INTRODUCTION:
India is undergoing a rapid epidemiological transition with increased urbanization and socioeconomic development leading to a dramatic change in lifestyle, consisting of physical inactivity, diet rich in fat, sugar and salt coupled with a high level of mental stress. This has led to increased incidence of lifestyle diseases like hypertension, type II Diabetes Mellitus, dyslipidemia, obesity and ischemic heart diseases [1]. The risk of becoming diabetic for an individual with a positive family history of diabetes varies with the age of the proband when the diagnosis was made and the type of diabetes. Family history represents the integration of shared genomic and environmental risk factors. First degree relatives share half their genomic information and also behaviour, life styles, beliefs, culture and physical environment, so their disease experience may offer a clue to shared susceptibilities [2]. The risk of becoming a diabetic for an individual with a positive family history of diabetes increases by two- to fourfold an offspring’s chance and individuals with a positive family history of diabetes have higher body mass index (BMI) than controls [3]. Type 2 Diabetes Mellitus in the presence of a low BMI is more strongly familial than that at a higher BMI [4]. Thus family history could be used as a tool for genomic studies in order to understand the underlying shared gene-environment interrelation associated with complex traits in managing various diseases. Parental history of type 2 diabetes mellitus increases risk of not only glucose intolerance but also other cardio metabolic risk factors like overweight, low high-density lipoprotein cholesterol, and high blood pressure.[5] A positive family history was associated with increased risk of IFG/IGT (Impaired Fasting Glucose /Impaired Glucose Tolerance) and type 2 DM as well as higher levels of obesity, HOMA-IR, fasting triglyceride (TG), lower levels of high density lipoprotein (HDL) cholesterol and HOMA-β . They concluded that apparently healthy individuals with family history of type 2 diabetes mellitus have higher anthropometric values and lower physical fitness than the controls.

Dalton M, Cameron AJ et al [7] studied about the waist circumference, waist–hip ratio and body mass index and their correlation with cardiovascular disease risk factors in Australian adults. They observed that simple anthropometrical measurements have been used as surrogate measurements of obesity and have more practical value in both clinical practice and for large-scale epidemiological studies.

Shobha MV, Ravindra PN, Deepali A [14] opined from their study that anthropometric changes precede the changes in lipid profile among the healthy young individuals with family history of type 2 diabetes mellitus. They observed a temporal dissociation between anthropometric and lipid changes, former preceding the later.

Khanna Neenu, Sharma Ram Sarup [15] conducted study in offspring’s of diabetic hypertensive parents and they reported that all the derived anthropometric indices like BMI, WHR, Waist Height Ratio (WHR) reflect significantly increased value in young healthy adults (20-30yrs of age) having positive family history of both the chronic diseases like type 2 diabetes mellitus and hypertension.

Chamukuttan Snehalatha, Vijay Viswanathan et al [16] studied about the cut off values for normal anthropometric variables in Asian Indian Adults and they concluded that the healthy BMI for an urban Indian is 23 kg/m², and cut off values for WC were 85 cm for men and 80 cm for women, and for WHR cut off values were 0.89 for men and 0.81 for women.

Marianne AB vander Sande, Gijs EL Walraven, Paul JM Milligean et al [17] examined whether a family history of high risk groups for major non communicable diseases (NCDs) was a significant risk factor for these conditions among family members in a study population. They concluded that individuals with a family history of diabetes had a higher BMI and higher concentrations of glucose, cholesterol, triglycerides, uric acid and their risk of obesity, diabetes was increased.

Mahanta BN, Mahanta TG [18] studied about the clinical profile of persons with family history of diabetes mellitus with special reference to body fat percentage and concluded that body fat percentage monitoring could be a useful tool for assessing the potential diabetics, particularly for high risk screening and it might prove as an important tool for evidence based monitoring of lifestyle modification approaches for health promotion.

Shah A, Bhandary S, Malik SL et al [19] studied about the waist circumference and waist-hip ratio as predictors of type 2 diabetes mellitus and they concluded that the WC and WHR are the best predictor of type 2 diabetes in both male and female population.

Sanjeev Dhakal, Uday N Singh et al [20] studied about the anthropometric indices in prediction of type 2 diabetes and they...
observed that BMI and WHR were strongly associated with an increased risk of developing type 2 diabetes.

Saska Hartwig, Alexander Kluttig, Daniel Tiller, Julia Fricke et al [21] conducted studies to assess the predictive ability of the association between different anthropometric measurements and incident type 2 diabetes mellitus in different regions of Germany. They reported that stronger association was observed between anthropometric markers that reflect abdominal obesity (i.e., WC and WHR) and incident type 2 diabetes than for BMI and weight.

Mercedes F Haffner, Stan M Haffner et al [22] conducted studies regarding different anthropometric measures in terms of their ability to predict type 2 diabetes and to determine whether predictive ability was modified by ethnicity. They observed that measures of central and overall adiposity predicted type 2 diabetes to a similar degree, except in African American subjects, for whom results suggested that central measures were more predictive.

