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Screening for Diabetes and their risk factors among adults in Rural Kolar – A community based study

COMMUNITY MEDICINE

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ABSTRACT

Background:
India is declared as the diabetic capital of the world with 32.7 million cases and the number is expected to rise. Most times diabetes goes unnoticed and presents for the first time with complications. Carefully planned screening programmes are an important component to help solve this problem. Hence a study was planned to assess prevalence of diabetes and its associated risk factors among adults in rural Kolar. **Material & Methods:** It was a cross sectional study done at Gaddekannur village in Kolar. Totally 589 residents aged ≥18 years were studied. A pretested, validated, semi structured questionnaire was administered after pilot study. Data on socio demographic details, various risk factors for diabetes and history of diabetes in the past was collected by house to house survey. Height, weight, body mass index was checked using standardised methods. Fasting capillary glucose levels were measured using glucometers. **Results and Analysis:** Thirty three (5.6%) reported to be suffering from diabetes. Twenty nine (4.9%) were newly diagnosed to have diabetes giving an overall prevalence of 10.5%. Impaired fasting glucose (IFG) was observed in 14.1%. Prevalence of risk factors for diabetes like inadequate daily intake of fruits and vegetables (79.1%), Physical inactivity (7.1%), smoking tobacco (30.7%), use of smokeless tobacco (53.3%), regular alcohol consumption (6.1%) and family history of diabetes (16.8%) was high. Twenty six percent of the study group were overweight and 10.1% obese. Diabetes prevalence was significantly higher among people who smoked tobacco, who consumed alcohol regularly, people with family history of diabetes and those who were overweight or obese than compared to those who did not ($p<0.05$). **Conclusion:** Prevalence of diabetes, IFG and their risk factors are high among rural population of Kolar indicating the impending diabetic epidemic in rural areas. The undiagnosed diabetes which is hidden danger is high among rural areas.

***Key words:* Community; Diabetes; Impaired fasting glucose; Prevalence; Screening**

Introduction

The prevalence of diabetes is rapidly rising globally. World Health Organization (WHO) reports show that 32 million people had diabetes in the year 2000 [1]. The International Diabetes Federation estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025 [2]. India leads the world with largest number of diabetic subjects earning the title "Diabetes capital of the world". Diabetes, which was known to be an epidemic in urban areas have found to be increasing rapidly in rural areas too as a result of the socioeconomic transitions [3]. Diabetes is no longer only disease of the elderly but is one of the major causes of morbidity and mortality affecting youth and middle aged people.

People with common risk factors like hypertension, poor metabolic control, smoking, obesity, greater duration of diabetes and dyslipidemia are more prone to develop diabetic complications. It is observed that Asian Indians are at a higher risk of developing complications due to diabetes compared to western countries [4]. It is of greater concern if epidemic shifts to children it could have serious consequences on the health of the nation [5]. Earlier age of onset combined with increasing prevalence of diabetes could have adverse effects on nation's health and economy.

Diabetes also known as a "silent disease," exhibiting no symptoms until it progresses to severe target organ damage [6]. Because of increasing burden of the disease, its iceberg nature, its complications and potential to prevent these complications with earlier diagnosis and treatment; active and opportunistic efforts are required for early diagnosis of diabetes by means of screening [7]. Early identification of at-risk individuals and appropriate lifestyle intervention would help in preventing or postponing the onset of diabetes mellitus. Hence this study was planned to assess prevalence and risk factors associated with diabetes among adults in rural Kolar.

Materials and Methods

A cross-sectional community based study was conducted among adults of Gaddekannur village in Kolar district. There were totally 955 people aged 18 years and above of which 492 were males and 463 females. Clearance from institutional ethical committee was taken. Study was carried out during April 2012 to July 2012.

To estimate a sample size of 15.5% [7] of diabetes prevalence at 95% confidence levels with 3% precision, 559 subjects had to be studied. Considering a non response rate of 5%, a final sample size of 587 was arrived which was rounded off to 600. Initially a house to house survey was done to identify all the adults in the village and a sample size of 600 was drawn by simple random sampling among them.

