Original Research Article

Association of Self-Reported Type 2 Diabetes Mellitus with Certain NCD Risk Factors in a Community Based Study

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ABSTRACT

Background: Type 2Diabetesis a significant cause of mortality and morbidity, individually as well as in the presence of other non-communicable diseases and their risk factors.
Aims & Objective: To determine the association between type 2 diabetes mellitus and certain NCD risk factors. Materials and
Methods: The present study is a part of cross sectional, community based study conducted among the employees of a University in North India. A total of 540 employees selected through random sampling proportionately from all grades of university staff. The definition of diabetes was based on the already diagnosed type 2 diabetes, by physician, as reported by the subjects themselves. The secondary analysis was done to look for an association between self-reported diabetes mellitus and certain other risk factors for non-communicable diseases.
Results: The prevalence of self-reported diabetes mellitus was found to be 7.9%. The self-reported diabetes was found to be higher with higher age (49±6 years vs. 42±10 years), weight (71.02±12.73 kg vs. 67.44±11.65 kg), higher BMI (25.46±3.89 kg/m^{2}vs.25.04±3.78 kg/m^2), higher waist circumference (93.01±8.03 cm vs. 88.01±10.46 cm) and mean systolic blood pressure (133±11 mm of Hg vs. 125±13 mm Hg).The proportions of subjects with abdominal obesity, hypertension and hyper-cholestrolaemia were found to be significantly higher among known diabetic subjects as compared to non-diabetics.
Conclusion: The self-reported type 2 diabetes mellitus was found to be significantly associated with raised waist circumference, hypertension and hyper-cholestrolaemia among the study population.

Key Words: type 2 diabetes mellitus, association, NCD risk factors.

INTRODUCTION

The raising burden of non-communicable diseases is the major public health concern globally. This group of diseases has been found to be the biggest cause of death world-wide [1] accounting for 63% of the 57 million deaths [2] in 2008. The majority of these deaths were attributed to cardiovascular diseases, diabetes, cancers and chronic respiratory diseases. [3] Diabetes Mellitus has been classified as the third leading cause of premature mortality world-wide. [3] According to recent estimates, around 387 million people world-wide are

living with diabetes while south east region is home to 75 million people with diabetes. [4] As per International Diabetes Federation (IDF) 4.9 million deaths occurred due to diabetes during 2014, and every 7 second one person dies due to it. [4] Common risk factors have been found to be implicated in the development of these diseases. The major behavioural risk factors identified by World Health Report 2002 are; tobacco use, harmful alcohol consumption, unhealthy diet (low fruit and vegetable consumption) and physical inactivity. While overweight and obesity, raised blood pressure, raised blood glucose, abnormal blood lipids and its subset raised total cholesterol have been identified as major biological risk factors. [5]

These risk factors are mostly interrelated and promote each-others' development. Diabetes is a significant cause of mortality and morbidity, individually as well as in the presence of other non-communicable diseases. For instance, the mortality due to coronary heart disease has been found to be 2-4 times higher in diabetics as compared to non-diabetics. [6] Similarly the chances of stroke are increased by two times in diabetics as compared to non-diabetics. [7] These diseases have reached to epidemic proportion but are amenable to prevention through reduction in their risk factors. [1] The present study is a part of a larger study which was conducted on the non-communicable diseases risk factors. The aim of the present study was to determine the association between self-reported diabetes and certain NCD risk factors.

MATERIALS AND METHODS
Present study is part of a larger cross sectional community based study that was conducted on the non-communicable disease risk factors among the employees of Aligarh Muslim University during study period of 1 year (June 2012 to May 2013).An estimated sample size of 540 was chosen. The subjects were taken from all the four sections of university staff namely; teaching, clerical, technical and grade four staff. The number of employees to be taken from each category was calculated as per probability proportionate to size (PPS) method. Individual subject then selected through simple random sampling from the respective lists of these four groups. The selected candidates were interviewed and examined.

