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A COMMUNITY BASED CROSS-SECTIONAL STUDY: INCREASING PREVALENCE OF TYPE 2 DIABETES AMONG RURAL ADULT POPULATION OF KARNATAKA, INDIA

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ABSTRACT: A community based cross-sectional study in the age group 25 years and above conducted at the field area of primary health centre Chakenahalli, Hassan district, Karnataka, India. The population was similar in characteristics regarding occupation, socio-economic status and food habits. Total of 626 subjects were included by multi-stage sampling. Information collected by the interviewers through face to face interview, after informed consent. The individuals were assessed on anthropometric parameters and screening was done by Random Blood Glucose (RBG) with a standardized technique; diagnosis of type 2 diabetes done by WHO criteria. Prevalence of diabetes was found in 11.3% males and 15% females, altogether the total prevalence was 13.09% with 8.79% self reported cases of diabetes . Hypertension was associated with 25.6% diabetic subjects. It was also observed that 28.1% of study population had BMI ≥ 25.

Keywords: Diabetes, Rural, Prevalence.

INTRODUCTION

Diabetes the silent epidemic is growing rapidly worldwide (Anjana *et al.* 2011) and confers a substantial burden on health care system and associated economic impact (Ramachandran 2009). According to International Diabetes Federation (IDF) number of people living with diabetes is expected to rise from 366 million in 2011 to 552 million by 2030, approximately three new cases every 10 seconds or almost 10 million per year. IDF also estimated that as many as 183 million people are unaware that they have diabetes (http://www.worlddiabetesfoundation.org.). India being home to an estimated 61.3 million diabetic patients will face one of the toughest struggles against diabetes due to its large childhood population accounting for 112,000 with type 1 diabetes. India is also the largest contributor to regional mortality with 983.000 deaths attributable to diabetes (http://www.idf.org/media-events/press-releases/diabetes-atlas-5th-edn./2011). Diabetes has been traditionally considered as diseases of affluence. A wealth of data indicated that Asian Indian people having abdominal obesity and insulin resistance can develop glucose

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intolerance more often (Mishra *et al.* 2001). Although the exact reasons why Asian Indians are more prone to diabetes at a younger age and premature cardiovascular disease (CVD) remain speculative, there is a growing body of evidence to support the concept of the 'Asian Indian Phenotype'. Approximately 742 million people in India live in rural areas where awareness of chronic diseases is extremely low and the ratio of unknown-to-known diabetes is 3:1 (compared to 1:1 in urban areas). Given that the overwhelming majority of India's population lives in rural areas and that there is a higher ratio of undiagnosed cases, the burden of diabetes may be much greater in rural areas (Anjana *et al.* 2011). In earlier years, there was a very low prevalence of diabetes in rural populations and rural-urban disparities in diabetes could be due to a low prevalence of overweight and obesity in rural subjects compared to urban subjects (Gupta and Mishra 2007). However, recent studies from rural areas of Maharashtra, Andhra Pradesh and Karnataka report very high prevalence rates similar to those in urban Indian populations (Chow *et al.* 2006, Deo *et al.* 2006, Rao *et al.* 2010).

Scarcity of good quality epidemiological data is a serious limitation in developing countries like India. There are very few studies conducted in recent years to estimate the exact scenario of diabetes in the rural population. The absence of an efficient non-communicable disease (NCD) surveillance system urges to have more epidemiological data regarding diabetes from all regions of India, especially of the rural population to plan and implement health promotion strategies. In view of the present need the study was undertaken with the objective of determining the prevalence of diabetes in a rural population of Karnataka.

MATERIALS AND METHODS

A community based cross-sectional study was conducted at the field practicing area of primary health centre Chakenahalli, Holenarsipurataluk, Hassan district, Karnataka, India. The population of the villages were having similar characteristics regarding occupation, socio-economic status and food habits. The study population comprising rural population which included male and female subjects in the age group 25 years and above. Pregnant and lactating females upto 12 weeks of post-partum were excluded from the study.

Considering prevalence of 15% of diabetes in rural adults with an absolute precision of 3% and 95% confidence level (Anjana *et al.* 2011), the estimated sample size was 544. With a non-response rate of 20%, the required a sample size was 653 for the study. Anticipated prevalence was considered keeping in mind a recent study conducted on rural population of Andhra Pradesh (Chow *et al.* 2006). Samples were selected through multistage sampling procedure. At the first stage, villages were selected from the field practice area according to convenience. In the second stage, a list of households was made and randomization was done. Initially before the commencement of the study, visits were made to the chief of the communities and other prominent people of the communities to establish contact. The selected households were visited to establish a good rapport with the head of the house and the purpose of the visit was explained to them. Requests were made to them to motivate other members of the household to actively participate in the study. Institutional ethical committee clearance was obtained before the initiation of the study. Training was conducted

Table 1 : Baseline characteristics of diabetic and non-diabetic subjects.