Ten enthusiastic medical students who were interested in conducting the survey were trained in administering questionnaire, taking anthropometric measurements and also in checking blood pressure and blood sugar levels. Initially, pilot study was carried out among 20 adults and preliminary analysis was done to reformate the questionnaire and to prepare the final proforma. Questionnaire was also validated for content with experts in the subject. It was translated into local languages (kannada and telugu) and back translated to English to ensure validity.

The study was conducted in three parts.

Part 1: A preliminary house to house survey of the entire village was done to identify adults aged 18 years and above. There were totally 955 adults of which 600 were randomly selected.

Part 2: House to house survey of selected 600 subjects was carried out in the village using predefined and pre-tested proforma. Informed consent was taken from all the participants. Data on socio demographic details, various risk factors for diabetes like dietary practices, smoking and alcohol consumption, physical activity levels, family history of diabetes and history of diabetes in the past was collected. Height and weight was checked using standardised methods and body mass index (BMI) was calculated. Blood pressure was checked twice at an interval of 10 minutes using Omron electronic BP apparatus (OMRON-HEM7111, OMRON Healthcare Co. Ltd. Uky-Ku, Kyoto, Japan).

Part 3: At the end of part 2, participants were asked to remain empty stomach overnight (at least 8 hours) [8] and get their blood sugars checked on the following day. Next day morning between 6am-8am, blood sample collection was carried out for the purpose of estimation of fasting capillary glucose (FCG) using Roche ACCU-CHEK® active glucometer, Roche Diagnostics. Interviewed persons, who had forgotten to remain fasting, were again explained about importance of fasting and sample collection of such a person was done on another day. Total five revisits were paid to

increase overall response rate. A copy of report of FCG was given to all participants regardless of the results.

Data analysis:

People consuming more than five servings of fruits and vegetables per day everyday were considered to have adequate fruits and vegetable intake. Study group consuming minimum of one drink for atleast two days per week is considered as regular alcohol intake. People consuming tobacco products for 3-5 days per week were considered as regular tobacco consumers. Physical activity was measured using International Physical Activity Questionnaire (IPAQ). The IPAQ is an instrument designed primarily for population surveillance of physical activity among adults. Activities are classified as vigorous and moderate physical activities. The total duration of physical activity, per week, is calculated to the nearest minute, metabolic equivalents (MET) are calculated. Adults with less than 5 days of any combination of walking, moderate-intensity or vigorous intensity activities achieving less than 600 MET-min/week were classified as "physically inactive".

Asia pacific guidelines [9] was considered to classify BMI as underweight (<18.5), Normal (18.5 to 23.0), overweight (23.1-27.5) and obese (>27.5). WHO criteria was considered to classify FCG levels as normal (<110mg/dl), impaired fasting glucose (110-126mg/dl) and diabetes (>126mg/dl).

Data was analysed using epi info 07 software. Proportion of people suffering with diabetes mellitus, impaired glucose tolerance and their risk factors was calculated and the difference in proportion was estimated using chi square test.

Results

Based on sample size calculation 600 subjects were contacted for the study of which complete data was available only for 589 subjects. Non response rate was 1.8%, this was mostly in the collection of fasting blood glucose levels. As shown in table 1, 47.9% of subjects were males and 52.1% females. Most of the subjects were between 18-40 years. Mean age of the study population was 39.7±16.8. Most (83.4%) of them belonged to below poverty line. Main Occupation of the study group was agriculture (41.6%).