Definitions: The definition of diabetes based on the already diagnosed type 2 diabetes by physician as reported by the subjects themselves. For defining Obesity and overweight, BMI was calculated and classified according to WHO classification. [8] Central or abdominal obesity was defined as the waist circumference $\geq$90 cm in males and $\geq$80 cm in females [9,10] Hypertension was considered as to be Blood Pressure $\geq$140/90 mm Hg or taking anti-hypertensive medications. Hypercholesterolemia defined as total lipids $\geq$ 240 mg/dl (NCEP-ATP III) [11] or under the treatment with hypo-lipidaemic drugs.

Statistical analysis: Data recorded, tabulated and was presented as percentages, proportions (qualitative data) and means±standard deviation (quantitative data). Statistical test of significance such as Chi-square and unpaired t test were used wherever applicable.

Ethical consideration: Study was approved by the Institutional Ethics Committee, JNMCH, AMU, Aligarh. Informed consent was taken from the subjects. Health education was provided to all the participants.

RESULTS
The age sex composition of study subjects is shown in table 1. Majority (79.1%) of study subjects were males and above 40 years of age.

Table 1: Age Sex Distribution of Study Subjects

Age Group	Male	Female	Total
20-29 years	54 (12.7%)	18 (15.9%)	72 (13.3%)
30-39 years	91(21.3%)	36 (31.9%)	127 (23.5%)
40-49 years	129 (30.2%)	30 (26.5%)	159 (29.5%)
50-59 years	153 (35.8%)	29 (25.7%)	182 (33.7%)
Total	427 (79.1%)	113 (20.9%)	540 (100%)

Among the total study subjects, around 43 were found to be previously diagnosed with type 2 diabetes mellitus (diagnosed by the physician) therefore the prevalence of self-reported diabetes was 7.96% (43/540). The association of individual risk factors was analysed for diabetics and non-diabetics.

Comparison between different parameters among diabetics and non-diabetics- Table 2 shows the comparison between different parameters among diabetic and non-diabetic subjects among the study population. The mean age was found to be higher among the known diabetic subjects as compared to non-diabetics (49 ± 6 years vs. 42 ± 10 years). Statistically this difference was found to be highly significant ($p<0.001$). Among the anthropometric parameters, highly significant difference ($p<0.001$) was observed with the mean waist circumference among known diabetics (93.01 ± 8.03 cm) as compared to non-diabetics (88.01 ± 10.46 cm). Though other parameters such as mean weight, height and Body Mass Index (BMI) were also observed to be higher among the diabetics, the difference was not found to be statistically significant ($p>0.05$).

Table 2: Comparison between different parameters among diabetics# and non-diabetics

Parameter (Mean± SD)	Diabetic (n=43)	Non-diabetics (497)	P value[*]
Age (years)	49 ± 6	42 ± 10	<0.001
Weight (kg)	71.02 ± 12.73	67.44 ± 11.65	0.059
Height (cm)	166.76 ± 5.08	164.01 ± 8.49	0.037
BMI(kg/m^2)	25.46 ± 3.89	25.04 ± 3.78	0.4859
Waist Circumference (cm)	93.01 ± 8.03	88.01 ± 10.46	<0.001
Mean Systolic Blood Pressure	133 ± 11	125 ± 13	<0.001
Mean Diastolic Blood Pressure	84 ± 6	82 ± 7	0.069

[#] defined as self-reported, diagnosed previously by the physician.
[*] p<0.001 highly significant; p<0.05 significant; p>0.05 Not significant at 95% confidence interval

The mean systolic blood pressure among diabetics was found to be higher than among the non-diabetics (133 ± 11 mm of Hg vs. 125 ± 13 mm Hg), and this difference was found to highly significant ($p<0.001$). The statistical difference between diastolic blood pressure among the two groups was not found to be significant ($p>0.05$) though it was observed to be slightly higher among the known diabetics (84 ± 6 mm Hg vs. 82 ± 7 mm Hg).

