Research Article

iMedPub Journals
http://www.imedpub.com

Diabetes Research and Endocrinology

2018
Vol.2No.1:1

Prevalence of Metabolic Syndrome in the Type 2 Diabetes Population of North-West Punjab

Neha Sudhera*, Ginjinder Kaur, Deepkiran Bassi, Gurinder Singh and Kulvir Singh

Department of Human Genetics, Punjabi University, Patiala, India-147002

Corresponding author: Neha Sudhera

neha_sudhera@yahoo.com

Department of Human Genetics, Punjabi University, Patiala, India-147002.

Tel: 09780680392

Citation: Sudhera N, Kaur G, Bassi D, Singh G, Singh K (2018) Prevalence of Metabolic Syndrome in the Type 2 Diabetes Population of North-West Punjab. J Diabetes Res Endocrinol. Vol. 2 No.1:1

Abstract

Background: Type 2 diabetes is a complex disorder and metabolic syndrome in combination with diabetes leads to increased risk of microvascular and macrovascular complications due to associated dyslipidemia, hypertension and obesity. The present study evaluates the prevalence of metabolic syndrome in type 2 diabetes patients and the risk factors associated with the metabolic syndrome.

Methods: Fasting blood samples of 680 diabetes patients (340 males and 340 females) were collected with informed consent. The lipid profile, blood pressure and anthropometric parameters (weight, height and waist measurements) were assessed using standardized techniques. The criteria given by IDF (2006) were used for assessment of metabolic syndrome.

Findings: The prevalence of metabolic syndrome was significantly higher in females (43.5%) as compared to males (34.1%). The prevalence of metabolic syndrome was more in females in the age group 31-40 years (29.1%) and 41-50 years (29.1%) whereas in males, the prevalence was more in 41-50 years (44.8%) and 51-60 years (44.8%) age groups. In females, central obesity (81.7%) and hypertension (64.7%) followed by hypertriglyceridemia (68.1%) were the driving forces for metabolic syndrome whereas in males, it were hypertriglyceridemia (68.1%) and central obesity (67.3%), followed by hypertension (59.4%). Based on BMI, 27.4% males were overweight; 55% were obese and only 17.6% had normal BMI whereas in the females, 15.6% were overweight; 75.9% were obese and only 8.5% had normal BMI ranges. The male diabetes patients with metabolic syndrome had clustering of central obesity and diabetes with any two other risk factors and in females, it was central obesity and diabetes with any one risk factor. Only few individuals had clustering of all the risk factors.

Conclusion: MetS risk factors were high among this population. Increased serum triglyceride for men and central obesity for women were the strongest risk factors. Metabolic syndrome is a significant health problem that needs to be tackled with proven strategies.

Keywords: Type 2 diabetes; Glucose tolerance; Metabolic syndrome; Triglycerides

Abbreviations: BMI: Body Mass Index; DBP: Diastolic Blood Pressure; HDL: High Density Lipoprotein; IDF: International Diabetes Federation; MetS: Metabolic Syndrome; NCEP ATP-III: National Cholesterol Education Program Adult Treatment Panel III; SBP: Systolic Blood Pressure; TG: Triglycerides; WC: Waist Circumference; WHO: World Health Organization

Received: January 18, 2018; **Accepted:** February 20, 2018; **Published:** March 01, 2018

Introduction

Type 2 diabetes is a complex disorder of impaired glucose tolerance, insulin resistance and lipid abnormalities. There is a rapid increase in the prevalence of diabetes due to modernization and urbanization that has resulted in a substantial burden on the healthcare services [1]. The top three countries with highest rates of diabetes include India, China and United States with alarming rates of prevalence of diabetes [2]. There is a sharp increase in the population with diabetes from 19 million in 1995 to 66.8 million in 2015 in India which is predicted to increase to 123.5 million by 2040. The crude prevalence rate of diabetes in urban areas is about 9% and the prevalence in rural areas has also increased to around 3% of the total population [3].