Table 1: Age and gender distribution of study population

Age groups in years	Male N (%)	Female N (%)	Total N (%)
18-30	99 (35.1)	134 (43.6)	233 (39.6)
31-40	52 (18.4)	68 (22.1)	120 (20.4)
41-50	52 (18.4)	46 (15.0)	98 (16.6)
51-60	35 (12.4)	33 (10.7)	68 (11.5)
61-70	27 (9.6)	17 (5.5)	44 (7.5)
>70	17 (6.0)	9 (2.9)	26 (4.4)
Total	282 (47.9)	307 (52.1)	589 (100)

Table 2: Results of diabetes screening in the study population

Diabetes status	Frequency	Percent
Normal (<110mg/dl)	444	75.4
IFG (110-126mg/dl)	83	14.1
Diabetes (>126mg/dl)	29	4.9
Known diabetes	33	5.6
Total	589	100.0

Table 2 shows the screening results of diabetes in the study population. Thirty three (5.6%) of the study subjects reported that they were diagnosed to have diabetes at the time of survey. Survey revealed 29(4.9%) newly detected

Table 3: Age and gender wise distribution of Diabetes and Impaired fasting glucose

Age Group in years	Diabetes (n=62)			IFG (n=83)		
	Male N (%)	Female N (%)	Total N (%)	Male N (%)	Female N (%)	Total N (%)
18-40	4 (2.6)	14 (6.9)	18 (5.1)	21 (13.9)	20 (9.9)	41 (11.6)
41-60	17 (19.5)	11 (13.9)	28 (16.9)	19 (21.8)	10 (12.7)	29 (17.5)
>60	10 (22.7)	6 (23.1)	16 (22.9)	8 (18.2)	5 (19.2)	13 (18.6)
Total	31 (11.0)	31 (10.1)	62 (10.5)	48 (17.0)	35 (14.1)	83 (14.1)

Table 4: Risk factors associated with Diabetes and Impaired fasting glucose.

Risk Factor	Frequency (n=589) N (%)	Diabetes (n=62) N (%)	IFG (n=83) N (%)
Illiteracy	211 (35.8)	29 (46.8)	34 (41.0)
Below poverty line	491 (83.4)	49 (79.0)	60 (72.3)
Inadequate fruit and vegetable intake	466 (79.1)	51 (82.3)	64 (77.1)
Physical inactivity	90 (15.2)	16 (25.8)	11 (13.3)
Regular smokeless tobacco use	314 (53.3)	30 (48.4)*	75 (51.7)*
Regular tobacco smoking	181 (30.7)	26 (41.9)*	54 (37.2)
Regular Alcohol intake	36 (6.1)	8 (12.9)*	8 (9.6)
Family history of diabetes	99 (16.8)	16(25.8)*	15 (18.1)
Overweight/Obesity	161 (36.1)	28 (45.2)*	24 (28.9)
Hypertension	121 (20.9)	47(77.0)	57 (68.7)

* $P<0.05$, $\chi 2$ test applied.

diabetes cases giving an overall prevalence of 10.5%. Impaired fasting glucose was observed in 14.1% of the study group.

Table 3 shows the age and gender wise distribution of diabetes and impaired fasting glucose among study population. Prevalence of diabetes (11.0%) and IFG (17.0%) among males was higher compared to prevalence of diabetes (10.1%) and IFG (14.1%) among females. As the age group increased the prevalence of diabetes and impaired fasting glucose levels also increased both among males, females and in overall study population.

Table 4 shows the association of various risk factors with presence of diabetes and IFG. Prevalence of risk factors for diabetes like inadequate intake of fruits and vegetables(79.1%), Physical inactivity(7.1%), smoking tobacco regularly (30.7%), use of smokeless tobacco regularly (53.3%), regular alcohol consumption(6.1%) and family history of diabetes (16.8%) was high in study population. Twenty six percent of the study group were overweight and 10.1% obese. Diabetes prevalence was significantly higher among people who smoked tobacco, who consumed alcohol regularly, people with family history of diabetes and those who were overweight or obese than compared to those who did not($p<0.05$). IFG was significantly higher among subjects who consumed tobacco regularly than compared to those who did not.

