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A Case-Control Study To Evaluate Waist To Hip Ratio And Body Mass Index In Type 2 Diabetics As Compared To Non-Diabetic Population

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Abstract
Diabetes mellitus is a collection of common metabolic disorder mainly considered by hyperglycemia which results commencing from defective insulin secretion or insulin action or together.It is a diverse group of diseases with different group of etiology such as social, environmental and genetic factors which acting concurrently or mutually.Obesity and particularly abdominal obesity are strongly associated with insulin resistance. The etiology of diabetes is attributed to environmental and genetic factors. The modifiable risk factors like abdominal obesity and physical inactivity are major contributors to the disease. Rapid lifestyle changes, other non-communicable diseases like hypertension, dyslipidemia are also major etiologic factors for the rising incidence of type 2 diabetes around the globe.
Materials And Method- In this case control study 80 diabetic and 80 non-diabetic patients attending at General Medicine department fulfilling the eligibility criteria were selected. Written consent was obtained from the participants. Participants were interviewed and details were entered in the structured proforma. Anthropometric details were weight, height, BMI, waist circumference, WHR were recorded. Blood samples were collected for BSL fasting and postprandial, HBA1c and lipid profile.
Results- Mean BMI of DM group was 33.43±2.32 and that of NDM was 22.34±1.71. When we compared the mean BMI between two groups, the difference was statistically significant ($p<0.05$). It means diabetic patients had higher BMI as compared to non-diabetics.Mean waist hip ratio of DM group was 0.95±0.09 and that of NDM was 0.9±0.08. When we compared the mean hip ratio between two groups, the difference was statistically significant ($p<0.05$). It means diabetic patients had higher waist hip ratio as compared to non-diabetics. Mean TG of DM group was 218.15±53.10 and that of NDM was 143.64±69.20. When we compared the mean TG between two groups, the difference was statistically significant ($p<0.05$). It means diabetic patients had higher TG as compared to non- diabetics. 76.3% of diabetics have abnormal WHR as against 63.8% having BMI>27.5 ($p<0.05$).
Conclusion-The present study concludes that Body mass index, waist circumference and waist hip ratio all were higher in diabetic participants in comparison to non-diabetic participants. WHR shows a better predictor and comparatively more sensitive parameter in DM individuals for cardiometabolic risk as compared to BMI in our study. This explains why BMI may underestimate the cardiometabolic risk which may be best evaluated by WHR. Further longitudinal study should be designed in high-risk groups that would aid in better understanding the relationship of anthropometric parameters with type 2 diabetes mellitus.

Key Words: Obesity, BMI, waist circumference, waist hip ratio

INTRODUCTION

Diabetes mellitus is a collection of common metabolic disorder mainly considered by hyperglycaemia which results commencing from defective insulin secretion or insulin action or together.[1]It is a diverse group of diseases with different group of aetiology such as social, environmental and genetic factors which acting concurrently or mutually. [2]

Insulin is a hormone which controls the body metabolism of carbohydrates, proteins and lipids at different level. Chronic poor glycemic control will cause disorder like dyslipidemia, hypo thyroidism, cardiac disease, central nerve system problems and also poor control of infections.[3]

In India, Type 2 DM is an epidemic disorder due to social influence and changes in life style. As per WHO estimation, the universal prevalence of Diabetes mellitus was 170 million (2.8%) in 2002, this number expected to grow up to 366 million (4.4%) or more in 2030.[4-6]

Diabetes is more prevalent in developing countries and India is becoming the diabetic capital in the world with prevalence range next to China. India has around 69.1 million people with diabetes. The increased prevalence is attributed to ageing of the population and obesity. Type 2 diabetes being a chronic disease is characterized by hyperglycemia and dyslipidemia due to underlying insulin resistance. As the disease progresses it leads to micro vascular and macro vascular complications.[7]

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Obesity and particularly abdominal obesity are strongly associated with insulin resistance. The etiology of diabetes is attributed to environmental and genetic factors.

The modifiable risk factors like abdominal obesity and physical inactivity are major contributors to the disease. Rapid lifestyle changes, other non-communicable diseases like hypertension, dyslipidaemia are also major etiologic factors for the rising incidence of type 2 diabetes around the globe. The Body Mass Index (BMI), Waist to Hip Ratio (WHR), and the Waist Circumference (WC) are three main anthropometric parameters to evaluate body fat and fat distribution in adults. These parameters vary between the different ethnic populations.[8]

Previous studies have shown that BMI and WHR can predict outcome of diabetes and WC correlates better with intraabdominal fat than WHR. In Indian population central obesity is more common in diabetic patients, hence their influence on diabetes and its complications gains importance. So, Waist Circumference and Waist Hip Ratio are better predictors of obesity than Body Mass Index in Indian population. Patients with type 2 diabetes mellitus-associated dyslipidaemia have a high risk of cardiovascular diseases and its complications.[9]