Yong Hao PUA, Peck Hoon ONG [23] studied about anthropometric indices as screening tools for cardiovascular risk factors in Singaporean women. They concluded that BMI, WHR, WC and waist girth ratio may be used as screening tools for cardiovascular risk factors, of which WC may be the best anthropometric index.

Rafael de Oliveira Alvim, Carlos Alberto Mourao-Junior et al [24] studied the use of the anthropometric indices of adiposity, especially body mass index and waist circumference in the prediction of diabetes mellitus and they observed that body adiposity index is a useful tool for the risk assessment of type 2 diabetes mellitus in admixture populations.

Ramadevi M, Padmini O, Kali Vara Prasad V [25] studied about WHR in predicting the risk for type 2 Diabetes and concluded that there is a strong association between waist hip ratio and incidence of type 2 diabetes.

AIMS AND OBJECTIVES:
The main objective of the study is to observe the correlation of anthropometric indices in young individuals with family history of diabetes.

MATERIAL AND METHODS:
The present study was conducted in 50 male subjects (healthy young adults aged 18-25 years with a family history of type 2 DM). Anthropometric measurements of weight, height, body mass index (BMI) with waist circumference, waist to hip ratio (WHR), waist-to-hip ratio (WHHR) were measured and their correlation with family history of type 2 Diabetes (mother/father/both) was recorded. Control subjects were selected from the same age group with no family history of type 2 diabetes mellitus. Informed consent was obtained from all the participants and ethical approval for the study was obtained from the Institutional Ethical Committee. Complete general physical examination was performed and various anthropometric measurements were recorded.

Anthropometric measurements: The following basic and derived anthropometric measurements (indices) were recorded in each subject, using standard methodology. Screening for normal fasting glucose levels (70-100mg/dl) was done using glucometer.

1. Height: Height in centimetres was measured (to the nearest 0.1centimetre) with steel, anthropometric rod, with the subject, standing barefooted in erect position.
2. Weight: in kilograms (to the nearest 0.5kg) was recorded with the subject standing on the weighing scale, barefooted wearing minimum clothes.
3. Circumferences: - The waist and hip circumferences in centimetres was measured with a non stretchable measuring tape.
4. Waist circumference (WC) – was measured midway between iliac crest and lowermost margin of ribs. According to the standard guidelines, cut-offs for waist circumference will be 90 cm for Indian men (as opposed to 102 cm globally) and 80 cm for Indian women (as opposed to 88 cm at the international level).
5. Hip circumference (HC) – was measured at the level of the greater trochanters in centimetres.
6. Body Mass Index (BMI) - BMI was calculated as weight in kilograms divided by squared height in meters (weight in kg / height in m²) [3]. Normal weight (BMI = 18.5 – <23.0 Kg/m²); Over weight (BMI ≥23.0 Kg/m²).
7. Waist-Hip Ratio (WHR) - It was calculated using following formula: WHR = WC / HC (cm). Elevated WHR = 0.95 for males and 0.88 for females [3].
8. Waist-Height Ratio (WHR) or Waist-Stature Ratio (WSR):- calculated using following formula: WSR = WC / Height (cm). The cut-off value will be 0.5 for both sexes (men & women) [3].
9. Fasting plasma glucose in capillary blood was measured with glucometer after 12 hrs of fasting. Normal level: 70-100 mg/dl

Statistical Analysis was done using SPSS software. Unpaired t test was used to compare the mean and SD for each parameter in between the two groups. A p value less than 0.05 was considered to be significant.

OBSERVATIONS AND RESULTS:

Table 1: Classification of the subjects according to the family history

<table>
<thead>
<tr>
<th>No. of subjects (18-25 years)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>With family history of Diabetes</td>
</tr>
<tr>
<td>25</td>
<td>With no family history of Diabetes</td>
</tr>
</tbody>
</table>

Table no.2 Anthropometric parameters

<table>
<thead>
<tr>
<th>Anthropometric and Physiological variables</th>
<th>Control group(25)</th>
<th>Study group(25)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight(kg)</td>
<td>68.44 ± 16.42</td>
<td>75.88 ± 13.58</td>
<td>0.09</td>
</tr>
<tr>
<td>Height(cm)</td>
<td>171.60 ± 5.38</td>
<td>174.14 ± 6.26</td>
<td>0.13</td>
</tr>
<tr>
<td>Hip Circumference (cm)</td>
<td>98.94 ± 12.44</td>
<td>101.76 ± 7.25</td>
<td>0.33</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>82.50 ± 12.98</td>
<td>89.20 ± 10.31</td>
<td>0.09</td>
</tr>
<tr>
<td>BodyMass Index (Kg/m²)</td>
<td>23.11± 4.87</td>
<td>25.03±3.77</td>
<td>0.12</td>
</tr>
<tr>
<td>Waist Hip Ratio</td>
<td>0.83± 0.04</td>
<td>0.86 ± 0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Waist Height Ratio</td>
<td>0.48 ± 0.07</td>
<td>0.51 ± 0.06</td>
<td>0.16</td>
</tr>
</tbody>
</table>

The results were expressed as mean ± standard deviation. The classification of the subjects according to the family history of type 2 diabetes was given in Table - 1. The mean and standard deviations of various anthropometric indices among study subjects and controls were given in Table - 2.

