International Journal of Research in Medical Sciences
Singh V et al. Int J Res Med Sci. 2017 Dec;5(12):5232-5236
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20175133

Original Research Article

Prevalence of different components of the metabolic syndrome in type 2 diabetics attending tertiary care hospital in Himalayan region

Vikram Singh[1], Mridu Singh[1]*, Anil Joshi[2], Chitra Joshi[3]

[1]Department of Medicine, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India
[2]Department of Orthopedics, [3]Department of Obstetrics and Gynecology, Doon Medical College, Uttarakhand, India

Received: 05 November 2017
Accepted: 09 November 2017

***Correspondence:**
Dr. Mridu Singh,
E-mail: mriduvsingh@gmail.com

ABSTRACT

Background: There are enormous studies on various aspect of Diabetes and Metabolic syndrome, majority of studies are on urban population, few in rural area but very few for the population living in far flung hilly region of Himalaya. The aim was to find the prevalence of different components of metabolic syndrome in Type 2 diabetics living in the hills of Himalaya and to find correlation with obesity.
Methods: All the Type 2 Diabetic patients age 35 years and above attending the inpatients and out patient's department of V. C. S. G. G. M. C and RI Srinagar, Uttarakhand from October 2012 to March 2013 were enrolled and were evaluated for metabolic syndrome by IDF (International Diabetes Federation) criteria.
Results: 128 diabetics were enrolled (76 males and 52 females), the prevalence of obesity in patients of type 2 diabetics was 45.3%. There was poor correlation between obesity and type 2 diabetes (correlation coefficient 0.08) The prevalence of metabolic syndrome was 40.6 % and high percentage (62%) had all five components of the syndrome.
Conclusions: The prevalence of obesity and Metabolic syndrome is relatively lower in Type 2 Diabetics of Shivalik range of Himalaya (Uttarakhand).

Keywords: Himalayan region, Metabolic syndrome, Obesity, Type 2 diabetes mellitus

INTRODUCTION

Emerging trend of diabetes mellitus (DM) is observed worldwide, its prevalence is projected to be 6.3% by 2025, which is a 24.0% increase compared with 2003. There will be 333 million (a 72.0% increase) diabetics by 2030 in individuals of 20 to 79 years of age.[1] Environmental factors like obesity (central or general), physical inactivity, and diet (saturated fats and trans fatty acids) and socioeconomic factors are responsible for development of DM.[2]

The dramatic rise in the prevalence of type 2 diabetes and related disorders like obesity, hypertension and the metabolic syndrome could be related to the rapid changes in life style that has occurred during the last 50 years.[3]

Environmental factors, lifestyle, dietary pattern and phenotype of the population are different in urban areas and hilly areas. Therefore, this study was conducted to know how prevalence of Diabetes and different component of Metabolic syndrome is different from urban areas of India. To diagnose Metabolic syndrome IDF criteria was used because of following reason- First- several studies on migrant Indians across the globe have shown that Asian Indians have an increased risk for developing type 2 diabetes and related metabolic abnormalities compared to other ethnic groups.[4-6]

Although the exact reasons are still not clear, certain unique clinical and biochemical characteristics of this ethnic group collectively called as the "Asian Indian phenotype" is considered to be one of the major factors contributing to the increased predilection towards diabetes.[7,8]

Second- 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 and consequently a greater degree of central obesity. Asian Indians have more total abdominal and visceral fat for any given BMI and for any given body fat they have increased insulin resistance.[9]

Obesity in Type II diabetic patients is very common phenomenon and often termed as "Diabesity". The relative risk of T2DM increases as BMI increases above 23, Visceral fat seems to be strongly associated with an abnormal metabolic profile rather than upper body subcutaneous fat.[10,11] The metabolic syndrome (MS) is a cluster of cardiovascular risk factors that is characterized by central obesity, insulin resistance, atherogenic dyslipidemia and hypertension.[12]

Table 1: Criteria's for diagnosis of metabolic syndrome.

