



## PREVALENCE OF DIABETES AND HYPERTENSION IN THE YOUNG ADULT POPULATION.

### General Medicine

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### ABSTRACT

**Aims and Objectives:** To estimate the prevalence of Diabetes Mellitus and Hypertension in the young adults of age 18-39 years, who have undergone pre-employment screening at a tertiary care hospital and document their parameters.

**Materials and methods:** Records of all candidates of either gender belonging to the age group 18 completed years to 39 completed years, who had undergone pre-employment screening during the period of 1<sup>st</sup> January 2016 till 30<sup>th</sup> June 2020, preserved in the Department of Medical Examination were examined for the purpose of this study. The candidates who had been diagnosed as hypertensive or diabetic or both were tabulated. The results and values were tabulated in MS Excel. The statistical software JASP was used for calculations.

**Results:** Records of 12257 candidates were scrutinized, out of which 9176 were males and 3081 were females. A total of 182 candidates were found to be Diabetic, Hypertensive or both. Majority of the candidates were males (175 out of 182, 96.15%). The prevalence of Diabetes Mellitus was 179 and that of Hypertension was 1362 per 100,000 population.

**Conclusion:** Diabetes and/or Hypertension are not uncommon in the young population of 18 to 39 years of age. Most of them are males. End organ affection can start early. Proper screening programmes can identify these cases early and ensure timely intervention.

### KEYWORDS

Diabetes, Hypertension, Prevalence, Young adults.

### INTRODUCTION

Diabetes and hypertension are important risk factors for cardiovascular diseases. Both of these entities go unrecognized in the general population and more so in the younger age group. The actual prevalence of these entities is not well known in the Indian population. Various surveys are available which point to a high prevalence. Surveys are hampered by the requirement of resources, both financial and human, the availability of subjects for screening, as well as geographical limits of the survey. Thus they give widely dispersed figures. Moreover, the associated parameters like kidney function tests and serum electrolyte values in case of hypertensive population, and fasting and post prandial blood sugar levels (FBS, and PPBS respectively) as well as glycated haemoglobin (HbA1c) in case of diabetics are not elucidated in most studies. Our study aims to estimate the prevalence of Diabetes and Hypertension in the young adults of age 18-39 years, who have undergone pre-employment screening at a tertiary care hospital and document the associated parameters and thus negate these limitations.

### MATERIALS AND METHODS

Records of all candidates of either gender belonging to the age group 18 completed years to 39 completed years, who had undergone pre-employment screening during the period of 1<sup>st</sup> January 2016 till 30<sup>th</sup> June 2020, were examined for the purpose of this study. The candidates who had been diagnosed as hypertensive or diabetic or both were tabulated. As per the Standard Operating Protocol (SOP) followed, the candidates who are to undergo the pre-employment screening are explained the process and asked to present to the centre after a 12 hour overnight fast. Their urine sample is taken and tested with glucostix. Then they are physically examined. Those candidates whose blood pressure is found to be 140/90 or higher are again counseled and their blood pressures measured again. If after 3 readings, their blood pressure remained 140/90 or higher, they undergo investigations related to hypertension. As per guidelines, their BP is also measured on subsequent visits, usually after a week. Borderline or doubtful cases undergo ambulatory BP monitoring under a cardiologist to confirm or rule out the diagnosis. Those candidates, whose urine tested positive for sugar, undergo all tests related to diabetes. End organ affection is also evaluated in both Diabetics as well as Hypertensive.

The investigations carried out include serum urea, serum creatinine, serum sodium, serum potassium, electrocardiography (ECG), echocardiogram (ECHO), ultrasonography of the abdomen, routine and microscopic examination of the urine (midstream catch of the first morning urine), fundoscopic examination of eyes for retinopathy

changes, in all cases and FBS, PPBS, Lipid profile, and HbA1c in diabetics. The results and finding were tabulated in MS Excel. Values of parameters which had not been recorded were not considered in calculation. Values were expressed in numerals with units and percentages wherever required. Normally distributed parameters were expressed as means with standard deviation (SD), while those with non-normal distribution were expressed as median with inter quartile range (IQR). The statistical software JASP was used for calculations. Since the number of females with Diabetes or Hypertension in our sample was very low, the values of both males and females have been combined.