Discussion

The overall prevalence of diabetes in the rural study is found to be 10.5% which is very high compared to the first national prevalence study done by Indian Council of medical Research (ICMR) with a diabetes prevalence of 2.8 per cent in rural areas [10]. A national rural diabetes survey done by Shridhar et al reported a prevalence of 2.8 per cent [11]. The Eluru survey which looked at the prevalence of known diabetes in four villages of Andhra Pradesh showed a prevalence of 1.5 per cent [12]. A study done in Chennai reported a prevalence of 2.4 per cent in the rural areas [13]. Deo et al in rural Maharashtra reported a diabetes prevalence of 9.3% [14]. The prevalence of diabetes in India study (PODIS) showed the prevalence of diabetes to be 2.7 per cent among the rural population [15]. The overall crude prevalence of diabetes in Chennai Urban Rural Epidemiological Study (CURES) was 15.5 per cent, while that of IFG was 10.6 per cent [16]. There is an increasing trend of diabetes prevalence from 2.8% in ICMR study to 15.5% in CURES study. This study adds to the evidence of rising diabetes prevalence in rural areas because of demographic transition.

It is surprising to know that 29(4.9%) of subjects were diagnosed to have diabetes for the first time during our survey. In CURES, the prevalence of undiagnosed diabetes was 9.1 % [16] and that in the Amrita Diabetes and Endocrine Population Survey (ADEPS) was 10.5 % [17]. In the Kashmir valley study the prevalence of undiagnosed diabetes was 4.25 % [18]. The undiagnosed diabetes is very dangerous as individuals who are unaware of their disease status are left untreated and end up with dreadful complications of diabetes. Hence, it is important to identify people with undiagnosed diabetes and start early treatment.

Prevalence of IFG was substantially high among the study population (14.1%). In a study done by Nayak et al in Ahmadabad showed the prevalence of IFG to be 6% [19]. The national urban diabetes study results indicate that the prevalence of IFG was higher than that of diabetes in four out of six cities studied, which is corresponding to the results of this study [20]. The prevalence of IFG was significantly high in rural populations of ADEPS [17] and PODIS [15] study. IFG is a pre-diabetic state and have a high risk of conversion to diabetes. Several studies have indicated that pre-diabetic states are also at high risk for cardiovascular disease [21]. It is important to screen for IFG so that primary prevention measures can be implemented at the earliest there by preventing or postponing the conversion to diabetes stage.

The present study shows increase in prevalence of diabetes with increase in age irrespective of the gender. Similar results were observed by other studies in India [22-25].The risk factors for diabetes like physical inactivity, regular tobacco use, regular alcohol use, overweight and coexistence of hypertension was higher among people suffering with diabetes. In a study done by Mohan et al diabetes was significantly observed among patients with sedentary physical activity [16]. Similar results observed in a study done in rural Tamilnadu by Gupta et al [26]. Previous studies in various parts of rural India did not find any association between tobacco consumption and diabetes, [25,27,28] but a study in urban Kolkata has shown significant association between tobacco smoking and diabetes similar to this study [29]. Overweight and obesity is significant independent predictor for diabetes in various studies done in India [28,30,31]. Most of the risk factors which are associated with diabetes are modifiable. Hence community based primary prevention interventions like leisure time physical activity, balanced diet education on cessation of tobacco use may reduce the prevalence of diabetes and IFG.

Conclusions

This study reports increase in diabetes prevalence in rural areas indicating the epidemiological transition which is happening in rural India. The prevalence of undiagnosed diabetes which is hidden danger is high among rural areas. Prevalence of IFG is more than the prevalence of diabetes indicating the impending diabetic epidemic in rural areas. Prevalence of modifiable risk factors is high among study population and among people diagnosed to have diabetes. Hence there is a greater scope for prevention of diabetes among rural population.

Recommendations

Initiation of monthly diabetes clinic to manage patients diagnosed with diabetes is essential. There is a need to understand self care practices and barriers in following them among patients diagnosed to have diabetes. Community based primary prevention strategies have to be implemented at village level to reduce the risk factors for diabetes. Due to rise of pre diabetes and diabetes among the rural population it is necessary to implement regular systematic screening among them for timely diagnosis and treatment.

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