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PREVALENCE OF DIABETES AND ITS CORRELATES IN URBAN POPULATION

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ABSTRACT

Objective: The aim of this study is to see the overall prevalence of diabetes and stratified prevalence in urban area, To Identify the anthropometric, personal and behavioral correlates for diabetes along with OR (odd ratio), and to identify personal habits especially sedentary and physical activity correlates for diabetes along with OR (odd ratio).

Methodology: The cross-sectional study was carried out including total 300 people (121 males, 179 females) from urban area of Ahmadabad. A questionnaire was administered to obtain information about demographic characteristics and risk factors of the Diabetes mellitus and anthropometric and Blood pressure measurements were obtained from participants.

Result: Higher waist circumference, >100 cm for males and >90 cm for females, is the maximum influence on diabetes prevalence with OR of 3.08 ($p<0.001$). Longer sitting time affects diabetes prevalence (OR 1.26) and self-reported hypertension negatively affects diabetic prevalence (OR 0.40). Hypertension based on SBP increase the diabetic prevalence (OR 1.41, $p=0.005$).

Discussion: Over-all prevalence of diabetes in present study is 21.9%. Present study results showed that diabetes increase as age advances. Obesity assessed by BMI is positively associated with diabetes. Waist circumference also positively increases diabetes prevalence. It is also discussed that watching TV more than 2 hrs/day is associated with incidence of diabetes in both men (OR 1.16) and women (OR 1.49) as compared to 1 hr/day TV watching. Physical inactivity is also a major risk factor for diabetes that is supported by several longitudinal studies.

Conclusion: Over-all prevalence of diabetes is 21.9% in this urban community living in Ahmadabad.

Introduction

Diabetes mellitus is one of the most prevalent metabolic, non-communicable disorders in the world. It is estimated, in 2014 there are 422 million adults that having diabetes (nearly doubled since 1980). Prevalence of diabetes has risen faster in low and middle income countries. There are about 1.5 million deaths accounted in 2012 due to diabetes. Increased blood glucose caused an additional 2.2 million deaths due to cardiovascular and other diseases (WHO 2016). The prevalence of diabetes mellitus is predicted to double globally from 171 million in 2000 and 366 million in 2030 with a maximum increase in India (Wild et al. 2014). The etiologies of diabetes mellitus in India include environmental factor, living standard, urbanization, obesity and sedentary life style. The study also shows that the culture, ethinicity, socio-economic conditions also are the major risk factors for diabetes in India. According to ICMR (Indian Council Of Medical Research), the prevalence of diabetes mellitus in Northern India states is greater as compared to South Indian states (Wild et al. 2014, Anjana RM et al. 2011). Indians are more prone to develop complications of diabetes aged between 20 to 48 years as they are genetically predisposed for coronary artery diseases due to dyslipidemia and low level of high density lipoproteins (Mohan et al. 2013). According to a National survey on diabetes and Impaired Glucose Tolerance the age adjusted prevalence was 12.1% for diabetes and 14% for IGT (Ramachandran et al. 2000).

The so called "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity i.e., higher waist circumference despite lower body mass index, lower adiponectin and higher high sensitive C-reactive protein levels. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease. At least a part of this is due to genetic factors. However, the primary driver of the epidemic of diabetes is the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity as evident from the higher prevalence of diabetes in the urban population.Even though the prevalence of microvascular complications of diabetes like retinopathy and nephropathy are comparatively lower in Indians, the prevalence of premature coronary artery disease is much higher in Indians compared to other ethnic groups. The most disturbing trend is the shift in age of onset of diabetes to a younger age in the recent years (Mohan et al., 2007). Prevalence estimates of diabetes and impaired glucose tolerance (IGT) are high for all Asian countries and are expected to increase further in the next two decades (Unwin et al., 2009).

Diabetes is the name given to a group of different conditions in which there is too much glucose (sugar) in the blood. The pancreas either cannot make insulin or the insulin it does make is not enough and cannot work properly. The effects of diabetes mellitus include long– term damage, dysfunction and failure of various organs. Diabetes mellitus may present with characteristic symptoms such as polydypsia, polyphasia, polyuria, blurring of vision, and weight loss. In its most severe forms, ketoacidosis or a non–ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death. Often symptoms are not severe, or may be absent, and consequently hyperglycaemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made. The long–term effects of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy that may lead to renal failure, and/or neuropathy with risk of foot ulcers, amputation, Charcot joints, and features of autonomic dysfunction, including sexual dysfunction. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease.

Several pathogenetic processes are involved in the development of diabetes. These include processes which destroy the beta cells of the pancreas with consequent insulin deficiency, and others that result in resistance to insulin action. The abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin.

