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Review Article

EFFECT OF BMI ON BLOOD PRESSURE AMONG TYPE-2 DIABETES MELLITUS PATIENTS

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ABSTRACT

This study was carried out in physiology department of Pcms and Rc. In this study 113 type 2 diabetics are included, we observe a proportionate increase in Diastolic Blood pressure with increasing BMI. Systolic blood pressure also shows similar trend but in group-3 there is less number of patients so this trend is not observed in them.

KEY WORDS: Diabetes Type 2, CAD, BMI, Blood pressure.

INTRODUCTION

Type 2 diabetes, accounting for about 90 to 95% of diabetes cases, was formerly known as non-insulin dependent or adult onset diabetes, is characterized by a resistance to the action of insulin, a relative deficiency of insulin production, or both. Insulin resistance leads to deficiency in the necessary insulin actions required for the proper metabolism of carbohydrates, fats, and proteins. There is alarming rise in prevalence of diabetes in developing nations. In india alone 31.7 million were affected in year 2000 & is expected to reach 79.44 million by the year 2030.[2] Over the past 30 years the status of diabetes has changed from being considered as mild disorder of elderly to one of the major cause of morbidity & mortality affecting youth & middle aged people.[3] Diabetes is associated with high morbidity and mortality due to its macrovascular and microvascular complications like myocardial infarction, hypertension, stroke, peripheral vascular disease, neuropathy, nephropathy and retinopathy.

Diabetes mellitus (DM) is one of the most potent independent risk factors for the development of coronary artery disease (CAD) and is recognized as a cardiovascular disease equivalent. Compared with individuals without DM, those with DM have a higher prevalence of CAD, a greater extent of coronary ischemia, and are more likely to have a myocardial infarction and silent myocardial ischemia. The vasculature of diabetic patients is more vulnerable in developing atherosclerotic plaques in comparison with the vasculature of the non diabetic individuals.[8] Diabetes is also associated with accelerated atherosclerotic macrovascular disease affecting arteries that supply the heart, brain and lower extremities. This study focuses on emerging trends of blood pressure among type-2 diabetes mellitus patients. Our study is carried out in physiology department of PCMS & RC Bhopal, India & About 113 patients of type 2 diabetes mellitus are included in this study & the trends of blood pressure with increasing BMI is monitored in this study.

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MATERIALS AND METHODS

Study Area: Department of Physiology, People's Medical College & Research Center, Bhopal.
Study Population: Patients of Type II Diabetes Mellitus attending the medicine and endocrine OPD.
Study Design: A Cross Sectional Study.
Study Period: From November 2011 to October 2012
Sample Size: All Type-2 diabetes cases as per selection criteria, attending the clinic during the study period.
Statistical Analysis: Data was analyzed using SPSS Statistics 20 software.
Inclusion Criteria: Patients of Type II Diabetes Mellitus attending the medicine and endocrine OPD during the study period, were included in the study.
Protocol: The proposed study was conducted in the Department of Physiology of People's Medical College & Research Center, Bhopal. Patients were included in the study from those attending the medicine and endocrine OPD during the study period.

The subjects were required to fill the consent form , if they agreed to participate in our study. Selected subjects were asked to get their fasting and postprandial blood glucose estimated and were requested to report to the Neurophysiology Laboratory of Department of Physiology.

After taking written consent and explaining the study procedure, the patient information including general profile, treatment history, personal history, daily activity, life style and routine food habits were recorded in a Case record form. The patients were examined in a separate room for anthropometric measurements & Blood pressure.

Anthropometric Measurements

Weight was recorded (to an accuracy of 0.5 kg) for each patient, with patient standing erect without any support and without shoes using standardized weighing scale.

Height- Patient was asked to stand on a flat surface after removal of shoes with the feet parallel and with the heels, buttocks, shoulders and the back of the head touching the upright wall. The head of the patient was positioned so that it was held comfortably erect, with the lower border of orbit of the eye in the same horizontal plane as the external canal of the ear with the arms hanging loosely by the sides. Then height was measured with the help of marking scale made on upright wall (to an accuracy of 1 cm).

Body Mass Index (BMI): was calculated by the formula

$$\text{BMI} = \frac{\text{Weight in kg}}{\text{Height in meter}^2}$$

The BMI thus calculated was used as the criterion to divide the study subjects into study subgroups for statistical analysis.

Waist Hip Ratio

Waist circumference was measured at the level midway between the lower rib margin and the iliac crest, at the umbilicus, with patient breathing out gently. Hip circumference was measured at the maximum width over the buttocks at level of the greater trochanters. From waist and hip circumference, the waist to hip ratio was calculated.

Blood Pressure

A recording the Blood Pressure of the patient was taken by a Mercury Sphygmomanometer in the supine position after 10 minutes of rest. Both auscultatory and palpatory methods were used as there may be auscultatory gap in high blood pressure patients.

Data collection

The collected data was entered in Microsoft excel worksheet. The subjects were divided into four study subgroups viz. A, B, C and D according to their BMI.

