

# Healthcare Planning in North-East India: A Survey on Diabetes Awareness, Risk Factors and Health Attitudes in a Rural Community

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## Abstract

**Aims and Objectives :** To determine the level of awareness and knowledge about diabetes in the community, to identify their risk factors for diabetes, the relationship between anthropometric measures and diabetes risk and estimate the burden of diabetes in this rural North-East Indian population with an objective to identify target areas for future healthcare planning.

**Materials and methods :** A healthcare team conducted a community-based survey of the residents of Khowai district, Tripura. All household members above the age of 25 years were eligible to participate, following voluntary consent. Survey questionnaires were administered with interpreter assistance including demographic information, diabetes knowledge, family history, smoking, diet, healthcare access and the international physical activity questionnaire (IPAQ). Anthropometric measurements were taken and blood glucose testing performed.

**Results :** One hundred and forty four participants completed the survey, 66 males and 78 females with a mean age of  $44.4 \pm 14.8$  years. Although 91% had heard about diabetes and 44% were concerned about developing it in the future, only 39% were aware of its association with overweight status and 37% knew it required long-term treatment. Nine percent were known to have pre-existing diabetes mellitus and a further 9% were newly detected to have diabetes mellitus or impaired glucose tolerance. Fifteen percent were hypertensive and 8% had a family history of diabetes. Their mean BMI was  $21.2 \text{ kg/m}^2$  and 31% were overweight, despite high levels of physical activity in 47%. For each predictor of increased risk - waist circumference (female  $>80\text{cm}$ , male  $>94\text{cm}$ ), waist-height ratio  $>50\%$  or  $\text{BMI} > 23 \text{ kg/m}^2$ , subjects measuring above the cut-off were more likely to have abnormal glucose tolerance than those in the normal range (27% vs 14.3%  $p=0.08$ , 26.5% vs 9.5%  $p=0.008$ , 27.3% vs 13.3%  $p=0.043$ , respectively.) with waist-height ratio being the best predictor of an abnormal BGL: OR 3.45 CI (1.34 – 8.88).

**Conclusion :** This is the first rural survey for diabetes in North-East India. This population had a low baseline knowledge and awareness about diabetes, despite significant diabetes prevalence. A greater emphasis on health education and risk factor modification for diabetes is warranted in the North-East part of the country.©

## Introduction

Diabetes and obesity are major health issues in India. Prevalence studies have previously estimated that around 6-12% of urban and 2-3% of rural Indians have diabetes.<sup>1,2</sup> The possible factors that have contributed towards this epidemic include an inherently high genetic risk compounded by recent rapid changes in lifestyle associated with urbanization.<sup>3</sup> However, there are concerns that the health system may be under equipped to cope with this burden,<sup>4</sup> especially in areas where health care, even if physically accessible, may not be evidence-based, but rather service-driven. Moreover, there is little epidemiological data on diabetes from the north-east part of the country which has many ethnic mongoloid groups, whose prevalence of diabetes may be different from that seen in South India.

The Khowai district in West Tripura in North East India is a mixed tribal and Bengali population located near the Bangladesh border. The national census of 2001 quotes a population of 17,689.<sup>5</sup> Although medical facilities exist in the main town of Khowai, there are no integrated diabetes services. Despite being only 3 hours away from the capital city of Agartala, many tribal people continue to live in relative isolation because of restricted facilities for travel.

Staff from the Burrows Memorial Hospital conducts mobile diagnostic health clinics in the Khowai area. While the mobile diagnostic clinic model is an excellent system for providing rapid, cost-effective management of surgical problems and simple infections, it does not adequately serve the needs of patients with chronic disease. Certainly, future healthcare planning should address the community's specific needs, yet no previous studies have assessed the lifestyle practices, baseline health characteristics, burden of diabetes or healthcare interactions in this area.