METHODOLOGY

Study Design: Cross sectional study using questionnaire

Sampling method: Random sampling
Response rate: 85.7% (350 people were asked for consent)
Sample size: 300 (121 males, 179 females)

Sample characteristics: Mean ± SD (minimum-maximum values) for age, height, and weight were 47.21 ± 13.54 yrs (30-94), 166.04 ± 9.53 cm (149.20-194.30), 67.01 ± 12.02 Kg (40112) respectively.

Outcome variable: Fasting blood glucose in mg.dL^{-}
Determinants:
1. Age
2. Sex
3. Community
4. Education
5. Income
6. BMI
7. Waist circumference
8. Smoking
9. Alcohol consumption
10. Fruit and vegetable usage (FV)
11. Veg or Non-veg (VNV)
12. ADL for house-hold activities
13. Sleep time
14. TV watching
15. Mobile talking
16. Self-reported hypertension
17. Hypertension
18. Hand-grip strength

Methodology:
Interviewer/investigator, 2 physiotherapists, visited door-to-door and invited the house holders to participate in this study. If they agree (85.7%), informed written consent was taken from all individual members from that house who aged 30 or more. Pre-designed questionnaire (in English), modified from pilot study done in 2015, and was administered to the individual participants and therapist assisted if there was a problem to understand. Following parameters were self-reported: age (in years), height (in centimeters), weight (in kilogram), community (classified into general, backward or schedule), education (classified into illiterate, upto 5th class, 6th-10th class, 11th and 12th class, undergraduate, postgraduate, MPhill, PhD), income (in Rs per month), smoking (yes/no), alcohol habits (yes/no), FV use (no and <14 serves vs>14 serves per week), VNV use (Vegetarian vs Non-vegetarian including egg use), ghee use (no and <7 spoons vs >7 spoons per week), ADL activity (hours per week), TV watching (hours per week), sitting (hours per week), mobile talk (minutes per week), self-reported HTN, family history of HTN, family history of diabetes. BMI was measured using following formula:Weight (Kg).Height^{-2} (in meters).

Following parameters were measured by therapists:
- Waist circumference (WC):
- Blood Pressure (BP) measurement:
- Fasting Blood Glucose (FBG) measurement:
- Hand-grip strength (HGS) measurement:

Definition of Parameters:
Abdominal obesity: 100 cm or more for men; 90 cm or more for women Diabetes: FBG 120 mg.dL^{-1} or more Hypertension: SBP 130 mmHg or more; DBP 85 mmHg or more Obesity: BMI 23 Kg.m^{-1} or more.

After explaining the study population characteristics, we used cross tabulation for chi square test. For the convenience of statistics/results following parameter (continuous values) were qualified (categorical values): age, income PM, ADL at home, sitting time, TV watching time, BMI, WC, BP, FBG, mobile talking, duration of sleep per day, hand-grip strength. Irrespective of significance we calculated OR for all parameters with 95% CI. If there was a significant difference chi-square test, we entered them in multiple logistic regression [enter or forward conditional, backward conditional] and used the best model that explain the diabetes prevalence in this population. All the calculation was done using IBMSPSS (20.0 versions).

RESULT

Table 1. Characteristics of selected variables with percentage (n=300)

S.no	Variable Name	Sub-groups (n)	Percentage
1	Sex	Female (179)	59.7
		Male (121)	40.3
2	Education	Illiterate (50)	16.7
		Primary to higher secondary (135)	45.0
		Graduation or more (115)	38.3
3	Community	General (131)	43.7
		Socially backward (169)	56.3
4	Smoking	No (269)	89.7
		Yes (31)	10.3
5	Alcohol	No (262)	87.3
	Consumption	Yes (38)	12.7
6	Fruit-Vegetable	No-up to 14 serving (222)	74.0
	use	More than 14 serving (78)	26.0
7	Food habit	Vegetarian (263)	87.7
		Non-vegetarian including eggs only (37)	12.3
8	Ghee use	No to 7 spoons per week (75)	25.0
		Greater than 7 spoons per week (225)	75.0

Table 1 shows characteristics, which cannot be quartiled, of selected Ahmedabad urban population. Females were significantly higher than males; only 16.7% of total population was illiterate; socially backward class is significantly higher than general population. 10.3 % of population was smokers and 12.7% of population has taken alcohol; these two parameters should be interpreted cautiously as only men normally do these activities and only 40% of total population was males. 26% of population was taking at least 14 servings/week of fruit and vegetables in their diets and 12.3% were non-vegetarians. 75% of studied population was taking 7 or more spoons/week ghee in their diet.