Subgroup A *– Normal weight*
Subgroup B- *Preobese*
Subgroup C- *Obese Class I*
Subgroup D- *Obese Class II*

Statistical analysis

The statistical analysis of the data thus obtained was done using statistical software SPSS version 20. The presence of microvascular complications viz. retinopathy, nephropathy and neuropathy in relation to BMI was analysed for significance by Chi square test. The association of microvascular complications with other parameters like age, gender, hypertension etc. were also studied. Differences were said to be significant at $p< 0.05$ and highly significant if $p< 0.001$.

RESULTS

Table 1 shows general characteristics of study subjects. More than $3/4^{th}$ of the study subjects (78.89%) are male. Majority among study subjects belong to urban area (70.00%) and have sedentary lifestyle (88.89%).

Table 1. General characteristics of study subjects (n=90)

	Number (Percentage)
Gender	
Male	71(78.89%)
Female	19 (21.11 %)
Urban resident	63(70.00%)
Rural resident	27(30.00%)
Sedentary lifestyle	80(88.89%)

Table 2. Anthropometric measurements and other biological health indicators of study subjects (n=90)

	Mean ± SD
Waist circumference (cm)	91.73 ±11.34
Waist Hip Ratio	0.925 ±0.41
Body Mass Index (BMI)	28.72 ± 5.49
Systolic BP (mm of Hg)	139.52 ±18.24
Diastolic B P (mm of Hg)	90.12 ±10.35
Blood glucose (fasting)	114.8 ±20.13

Table 2 shows anthropometric measurements and biological health indicators of interest related to the present study. The parameters of Obesity included in the study were Waist Circumference, Waist Hip Ratio and Body Mass Index. While the waist circumference (91.73 ±11.34) and waist hip ratio (0.925 ±0.41) were on the higher side, the mean BMI of study subjects was in Category Pre-obese, as per WHO classification of BMI. The range of mean Systolic Blood Pressures (139.52 ±18.24) and Diastolic Blood Pressure (90.12 ±10.35) is represented among study subjects as 35.55% subjects being hypertensive. Mean blood glucose levels exceeded the normal range.

Table 3. Blood pressure among BMI categories of study subjects (n=90)

	A (n= 25)	B (n=30)	C (n=23)	D (n=12)
DBP (mm of Hg)	86.96	88.46	91.73	97.75
SBP (mm of Hg)	136.6	136.3	145.65	141.83
Hypertension	8	6	14	3

Table 5 shows distribution of hypertension among BMI Categories of study subjects. More than $1/3^{rd}$ of the study subjects (34.44%) are hypertensive. Out of all the hypertensive subjects of the present study, 45.16% are from BMI Category C. Category A and Category B are almost equally represented with 25.81% and 19.35% of hypertensive subjects. Only 9.68% hypertensive subjects belong to Category D. Less representative subjects (13.3%) in Category D may be the reason for less number of hypertensive subjects in the group since remaining groups A, B and C are represented with 27.8%, 33.3% and 25.6% study subjects. The present study is a cross sectional study that was carried out in the Department of Physiology from November 2011 to October 2012 to study effect of Body Mass Index (BMI) on microvascular complications of type-2 diabetes mellitus. The study included 113 subjects with type 2 diabetes mellitus out of which 23 subjects were excluded as per exclusion criteria. A total 90 Type-2 Diabetes mellitus patients fulfilled the inclusion criteria and were included in the study. They were divided into four subgroups according to WHO criteria of BMI –

Subgroup A: BMI-18.5-24.99.(N=25);
Subgroup B: BMI-25-29.99.(N=30),

Subgroup C: BMI-30-34.99.(N=23); and,
Subgroup D: BMI-35-39.99.(N=13).

The BMI of the subjects ranged from 18.9 to 38.7, the mean BMI was 28.72 (Table2). About 72 % subjects were overweight (Table 3). In the present study no subject fell in the extreme categories of underweight and Obese type III of the WHO classification. A study by Bays H E & colleagues explored the relation between body mass index (BMI) and prevalence of diabetes mellitus and they found diabetes across all ranges of BMI but the prevalence increased with higher BMI [5.] Astrup and Finer (2000) also found higher prevalence of diabetes in obese subjects.[4] In our study we found that almost 70 % cases were urban residents as compared to only 30 % being rural. A relation may exist between diabetes and area of residence due lifestyle factor like dietary habits and level of activity as is evident by 80 % of the subjects following a sedentary lifestyle in our study. Our study had a similar finding as of Al-Moosa et al (2006) in Oman who found that the prevalence diabetes in the capital region as 17.7% compared to 10.5% in rural areas, With high prevalence of obesity among urban individuals.[12] The mean blood pressure of the study subjects as a whole was found to be almost in the normal range touching the highest mark of normal. But in the BMI categories C and D i.e. Obese type I and II the mean BP was in the range of hypertension.

DISCUSSION

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Conclusion

we conclude that with increasing BMI diastolic blood pressure increases proportionately among the groups, we observe similar trends in systolic blood pressure but group-4 shows contrasting result that is due to less number of patients among this group of BMI.

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