NCEP-ATP III (National Cholesterol Education Program Adult Treatment Panel III)	International diabetes federation (IDF) criteria
Presence of > 3 of the following:	Presence of central obesity with waist circumference >90 cm (men) and >80 cm (women) plus any 2 of the following:
(i) Waist circumference (>102 cm in men, >88 cm in women)	(i) TG >150 mg/dl or specific treatment for this lipid abnormality
(ii) SBP >130 mmHg and/or DBP >85 mmHg or medical treatment of previously diagnosed hypertension	(ii) HDL-C <40 mg/dl (men), <50 mg/dl (women) or specific treatment for this lipid abnormality
(iii) TG >150 mg/dl (1.7 mmol/l)	(iii) SBP >130 mmHg and/or DBP >85 mmHg or medical treatment for previously diagnosed hypertension.
(iv) HDL-C <40 mg/dl (1.03 mmol/l) in men, <50 mg/dl (1.29 mmol/l) in women	(iv) Fasting plasma glucose (>100 mg/dl) or previously diagnosed type 2 diabetes
(v) Fasting glucose >110 mg/dl	

Several studies indicate a rising prevalence of diabetes and insulin resistance in India with varying prevalence of MS in Asian Indian immigrants (31.6 to 33.9%) and in urban Asian Indian adults (41.1 to 49.2%).[13-16]

In this study we aim to find the prevalence of different components of the metabolic syndrome in patients with type 2 diabetes mellitus in Uttarakhand region of India.

METHODS

The study was conducted over a period of 6 months from October 2012 to March 2013. The study involved diabetic patients attending the Inpatients and Outpatients Department of Veer Chandra Singh Garhwali Government Medical College and Research Institute, Srinagar, Uttarakhand.

A cross sectional study was conducted using a structured questionnaire and all patients above 35 years of age with type 2 diabetes mellitus were enrolled. Informed consent was obtained from all patients.

Inclusion criteria

- All Patients above 35 years with type 2 diabetes.

Exclusion criteria

- Patients < 35 years of age,
- Type 1 diabetes,
- Gestational diabetes.

Data was recorded that included name, age, sex, occupation, duration of diabetes, activity level, h/o smoking, diet, height, weight, BMI, waist circumference, BP, lipid profile, blood sugar, creatinine, HbA1c, ECG, urinary microalbumin and presence of diabetic complications. Blood samples were collected after an overnight fast of at least 8 hours and analyzed for fasting blood sugar, triglyceride, HDL, S. creatinine, HbA1c.

Waist circumference was measured at the end of inspiration, in the horizontal plane midway between the inferior margin of the ribs and the superior border of the iliac crest with the subject standing erect, arms by the sides but away from the trunk, abdomen and breathing normally. Two consecutive measures of systolic and diastolic values were recorded and mean value of the two readings was taken into account.

IDF (International Diabetes Federation) criteria for metabolic syndrome was used in this study. The data collected was analyzed using chi square test and Pearson

correlation coefficient. Point prevalence for different components of metabolic syndrome was calculated.

RESULTS

The study included 128 patients with type 2 diabetes mellitus were enrolled which comprised of 76 males and 52 females. All diabetics were above 35 years of age. Out of 128 Diabetics, 52 were having Metabolic syndrome, 24 male and 28 female. Data collected was analyzed at the end of 6 months to find the prevalence of various components of the metabolic syndrome. The prevalence of metabolic syndrome using IDF criteria i.e. abdominal obesity with at least two other criteria namely elevated triglyceride, low HDL, elevated blood pressure and impaired fasting blood sugar was 40.6% in our study. Among females prevalence was 53.8% while it was 31.6% in males. Obesity as defined by IDF criteria was present in 45.3% of the cases. Of the total females as much as 57.7% were obese, among the males prevalence was 36.8%. The mean abdominal circumference was 86.8 ±11 cm.

Hypertension was the single most common component of the metabolic syndrome in our study, present in as much as 78 % of the cases.