Table 2. Best model of binary logistic regression when all 6 risk factors* entered

Sno	Variable	Chi square	Significance	OR with 95% CI
Backward Stepwise (Conditional) with Constant 78% correctness				
1	Age		0.052	1.33 (1.00-1.78)
2	WC	25.84	0.004	2.48 (1.35-4.58)
3	Self-reported HTN		0.035	0.35 (0.27-0.95)
Forward Stepwise (Conditional) with Constant- 80.9% correctness				
1	WC		0.002	2.66 (1.45-4.88)
2	Self-reported HTN	25.82	0.018	0.47 (0.26-0.88)
3	HTN based on SBP		0.050	1.82 (1.00-3.33)

*Age, education, WC, sitting time, self-reported HTN and HTN based on SBP

Table 2 shows the best model in binary logistic regression,

when all 6 significant variables were entered, that explains the prevalence of diabetes. We used all the three models (i.e) enter, forward stepwise (conditional) and backward stepwise (conditional)-all three were with constant and found forward stepwise (conditional) with constant that explains 80.9% of diabetes prevalence followed by backward stepwise (conditional) with constant. Four parameters collectively explain in these two models. They are age (OR 1.33), waist circumference (OR 2.66), hypertension based on SBP (OR 1.82) and self-reported hypertension (OR 0.47).

DISCUSSION

Over-all prevalence of diabetes in present study is 21.9%. Present study results showed that diabetes increase as age advances. This is supported by Anjana et al., 2011; Pouranik et al., 2011; Kumar et al., 2008; Ramachandran et al., 2008; Mohan et al., 2003; Haffner et al., 1991. Females are more prone to diabetes than their male counterparts (Hillier et al., 2001; Haffner et al., 1991). However, Indian studies show males are more prone to diabetes than females (Anjana et al., 2011; Ramachandran et al., 2008; Mohan et al., 2003). Diabetes prevalence decrease as the education level progress is supported by Haffner et al., 1991.

Obesity assessed by BMI is positively associated with diabetes [Hartwig et al., 2015 (OR 1.70); Adegbija et al., 2015 (HR 1.8); Bao et al., 2015 (HR 1.16); Gaikwad et al., 2014; Anjana et al., 2011; Berentzen et al., 2011 (HR 1.18); Mohan et al., 2003; Haffner et al., 1991]. Waist circumference also positively increase diabetes prevalence which is supported by Snidjer et al., 2016; Hartwig et al., 2015; Adegbija et al., 2015 and Berentzen et al., 2011 in their longitudinal studies. In India, several cross-sectional studies supported central obesity as a risk factor in diabetes (Anjana et al., 2011; Vijayakumar et al., 2009; Kumar et al., 2008; Ramachandran et al., 2008 and 2004; Mohan et al., 2003).

Dunstan et al., (2004) reported watching TV more than 2 hrs/day is associated with incidence of diabetes in both men (OR 1.16) and women (OR 1.49) as compared to 1 hr/day TV watching. Hu et al., (2003) also reported similar findings (RR 1.10 and 1.30 for 2-5 hrs/week and 6-20 hrs/week as compared to 0-1 hr/week) in their longitudinal study. Long sleep (greater than 7 hours) is associated with higher incidence of diabetes in longitudinal studies [Chaput et al., (2008) (OR 1.58 for 9-10 hrs sleep); Yaggi et al., (2006) (RR 3.12 for >8 hrs sleep); Gottlieb et al., (2005) (OR 1.85 for >9 hrs sleep); Ayas et al., (2003) (RR 1.47 for 9 hrs sleep)].

Hypertension is risk factor for diabetes which is supported by many Indian studies (Gaikwad et al., 2014; Anjana et al., 2011; Vijayakumar et al., 2009; Kumar et al., 2008; Mohan et al., 2003.

Physical inactivity is a major risk factor for diabetes that is supported by several longitudinal studies (Kabeya et al., 2015; Waller et al., 2010; Ansari, 2009; Dunstan et al., 2004; Ramachandran et al., 2004; Helmrich et al., 1991).

CONCLUSION

Based on the results, present study can be concluded with following points

- Over-all prevalence of diabetes is 21.9% in this urban community living in Ahmedabad.
- Age, female sex, obesity (both general and abdominal), low education, lower income, smoking, alcohol habit, being non-vegetarian, low physical activity, longer sitting time with or without TV watching, longer sleeping, hypertension, low hand-grip strength are associated with higher odds for diabetes.
- Out of these 14 variables, age, education, abdominal obesity, sitting time and hypertension based on SBP, self-reported hypertension are significantly influence the diabetes prevalence.
- Out of these 6 variables, 4 variables (i.e) age, abdominal obesity, hypertension based on SBP and self-reported hypertension- explains more than 70% of prevalence of diabetes.

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