Risk factors for diabetes include both non-modifiable (age/ethnicity/family history) and modifiable ones (adiposity, decreased physical activity and dietary factors). Those with a borderline elevation of blood glucose - impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) also have a

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significantly higher risk of developing frank diabetes. Previous studies show that while the rates of IGT may remain stable, a change in lifestyle factors associated with urbanization increases the conversion rate to frank diabetes.<sup>3</sup> Identification and measurement of these factors is a vital step towards prevention. More recent studies from South India have shown that the rural-urban differences in the prevalence of glycaemic disorders may be narrowing down.<sup>6,7</sup>

In this study, we aimed to 1) determine the level of awareness, knowledge and concern about diabetes in this community 2) identify risk factors for diabetes/ metabolic disease such as adiposity, diet, physical activity, 3) understand the relationship between anthropometric measures and diabetes risk, 4) appreciate existing patterns of healthcare access and 5) estimate the burden of diabetes. Through this work, we wanted to increase awareness about diabetes in the community and identify target areas for future healthcare planning and provision.

## Patients and Methods

A survey of residents of Khowai district was conducted over 4 days in May 2007. The assistance and approval of a local medical officer and local government office was confirmed before the study was conducted. Areas representative of small villages, a large village, a small town, and a large town were identified on a plan of Khowai district, drawn by the local people. Within each area, a team of medical students, doctors and nurses divided into three groups and each group randomly selected houses to visit within the allotted time period. For every dwelling, all members of the household above the age of 25 years were invited to participate. Local guides and translators, provided by

the village community, obtained voluntary consent from each household before the survey team proceeded.

Survey questionnaires were individually administered to participants, with an interpreter's assistance. The survey included demographic information (age, ethnicity, level of education, occupation, and household income), questions about diabetes knowledge, family history of diabetes, smoking, diet history (based on personal recall of the previous day) and health care access. The international physical activity questionnaire (IPAQ) was also included.<sup>8</sup> Height, weight, waist circumference (midway between the lowest rib and top of the iliac crest) and sitting blood pressure were measured. Body mass index (BMI) and waist-to-height ratio (WHtR) were calculated. A standardized health education talk about diabetes and its risk factors was given to all participants. After education, subjects who gave consent were offered voluntary free random blood glucose testing and counseled about the result according to a set protocol (Table 1).

Accucheck active glucometers (Roche) were utilized for measuring capillary blood glucose.

### Statistical Analysis

The data was analyzed using SPSS version 14.0. Comparisons between groups were made using the Chi-square test. A p-value of < 0.05 was considered significant. Due to resource limitations, we were unable to perform a systematic random sampling.

## Results

One hundred and forty four participants completed the survey. The demographic data is shown in Table 2.

Table 1 : Protocol for recommendations based on capillary blood glucose results

Fasting blood glucose (mg/dl)	Random blood glucose (mg/dl)	Family history of diabetes or BMI >23kg/m <sup>2</sup>	Recommendation
<100 mg/dl	< 140 mg/dl	No	Diabetes unlikely, general education about healthy lifestyles
< 100 mg/dl	< 140 mg/dl	Yes	Diabetes unlikely, some risk for future diabetes. Minimum weight loss required to reach BMI of 23 recommended.
100 -126 mg/dl	140 to 200 mg/dl	Yes/ No	Borderline results, recommend repeat formal testing
>126 mg/dl	> 200 mg/dl	Yes/ No	Borderline results, recommend repeat formal testing

Table 2 : Demographic details of survey population

Gender (n)	78 (females), 66 (males)
Age*(years)	44.5 ± 14.8
Educational status (%) - Nil	12 (8%)
1 <sup>st</sup> to 6 <sup>th</sup> Grade (Primary)	29 (20%)
7 <sup>th</sup> to 12 <sup>th</sup> Grade (Secondary/ Higher secondary)	84 (58%)
Graduate studies/ University	19 (13%)
Household income*	Rs. 6195 ( range: 500 – 22,000 INR)
Ethnicity – Tribal	
Immigrant (Bengali /others)	88 (61%)56 (39%)
Settlement area – Semiurban (town)	
Rural	84 (58%)60 (42%)
Average height	Males:161 cm Females: 153 cm

Table 3 : Responses to questions evaluating diabetes awareness

	True ( YES)	False (NO)	Unsure
I have heard about diabetes	131 (91%)	13 (9%)	
Diabetes can be spread from person to person (like TB)	20 (14%)	82 (57%)	42 (29%)
In diabetes, the sugar level in the blood is too high	83 (58%)	13 (9%)	48 (33%)
Being overweight, increases your risk of diabetes	56 (39%)	40 (28%)	48 (33%)
Diabetes treatment is only for a short-time	40 (28%)	53 (37%)	51 (35%)
I am concerned about developing diabetes	63 (44%)	81 (56%)	

Table 4 : Proportion of persons with abnormal glucose tolerance within anthropometrically-defined risk groups

	Risk factor	% with abnormal glucose tolerance	p-value	Odds ratio	95% confidence interval for OR
WHtR	>50%	26.5 %			
	<50%	9.5 %	0.008	3.45	1.34 – 8.88
WC	>80 (F), >94 (M)	27 %			
	<80 (F), <94 (M)	14.3 %	0.08	2.22	0.89 – 5.51
BMI	>23	27.3 %			
	<23	13.3 %	0.043	2.45	1.01 -5.93

### Diabetes Awareness

Although most participants had heard about diabetes, at least a third of the population lacked basic knowledge about risk factors and treatment. Forty-percent agreed that they were concerned about developing diabetes in the future (Table 3).

### Blood Glucose Levels

Random blood glucose levels (BGL) were obtained in 141 subjects. Nine-percent of the subjects had known pre-existing diabetes. A further 9% had 'borderline' (in the impaired glucose tolerance range) or elevated levels, with no previous history of diabetes. 24% had a normal BGL, but an existing risk factor for diabetes (family history or overweight) and 58% had a normal BGL and no identifiable risk factor.

Thirteen subjects with known diabetes had random BGL measurement. Of these, 8 had levels above 200 mg/ dl.

### Blood Pressure (BP)

The mean BP was 125/82 mmHg and 14% had a systolic BP >140mmHg, 13% had a diastolic BP > 90mmHg. The overall prevalence of systolic or diastolic hypertension was 15%.

### Risk Factor Evaluation

#### Family History

A family history of diabetes was reported by 8% of respondents. Subjects with a family history were significantly more likely to have known diabetes or borderline/elevated glucose levels (random BGL >140 mg/dl). (45.5% vs 12.2%, p =0.003.)

#### Ethnicity

There was no difference in abnormal glucose tolerance rates between tribal and non-tribal groups in the study population (17.6% vs 18.2%).

#### Physical Activity

Using the IPAQ scoring criteria, self-reported physical activity was high in 47.2%, moderate in 40.3%, and low in 12.5%. Main activities included walking/cycling to work, carrying water, household chores and working in the fields. The presence of abnormal glucose tolerance strongly correlated with physical

activity level; 7.6% vs 22.4% vs 38.9% for the high, moderate and low activity categories respectively (p=0.004).

### Anthropometric Measures of Adiposity

The average height of men was 1.63 m and women 1.51 m. The average BMI was 21.2 kg/m<sup>2</sup> (SD 3.63, range 14.9 – 32.5). Using definitions based upon the recommended cut-off points for people of Asian origin,<sup>11</sup> 23% of subjects were classified as underweight (BMI <18kg/m<sup>2</sup>), 46% were in healthy weight range (BMI: 18-23 kg/m<sup>2</sup>) and 31% overweight (>23kg/m<sup>2</sup>).

Apart from BMI, two alternative measures of adiposity were used – waist circumference (WC) and waist: height ratio (WHtR). Using pre-defined cut-offs from the existing literature,<sup>12</sup> the proportion of persons at 'increased risk' varied according to the variable used. In men, 12% had a WC over 94 cm, 51% had WHtR >50% and 33% had BMI >23 kg/m<sup>2</sup>. In women, 40% had WC >80cm, 46% had WHtR>50% and 29% had BMI >23 kg/m<sup>2</sup>. Of these three measures of adiposity, we found that WHtR correlated best with the presence of abnormal glucose tolerance (i.e., known diagnosis of diabetes, IFG, or random BGL above 140 mg/dL) (Table 4).

Higher rates of hypertension were also found in subjects with a BMI>23 kg/m<sup>2</sup> (33.3% vs 8.3%, p <0.001) and a WHtR>50% (25.4% vs 7%, p=0.003), but the difference was not significant for waist circumference (24.3% vs 12.9%, p=0.1)

### Weight Perception

Subjects were asked to identify themselves as 'too thin', 'too heavy' or 'just right'. Overall, 51% of subjects correctly identified their weight category. Observing the columns in Figure 1, there was no suggestion of a skew in weight perception in one direction, i.e. equal numbers over-estimated or under-estimated their weight category.

### Diet

Meal patterns were variable and the traditional Western concept of breakfast/lunch/dinner was not always apparent. Their typical meal pattern involved a light snack of tea, biscuits or puffed rice upon waking followed by 2 to 3 rice-based meals during the day, the last meal eaten just before bed. Sixty percent of respondents had three equally proportioned white rice-based

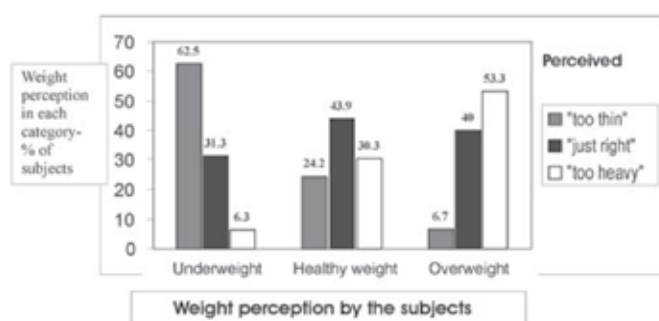


Fig. 1 : Weight perception according to BMI category.

meals per day and 76% consumed their last meal between 21.00 hours and 2.30 hours. The majority of participants ate traditional meals prepared at home.

Only 2 of 144 subjects had consumed commercially-prepared foods on the previous day. Seventy eight percent of the subjects consumed no dairy products apart from a small amount of milk in tea.

#### Smoking

Twenty-four percent of the study population smoked cigarettes, averaging 7 cigarettes per day.

#### Medical Access

The average time taken to reach their usual doctor was 36 min, range 5 min to 3 hrs. 75.5% had seen a doctor within the last year. 30% had used traditional medicines.

## Discussion

In the 30 year period between 1995 – 2025, King et al projected that the diabetes prevalence in India would increase by 195%, the highest rate anywhere in the world. By 2025, 57 million people in India will have diabetes.<sup>9</sup> But how does this alarming figure translate in practical terms to clinicians and other health care planners? What factors drive this increase in prevalence at a local level? What impact will it have on people with diabetes and their communities and how can under-resourced areas of the country prepare to meet the challenges ahead?

To date, very little information exists on the diabetes situation in the isolated areas in the North-Eastern part of India. This population is more mongoloid in ethnicity than the rest of the Indian subcontinent. One previous study has measured diabetes prevalence and risk factors in the Hill-tribes of Bangladesh, demonstrating an age-standardized prevalence of diabetes of 6.4%, and 8.4% for impaired fasting glucose, significantly higher than the non-indigenous rural population.<sup>10</sup> Otherwise very few epidemiological studies in the indigenous people of South-East Asia exist. This study is unique in being a grass-roots attempt to understand many facets of an increasing clinical problem.

Despite a 9% prevalence of known diabetes in our survey population and 44% of subjects expressing concern about developing diabetes in the future, the general knowledge about diabetes was limited. Only 57% of the participants knew that diabetes could not be transmitted from person to person akin to an infectious disease, and the relationship between an overweight state and diabetes was not appreciated by 61% of subjects.