Among the males prevalence was 78.9% and among females it was 76.9%. The mean systolic blood pressure in my study was 137.9 ± 21.5 mm of Hg and diastolic blood pressure 86.6±13.4 mm of Hg. Prevalence of elevated triglyceride in our study was 50%. Of the total females as much as 42.3% had elevated triglycerides while among the males prevalence was 55.3 %. The mean triglyceride was 141.3± 49.1 mg/dl.

Gender wise distribution of different component of Metabolic syndrome (Table 2).

Table 2: Gender wise distribution of different components of metabolic syndrome.

Parameters	Male (n)	Female (n)	Total (n)	Percentage
Diabetes mellitus	76	52	128	100
Obesity	28	30	58	45.3
Raised triglyceride	42	22	64	50
Low HDL	38	44	82	64
Hypertension	60	40	100	78
Metabolic Syndrome	24	28	52	40.6

Table 3: Showing values of different component of metabolic syndrome in male and females with the standard deviation.

Component	Male	Female	Total
Fasting Blood sugar	180.9(±81.2) mg/dl	172.8(±73.7) mg/dl	177.6(±77.8) mg/dl
Abdominal circumference	88(±10.1) cm	85(± 12.2) cm	86.8(±11) cm
Triglyceride	143(± 49.1) mg/dl	138.8(±50) mg/dl	141.3(± 491) mg/dl
HDL	40.3(±6.4) mg/dl	40.8(±6.8) mg/dl	40.5(±6.5) mg/dl
Systolic BP	141.8(±24.40) mmHg	132.3(±15.1) mmHg	137.9(±21.5) mmHg
Diastolic BP	90.1(±15.6) mmHg	81.5(±7.1) mmHg	86.6(±13.4) mmHg

Values of different component of Metabolic syndrome in Male and Females with the standard deviation is given in Table 3.

DISCUSSION

Metabolic syndrome is a constellation of metabolic abnormalities namely hypertriglyceridemia, decreased HDL cholesterol, impaired fasting glucose which along with hypertension and central obesity confer an increased risk for development of cardiovascular disease and diabetes mellitus.

Various studies have shown that obesity dramatically increases prevalence of metabolic syndrome especially as the age increases. Obesity is itself a major risk factor for development of type 2 diabetes mellitus due to insulin resistance.

Various criteria's have been defined for diagnosis of metabolic syndrome. We have used the International Diabetes Federation (IDF) criteria. The IDF definition of Metabolic syndrome requires central obesity to be the essential criterion. Since our study population was diabetic, the presence of diabetes or raised plasma glucose also became an unchangeable criterion in our study cohort.

A total of 128 type 2 diabetics were recruited for the study. It included 76 (53.4 %) males and 52 (40.6%)

females. Hypertension was the single most common component of the metabolic syndrome in our study, present in as much as 78 % of the cases. Among the males prevalence was 78.9% and among females it was 76.9%. The mean systolic blood pressure in our study was 137.9 ± 21.5 mm of Hg and diastolic blood pressure 86.6±13.4 mm of Hg.

These findings are similar to those of Osuji et al were hypertension (74.5%) was the most prevalent risk factor in both sexes followed by dyslipidemia (60.8%) and obesity (45.1%).[17]

Obesity as defined by IDF criteria was present in 45.3% of the cases. Of the total females as much as 57.7% were obese, among the males prevalence was 36.8 %. The mean abdominal circumference was 86.8 ±11 cm. Most studies have found a higher prevalence of obesity than in our study. In a study by Pandya et al it was found that almost 70% of diabetic patients were obese. Surprisingly, more female diabetic patients (84%) were found to be obese than male diabetic patients (58%), and this trend seen in both urban (M: 88%, F: 71%) as well as rural area also (M: 49%, F: 80.5%). This implies that doing routine household work might not be sufficient for control of obesity.[18]

There was poor correlation between obesity and type 2 diabetes (correlation coefficient 0.08) in our study. The correlation in males was: 0.16 and in female is it was -0.05. This is in contrast to most studies but can be explained by the small sample size in our study.

