WHR (waist hip ratio) as risk factor irrespective of body mass index (BMI) among patients of noninsulin dependent diabetes mellitus (NIDDM)

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INTRODUCTION
Type 2 Diabetes mellitus is one of the modern pandemics. It is estimated to affect 320 million people by the year 2020 worldwide. Diabetes today is an important single disease in the medical specialty and a chronic illness that requires continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complication.1 Epidemiologic studies reveal that the prevalence of type 2 diabetes mellitus has increased exponentially in urban populations and that even the underprivileged are not exempt. Changing societal structures and lifestyles are accelerating the epidemic of Diabetes mellitus in South Asian countries. Proximate causes for this epidemic are excessive consumption of calories and declining physical activity, which leads to increasing in obesity, especially central obesity.2 Material & Methods: A cross sectional study was conducted from October 2010 to October 2012. Waist Hip Ratio was correlated with the disease. Total 120 cases were studied. Results: Out of 120 patients 88 (73.33%) are male and 32 (26.66%) are female. Most common age period in which prevalence of diabetes found in each sub groups is 40-59years. Lean and Ideal body weight (IBW) patients are having abnormal WHR despite having BMI of <25. More than half (52.5%) of lean patients and 82.5% of IBW patients are having abnormal high WHR where as in obese group all patients (100%) are having abnormal WHR. Conclusion: Central obesity, as measured by the WHR, is importantly and independently associated with NIDDM irrespective of BMI.

Key Words: WHR (waist hip ratio), body mass index (BMI), noninsulin dependent diabetes mellitus (NIDDM)
fat in Indians lead to dyslipidemia, increased insulin resistance even with lesser Body Mass Index (BMI) as compared to western population\cite{6}. Studies in different parts of India has shown that Type 2 DM-lean patients had a marked lower incidence of hypertension, CAD, nephropathy and higher prevalence of retinopathy and a markedly higher incidence of peripheral neuropathy and infections.\cite{7,8} Type 2 diabetes mellitus presents in a varied form in the Indian population compared to the west. Thus a need arises to further characterize and analyze its epidemiology in the Indian population especially in relation to markers of obesity; i.e., Body mass index, waist circumference and waist to hip ratio.

**MATERIAL AND METHODS**

This cross sectional study was carried out among purposively selected 120 patients of type 2 diabetes mellitus at Department of Medicine, New Civil Hospital, Surat during October 2010 to October 2012.

**Inclusions Criteria:**
- K/C/O type-2 DM both male & female.
- Age > 18 years.

**Exclusions Criteria:**
- Freshly detected case of type 2 Diabetes
- Patient who had abrupt onset of Diabetes with acute weight loss or require insulin at the time of diagnosis.
- Patients with diseases of exocrine pancreas-pancreatitis, pancreatectomy, neoplasia, cystic fibrosis, hemochromatosis, fibrocalculous pancreatopathy(FCPD)
- Patients with endocrinopathies-acromegaly, cushing’ssyndrome, glucagonama, pheochromocytoma, hyperthyroidism, somatostatinoma, aldosteronoma.
- Gestational diabetes mellitus(GDM)

**History and Clinical Examination:** The detailed history was taken of patients enrolled in study. All findings were recorded on predesigned questionnaire.

**Anthropometric measurements** including height (in cm.), weight(kg.), waist circumference, hip circumference were taken. Waist measurements were taken as abdominal circumference at midpoint between the costal margin and anterior superior iliac spine. Hip measurement was taken as maximum diameter at the greater trochanter. Waist to hip ratio (WHR) was calculated in each patient. Body mass index was calculated in kg/m² and based on BMI, the patients were divided into the following groups:

- Lean: BMI of < 18.5
- Ideal body weight(IBW): BMI of 18.5-24.9
- Obese/overweight: BMI of ≥ 25

Minimum 40 patients were taken in each group.

**RESULTS**

**Table: 1 Distribution of study population according to age, sex of having Type 2 Diabetes.**

<table>
<thead>
<tr>
<th>SEX</th>
<th>LEAN (n= 40)</th>
<th>IBW (n= 40)</th>
<th>OBESE (n= 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>29(72.5%)</td>
<td>32(80%)</td>
<td>27(67.5%)</td>
</tr>
<tr>
<td>Female</td>
<td>11(27.5%)</td>
<td>8(20%)</td>
<td>13(32.5%)</td>
</tr>
<tr>
<td>AGE (YEARS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-39</td>
<td>5(12.5%)</td>
<td>5(12.5%)</td>
<td>2(5%)</td>
</tr>
<tr>
<td>40-59</td>
<td>23(57.5%)</td>
<td>22(55%)</td>
<td>19(47.5%)</td>
</tr>
<tr>
<td>≥60</td>
<td>12(30%)</td>
<td>13(32.5%)</td>
<td>19(47.5%)</td>
</tr>
</tbody>
</table>

Out of 120 patients 88 (73.33%) are male and 32 (26.66%) are female. In lean group, out of 40 patients 29(72.5%) are male and 11 (27.5%) are female. In IBW group, out of 40 patients 32(80%) are male and 8 (20%) are female. In Obese group, out of 40 patients 27(67.5%) are male and 13(32.5%) are female. Above table shows, most common age period in which prevalence of diabetes found in each sub groups is 40-59 years. Higher diabetes risk is found in early age group 18-39yrs is 12.5% in lean & IBW as compared to 5% in obese. while there is no significant difference between 3 sub group at the age between 40-59yrs 57.5%, 55%, 47.5% respectively. In our study, higher diabetes risk is found in early age group 18-39yrs because of weight gain in early adulthood is related to a higher risk of type 2 diabetes than later weight gain in both normal and overweight.\cite{9}
Table: 2 Distribution of study population according to Waist Circumference and Waist Hip Ratio.