Self-Reported type 2 diabetes mellitus with selected NCD Risk Factors- The association of self-reported diabetes with selected non-communicable disease risk factors is shown in table 3.

1. Smoking: The majority (31/43) of the known diabetics were found to be currently non-smokers. The proportion of current smokers was found to be lower among the known diabetics as compared to non-diabetics but this was not found to be statistically significant ($p>0.05$). When the past smokers were also included in the analysis and the association was looked for between ever smoking and self-reported diabetes, then again proportion of ever smokers was observed to be lower among the known diabetes, the difference also being non-significant ($p>0.05$).

Table 3: Self-Reported type 2 diabetes mellitus with selected NCD Risk Factors among the study population

NCD Risk Factor	Diabetes Mellitus		Statistical Significance	
	Yes (43)	No (497)		
Current Smoking				
Current Smokers	12 (27.9%)	151 (30.3%)	$\chi^2 = 0.115$, d.f.=1, p>0.05,	Not Significant
Currently Non-smokers	31 (72.09%)	346 (69.6%)		
Body Mass Index (BMI)				
Normal (<24.9 kg/m^2)	21 (48.8%)	256(51.5%)	$\chi^2 = 0.293$, d.f.=2, p>0.05,	Not Significant
Overweight (25-29.99kg/m^2)	18 (41.8%)	188(37.8%)		
Obese ($\geq$30 kg/m^2)	04 (9.3%)	53(10.6%)		
Waist Circumference				
$\geq$90 (Males), $\geq$80 (Females)	27 (62.7%)	207 (41.6%)	$\chi^2 = 7.201$, d.f.=1, p<0.05,	Significant
<90 (Males), < 80 (Females)	16 (37.2%)	290 (53.4%)		
Hypertension*				
Yes (127)	20 (46.5%)	107(21.5%)	$\chi^2 = 83.657$, d.f.=1, p<0.001,	Highly Significant
No (413)	23 (53.5%)	390 (78.5%)		
Hypercholesterolemia**				
Yes (39)	18(37.5%)	21(4.2%)	$\chi^2 = 83.657$, d.f.=1, p<0.001,	Highly Significant
No (501)	25(58.1%)	476(95.8%)		

*defined as Blood Pressure$\geq$ 140/90 mm Hg, or taking anti-hypertensive medications.
** defined as total lipids $\geq$ 240 mg/dl, or taking hypo-lipidemic drugs.

2. Body Mass Index: The subjects were classified based on their body mass index (BMI), according to WHO classification for over-weight and obesity. Although the proportion of overweight was observed to be higher among known diabetics as compared to non-diabetics but the association of diabetes with higher BMI was not found to be statistically significant (p>0.05).

3. Abdominal Obesity: Abdominal obesity was assessed by Waist circumference to be more than 90 cm for males and 80 cm in females as per Adult Treatment Panel III classification modified for south Asians for defining abdominal obesity. The proportion of subjects with abdominal obesity was found to be higher among known diabetic subjects as compared to non-diabetics. The association between diabetes and abdominal obesity was found to be statistical significant (p<0.05).

4. Hypertension: The proportion of hypertensive subjects was observed to be higher among the known diabetics as compared to non-diabetics. The association between self-reported diabetes and hypertension was found to be highly significant (p<0.01).

5. Hypercholesterolemia:

Hypercholesterolemia was defined as total serum cholesterol $\geq$ 240 mg/dlor under the treatment of hypo-lipidaemic drugs. Higher proportion of the diabetic subjects were also observed to be suffering from the hypercholesterolemia. Its association with self-reported diabetes was found to be highly significant (p<0.01).

DISCUSSION

This study was conducted among the employees of a university in North India to analyse the risk factors associated with self-reported Diabetes.