Prevalence of elevated triglyceride in our study was 50 %. Of the total females as many as 42.3% had elevated triglycerides while among the males prevalence was 55.3%. The mean triglyceride was 141.3± 49.1 mg/dl. Low HDL was found in 64.1% of the cases. It was significantly associated with sex (p value 0.005) with almost 84.6 % of females having low HDL, compared to 50 % of males.

Studies have shown that serum triglyceride in men effectively indicated the presence of Metabolic syndrome in newly detected T2DM individuals, whereas, in women the HDL-C was the stronger predictor of MS.[19] The prevalence of metabolic syndrome using IDF criteria i.e. abdominal obesity with at least two other criteria namely elevated triglyceride, low HDL, elevated blood pressure and impaired fasting blood sugar was 40.6% in our study.

Among females prevalence was 53.8 % while it was 31.6% in males. The age and gender adjusted prevalence of MS, using the IDF criteria, in a study on the South Indian population was as high as 73.3%. The prevalence was higher in women (83.3%), compared to men (65.3%).[20] Out of these 52 patients, 62% (32) had all 5 components of metabolic syndrome, 19% (10) had 4 components and 19% (10) had 3 components.

In a study by Surana et al in which the 3928 diabetic patients were diagnosed with metabolic syndrome, it was found that 748 (19.04%) were positive for all five risk factors, 1428 (36.35%) had four risk factors, and 1752 (44.6%) had three risk factors.[21] In their study the prevalence of metabolic syndrome was 77% using NCEP ATP III criteria. There was a higher prevalence of metabolic syndrome among women as compared to men. Women also had a higher prevalence of low HDL and central obesity which is similar to our study.

In our study we have used the IDF criteria for metabolic syndrome where presence of abdominal obesity is an essential criterion and so this could explain the lower prevalence of metabolic syndrome as compared to other studies. In our study cases with all five components of metabolic syndrome are significantly higher (62%).

It is well known that individual components of metabolic syndrome are high risk factors for cardiovascular morbidity and mortality. Further, in adults who have type 2 diabetes, the presence of metabolic syndrome is associated with a fivefold increase in CV risk independent of age, sex, smoking status, and glycated hemoglobin (HbA1c). Therefore, it is imperative that aggressive therapy be aimed at controlling impaired glycemia, dyslipidemia and hypertension. Substantial benefits of such a multifactorial intervention have been documented by the Steno-2 study.

CONCLUSION

Obesity was present in 45.3% of the cases, which is much lower than in most studies. There was poor correlation between obesity and type 2 diabetes (correlation coefficient 0.08) in our study. The correlation in males was 0.16 and in females it was -0.05.

This suggest that trucal obesity and inflammatory markers secreted by adipocytes may not be important etiopatogenesis of Type 2 Diabetics in the Shivalik range of Himalaya but this hypothesis need to be verified by large scale study involving molecular tool to testify the etiopathogenesis of Diabetes in this area.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Madhukar Rai, Dr. Shyam Sunder for mentoring author to do the study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Venkat Narayan KM, Zhang P, Kanaya AM. "Diabetes: the pandemic and potential solutions," in Disease Control Priorities in Developing Countries,

