertension and dyslipidaemia associated with obesity level based on BMI. The mean age of type 2 diabetics, hypertensives and dyslipidemic patients was higher than 35 yrs and was significantly lower in type 1 DM. Similar observations were reported by Singh et al[10] and Brown et al.[11]

The mean BMI of patients with Type1 DM, Type2 DM, hypertensive and dyslipidemic patients were 18.22±2.23, 26.98±2.1, 26.7±3.75 and 27.52±3.43 respectively, suggesting they were

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overweight (pre obese) except type 1 diabetics. Similar increased BMI was observed by Cercato et al.[12], and Han et al.[13]

Aziz et al[14] reported statistically significant elevation in SBP, DBP, triglyceride levels and decrease in HDL cholesterol levels when compared between subgroups of BMI. They also reported elevation of total cholesterol and LDL cholesterol. However, the difference amongst subgroups of BMI were not statistically significant.

In our study mean SBP in normal weight group was 130.57±8.39, in overweight group it was 152.62±19.24 and in obese group it was 174.5±5.5. Mean SBP levels were higher in overweight patients when compared to normal weight patients and the difference was statistically significant. ($p < 0.01$). Mean SBP levels were higher in obese patients when compared to normal weight patients and the difference was statistically significant. ($p < 0.001$). Mean SBP levels were higher in obese patients when compared to overweight patients and the difference was statistically significant. ($p < 0.01$). In our study as BMI increased there was a statistically significant increase in systolic blood pressure.

In our study mean DBP of normal weight group was 81.14±6.4, in overweight group it was 99.36±18.85 and in obese group it was 104±16. 67. Mean DBP levels were higher in overweight patients when compared to normal weight patients and the difference was statistically significant. ($p<0.01$). Mean DBP levels were higher in obese patients when compared to normal weight patients and the difference was statistically significant ($p < 0.01$). Mean DBP levels were higher in obese patients when compared to overweight patients and the difference was statistically significant. ($p < 0.01$). In our study as BMI increased there was a statistically significant increase in diastolic blood pressure. These findings are consistent with study by Aziz et al.[14]

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In our study mean HDL-cholesterol in normal weight group was 39.0±2.1, in overweight group it was 37.25±1.23 and in obese group it was 34.83±2.1. Mean total HDL-cholesterol levels were lower in overweight patients when compared to normal weight patients and the difference was statistically significant. ($p < 0.025$). Mean total HDL-cholesterol levels were lower in obese patients when compared to normal weight patients and the difference was statistically significant. ($p < 0.01$). Mean total HDL-cholesterol levels were lower in obese patients when compared to overweight patients and the difference was statistically significant. ($p < 0.01$). In our study as BMI increased, there was significant decrease in HDL-C levels. Similar results were observed by Cercato et al.[12] and Jawed Aziz et al.[14]

In our study mean LDL-cholesterol in normal weight group was 145.83±42.8, in overweight group it was 172.55±36.62 and in obese group it was 215.33±52.4. Mean total LDL-cholesterol levels were higher in overweight patients when compared to normal weight patients and the difference was statistically not significant. ($p = 0.10$). Mean total LDL-cholesterol levels were higher in obese patients when compared to normal weight patients and the difference was statistically significant. ($p < 0.01$). Mean total LDL-cholesterol levels were higher in obese patients when compared to overweight patients and the difference was statistically not significant. ($p > 0.05$).

In our study mean RBS, FBS and PPBS in underweight group was 337.27±125.57, 179.72±53 and 265.72±74.62 respectively. Mean RBS, FBS and PPBS in overweight group was 397.6±96.59, 207.33±47.56 and 238.76±34.63 respectively. All patients with type 1 DM were in underweight and normal weight group. As BMI increased there was no increased risk of developing type 1 DM. Similar results were observed by Marga Gimenez et al.[15]

In our study mean RBS, FBS and PPBS in normal weight group was 188.0±47.67, 150.66±22.92 and 190.16±14.91 respectively. Mean RBS, FBS and PPBS in overweight group

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was 264.6±72.2, 178.9±32.2 and 232.72±31.3 respectively. Mean RBS, FBS and PPBS in obese group was 335.2±75.2, 201±12.0 and 270.6±29.8 respectively. Mean RBS, FBS, PPBS levels were higher in overweight patients when compared to normal weight patients and the difference was statistically significant. Mean RBS, FBS, PPBS levels were higher in obese patients when compared to normal weight patients and the difference was statistically significant. Mean RBS, FBS, PPBS levels were higher in obese patients when compared to overweight patients and the difference was statistically significant. In our study as BMI increased there was a statistically significant increase in blood sugar levels. Similar results were observed by Cercato et al.[12]

CONCLUSION:

From our study, we conclude that BMI was significantly higher in type 2 DM, hypertension and dyslipidemic patients, Whereas BMI was lower in type 1 DM. Type 2 DM was significantly higher in overweight and obese patients. As BMI increased the risk of developing type 2 DM increased. Systemic hypertension was significantly higher in overweight and obese patients. As BMI increased, both systolic and diastolic blood pressure increased. Significantly decreased HDL-C levels were observed in overweight and obese patients. Significantly increased levels of total cholesterol and LDL-C were observed only in obese dyslipidemic group.

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