Metabolic syndrome is defined as a cluster of cardiovascular risk factors which include dysglycemia, central obesity, hypertension and dyslipidemia. There are different definitions of metabolic syndrome given by WHO [4], NCEP ATP-III [5] and IDF [6] with little variations in each. Type 2 diabetes and metabolic syndrome are both heterogeneous and complex conditions due to the interaction between environmental and genetical factors and in the population with type 2 diabetes, nearly 70-80% are diagnosed with metabolic syndrome [7-9].

There is growing evidence that like diabetes, metabolic syndrome besides resulting in macrovasular complications also causes microvascular complications in type 2 diabetes patients [10-12]. The risk of macrovascular and microvascular complications increases with metabolic syndrome in combination with diabetes due to associated dyslipidemia, hypertension and obesity [11]. The studies in American and European populations have shown the correlation between metabolic syndrome and macro- and microvascular complications, in patients with diabetes [13-15].

Most of the studies have looked into the metabolic syndrome prevalence in general population [16-19]. There are few studies that have calculated the prevalence in the diabetic population [13,20-21] but there is complete paucity of such studies in the population of Northern Punjab.

Therefore, the present study aimed at determining the prevalence of metabolic syndrome in type 2 diabetes patients according to IDF criteria [6] and the risk factors associated with the metabolic syndrome.

Methods

A total of 680 type 2 diabetic patients (340 males and 340 females) ranging in age from 35 to 60 years and belonging to North-West region of Punjab were included in the study. Informed consent was obtained from the participants after explaining the procedure and the objectives of the study and complete confidentiality of the collected data was ensured to them. The study protocol was reviewed and approved by the Institutional Ethical Committee of Punjabi University, Patiala.

A prospective study was planned to analyze the pattern of dyslipidemia in diabetic patients attending the Diabetes Clinics from different hospitals and clinics of Malwa region of Punjab over a period of 2 years (July 2013 to June 2015). The study population included already diagnosed, on treatment diabetic patients. The patients who already had history of CAD or cerebrovascular accident (CVA) or having other major chronic systemic disorders were not included in the study.

MetS was defined using the International Diabetes Federation [6] consensus group guidelines as abdominal obesity (waist circumference ≥ 90 cm for men and ≥ 80 cm for women) plus two or more of the following risk factors: blood pressure ≥ 130/85 mm Hg, fasting plasma glucose (100 mg/dl) or pre-existing diabetes, serum triglycerides (≥ 150 mg/l) and HDL levels for men (<40 mg/dl) and women (<50 mg/dl).

Anthropometric measurements including weight, height and waist circumference were obtained using standardized techniques. The blood pressure was recorded, in the sitting position, in the right arm to the nearest 2 mm Hg using the mercury sphygmomanometer (Diamond Deluxe BP apparatus, Pune, India). Two readings were taken, five minutes apart, and their mean was taken as the blood pressure.

The overnight fasting blood samples were taken with the help of trained technician after eight hours of overnight fasting to estimate the plasma glucose and serum lipids. The biochemical analysis was done on Med-o-Source, automated analyzer. The total serum cholesterol (CHODPOD method), HDL (after protein precipitation CHOD-POD method) and serum triglycerides (CHOD-POD) were estimated.

A computerized database was created for all the records. A statistical package for the Social Sciences-SPSS (version 16.0) was used for statistical analysis. All the data were expressed as mean ± S.D or as percentage. The statistical significance was assumed at p-value <0.05. The student t-test was used to analyse the differences between patients with MetS and without MetS and chi square analysis was performed to find out the significant differences in the proportions.

Results

The study revealed significant gender differences with higher prevalence of metabolic syndrome in females (43.5%) as compared to males (34.1%). On the basis of BMI (Table 1), 27.4% males were overweight; 55% were obese and only 17.6% had normal BMI whereas in the females, 15.6% were overweight; 75.9% were obese and only 8.5% had normal BMI values. Higher rates of metabolic syndrome were observed in older age groups in males and middle age groups in females (Table 2).