Characteristics	Diabetic subjects	Non-diabetic subjects
Male (n=327)	37 (11.3%)	290 (88.7%)
Female (n=299)	45 (15%)	254 (85%)
Family history of diabetes	26 (31.7%)	69 (12.7%)
Hypertension	21 (25.6%)	91 (16.7%)
Tobacco consumption		
Smoker	30 (36.6%)	213 (39.1%)
Non-smoker	38 (47.6%)	258 (47.4%)
Smokeless tobacco	14 (17%)	73 (13.4%)
Alcohol consumption		
Alcoholic	33 (40.2%)	157 (28.9%)
Non-alcoholic	49 (59.8%)	387 (71.1%)
Occupation		
Govt. employee	6 (7.3%)	30 (5.5%)
Non- govt. employee	5 (6.1%)	26 (4.8%)
Self employed	35 (42.7%)	212 (38.9%)
Home maker	29 (35.4%)	231(42.5%)
Retired	7 (8.5%)	45 (8.3%)
BMI (kg/m^2)		
<18.5	—	39 (7.2%)
18.5-22.9	3 (3.6%)	223 (40.9%)
23-24.9	42 (51.2%)	143 (26.3%)
=25	37 (45.1%)	139 (25.5%)

by the investigators for physicians, data collectors and volunteers on various field techniques (*e.g.* data collection through questionnaire, blood pressure measurement and anthropometric measures).

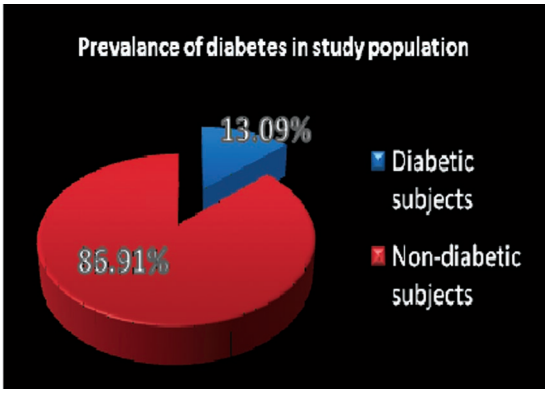
A pretested questionnaire was prepared which registered name, age, sex, actual residence, marital status, occupation, history of tobacco use and alcohol intake, presence of disease, family history of diabetes etc. Information was collected by the interviewers through the administered questionnaires. The individuals were subjected to anthropometric data assessment (height, weight). Weight was measured to the nearest 0.1 kg with a standard weighing scale. Height was measured to the

Table 2. Prevalence of Diabetes Mellitus according to age and sex.

Age group (years)	No. of diabetic subjects / Sample Population (%)		Total no. of diabetic subjects / Total sample population (%)
	Male	Female	
30 - 39	2 / 89 (2.24)	7 / 91 (7.69)	9 / 180 (5.00)
40 - 49	12 / 97 (12.3)	9 / 68 (13.23)	21 / 165 (12.72)
50 - 59	14 / 82 (17.07)	20 / 92 (21.73)	34 / 174 (19.54)
=60	9 / 59 (15.25)	9 / 48 (18.75)	18 / 107 (16.82)

nearest 0.1 cm with a standard measuring tape. Subjects were requested to stand upright without wearing shoes with their back against the walls, heels together and looking forward. The body mass index (BMI) was calculated as weight (kg)/height (m^2). Blood pressure was measured on the right arm in a sitting posture and relaxed state of mind with a standard mercury sphygmomanometer having a adult size cuff. Two readings were taken 5 minutes apart to the nearest 2 mm Hg and the mean of the two was taken as the blood pressure and correlated accordingly as hypertensive or normal. Screening for diabetes was done by estimating Random Blood Glucose (RBG) during the interview with a standardized blood glucometer (Accu Chek) using capillary finger prick method. Subjects with RBG measurement = 140 mg/dl, in a pre-informed date was estimated for fasting blood glucose (FBG) after having an overnight fast of at least 8 hours. RBG was done irrespective of their diabetic status. Subjects with previous history of diabetes or who were under hypoglycemic agents were already considered to be diabetic and were not further tested for FBG. In addition same applied for the subjects who were previously hypertensive or under anti-hypertensive agents were considered to be hypertensive.

Definitions and diagnostic criteria: Diabetes was diagnosed based on drug treatment for diabetes (insulin or oral hypoglycaemic agents) and/or criteria laid by the WHO in 2006 *i.e.* fasting plasma glucose (FPG) =126mg/dl or 2 hr post glucose value (venous plasma glucose 2 hr after ingestion of 75g oral glucose load) = 200mg/dl(http://www.idf.org/webdata/docs/WHO_IDF_definition_diagnosis_of_diabetes.pdf/ 2009). Hypertension was diagnosed based on drug treatment for hypertension and/or criteria if systolic and diastolic blood pressure is persistently above 140mm and 90mm of Hg respectively(Mishra *et al.* 2001). Obesity was defined using the revised criteria for Asian Indians: underweight: BMI < 18 .5 Kg/m^2, normal range: BMI 18.5 -22.9 Kg/m^2, overweight: at risk: BMI 23 - 24.9 Kg/m^2, obese I: BMI 25 - 29.9 Kg/m^2, obese II : BMI > 30 Kg/m^2 for both males and females(Ahmad *et*



al. 2011). Family history of diabetes was considered as positive if either the parent or a sibling had diabetes.