D. T. Jamison, J. G. Breman, A. R. Measham et al., Eds., Oxford University Press, New York, NY, USA, 2nd edition; 2006.
2. Qiao Q, Williams DE, Imperatore G, Venkat Narayan KM, and Tuomilehto J. "Epidemiology and geographyof type 2 diabetes mellitus," in International Textbook of Diabetes Mellitus, R. A. de Fronzo, E. Ferrannini, H. Keen, and P. Zimmet, Eds., JohnWiley and Sons, Chichester, UK, 3rd edition, 2007. pp. 33-56.
3. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Ind J Med Res. 2007;125(3):217-30.
4. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. Lancet. 1991;337:382-6.
5. Mohan V, Sharp PS, Cloke HR, Burrin JM, Schumer B, Kohner EM. Serum immunoreactive insulin responses to a glucose load in Asian Indian and European Type 2 (noninsulin-dependent) diabetic patients and control subjects. Diabetologia. 1986;29:235-7.
6. Abate N, Chandalia M. Ethnicity and type 2 diabetes: focus on Asian Indians. J Diabetes Complications. 2001;15:320-7.
7. Joshi R. Metabolic syndrome - Emerging clusters of the Indian phenotype. J Assoc Physicians India. 2003;51:445-6.
8. Deepa R, Sandeep S, Mohan V. Abdominal obesity, visceral fat and type 2 diabetes- "Asian Indian phenotype. In: Mohan V, Rao GHR, editors. Type 2 diabetes in South Asians: Epidemiology, risk factors and prevention. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2006 p. 138-52.
9. Chandalia M, Abate N, Garg A, Stray-Gunderson J, Grundy SM. Relationship between generalized and upper body obesity to insulin resistance in Asian Indian men. J Clin Endocrinol Metab. 1999;84: 2329-35.
10. Colditz GA. Weight as a risk factor for clinical diabetes in women. American Journal of Epidemiol. 1990;132:501-13.
11. Liu J. Impact of abdominal visceral and subcutaneous adipose tissue on cardiometabolic risk factors: The Jackson Heart Study. J Clinic Endocrinol Metabolism. 2010;95:5419-26.
12. Deedwania PC, Gupta R. Management issues in the metabolic syndrome. J Assoc Physicians India. 2006;54:797-810.
13. Misra KB, Endemann SW, Ayer M. Leisure time physical activity and metabolic syndrome in Asian Indian immigrants residing in northern California. Ethn Dis. 2005;15:627-34.
14. Gupta R, Deedwania PC, Gupta A, Rastogi S, Panwar RB, Kothari K. Prevalence of metabolic syndrome in an Indian urban population. Int J Cardiol. 2004;97(2):257-61.
15. Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome in urban Asian Indian adults - a population study using modifi ed ATP III criteria. Diabetes Res Clin Practice. 2003;60:199-204.
16. Wasir JS, Misra A, Vikram NK, Pandey RM, Gupta R. Comparison of defi nitions of the metabolic syndrome in adult Asian Indians. J Assoc Physicians India. 2008;56:158-64.
17. Osuji CU, Nzerem BA, Dioka CE, Onwubuya El. Metabolic syndrome in newly diagnosed type 2 diabetes mellitus using NCEP-ATP III, the Nnewi experience. Nigerian J Clinic Practice. 2012;15(4): 75-480.
18. Pandya H, Lakhani JD, Patel N. Obesity is becoming synonym for diabetes in rural areas of India also – an alarming situation Int J Biol Med Res. 2011;2(2):556-60.
19. Ethiraj D, Bhansali A, Jaggi S, Dutta P, Jain S, Tiwari P, et al. Predictors of metabolic syndrome in Asian north Indians with newly detected type 2 diabetes. Indian J Med Res. 2009;129:506-14.
20. Raman R. Prevalence of Metabolic Syndrome and its influence on microvascular complications in the Indian population with Type 2 Diabetes Mellitus. Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetic Study (SN-DREAMS, report 14). Diabetology and Metabolic Syndrome. 2010,2:67.
21. Surana SP, Shah DB, Gala K, Susheja S, Hoskote SS, Gill N, et al. Prevalence of Metabolic Syndrome in An Urban Indian Diabetic Population Using The NCEP ATP III Guidelines. JAPI. 2008;56:865-8.

Cite this article as: Singh V, Singh M, Joshi A, Joshi C. Prevalence of different components of the metabolic syndrome in type 2 diabetics attending tertiary care hospital in Himalayan region. Int J Res Med Sci 2017;5:5232-6.