The values of waist circumference (WC), TG, BMI, SBP and DBP were significantly greater in males with MetS as compared to males without MetS and the differences were statistically significant (Table 3). In females with MetS, WC, TG, DBP were significantly higher and HDL was significantly lower as compared to females without MetS (Table 4).

In females, central obesity (81.7%) and hypertension (64.7%) followed by hypertriglyceridemia (68.1%) were the driving forces for metabolic syndrome whereas in males, it were hypertriglyceridemia (68.1%) and central obesity (67.3%) followed by hypertension (59.4%) (Table 5).

The type 2 diabetes male patients with metabolic syndrome had clustering of central obesity and diabetes with any two other risk factors and in females; it was central obesity and diabetes with any one risk factor. Only few individuals had clustering of all the risk factors (Table 6).

Discussion

Metabolic syndrome has been on the rise, contributing to the increasing prevalence of non-communicable disorders such as cardiovascular diseases and type 2 diabetes mellitus. But there are few studies that have reported the prevalence of metabolic syndrome in diabetes population. In the present study, attempt has been made to study the prevalence of metabolic syndrome risk factors in diabetes population of North-West Punjab.

Table 1 Age distribution and gender differences in the prevalence of obesity and metabolic syndrome in type 2 diabetes patients.

Variables	Males	Females	χ^2	p value
Age (years) 31-40 41-50 51-60 61-70	 19 (5.59%) 127 (37.53%) 157 (46.18%) 37 (10.88%)	 67 (19.71%) 120 (35.29%) 72 (21.18%) 81 (23.82)	5.12	0.05
BMI (kg/m^2) Normal Overweight Obese	 60 (17.65%) 93 (27.35%) 187 (55%)	 29 (8.53%) 53 (15.59%) 258 (75.88%)	29.92	<0.0001
Metabolic syndrome Absent Present	 224 (65.88%) 116 (34.12%)	 192 (56.47%) 148 (43.53%)	5.95	0.01

Table 2 Prevalence of metabolic syndrome across different age groups.

Age Group	Females	Males
31-40	43 (29.1%)	8 (6.9%)
41-50	43 (29.1%)	52 (44.8%)
51-60	29 (19.5%)	52 (44.8%)
61-70	33 (22.3%)	4 (3.5%)

The overall prevalence of the metabolic syndrome (MetS) in the present study was 41.25% (43.5% in females and 34.1% in males). The prevalence of MetS as defined by IDF was found to be 71.7% and 60.4% as defined by NCEP-ATP III in a study among diabetes patients in Cameroon [22]. Another reported an overall MetS prevalence of 51% (44% in men and 56% in women) based on the WHO criteria [23]. Makuyana et al. [24] reported prevalence rate of MetS to be 43% in diabetic subjects in a tertiary care diabetes clinic. Kelliny et al. [25] reported MetS rates of 66.8%, 85.5%, 74% among men and 87.1%, 79.7%, 93% among women, according to the NCEP-ATP III, WHO and IDF criteria, respectively, in some parts of Africa and rates of 46% and 74% in Black and White South Africans respectively based on the IDF criteria [26].

The differences could be due to the variable criteria used in defining MetS as well as ethnic differences.

In the present study, metabolic syndrome was found to be more common in females suffering from type 2 diabetes as compared to their male counterparts. Similar findings have been reported by many studies in the developing countries [27-30]. The high prevalence of the MetS found among women in the present study could be due to the fact that a significant proportion of women had abdominal obesity which is one of the components of the MetS according to the IDF criteria used in the study.