In the present study, type 2 diabetes was found to be significantly associated with higher waist circumference. In a study among Mexican American families, waist circumference was found to be independent predictor of type 2 diabetes mellitus. Moreover they have argued it to be strongest anthropometric index associated with type 2 diabetes and insulin resistance among their study population. [12] It has also been reported by another study that there is more than two fold increased risk of diabetes with raised abdominal obesity. [13]

The association of type 2 diabetes with hypertension and raised total cholesterol was found to be highly

significant in our study (p<0.001). Several studies have demonstrated that raised blood pressure occurs more frequently along with diabetes as compared to general population. [14-16] Similarly, significant relationship between diabetes and the different components of a lipid panel has been reported by many studies. [17]

In our study the association between diabetes and smoking was not found to be significant (p>0.05). However, as per US Surgeon General's report, smoking has been argued as a cause of type 2 diabetes mellitus and the risk of developing diabetes has been estimated to be 30-40% higher for active smokers than non-smokers. [18] Also the association of smoking with diabetes is an established finding as reported by several studies from different parts of world. [19-21]

This non-association in our study may be because of the reason that only self-reported diabetics are included in the study and there is possibility that many of the smokers might be unaware of their diabetes status. For instance, as per International Diabetes Federation, 1 in 2 people with diabetes do not know that they have it. [4]

In our study, the association between type 2 diabetes and higher BMI was also not found to be significant. This has also been reported by many studies, for instance, in a study conducted among the patients of type 2 diabetes in the adult population in Iran the association of diabetes with BMI was found to be non-significant among both males and females. [22] Similarly in a study conducted among industrial population in south India, the association between diabetes and BMI was also not found to be significant. [23]

This non-association between BMI and type 2 diabetes in the present study supports the notion that the development of diabetes is observed at lesser degree of obesity in Asian populations. [24] However, the lifetime risk of diabetes has been reported to be substantially increased by the presence of overweight and especially obesity, particularly at younger ages among adults in United States. [25] Also in a study conducted in a secondary care centre in United Kingdom, the prevalence of overweight/obesity has been found to 86%, while 52% were obese, among type 2 diabetes patients by using the Body Mass Index (BMI) to define obesity. [26]

CONCLUSION

Type 2 diabetes mellitus is an important public health concern world-wide. In the present study which was conducted in an urban area, the self-reported type 2 diabetes was found to be significantly associated with abdominal obesity, hypertension and hypercholesterolemia. The non-association between diabetes and higher BMI indicates that waist circumference or abdominal obesity is more important marker for diabetes than BMI.

Limitations: As the study was conducted on a specific population the results cannot be generalized. There remains a possibility of under reporting by the study participants, so the actual burden may be more than that reported among the study population in the present study.

REFERENCES

1. World Health Organization. Non-communicable Diseases Country Profiles 2011. Geneva, Switzerland: WHO; 2011.
2. Alwan A, McLean DR, Riley LM, d'Espaignet TA. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. *Lancet* 2010;376:1861–8.
3. World Health Organization. *Global Health Risks: mortality and burden of disease attributable to selected major risk factors*. Geneva, Switzerland: World Health Organization; 2009.
4. International Diabetes Federation. IDF Diabetes Atlas Poster Update. 6th Ed

Brussels, Belgium: International Diabetes Federation, 2014.

5. World Health Organization. World Health Report 2002: Reducing risks, promoting healthy life. Geneva, Switzerland: WHO; 2002.

6. Morrish NJ, Wang SL, Stevens LK, Fuller JH, Keen H. Mortality and causes of death in the WHO Multinational Study of Vascular Disease in Diabetes. *Diabetologia*, 2001, 44 Suppl 2:S14-S21.