The mean weight of control group was non-significantly less (68.44 ± 16.42 kg) when compared to the mean weight of study group (75.88 ± 13.58 Kg, p< 0.09) (Table - 2). The mean height of control group was non-significantly less (171.60 ± 5.38 cm) when compared to the height of the study group (174.14 ± 6.26 cm, p<0.13) (Table – 2).

The mean hip circumference of control group was non-significantly less (98.94 ± 12.44 cm) when compared to the mean hip circumference of study group (101.76 ± 7.25 cm, p<0.33) (Table - 2). The mean waist circumference of control group was non-significantly less (82.50 ± 12.98 cm) when compared to the mean waist circumference of study group (89.20 ± 10.31 cm, p<0.09) (Table - 2). The mean body mass index of control group was non-significantly less (23.11± 4.87 Kg/m²) when compared to the mean body mass index of study group (25.03 ± 3.77 Kg/m², p<0.12) (Table - 2).

The mean waist hip ratio of control group was significantly less (0.83 ± 0.04) when compared to the mean hip circumference of study group (0.86 ± 0.06, p<0.02) (Table - 2). The mean waist height ratio of control group was non-significantly less (0.48 ± 0.07) when compared to the mean waist height ratio of study group (0.51 ± 0.06, p<0.16) (Table - 2).

DISCUSSION:
Various anthropometric indices which assess the degree of obesity and its associated diseases are in practice currently. However, the accuracy among these indices is still controversial. The present study was conducted on 50 male subjects (25 subjects with a family history of type 2 diabetes and 25 normal subjects) and their anthropometric indices like BMI, WC, HC, WHR and Waist Height Ratio were recorded.

From the results of our study we observed a statistically significant increase in waist hip ratio (p value = 0.02) among all the anthropometric indices and random blood sugar in subjects (p value =0.01) with a family history of type 2 diabetes when compared with normal subjects. Other anthropometric indices like body mass index, waist circumference, hip circumference and waist height ratio increased (non significant) when compared between subjects with...
family history of diabetes and normal subjects.

High Waist Circumference (WC), Waist-Hip Ratio (WHR), Body Mass Index (BMI) and age are risk factors as well as predictors of type 2 DM. The higher risk of type 2 DM in people with a high WHR and WC may be due to increase in visceral fat accumulation. Among various anthropometric measurements used to measure the obesity, WC and WHR have been used as measures of visceral obesity whereas BMI as general obesity. A higher WHR reflects a greater proportion of abdominal fat with greater risk for hyperinsulinemia, insulin resistance, diabetes type 2, endometrial cancer, hypercholesterolemia, hypertension and atherosclerosis. [26]

Statistically significant increase in hip ratio observed in our study partly correlates with the study of Khanna Neenu et al [15] who observed a significant increase in WR and also other anthropometric indices like BMI, WHR. Increase in WR observed in our study corroborate with the findings of another similar study done by Sanjeev Dhakal [20]. We observed an increase in the BMI in subjects with family history of diabetes as compared to general population when it was observed that the proportion of overweight is higher in diabetic than in non-diabetic subjects.腰围与臀围比值在糖尿病患者中的存在提示了其作为预测糖尿病风险的潜在价值。[26]

We observed a few limitations for this study. First, the study is a cross-sectional study and cannot determine any cause effect relation between the anthropometric indices and development of type 2 diabetes. Secondly the sample size is small as the study was a pilot study. We did not consider both maternal and paternal history of type 2 diabetes in particular. Prospective studies with a large sample size may be beneficial in identifying the role of different anthropometric indices and development of diabetes.

Although family history is a predictor of increased susceptibility to disease because of an interaction between genetic traits, environmental factors and behaviour, which are shared to a larger extent than among the general population, these factors are difficult to disentangle. An implication of our study results might be that general practitioners should be encouraged to pay attention to the distribution of body fat of their patients when assessing the risk for diabetes, since visceral fat is more hazardous than evenly distributed body fat.

CONCLUSION:
The measurement of anthropometric indices is non invasive, simple and the indices are good predictors of medical complications of obesity. Waist hip ratio can be used as a predictor of type 2 diabetes in individuals with a family history of diabetes and it can be used for early detection of diabetes.

Summary: Basic and derived anthropometric indices may aid in predicting the onset of obesity related diseases like type 2 diabetes.

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REFERENCES: