Original Article

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Effect of Modifiable Risk Factors on the Prevalence of Type 2 Diabetes in the Tribal Adult Population of Boko Bongaon Block of Kamrup District of Assam

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Abstract

Introduction: The prevalence of chronic non-communicable diseases such as diabetes is showing an upward trend in most countries, and for several reasons this trend is likely to increase. The estimated number of adults with diabetes in 2007 was 246 million of these, 80% live in developing countries, the largest numbers on the Indian subcontinent and in China Approximately 85-95% of all cases of diabetes are Type 2 diabetes, and the worldwide explosion of this disorder is a major health care burden.

Objective: To assess the effect of various modifiable risk factors on the prevalence of Type 2 diabetes among the tribal adult population of Boko.

Materials and Methods: A community-based cross-sectional study was conducted among 330 tribal adult respondents of Boko. Data were collected by house to house visits, and anthropometric measurements were done along with an estimation of fasting blood sugar using a glucometer.

Results: Increased physical activity was found to significantly decrease the risk of diabetes. Both increased body mass index and waist-hip ratio were found to significantly increase the risk of diabetes.

Conclusion: Physical activity and anthropometric parameters were found to significantly effect the prevalence of diabetes among the tribal adult population of Boko.

Key words: Body mass index, Fasting blood sugar, Waist-hip ratio

INTRODUCTION

Diabetes mellitus is a prototypical chronic health problem. The disease sequel and economic burden of diabetes are extensive owing to its degenerative nature despite the best available treatments. Effective delivery of preventive strategies to delay progression of the disease and its complications are challenging at best, with the persistent need for interventions integrating individual, clinical, and community level approaches. In developing countries like India, it threatens to undermine the family and national economic progress it substantially impacts the working age population.[1]

As we enter the new millennium, diabetes mellitus has reached epidemic proportions worldwide. The World Health Organization has commented there is an apparent epidemic of diabetes which is strongly related to lifestyle and economic change.[2] The estimates are changing rapidly and showing a rather disturbing state. The total number of people with diabetes were projected to rise from 171 million (2.8%) in 2000 to 366 million (4.4%) in 2030.[3] Estimates in 2010 of the total number of people with diabetes was projected to rise from 285 million (6.4%) to 439 million (7.7%) worldwide in 2030.[4] Nearly 90-95% of diabetics have Type 2 diabetes.[5]

The dramatic rise in the prevalence of Type 2 diabetes and related disorders like obesity hypertension and the metabolic syndrome could be related to the rapid changes

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in lifestyle that has occurred during the last 50 years. From 31.71 million diabetic subjects in the year 2000 to an expected 79.44 million diabetics by the year 2030,[3,] India is on its march toward having the most number of diabetics worldwide and is aptly called the "diabetic capital" of the world. In 2010, the average age-adjusted prevalence of diabetes in India was 7.8%, higher than that in most European countries.[6]

Urban, rural differences in the prevalence of diabetes have been consistently reported from India. While the ICMR study reported that the prevalence was 2.1% in urban and 1.5% in rural areas,[7] a later study showed that the prevalence was three times higher among the urban (8.2%) compared to the rural population (2.4%).[8]

As seen a number of studies on diabetes prevalence in rural areas have been carried out in different parts of India but such studies are lacking in the rural areas of Kamrup district of Assam. So, a study was carried out to assess the prevalence of diabetes and the effect of various correlates on it among the adult population of Boko Bongaon Block of Rural Kamrup District of Assam.

Aims and Objectives

To assess the effect of various modifiable risk factors on the prevalence of Type 2 diabetes among the tribal adult population of Boko.

MATERIALS AND METHODS

The present study had been undertaken in the Boko Bongaon Community Development Block, which comes under Kamrup district of Assam. The block was started in 1959. It is situated at a distance of about 85 km from the capital city of Guwahati, Assam and connected by NH-37 highway. The majority of the population are tribal which mainly consists of Rabha, Bodo-kachari, and garo tribes distributed throughout the block.

A community-based cross-sectional study was conducted among the tribal adult population of Boko Bongaon Bock of Kamrup District, Assam. A total 330 adult respondents of age 30-60 years who were permanent residents were taken for the study after obtaining their informed consent.

Adults with serious or acute medical illness other than diabetes, pregnant women, adults who were on drugs such as corticosteroids, oral contraceptive pills, and β-blockers, and respondents who were not willing to participate were excluded from the study. The present study was undertaken for a period of 1-year (August 2014 to July 2015). Permission to conduct the study was obtained from the Institutional Ethics Committee, Gauhati Medical College, Assam before the commencement of the study.

The sample size was calculated by taking the prevalence of diabetes to be 3.23% among the tribal[9] to evaluate the prevalence of Type 2 diabetes mellitus and anthropological status in tribals and non-tribals of Paschim Medinipur district of West Bengal. The prevalence of diabetes was found to be 3.23% among tribal. Keeping in mind the limited available resources (time, manpower, etc.,) and taking an absolute error of 2% with 95% confidence interval and using the formula:

$$N = 4pq/L^2$$

Where, N = Required sample size, p = Prevalence, $q = (100-p)$, and L = 2% (absolute error), the minimum sample size required for the study was calculated to be 312 which was rounded off to 330.

From the total tribal villages, 10 tribal villages were selected through cluster random sampling using the method of probability proportional to size. From each selected village, 33 households were selected randomly and from each selected household the eldest adult available during home visit irrespective of gender is taken to get the total sample size of 330, i.e., 33 × 10 = 330 from the selected tribal. In case, no adult was found in a household or did not fulfill our inclusion and exclusion criteria then the next nearest household was taken. If the required number of sample units was not met in that village, then the adjacent village was taken to get the remaining sample units.

The interviews were conducted by house to house visits. Data were collected using semi-structured schedule by interviewing the eldest adult irrespective of gender present in each selected household during the visit for evaluating the correlates. They were interviewed, and observations were done. Information was collected on a socio-demographic profile such as age, sex, religion, caste, marital status, type of family, family history of diabetes, occupation, education, income, dietary intake, physical activity, alcohol and tobacco consumption, any history of diabetes and hypertension in past and present.

This was followed by anthropometric measurements such as weight, height, waist and hip circumference of each interviewed adult and measurement of blood pressure. All selected adults were tested for fasting blood sugar (FBS) using glucometer before the start of the interview and those having FBS more than or equal to 126 mg/dl were taken as diabetic. Those with blood glucose levels between 100 and <126 mg/dl were taken as impaired or pre-diabetes. Those having FBS below 100 mg/dl were

taken as normal (American Diabetes Association, 2003). Known diabetics on oral hypoglycemic agents were taken as diabetic irrespective of their FBS levels.

RESULTS

The present study was carried out among the adult population of Boko, who were between 30 and 60 years of age. There were 330 tribal respondents of which 145 (43.9%) were males, and 185 (56.1%) were females.

Table 1 shows the socio-demographic profile of the respondents which shows that majority (36.4%) belonged to 40-49 years age group and only 29.7% belonged to 50-60 years group. The majority (71.2%) were Hindus followed by Christians (20%). The majority of respondents (83.3%) were married. Most of them (60%) belonged to the nuclear family. In education level, 10.6% were illiterate, whereas 44.8% have completed secondary education. A majority of respondents (68%) were agricultural laborers. As per the modified BG Prasad's Classification 2013 (July)[10] on social class 35.2% belonged to lower middle class, 33.9% belonged to upper lower class whereas only 3.6% belonged to upper class. About 54% of respondents had a positive family history of diabetes.

As evident from Tables 2 and 3, there was an increase in the prevalence of diabetes among those who took non-vegetarian diet than among those who took vegetarian diet with a relative risk (RR) of 1.022 which was not significant. Similarly, with factors such as decreased fruit intake, alcohol use, frequency of alcohol use, tobacco use, form of tobacco use, and hypertension, there was no significant increase in the prevalence of diabetes, whereas there was significant decrease in the prevalence of diabetes with increased physical activity with an RR of 0.8809 among

Table 1: Socio-demographic characteristics of the respondents

Variables	Respondents *n* (%)
Age group	
30-39	112 (33.9)
40-49	120 (36.4)
50-60	98 (29.7)
Gender	
Male	145 (43.9)
Female	185 (56.1)
Religion	
Hindu	235 (71.2)
Muslim	29 (8.8)
Christian	66 (20)
Marital status	
Married	275 (83.3)
Others (unmarried/separated/widow	55 (16.7
Type of family	
Nuclear	196 (59.4)
Joint	134 (40.6)
Education level	
Illiterate	35 (10.6)
Primary education	66 (20)
Secondary education	148 (44.8)
Higher education	81 (24.6)
Occupation	
Agricultural laborer	224 (68)
Non-agricultural laborer	39 (11.8)
Homemaker	32 (9.7)
Service	11 (3.3)
Shopkeeper/Business	24 (7.2)
Socio-economic status	
Upper	12 (3.6)
Upper middle	40 (12.1)
Lower middle	116 (35.2)
Upper lower	112 (33.9)
Lower	50 (15.2)
Family history of diabetes	
Present	178 (53.9)
Absent	152 (46.1)

Table 2: Distribution of the diabetes status of the respondents according to the various lifestyle factors

Variables	*n* (%)			*P* value
	Total	Non-diabetic	Diabetic	
Diet				1.000
Vegetarian	42 (12.7)	41 (13)	1 (7.1)	
Non-vegetarian	288 (87.3)	275 (87)	13 (92.9)	
Fruit intake				0.7442
≥1-3 times/week	66 (20)	64 (20.3)	2 (14.3)	
≤1-3 times/month	264 (80)	252 (79.7)	12 (85.7)	
Physical activity				0.0475*
Sedentary	22 (6.7)	19 (6)	3 (21.4)	
Moderate	206 (62.4)	197 (62.3)	9 (64.3)	
Heavy	102 (30.9)	100 (31.7)	2 (14.3)	
Alcohol use				0.7428
User	257 (77.9)	245 (77.5)	12 (85.7)	
Non-user	73 (22.1)	71 (22.5)	2 (14.3)	
Frequency of alcohol intake				0.3481
1-7 days/week	170 (66.1)	160 (65.3)	10 (83.3)	
1-3 days/2-4 weeks	87 (33.9)	85 (34.7)	2 (16.7)	
Tobacco use				0.1570
User	123 (37.3)	115 (36.4)	8 (57.1)	
Non-user	207 (62.7)	201 (63.6)	6 (42.9)	
Form of tobacco use				0.0852
Smokers	39 (31.7)	36 (31.3)	3 (37.5)	
Chewers	67 (54.5)	65 (56.5)	2 (25)	
Mixed variety	17 (13.8)	14 (12.2)	3 (37.5)	
HTN				0.2051
Present	20 (6.1)	18 (5.7)	2 (14.3)	
Absent	310 (93.9)	298 (94.3)	12 (85.7)	
BMI				0.0018**
Normal	294 (89.1)	286 (90.5)	8 (57.1)	
Overweight/obese	36 (10.9)	30 (9.5)	6 (42.9)	
WHR				0.0013**
Normal	296 (89.7)	288 (91.1)	8 (57.1)	
Obese	34 (10.3)	28 (8.9)	6 (42.9)	

*P<0.05, **P<0.01, ***P<0.001. WHR: Waist-hip ratio, BMI: Body mass index, HTN: Hypertension

those doing heavy activity than those who were sedentary (RR of 1) which was significant. The prevalence of diabetes was found to be significantly higher among the obese and overweight respondents as measured by body mass index (BMI) and waist-hip ratio (WHR) with RR of 1.167 and 1.181 among the overweight/obese than among the normal (RR of 1) as per BMI and WHR, respectively, which was highly significant.

DISCUSSION

This study was carried among 330 adult tribal respondents of Boko Bongaon Block of rural Kamrup of which majority 69.1% belonged to the lower middle class and upper lower class of the society. Most of them (68%) were agricultural laborers. The majority are Hindus and married with the nuclear type of family. The majority of the respondents are of age 30-49 years.

Among the various modifiable risk factors as evident from Tables 2 and 3, a significant decrease in the prevalence of diabetes had been found with the increase in physical activity of the respondents. Similar studies quoted a significant association between physical activity and diabetes. Rao *et al.*[11] in a cross-sectional community-based survey during August 2006 to October 2007 among 1239 individuals of age 30 years and above in the rural field practice area of Kasturba Medical College, Manipal revealed odds of 1.00 in heavy, 2.24 (0.78-6.36) in moderate, 4.54 (1.62-12.71) in light, and 9.10 (3.13-26.47) in sedentary respondents, the difference being very highly significant statistically ($P < 0.001$). Majgi *et al.* (2012),[12] in a cross-sectional study during January 2007 to April 2008 in two villages of Puducherry, studied 1403 subjects of more than 25 years age from two villages and found that prevalence of diabetes was 8.1%, 6.5%, and 3.1% in respondents with low, moderate, and heavy physical activity, showing a significant decrease ($P < 0.05$) in prevalence of diabetes with increase in physical activity.

Furthermore, as shown in Tables 2 and 3, a significant increase in the prevalence of diabetes was seen from normal to overweight/obese respondents as measured by BMI and WHR with RRs of 1.167 and 1.181, respectively. Similar findings were found from following studies. Rao *et al.*,[11] in a cross-sectional community-based survey during August 2006 to October 2007 among 1239 individuals of age 30 years and above in the rural field practice area of Kasturba Medical College, Manipal, found significantly higher odds of 1.88 (1.19-2.95) in respondents with BMI 23.0-24.9 and 3.43 (2.44-4.83) in participants with BMI of >25 as compared to respondents with BMI <22.9 and found that participants with central obesity had a significantly higher odds (3.01 [2.12-4.29]) of developing diabetes as compared to participants with no central obesity. Vaz *et al.* (2011),[13] in a cross-sectional study done in rural area of Mandur, Goa among 1266 participants of >20 years of age, found prevalence of diabetes at 3.3%, 10.3%, 22.2%, and 88.9% among underweight, normal, pre-obese, and obese individuals, respectively, the increase being very highly significant statistically ($P < 0.001$).

Table 3: Estimates of relative risks and confidence intervals of the various lifestyle factors

Variables	RR	95% CI	*P* value
Diet			
Vegetarian	1		
Non vegetarian	1.022	0.9691-1.079	1
Fruit Intake			
≥1-3 times/ week	1		
≤1-3 times/month	1.016	0.9662-1.068	0.7442
Physical activity			
Sedentary	1		
Moderate	0.9031	0.7630-1.069	0.0968
Heavy	0.8809	0.7444-0.9982	0.0387*
Alcohol use			
User	1		
Non user	0.9802	0.9351-1.027	0.7428
Frequency of alcohol intake			
1-7 days/week	1		
1-3 days/2-4 weeks	0.9633	0.9168-1.012	0.3481
Tobacco use			
User	1		
Non user	0.9629	0.9139-1.014	0.1570
Form of tobacco use			
Smokers	1		
Chewers	0.9515	0.861-1.051	0.3547
Mixed variety	1.121	0.8835-1.422	0.3540
Hypertension			
Present	1		
Absent	0.9362	0.8076-1.085	0.2051
BMI			
Normal	1		
Overweight/ obese	1.167	1.007-1.353	0.0018**
WHR			
Normal	1		
Obese	1.181	1.010-1.382	0.0013**

*P<0.05, **P<0.01, ***P<0.001, CI: Confidence interval, BMI: Body mass index, RR: Relative risk, WHR: Waist hip ratio, CI: Confidence Interval

CONCLUSION

Among the modifiable risk factors effecting the prevalence of diabetes among the tribal adult population of Boko increased physical activity with normal BMI and WHR played a significant protective role.

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