The lipid parameters serum Cholesterol, serum Triglyceride, serum Low Density Lipoprotein (LDL), serum High Density Lipoprotein (HDL) are correlated with blood sugar levels in this study. An understanding of the complex interplay of how treating dyslipidaemia reduces the risk for CVD events in patients with type 2 diabetes mellitus and an ability to assess at-risk patients is necessary to ensure the most appropriate treatment strategies are implemented.[10]

Glycated haemoglobin (HbA1c) is a routinely used marker for long-term glycemic control. HBA1c predicts risk for development for diabetic complication. Lifestyle changes such as nutrition therapy, weight loss, regular physical exercise, and appropriate education and self-management strategies are vital to improve outcomes. [11]

MATERIALS AND METHODS

This is a Case control study was conducted in a Tertiary care centre of Raichur. Inpatients and outpatients of type 2 diabetes and non-diabetes visiting at General Medicine department fulfilling the eligibility criteria were selected.

Inclusion criteria:

Cases: Patients (>35 years of age) visiting the OPD and admitted in IPD with confirmed diagnosis of Type-2 Diabetes Mellitus.

Controls: Age and gender matched Non diabetic healthy subjects willing to participate in our study.

Exclusion criteria:

- Patient with serious illness
- Type 1 DM& other specific types of Diabetes Mellitus
- Causes of abdominal distension other than obesity
- Pregnancy
- Study participants who are not willing to participate in the study.

Methods of data collection:

Details of all the participants like age, name, gender, history of diabetes, treatment details were recorded. Anthropometric details were weight, height, BMI, waist circumference, WHR were recorded. Blood samples were collected for BSL fasting and postprandial, HBA1c and lipid profile.

Body weight was measured to the nearest 0.1 kg with an electronic standard weight scale machine, with participants wearing underwear or light clothing. Body height was measured without shoes to the nearest 1 cm using a stadiometer.

Thigh, waist, and hip circumferences (HCs) were measured when the patient was upright and weight was evenly distributed. TC was measured at the level of the midpoint on the lateral surface of the right thigh, midway between trochanter and the lateral border of the head of the tibia to the nearest 0.1 cm. WC was measured using a standard flexible inelastic measuring tape to the nearest 0.1 cm in the horizontal plane, midway between the inferior rib margin and the iliac crest, whereas HC was measured at a point over the buttocks yielding the maximum circumference. All anthropometric measurements were in accordance with the WHO standards. Three readings of all the anthropometric measurements were taken, and the average value was used for calculations.

Skin fold thickness:

A large proportion of total body fat is located just under the skin. Since it is most accessible, the method most used is the measurement of skinfold thickness. It is a rapid and "non-invasive" method for assessing body fat. Several varieties of callipers

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(e.g., Harpenden skin callipers) are available for the purpose. The measurement may be taken at all the four sites - mid-triceps, biceps, subscapular and suprailiac regions. The sum of the measurements should be less than 40 mm in boys and 50 mm in girls.

Unfortunately, standards for subcutaneous fat do not exist for comparison. Further, in extreme obesity, measurements may be impossible. The main drawback of skin fold measurements is their poor repeatability.

Statistical analysis

Data was collected by using a structure proforma. Data entered in MS excel sheet and analyzed by using SPSS IBM USA. Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Comparison of mean and SD between two groups was done by using unpaired t test to assess whether the mean difference between groups is significant or not. Descriptive statistics of each variable was presented in terms of Mean, standard deviation, standard error of mean. Association between two qualitative variables was seen by using Chi square/ Fischer's exact test. Correlation between two quantitative variables was assessed by using Pearson's correlation coefficient test (r). A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

DISCUSSION

We included total 80 DM and 80 NDM patients in our study. Out of 80 DM, majority i.e. 40(50%) were from 56-65 years, 24(30%) from >65, 16(20%) from 46-55 years. Out of 80 NDM, majority i.e. 38(47.5%) were from 46-55 years, 32(40%) from 35-45 years, 10(12.5%) from 56-65 years. We found statistically significant difference in the proportion of patients within each age group (p<0.05).

Proportion of DM males were 45% as against 47.5% of NDM. Proportion of DM females were 55% as against 52.5% of NDM. We found statistically non- significant difference in the proportion of males and females (p<0.05).

In our study, mean age of DM group was 56.76±8.68 years and that of NDM was 43.98±5.84 years. When we compared the mean age between two groups, the difference was statistically significant (p<0.05).
Jain V et al[12]reported that out of 60 patients included in their study, 40% were diabetic for 7–10 years (62% men and 38% women), we included 30 patients from 40-45 years age group (mean age 42.5 ± 1.5 years) and 30 patients from 45-50 (mean age 48.2 ± 1.42 years).

Awasthi A et al[13]in 2017 conducted a case-control study among 102 individuals; of whom 51 cases included diagnosed T2DM. Cases and controls were group matched by gender. Nearly 70% of cases belonged to age group of 40-59 years, while controls constituted 45% in the same age bracket. Males in cases group were 49% while females were 51%.

Mean skinfold thickness of DM group was 120.86±18.45 mm and that of NDM was 84.83±12.30 mm. When we compared the mean skinfold thickness between two groups, the difference was statistically significant (p<0.05). It means diabetic patients had higher skinfold thickness as compared to non-diabetics.

The impact of obesity, assessed by BMI, waist circumference and waist-to- height ratio, on the development of T2DM has been largely described in large cohort prospective studies.[14] However, there is still very limited prospective information assessing the association of skinfold thickness with incident T2DM.

Many markers of insulin secretion and its metabolism have been studied according to fat distribution. These studies have indicated that visceral and upper body fat are more related to the release of free fatty acids and their accumulation in the liver, which subsequently leads to glucose metabolism impairment and even cardiovascular mortality.[15]Few observational studies have approached the relationship between sub- scapular skinfold-thickness and the risk of developing T2DM. Of these studies, only three were prospective in nature. [16]

Mensik et al[17]reported that a greater sub-scapular skinfold thickness was strongly associated with the risk of transient and persistent impaired glucose tolerance after 4 months of follow-up compared to BMI, WC, and the sum of all skinfold measurements. However, Chei et al[18]questioned this association, as only a marginal significant risk for T2DM and HT was found.

Sosenko et al[19]noted a strong association between subscapular skinfold-thickness and non-insulin dependent diabetes. Compared to BMI and WHtR, subscapular skinfold- thickness was superiorly associated with T2DM, even after controlling for sex.

In a similar study in Pakistan Ali et al[20]found that mean WC, WHR and BMI were higher in both male and female diabetic participants than non-diabetics. In a similar cohort study Wei et al[21]on Mexican Americans concluded that weight, BMI, waist circumferences, and waist-to-hip ratio positively predict Type 2 diabetes independent of age and sex.

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Similarly, Patel et al[22]in a comparative study found that cutoff point of BMI was higher for diabetic than non-diabetics which is in consistent with present study. Likewise in a similar study done in a tertiary care centre of Nepal, Ranabhat et al[23]found that BMI and WC of diabetic individuals were higher than non-diabetics.

These results indicate that the risk of developing diabetes is certainly higher among male and female diabetics than non-diabetic participants as WHR, the marker of central obesity is significantly higher in diabetics than non-diabetic participants. So, the result of comparison of WHR was highly supported by another similar study in Nepalas they found that WHR of the diabetic male and females participants was significantly higher than the non-diabetic male and female participants.[24]

Similar studies by Qiao[25]and Wang et al[26]also concluded that WHR was significantly higher in diabetic individuals than non-diabetics and WHR was associated with type 2 diabetes independently. A possible pathophysiological explanation is that excess intra-abdominal adiposity may have the potential toinfluence metabolism through alterations in the secretion of adipokines. Previous studies have also reported that larger thigh and hip circumferences are associated with better glucose tolerance and an inverse relationship exists between increasinghip circumference and diabetes. [27]

CONCLUSION

The present study concludes that Body mass index, waist circumference and waist hip ratio all were higher in diabetic participants in comparison to non-diabetic participants. WHR shows a better predictor and comparatively more sensitive parameter in DM individuals for cardiometabolic risk as compared to BMI in our study. This explains why BMI may underestimate the cardiometabolic risk which may be best evaluated by WHR. Further longitudinal study should be designed in high-risk groups that would aid in better understanding the relationship of anthropometric parameters with type 2 diabetes mellitus.