### RESULTS

Records of total of 12257 candidates were examined, out of which 9176 candidates were males and 3081 candidates were females. A total of 182 candidates were found to be hypertensive, or diabetic or both. Of these, 175 candidates were male (96.15%) and only 7 were females (3.85%). 160 (87.97%) candidates were Hypertensive, 15 (8.24%) were Diabetic and 7 (3.85%) were both Diabetic as well as Hypertensive.

The gender wise breakup of the cases is given in Table 1. The prevalence of Diabetes, Hypertension, and Diabetes with Hypertension in the total population as well as in males and females is given in Table 2. The parameters recorded have been given in Table 3, the Body Mass Index (BMI) in table 4, while the end organ affection has been given in Table 5.

**Table 1: Gender Wise Breakup Of The Cases.**

| Disease                   | Male       | Female   | Total      |
|---------------------------|------------|----------|------------|
| Diabetic                  | 13         | 2        | 15         |
| Diabetic and hypertensive | 7          | 0        | 7          |
| Hypertensive              | 155        | 5        | 160        |
| <b>Total</b>              | <b>175</b> | <b>7</b> | <b>182</b> |

**Table 2: Prevalence Of Diabetes And Hypertension In The Population Aged 18-39 Years.**

| Sl No | Condition             | Number    | Prevalence (per 100,000) |
|-------|-----------------------|-----------|--------------------------|
| 1.    | Diabetes (Total)      | 22/12257  | 179                      |
| 2.    | Diabetes (Male)       | 20/9176   | 218                      |
| 3.    | Diabetes (Female)     | 2/3081    | 65                       |
| 4.    | Hypertension (Total)  | 167/12257 | 1362                     |
| 5.    | Hypertension (Male)   | 162/9176  | 1765                     |
| 6.    | Hypertension (Female) | 5/3081    | 162                      |

**Table 3: Table Showing The Values Of BMI (kg/m<sup>2</sup>) In The Three Groups.**

| BMI * DISEASE             | Obs | Mean        | Std Dev    | Min       | 25%        | Median | 75%        | Max       |
|---------------------------|-----|-------------|------------|-----------|------------|--------|------------|-----------|
| DIABETIC                  | 15  | 25.46<br>47 | 3.82<br>79 | 17.3<br>2 | 23.7<br>3  | 25.1   | 27.6<br>6  | 31.3<br>8 |
| DIABETIC AND HYPERTENSIVE | 7   | 31.13<br>57 | 5.61<br>76 | 21.8      | 27.2<br>2  | 31.22  | 35.9<br>9  | 38.7<br>7 |
| HYPERTENSIVE              | 160 | 27.20<br>23 | 5.61<br>19 | 18.6<br>1 | 23.8<br>75 | 26.53  | 29.9<br>45 | 71.8<br>3 |

**Table 4: Table Showing The Investigations Done Along With Values In Each Of The Three Groups. 'n' Indicates The Number Of Records With The Relevant Value.**

| Sl No                          | Parameter                         | mean ± SD   | Median | IQR       | n   |
|--------------------------------|-----------------------------------|-------------|--------|-----------|-----|
| <b>HYPERTENSION</b>            |                                   |             |        |           |     |
| 1                              | Systolic BP (mm Hg)               | 159 ± 15    |        |           | 167 |
| 2                              | Diastolic BP (mm Hg)              | 94 ± 13     |        |           | 167 |
| 3                              | Urea (mg/dL)                      | 23 ± 6      |        |           | 123 |
| 4                              | Creatinine (mg/dL)                | 0.8 ± 0.2   |        |           | 127 |
| 5                              | Sodium (mEq/L)                    | 140 ± 3     |        |           | 107 |
| 6                              | Potassium (mEq/L)                 | 4.6 ± 0.4   |        |           | 107 |
| <b>DIABETES</b>                |                                   |             |        |           |     |
| 1                              | Fasting Blood Sugar (mg/dL)       | 174 ± 72    |        |           | 22  |
| 2                              | Post Prandial Blood Sugar (mg/dL) | 227 ± 97    |        |           | 21  |
| 3                              | Glycated haemoglobin (%)          | 9.8 ± 2.4   |        |           | 17  |
| 4                              | Urea (mg/dL)                      | 22 ± 6      |        |           | 12  |
| 5                              | Creatinine (mg/dL)                | 0.7 ± 0.2   |        |           | 13  |
| 6                              | Sodium (mEq/L)                    | 136 ± 4     |        |           | 7   |
| 7                              | Potassium (mEq/L)                 | 4.4 ± 0.5   |        |           | 8   |
| 8                              | Total Cholesterol (mg/dL)         | 175 ± 60.58 | 173    | 137 - 229 | 16  |
| 9                              | LDL (mg/dL)                       | 108 ± 42.19 | 105    | 83 - 131  | 17  |
| 10                             | HDL (mg/dL)                       | 37.4 ± 6.93 | 36     | 31 - 44   | 16  |
| 11                             | Triglyceride (mg/dL)              | 152 ± 97.49 | 126    | 77 - 187  | 17  |
| <b>DIABETES + HYPERTENSION</b> |                                   |             |        |           |     |
| 1                              | Urea (mg/dL)                      | 21 ± 6      |        |           | 7   |
| 2                              | Creatinine (mg/dL)                | 0.7 ± 0.1   |        |           | 7   |
| 3                              | Sodium (mEq/L)                    | 138 ± 0.9   |        |           | 5   |
| 4                              | Potassium (mEq/L)                 | 4.4 ± 0.5   |        |           | 5   |