RESULTS AND DISCUSSION

The final study analysis included 626 subjects, among them 327(52.2%) were males and 299(47.8%) were females. Of the study subjects 71.7% were Hindus, 26.7% were Muslims and 1.6% represented other religions. The baseline characteristics of the study subjects are shown in Table 1. Positive family history of diabetes was present among 31.7% individuals and among the non-diabetic subjects 12.7% had history of diabetes in the family which puts them in the risk group of developing diabetes. Over one fourth (28.1%) of the study population had BMI = 25. It was also observed that 40.2% diabetic consumed alcohol and 53.6% diabetics indulged in some form of tobacco abuse.

The overall prevalence of diabetes was found to be 13.1%. Among females 15% were having diabetes compared to 11.3 % males. There was 8.79% (55) self reported cases of diabetes, while 4.31% (27) of previously normal subjects were found to have high fasting capillary blood glucose levels (new cases) according to the screening criteria of the study. Distribution of data concerning the prevalence of diabetes according to age and sex is presented in Table 2.

Epidemiological data shows a rising in prevalence of Diabetes epidemic worldwide especially in developing nations with India being the diabetic capital (http:// www.worlddiabetesfoundation.org / composite-35.htm./2011).This study was planned to determine the rising prevalence of diabetes with its rising problems in rural community of Karnataka. In a limited setting and resources looking to the socio-demographical aspect of the rural population fasting plasma glucose (FPG) was considered to be reliable in diagnosing diabetes. The overall prevalence of type 2 diabetes in this study was found to be 13.09%, out of which 8.79% of the subjects were known diabetics. Prevalence of diabetes was seen more in females (15%) compared to males (11.3%). Obesity was recognizing factor where 96.3% diabetics were overweight. In our findings 31.7% of diabetics had family history of diabetes compared to only 12.7% among non-diabetics. Hypertension was present among 25.6% diabetics while 16.7% of the non-diabetic population had hypertension. Alcohol consumption 30.4% and use of tobacco 38.8% was very high among the study population. Predominance of diabetes 35.4% was seen in females who were homemakers.

Previous studies on rural population from the year 2000 onwards showed diabetes prevalence ranging from 1.8% to 6.05% (Gupta and Mishra 2007, Ahmad *et al.* 2011, Kutty*et al.* 2000). However, two studies from rural areas of Andhra Pradesh and Maharashtra reported diabetes prevalence of 13.2% and 9.3% respectively (Chow *et al.* 2006, Duo *et al.* 2006).

A prevalence study from Karnataka in 2005 showed a prevalence of 3.77% among rural inhabitants (Basavanogowdappa *et al.* 2005) but surprisingly a very recent community-based survey conducted among adults aged =30 years, reported 16% prevalence of diabetes among coastal population of Karnataka (Rao *et al.* 2010) showing there is remarkable increase in the diabetes prevalence among rural population in the past few years.

Similar trend about the diabetic prevalence of 13.09% found in this study was relevant with the increased trend of diabetes prevalence in the region. Past studies showed age wise increase and predominance of diabetes among men (Rao *et al.* 2010, Basavanogowdappa *et al.* 2005, Wild *et al.* 2004, Mohan *et al.* 2007), where age wise increase of diabetes is similar to our findings with most number of cases belonging to age group of 50-59 but contrast in the finding for female predominance found in our study. The increase in female predominance of diabetes in our study can be contributed to the sedentary lifestyle, as the females were mainly homemakers. Many studies from southern part of India showed diabetes prevalence in accordance to our study (Gupta and Mishra 2007, Sandeep *et al.* 2011), which may be attributed to the dietary habits of the region which include diet rich in carbohydrates. Data from this study showed 28.1% participants are having BMI more than 25 kg/m^2 and 17.9% having hypertension with history of smoking in men specially can attribute to important associations of coronary artery disease (CAD). Metabolic syndrome (as a whole) is strongly associated with presence of CAD (Achari *et al.* 2006). Increased BMI in Asian Indian population, particularly in females the metabolic complications of excess fat are likely to be present in these women with high body fat, even when their BMI is in a normal range. Such women, when postmenopausal and without the benefit of hormonal protection, are more likely to develop occlusive consequences of atherosclerosis (Mishra *et al.* 2001).

This community based study consisted of a small sample size and areas of ambiguity may be present during collection of data and blood samples. Quantifying life style determinants was not made and house to house survey with a very limited resource can be attributed to our shortcomings.

CONCLUSIONS

Diabetes in India has a long history with the increasing trend, it is now a major public health challenge. Despite recent advances in knowledge, the prevention and control of non-communicable diseases like diabetes remain a major challenge in India (Ajana *et al.* 2011). Several important questions regarding the regional distribution, determinants and interventions for diabetes remain unanswered.The present study reporting prevalence of 13.09% can be informative epidemiological evidence to quantify impacts and predictors of disease and facilitate formulation of prevention and control strategies in rural India.

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