The variable rates of the components of the MetS were observed. Similar to the findings of Ogbera [31] and Kelliny et al. [25] abdominal obesity was one of the components of the MetS that occurred frequently. However, contrary to their findings, it was more prevalent in women than in men. The most common abnormality among women was central obesity and men were more likely to have hypertension and hypertriglyceridemia. The present study reported that the age group of 40-60 years had a higher prevalence of metabolic syndrome which is in accordance with the study done in South Asians [32].

It is evident from this study that metabolic syndrome is quite prevalent in our type 2 diabetes patients like in other parts of the world.

Limitations of the Study

The main limitation of our study was the average size of the

Table 3 Demographic, anthropmetric and biochemical indices in type 2 diabetes males with and without metabolic syndrome.

Variables	With MetS (Mean ± SD)	Without MetS (Mean ± SD)	t-value
Age (years)	50.74 ± 5.13	53.05 ± 7.84	1.68
Duration of Diabetes (years)	6.38 ± 4.81	7.07 ± 4.93	0.64
Waist Circumference (cm)	98.22 ± 6.22	90.75 ± 8.00	4.53**
BMI (kg/m^2)	26.49 ± 2.30	24.99 ± 2.92	2.48*
Fasting Blood Sugar (mg/dl)	242.52 ± 97.44	256.33 ± 118.52	0.59
Triglycerides (mg/dl)	242.70 ± 91.16	179.74 ± 89.50	3.16*
HDL (mg/dl)	53.14 ± 14.11	53.56 ± 12.93	0.14
SBP (mm/Hg)	131.71 ± 13.03	125.03 ± 9.96	2.72*
DBP (mm/Hg)	90.80 ± 11.48	83.16 ± 9.56	3.36**

*represents statistically significant at p<0.05
**represents statistically significant at p<0.01

Table 4 Demographic, anthropometric and biochemical indices in type 2 diabetes females with and without metabolic syndrome.

Variables	With MetS (Mean ± SD)	Without MetS (Mean ± SD)	t-value
Age (years)	49.96 ± 11.01	50.92 ± 9.99	0.38
Duration of Diabetes (years)	6.04 ± 3.41	5.98 ± 3.64	0.07
Waist Circumference (cm)	90.94 ± 7.45	85.03 ± 10.61	2.72*
BMI (kg/m2)	28.18 ± 4.15	27.03 ± 4.52	1.12
Fasting Blood Sugar (mg/dl)	208.46 ± 93.84	183.93 ± 121.87	0.96
Triglycerides (mg/dl)	197.69 ± 87.65	129.01 ± 74.49	3.49*
HDL (mg/dl)	45.67 ± 13.49	54.16 ± 14.71	2.52*
SBP (mm/Hg)	133.16 ± 16.22	133.08 ± 17.16	0.02
DBP (mm/Hg)	85.00 ± 11.10	79.57 ± 8.53	2.32

*represents statistically significant at p<0.05
**represents statistically significant at p<0.01

Table 5 Gender differences in the prevalence of MetS risk factors.

	Males	Females
Increased FBS	328 (96.5)	312 (91.7)
Central obesity	232 (67.3)	278 (81.7)
Increased TG	232 (68.1)	177 (52.1)
Decreased HDL	67 (19.71)	158 (46.5)
Hypertension	202 (59.4)	220 (64.7)

sample, which may have limited the power of the results. This study took place in one particular region and may limit the extrapolation to other regions of Punjab.

Conclusion

Frequency of MetS was found to be significantly high in this study with female preponderance. All the components, except hypertension were more frequent in females. It is very important to diagnose it early to prevent the life threatening cardiovascular complications.

Table 6 Pattern of Clustering of components of metabolic syndrome.