**Table 5: Table showing end organ affection in the cases. 'N' denotes the total number of cases, and 'n' denotes the number of records present.**

|   |                           | DIABETES             | HYPERTENSION                                                                      | Diabetes + Hypertension                                 |
|---|---------------------------|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------|
|   | N                         | 15                   | 156                                                                               | 7                                                       |
| 1 | Proteinuria               | 0 (n = N)            | One – 3+ Proteinuria (n = N)                                                      | (n = N)<br>One – 1+ Proteinuria<br>One – 2+ Proteinuria |
| 2 | Retinopathy changes       | (n = 12)<br>1 (NPDR) | (n = 81)<br>1                                                                     | (n = 7)<br>0                                            |
| 3 | ECG changes               | 0 (n = 7)            | Abnormal ECG = 3 (n=127)<br><br>2 Patients – LVH<br>1 Patient – Prolonged P wave  | 0 (n=6)                                                 |
| 4 | Echocardiographic changes | 0 (n = 3)            | Abnormal 2-Dimensional Echocardiogram - 6 (n = 114)<br><br>Grade 1 LVDD – 1       | 0 (n = 5)                                               |
|   |                           |                      | Mild Conc LVH + Trace AR – 1<br>Mild Conc LVH – 3<br>Mild Conc LVH and EF 50% - 1 |                                                         |

|   |                     |                                                                       |                                                                                                                                                                                                                          |                                                |
|---|---------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 5 | Fatty liver changes | 1 Abnormal (n=5)<br><br>Mild hepatomegaly with Moderate fatty changes | 34 Abnormal (n=101)<br><br>4 – Had Renal calculus/Renal concretions (No liver changes)<br><br>Fatty Liver(No grade mentioned) – 1<br><br>Grade 1 Fatty Liver – 16<br>Grade 2 Fatty Liver – 10<br>Grade 3 Fatty Liver – 3 | 4 Abnormal (n=4)<br><br>Grade 2 Fatty liver =4 |
|---|---------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|

Note: NPDR= Non Proliferative Diabetic Retinopathy, ECG= Electrocardiogram, LVH= Left Ventricular Hypertrophy, LVDD= Left Ventricular diastolic dysfunction, AR= Aortic regurgitation, EF= Ejection Fraction, Conc= concentric.

## DISCUSSION

The mean age of our sample was  $27.8 \pm 6.4$  years with an Inter quartile Range (IQR) of 24-31 years. 130 of the 182 subjects (71.43%) were less than 30 years of age. The mean body mass index (BMI) was  $27.21 \pm 5.54$  kg/m<sup>2</sup> with an IQR of 23.8 to 30.12 kg/m<sup>2</sup>. 36 out of the 182 candidates (19.7%) were having normal BMI, 27 (14.8%) were overweight, and 119 (65.38%) were obese as per Indian standards (1) However, the differences between the BMI of the 3 groups were not statistically significant. (Kruskall-Wallis H = 5.4288, p value = 0.0662).