REFERENCES

1. Shekhar Chandra Yadav, AlwinSaldhana, BiswajitMajumdar. Status of Thyroid profile In Type-2 Diabetes Mellitus. Journal of Nobel Medical College. 2012; 2: 64.
2. Park K. Textbook of preventive and social medicine. BanarsidasBhanot. 19th ed. Jabalpur: India; 2007; 327-32.
3. Diabetes mellitus. WHO Tech. Rep. Ser. 1985: No.646.
4. Wild, S., Roglic, G., Green, A., Sicree, R. and King, H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004; 27:1047-1053.
5. David R. Whiting A, Leonor Guariguata A, Clara Weil A, Jonathan Shaw B IDF Diabetes Atlas: Global estimates of the prevalence of diabetes for 2011 and 2030.
6. Sathisha TG, Cariappa KB, Nirmal Kumar, P Kanagavalli, and Pavithra V. The impact of T2DM on Thyroid Profile and Outcomes in a Female Population. RJPBCS. 2014; 5(2): 1554.
7. Rama Lakshmi G, Bandyopadhyay SS, Bhaskar LVKS, Sharma M, Rao RV. Appraisal of risk factors for diabetes mellitus type 2 in central Indian population: a case control study. Antrocom Online J Anthropol 2011;7:103-10.
8. Cassano PA, Rosner B, Vokonas PS, Weiss SI. Obesity and body fat distribution in relation to the incidence of non-insulin-dependent diabetes mellitus. Am J Epidemiol. 1992; 136:1474-1486.
9. Chan JM, Rimm EB, Colditz GA, Stampfer MJ, Willett WC. Obesity, fat distribution, and weight gain as risk factors for clinical diabetes in men. Diabetes Care. 1994; 17:961-969.
10. Kaku K. Pathophysiology of type 2 DM and its treatment policy. JMAJ .2010; 53(1):41-46
11. Redmon B, Caccamo D, Flavin P, MichelsR, Myers C, O'Connor P, et al. Institute for Clinical Systems Improvement. Diagnosis and Management of Type 2 Diabetes Mellitus in Adults. 2014.
12. Jain V, Yadav SS, Jain J. Metabolic syndrome in type 2 diabetes, an anthropometric and biochemical evaluation--A cross-sectional study from Central India. International Journal of Medical Science and Public Health. 2018 Oct 1;7(10):784-90.
13. Awasthi A, Rao CR, Hegde DS. Association between type 2 diabetes mellitus and anthropometric measurements–a case control study in South India. Journal of preventive medicine and hygiene. 2017 Mar;58(1):E56.
14. Richard I. G. Holt, Clive Cockram, Allan Flyvbjerg, Barry J. Goldstein. Textbook of Diabetes. 4th ed. p - 69.
15. A Nicholas. Type 2 diabetes mellitus and thyroid dysfunction: an intertwined duo. African Journal of Diabetes Medicine. 2014; 22(2):
16. World Health Organization. Report of WHO study group. WHO Technical Report Series. 1985: No 727.
17. Global report on diabetes. World Health Organization, Geneva, 2016. 29. International Diabetes Federation, 2015. https://issuu.com/int._diabetes_ federation/docs /idf_ atlas_ 2015_uk.
18. Chei C-L, Iso H, Yamagishi K, et al. Body Fat Distribution and the Risk of Hypertension and Diabetes among Japanese Men and Women. Hypertens Res. 2008; 31:851–857. [PubMed] [Google Scholar]

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 11, 2023

19. Sosenko JM, Kato M, Soto R, et al. A comparison of adiposity measures for screening non-insulin dependent diabetes mellitus. Int J ObesRelatMetabDisord. 1993;17:441–4. [PubMed] [Google Scholar Dan L. Longo et al. Harrison's Principles of Internal Medicine. 19th ed. 2015, chapter 417, page no: 2399-2406.
20. Ali A, Abbasi AS, Mushtaq S, Azim S, Jamil M. A Comparative Study of Waist Circumference, Waist-Hip Ratio and BMI in Diabetics and Non-Diabetics. Ann Pak Inst Med Sci. 2017;27. 16.
21. Wei M, Gaskill SP, Haffner SM, Stern MP. Waist circumference as the best predictor of noninsulin dependent diabetes mellitus (NIDDM) compared to body mass index, waist/hip ratio and other anthropometric measurements in Mexican Americans: a 7- year prospective study. Obes Res. 1997;5:16-23. 17.
22. Patel DN, Singh MP. Comparison of Anthropometric Indicator of General Obesity (BMI) to Anthropometric Indicators of Central Obesity (WC, WHR) in Relation to Diabetes Mellitus in Male Population. Natl J Community Med 2013; 4(3): 377-380.
23. Ranabhat K, Mishra SR, Dhimal M, Shrestha B, Khanal V. Type 2 Diabetes and Its correlates: A Cross Sectional Study in a Tertiary Hospital of Nepal. J Community Health. 2017;42:228-234.
24. RatnaManjulaSonga, Viswabarathi, Siddhartha K. Comparative study of lipid profile in obese type 2 diabetes mellitus and obese non diabetes. 2015; 14(11):87- 91.
25. Qiao Q, Nyamdorj R. Is the association of type II diabetes with waist circumference or waist-to-hip ratio stronger than that with body mass index? Eur J ClinNutr. 2010;64:30-34.
26. Wang Z, Hoy WE. Body size measurements as predictors of type 2 diabetes in Aboriginal people. Int J ObesRelatMetabDisord. 2004;28:1580-1584.