Components of MetS	Males	Females
Any 1	78 (22.9%)	124 (36.4%)
Any 2	111 (32.6%)	105 (30.8%)
Any 3	4 (1.1)	42 (12.4%)

+ Any 1, Diabetes + Obesity + Any of hypertension, reduced HDL or elevated triglyceride
+ Any 2, Diabetes + Obesity + Any two of hypertension, reduced HDL or elevated triglyceride
+ Any 3, Diabetes + Obesity + All three of hypertension, reduced HDL or elevated triglyceride

Recommendations

To curb the diabetes epidemic, primary prevention through the promotion of a healthy diet and lifestyle should be a global public policy priority. Diabetic patients with metabolic syndrome need more aggressive approach in management so as to decrease the incidence of cardiovascular complications.

Funding Source

The present study was carried out from the grant received from the University Grants Commission (UGC), New Delhi for carrying out Major Research Project sanctioned to the first author.

Acknowledgement

The authors thank all the subjects for their full participation in the study. Without their cooperation, the study would not have been completed.

References

1 Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, et al. (2009) Diabetes in Asia: Epidemiology, risk factors and pathophysiology. JAMA 301: 2129-2140.

2 Shaw JE, Sicree RA, Zimmet PZ (2010) Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract 87: 4-14.

3 http://diabetesindia.com/diabetes/itfdci.htm

4 Alberti KG, Zimmet PZ (1998) Definition, diagnosis and classification of diabetes mellitus and its complications. Diabet Med 15: 539-553.

5 National Cholesterol Education Program (NCEP) (2002) Expert panel on detection and treatment of high blood cholesterol in adult. 106: 3143-3421.

6 Alberti SG, Zimmet P, Shaw J, Grundy SM (2006) The IDF consensus worldwide definition of the metabolic syndrome. International Diabetes Federation, pp: 1-23.

7 Alexander C, Landsman PB, Teutsch SM, Haffner SM (2003) Third National Health and Nutrition Examination Survey (NHANES III) National Cholesterol Education Program (NCEP). Diabetes 52: 1210-1214.

8 Bonora E, Kiechl S, Willeit J, Oberhollenzer F, Egger G, et al. (1998) Prevalence of insulin resistance in metabolic disorders: The Bruneck study. Diabetes 47: 1643-1649.

9 Marchesini G, Forlani G, Cerrelli F, Manini R, Natale S, et al. (2004) WHO and ATPIII proposals for the definition of the metabolic syndrome in patients with Type 2 diabetes. Diabet Med 21: 383-387.

10 Isomaa B, Henricsson M, Almgren P, Tuomi T, Taskinen MR, et al. (2001) The metabolic syndrome influences the risk of chronic complications in patients with type II diabetes. Diabetologia 44: 1148-1154.

11 Shimajiri Y, Tsunoda K, Furuta M, Kadoya Y, Yamada S, et al. (2008) Prevalence of metabolic syndrome in Japanese type 2 diabetic patients and its significance for chronic vascular complications. Diabetes Res Clin Pract 79: 310-317.

12 Szalat A, Raz I (2006) Metabolic syndrome and microangiopathy. Isr Med Assoc J 8: 424-425.

13 Bonadonna RC, Cucinotta D, Fedele D, Riccardi G, Tiengo A (2006) The metabolic syndrome is a risk indicator of microvascular and macrovascular complications in diabetes: Results from Metascreen, a multicenter diabetes clinic-based survey. Diabetes Care 29: 2701-2707.

14 Costa LA, Canani LH, Lisboa HRK, Tres GS, Gross JL (2004) Aggregation of features of the metabolic syndrome is associated with increased prevalence of chronic complications in Type 2 diabetes. Diabetic Med 21: 252-255.

15 Kilpatrick ES, Rigby AS, Atkin SL (2007) Insulin resistance, the metabolic syndrome, and complication risk in type 2 diabetes: Double diabetes in the diabetes control and complications trial. Diabetes Care 30: 707-712.

16 Deepa M, Farooq S, Datta M, Deepa R, Mohan V (2007) Prevalence of metabolic syndrome using WHO, ATPIII and IDF definitions in Asian Indians: The Chennai urban rural epidemiology study (CURES-34). Diabetes Metab Res Rev 23: 127-134.