Thirty one percent of subjects had a BMI > 23 kg/m<sup>2</sup>, a cut-off point suggested by the World Health Organization as a public health action point in Asian populations, indicating an increased risk.<sup>9</sup> Interestingly, an even greater proportion of subjects

could be classed as at 'increased risk' if a WHtR of > 50% was used as the cut-off point, instead of a BMI-based definition. Several studies have suggested a better utility of WHtR as an indicator of abdominal adiposity and a predictor of metabolic risk, particularly in an Asian population.<sup>12</sup> This may be related to their relative short stature, a feature of this population with an average female height of only 151 cm.

The validity of the WHtR cut-off of 50% as a marker of diabetes risk in our population is supported by our findings of a highly significant difference in rates of abnormal glucose tolerance between the lower and higher groups.

The first step towards combating rising rates of diabetes must involve improving public awareness about diabetes and its risk factors, particularly the overweight state. Community education about healthy weight ranges and validation of other anthropometric cut-off points that signify an increased risk of developing diabetes mellitus are strongly recommended.

We have taken into account the modifiable factors that might contribute to increasing abdominal adiposity. Interestingly, physical activity levels were high, with 87.5% of subjects scoring a high or moderate on the IPAQ scale. Despite this, a clear increase in the proportion with abnormal glucose tolerance was noticed progressing from the high to the low activity categories. A rapid transition in lifestyle may underlie this alteration. The vast majority of tribal people live in traditional houses in rural areas (>98% in 1991),<sup>13</sup> but many of those surveyed listed 'public service' as their major source of income, rather than agriculture. It is possible that Western recommendations for desirable levels of physical activity may underestimate the requirements for populations with a traditionally highly active lifestyle. Specific recommendations relevant to this community need to be developed if health education is to effectively prevent future metabolic disease.

The role of dietary factors in the Indian diabetes epidemic has been debated. Surprisingly, some studies have demonstrated that dietary intake does not appear to differ significantly between groups with or without diabetes in India.<sup>14,15</sup> Rather, they have suggested that the Indian diet remains largely unaffected by affluence. This is supported by our results, which reveal the consumption of traditional home-prepared rice and vegetable-based meals in the vast majority of cases. A limitation of our study is the lack of quantification of caloric and fat intake due to our limited resources.

Dietary records do however provide insight into issues faced in making recommendations to persons with or at risk of diabetes. In particular, there are few carbohydrate alternatives to white rice in the traditional diet. Where a focus on reading nutritional panels, calculating carbohydrate servings and a fat content and interpreting the glycaemic index, forms a standard part of diabetic dietary education in developed countries, this system is challenging when most foods are prepared from raw ingredients by a family member and shared around a large household. Diet sheets and portion calculators relevant to this area need to be developed. The timing of meals is also noteworthy. Twice-daily pre-mixed insulin regimes which have been designed for typical Western meal patterns may require adaptation in these circumstances. A further dietary concern is the lack of calcium consumption in this area, a possible risk factor for the development of diabetes.<sup>16</sup>

In this population, the uptake of medical services was high. A doctor had been visited by 75% of the subjects in the last year and few new cases of diabetes were identified.



However, poor diabetes knowledge and glycaemic control amongst those with a known diagnosis suggests a gap in effective health care provision.

Our study had some limitations, in that we lacked the appropriate resources to perform a true diabetes prevalence study using systematic random sampling. The numbers are small and age-standardized diabetes prevalence was not calculated. The results of 141 capillary blood glucose tests obviously cannot be generalized to the larger population, in particular, it is not possible to draw conclusions about the interaction of tribal or non-tribal ethnicity with diabetes prevalence and risk factors.

However, this situation is representative of many isolated and under-resourced locations across the developing world, in which the steady rise in diabetes-related problems continues to be felt. It remains up to individual institutions to obtain location-specific information -to assess the extent of the problem, identify areas for intervention, and plan for the future. We believe that involving community members in this process will result in greater diabetes awareness and health empowerment. This study also happens to be one of the first surveys to be conducted in a semi-rural part of North-east India.

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