<table>
<thead>
<tr>
<th>Waist Circumference</th>
<th>LEAN</th>
<th>IBW</th>
<th>OBESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤90</td>
<td>25(86.2%)</td>
<td>12(37.5%)</td>
<td>2(7.4%)</td>
</tr>
<tr>
<td>&gt;90</td>
<td>4(13.8%)</td>
<td>20(62.5%)</td>
<td>25(92.6%)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤80</td>
<td>9(81.8%)</td>
<td>2(25%)</td>
<td>0</td>
</tr>
<tr>
<td>&gt;80</td>
<td>2(18.2%)</td>
<td>6(75%)</td>
<td>13(100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waist Hip Ratio Male</th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.95</td>
<td>18(62%)</td>
<td>6(18.75%)</td>
<td>0</td>
</tr>
<tr>
<td>≥0.95</td>
<td>1(138%)</td>
<td>26(81.25%)</td>
<td>27(100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waist Hip Ratio Female</th>
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</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.80</td>
<td>1(99%)</td>
<td>1(12.5%)</td>
<td>0</td>
</tr>
<tr>
<td>≥0.80</td>
<td>1(01%)</td>
<td>7(87.5%)</td>
<td>13(100%)</td>
</tr>
</tbody>
</table>

DISCUSSION

The prevalence of type 2 diabetes mellitus is rapidly rising all over the globe at an alarming rate. Over the past 30 years, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people. 60% to 80% of the diabetics in developed countries are obese whereas in India most patients fall in normal weight group and some even lean. Since obesity does contribute in a considerable way to complications of diabetes, it is worthwhile to study if BMI has any implications on the complications of type 2 diabetes mellitus.

In our study, out of 120 patients, 40 patients are divided in each subgroup according to their BMI. Out of 120 patients 88(73%) are males and 32 (27%) are females. Table 1: Sex distribution was also not significantly different in subgroups of previous studies conducted by Mukhayprana and V.Mohan. Most common age period in which prevalence of diabetes found in each sub groups is 40-59 years. In our study, higher diabetes risk is found in early age group 18-39yrs because of weight gain in early adulthood is related to a higher risk of type 2 diabetes than was later weight gain in obesity.
both normal and overweight. Excess abdominal fat, assessed by measurement of waist circumference is independently associated with higher risk for diabetes mellitus and cardiovascular disease.

Despite having lower prevalence of obesity as defined by body mass index (BMI), Asian Indians tend to have greater waist circumference and waist to hip ratios thus having a greater degree of central obesity. Again, Asian Indians have more total abdominal and visceral fat for any given BMI and for any given body fat they have increased insulin resistance. Moreover, they have lower levels of the protective adipokine adiponectin and have increased levels of adipose tissue metabolites. In our study population 85% of lean patients are having normal waist circumference where as in obese group 95% patients are having abnormal waist circumference coincides with their obese body characteristics. [Table:2] Out of 13 female patients of obese group, none is having waist circumference ≤ 80 cm. and all patients 13 (100%)are having waist circumference >80 cm. [Table:2] In IBW group 35% are having normal waist circumference, 65% of IBW patients and 15% of lean diabetics are having abnormal waist circumference despite having body mass index of <25. [Table:2] Among female patients belonging to lean group only 1 patient is having WHR≤0.80 and remaining 10 despite being a lean are having waist to hip ratio >0.80 [Table:2]. Genetic factors that determine body fat distribution and glucose metabolism have to be fully elucidated for the better understanding of the biochemical and molecular mechanisms behind the aetiopathogenesis of diabetes. In study conducted by Mukhayprana, the abnormal WHR was present in 48% of lean and 79% of normal weight patients which was low in lean and normal weight patients respectively as compared to our study.

CONCLUSIONS

- In our study we found that lean and IBW patients are having abnormal WHR in both gender despite having BMI of <25. In our study 52.5% of lean patients and 82.5% of IBW patients are having abnormal high WHR where as in obese group all 100% patients are having abnormal WHR. Central obesity, as measured by the WHR, is importantly and independently associated with NIDDM.

- In our study 10(91%) female having abnormal WHR in lean group. Thus abnormal WHR is risk factor for female.

- In our study, we reported that among lean and IBW patients despite of BMI<25 there is abnormal waist circumference and abnormal WHR. Thus Central obesity, as measured by the WHR, is importantly and independently associated with NIDDM

Funding: Nil.
Conflicts of interest: None.

REFERENCES


WHR (waist hip ratio) as risk factor irrespective of body mass index


13. Harrison’s principles of internal medicine seventeenth edition (2275-2304)