17 Iqbal Hydrie MZ, Shera AS, Fawwad A, Basit A, Hussain D Sc A (2009) Prevalence of metabolic syndrome in urban Pakistan (Karachi): Comparison of newly proposed International Diabetes Federation and modified adult treatment panel III criteria. Metab Syndr Relat Disord 7: 119-124.

18 Strazzullo P, Barbato A, Siani A, Cappuccio FP, Versiero M, et al. (2008) Diagnostic criteria for metabolic syndrome: A comparative analysis in an unselected sample of adult male population. Metabolism 57: 355-361.

19 Wasir J, Misra A, Vikram N, Pandey R, Gupta R (2008) Comparison of definitions of the metabolic syndrome in adult Asian Indians. J Assoc Physicians India 56: 158-164.

20 Lu B, Yang Y, Song X, Dong X, Zhang Z, et al. (2006) An evaluation of the International Diabetes Federation definition of metabolic syndrome in Chinese patients older than 30 years and diagnosed with type 2 diabetes mellitus. Metabolism 55: 1088-1096.

21 Koehler C, Ott P, Benke I, Hanefeld M, The DIGSG (2007) Comparison of the prevalence of the metabolic syndrome by WHO, AHA/NHLBI, and IDF definitions in a German population with type 2 diabetes. Horm Metab Res 39: 632-635.

22 Kengne AP, Limen SN, Sobngwi E, Djouogo CF, Nouedoui C (2012) Metabolic syndrome in type 2 diabetes: Comparative prevalence according to two sets of diagnostic criteria in sub-Saharan Africans. Diabetol Metab Syndr 4: 22.

23 Adediran O, Edo A, Jimoh A, Ohwovoriole A (2007) Prevalence of the metabolic syndrome among Nigerians with type 2 diabetes. Diabetes Int 15: 13-14.

24 Makuyana D, Gomo Z, Munyombwe T, Matenga J, Hakim J (2004) Metabolic syndrome disorders in urban black Zimbabweans with type 2 diabetes mellitus. Cent Afr J Med 50: 24.

25 Kelliny C, William J, Riesen W, Paccaud F, Bovet P (2008) Metabolic syndrome according to different definitions in a rapidly developing country of the African region. Cardiovasc Diabetol 7: 27.

26 Kalk W, Joffe B (2008) The metabolic syndrome, insulin resistance, and its surrogates in African and white subjects with type 2 diabetes in South Africa. Metab Syndr Relat Disord 6: 247-255.

27 Abdul-Ghani M, Nawaf G, Fawaz G, Itzhak B, Minuchin O, et al. (2006) Increased prevalence of microvascular complications in type 2 diabetes patients with the metabolic syndrome. IMAJ-RAMAT GAN 8: 378.

28 Dhanaraj E, Bhansali A, Jaggi S, Dutra P, Jain S, et al. (2008) Prevalence and predictors of metabolic syndrome in non-obese Asian Indians with newly detected type 2 diabetes mellitus. J Indian Med Assoc 106: 366-368.

29 Nahar S, Rahman M, Ullah M, Debnath B, Sultana N, et al. (2011) Prevalence of metabolic syndrome in newly diagnosed type 2 diabetes mellitus. Cardiovasc J 4: 17-25.

30 Raman R, Gupta A, Pal SS, Ganesan S, Venkatesh K, et al. (2010) Prevalence of metabolic syndrome and its influence on microvascular complications in the Indian population with type 2 diabetes mellitus. Diabetol Metab Syndr 2: 67.

31 Ogbera AO (2010) Prevalence and gender distribution of the metabolic syndrome. Diabetol Metab Syndr 2: 4.

32 Nestel P, Lyu R, Low LP, Sheu WH, Nitiyanant W, et al. (2007) Metabolic syndrome: Recent prevalence in East and Southeast Asian populations. Asia Pac J Clin Nutr 16: 362-367.