The Clinical Practice Guidelines of 2020 International Society of Hypertension Global Hypertension Practice Guidelines (2) classifies a patient as hypertensive if the systolic Blood Pressure (SBP) is  $\geq 140$  mm Hg or Diastolic Blood Pressure (DBP) is  $\geq 90$  mm Hg on 2-3 office visits separated by 1-4 weeks. In our study, the BP measurement was repeated after a week, and as mentioned before, few candidates also underwent ABPM.

The prevalence of Hypertension in our sample population was 1362 per 100,000 population (1.36%) though males had higher prevalence than women (1765 vs 162 per 100,000 population). Compared to other studies, it is lower. A study from Uttar Pradesh (3) among population of same age group showed a prevalence of 17.7% with that in males being higher (18.8%) than females (15.2%). The Screening India's Twin Epidemic (SITE) study (4) found 22% of the population aged 18-39 years as hypertensive, while a study by Prasad M et al, found a prevalence of 12% (5) and the corresponding figures in the population of western India was 10.7% (6) in the same age group of 18-39 years. Only a study among college going students in Jaipur, Rajasthan (7) showed a prevalence of 5.1%, which is nearer to our values. The widely divergent values ranging from 5.1% to 22% are at present inexplicable and point to the need to much larger screening studies. In all studies, the male population had higher prevalence of hypertension.

Compared to those subjects who were not hypertensive, the subjects who were hypertensive had significantly higher mean SBP (123 mm of Hg vs 159 mm of Hg, Kruskal-Wallis H = 40.064, p value < 0.001) and DBP (79 mm of Hg vs 94 mm of Hg, Kruskal-Wallis H = 21.554, p value = < 0.001).

The prevalence of diabetes in our sample was 179 per 100,000 population. Among males it was 218, while among females, it was lower at 65 per 100,000 population. However, it needs to be clarified at the outset that these figures are an underestimation as the candidates underwent strip test for sugar in urine, and this test becomes positive only at a corresponding blood sugar level of 180 mg/dL. Thus this study failed to pick up the cases of Diabetes with FBS ranging from 126 mg/dL to 180 mg/dL as per American Diabetes Association (8). This constitutes one of the limitations of this study. The Standard Operating Protocol recommended by the government is only to do a strip test for presence of sugar in urine and not the FBS (9) and hence FBS could not be done unless the strip test was positive for sugar.

There is paucity of studies on prevalence of DM among the young

population of India. The SITE study (4) shows a prevalence of 12.89% in the population aged 18-39 years, whereas the STEPS survey in Punjab, India, shows a prevalence of 3.75% in the 18-44 years age group (10). However, the fasting status in different surveys cannot be assured, while the fasting status in our sample is assured as no candidate would risk being suspected of diabetes in a pre-employment check up. This very pertinent point of fasting assuredness was raised in the study by Geldsetzer P, Manne-Goehler J, Theilmann M, et al (11). Regression results from this study reveal figures closer to our values in the young adult group.

The biochemical parameters of these candidates were within the normal population limits as set by our laboratory. However, end organ affection was noted with the highest number being in the hypertensive candidates in form of cardiac affection. Fatty liver was also noted in a large number of candidates with the highest proportion being in those with both hypertensive and diabetes (4 out of 7), followed by those with hypertension only (34 out of 101).

Other limitations of our study include the absence of data, and the absence of family history of the candidates in the records. While the former is an unavoidable part of all retrospective studies, the latter is due to the fact that the family history is a part of the documents of the candidate meant solely for the employer and is completely confidential; hence copy of the same is not retained in our records. Moreover, our data does not distinguish between type 1 and type 2 diabetes.

Nevertheless, our study has the advantages of a sample belonging to all strata of society and thus more representative of the population. It also has the advantage of having a detailed evaluation and workup including that of end organ affection before confirming them as hypertensive or diabetic. The fasting status of candidates in our sample is assured. Thus the actual figures of diabetes and hypertension cannot be lower than the figures obtained in our study.

We conclude that pre-employment screening with incorporation of minor changes like measurement of FBS can provide an excellent method of survey of population, especially the young adult population for these 'lifestyle' diseases and a truer estimate of the burden of such diseases. End organ changes can also occur early and hence surveys of the population are required to detect and treat these diseases at an earlier stage to prevent long term complications. Of importance is to note being overweight or obese as important factors which needs to be addressed.

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