7. Bell DS. Stroke in the diabetic patient. *Diabetes Care,* 1994, 17(3):213-219.

8. World Health Organization. (2003). *Tech Rep. Ser. No 916.*

9. The IDF consensus worldwide definition of the metabolic syndrome. IDF 2006.Available from: http://www.idf.org/webdata/docs/IDF_Meta_def_final. pdf

10. Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, et al. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. *J Assoc Physicians of India* 2009;57:163-70.

11. U.S. Department of Health and Human Services. *National Cholesterol Education Program, ATP III Guidelines At-A-Glance Quick Desk Reference*. U.S. Department of Health and Human Services. Public Health Service, National Institutes of Health, National Heart, Lung, and Blood Institute. 2001 (NIH Publication No. 01-3305) www.nhlbi.nih.gov/files/docs/guidelines/atglance.pdf

12. Mamtani M,Kulkarni H, Dyer TD, Almasy L, Mahaney MC, Duggirala R. Waist Circumference Independently Associates with the Risk of Insulin Resistance and Type 2 Diabetes in Mexican American Families. PLoS One. 2013; 8(3): e59153.

13. Freemantle N, Holmes J, Hockey A, Kumar S. How strong is the association between abdominal obesity and the incidence of type 2 diabetes? *International journal of clinical practice* 62.9 (2008): 1391-1396.

14. Kannel W, McGee D. Diabetes and cardiovascular disease. The Framingham study. JAMA.1979; 241: 2035-2038.

15. Cowie CC, Harris MI. Physical and metabolic characteristics of persons with diabetes. In: Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, editors. Diabetes in America. 2nd. Washington DC: National Institutes of Health National Institute of Diabetes and Digestive and Kidney Diseases; 1995.

16. Hypertension in Diabetes Study Group. HDS I: Prevalence of hypertension in newly presenting type 2 diabetic patients and the association with risk factors for cardio-vascular and diabetic complications. *J Hypertens.* 1993; 11: 309–317.

17. Snipelisky D, Ziajka P. Diabetes and hyperlipidemia: A direct quantitative analysis. *World Journal of Cardiovascular Diseases*, 2012(2): 20-25.

18. U.S. Department of Health and Human Services. The Health Consequences of Smoking- 50 Years of Progress: A Report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. http://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm

19. Chang S A. Smoking and Type 2 Diabetes Mellitus. *Diabetes Metab J* 2012;36:399-403.

20. Rimm EB, Chan J, Stampfer MJ, Colditz GA, Willett WC. Prospective study of cigarette smoking, alcohol use, and the risk of diabetes in men. *BMJ.* 1995;310:555–559.

21. Jee SH, Foong AW, Hur NW, Samet JM. Smoking and risk for diabetes incidence and mortality in Korean men and women. *Diabetes Care*. 2010;33: 2567–2572

22. Lotfi MH, Saadati H, Afzali M. Association between Anthropometric Parameters (WC, BMI, WHR) and Type 2 Diabetes in the Adult Yazd Population, Iran. *J Diabetes Metab* 2014;5:444.

23. Kaur P, Sankarasubbaiyan S, Kondalsamy-Chennakesavan S. A Comparison of Anthropometric Indices for Predicting Hypertension and Type 2 diabetes in a Male Industrial Population of Chennai, South India. *Ethnicity & Disease* 2008;18:31-36

24. Yoon KH, Lee JH, Kim JW, Cho JH, Choi YH, Ko SH et al. Epidemic obesity and type 2 diabetes in Asia. *The Lancet* 2006;368(9548): 1681-1688.

25. Narayan K M V, Boyle J P, Thompson T J, Gregg E W, Williamson D F. Effect of BMI on lifetime risk for diabetes in the US. *Diabetes Care* 2007;30(6): 1562-1566.

26. Daousi C, Casson IF, Gill GV, MacFarlane IA, Wilding JPH, and Pinkney JH. Prevalence of obesity in type 2 diabetes in secondary care: association with cardiovascular risk factors. *Postgraduate medical journal* 82.966 (2006): 280-284.

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