Original Research Article

Prevalence of diabetes and associated dietary risk factors among adults in tea garden areas of Dibrugarh district

Jyotirmoy Das*, Ratna Sarma, Rupali Baruah, Manjit Boruah

Department of Community Medicine, Assam Medical College, Dibrugarh, Asssam, India

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*Correspondence:
Dr. Jyotirmoy Das,
E-mail: das.jyotirmoy1@gmail.com

ABSTRACT

Background: Diabetes is an important public health problem. Recent studies in India indicate rising trends of diabetes. The tea growing populations are marginalized and thus it is seen that they have a poor access to health care facilities Aims and Objectives: The present study has been conducted to estimate the prevalence of Diabetes and its association with dietary risk factors among adults in tea garden areas of Dibrugarh district.
Methods: A community based cross sectional study among adults in tea garden areas of Dibrugarh district was done. The sample size was calculated to be 400 using the formula, $n=4pq/d^2$ considering prevalence to be 50% and 10% relative error.
Results: Out of the 400 study participants, the prevalence of Diabetes was found to be 7.5%.The prevalence of Diabetes was found to be associated with intake of rice, dals, roti, green leafy vegetables, fruits, refined oil, roots and tuber, fish and salted tea (p<0.05).
Conclusions: From the findings of the study it was concluded that the prevalence of Diabetes among adults in tea garden areas of Dibrugarh district was similar to that of general population.

Keywords: Diabetes, Adults, Tea garden

INTRODUCTION

The prevalence of diabetes is rising all over the world.[1] Current estimates are that there are at least 150 million people living with diabetes worldwide of which two-third is in developing countries.[2] The total number of people with diabetes is predicted to rise above 300 million by 2025. In 2014 the global prevalence of diabetes was estimated to be 9% among adults aged 18+ years.[3] The high incidence is attributed to a combination of genetic susceptibility plus adoption of a high-calorie, low-activity lifestyle by India's growing middle class.[4]

Population based studies showing the prevalence of type 2 diabetes mellitus in different parts of India have been recently reviewed and shows that prevalence have has risen five-fold from 2.1% in 1975 to 12.1% in 2000.[5,6] The CUPS (Chennai Urban Rural Population study) showed age standardized prevalence rate of 12% for urban India.[7-9]

The CURES study showed an age standardized prevalence of 14.3% whereas in the CUPS study showed 9.3%. The overall prevalence in CUPS study was reported to be 12%. Similarly in the Amrita diabetes and endocrine population survey (ADEPS) study from Kerala, the prevalence of known and undiagnosed Diabetes was 9.0 and 10.5% respectively.[10]

The north-eastern states of India are ethno-culturally diverse and each ethnic group has a distinct lifestyle. Tea-garden workers are a distinct occupational group who

migrated to Assam about a century ago from different States of India to work as tea-leaf pickers and have been residing within tea-estates.[11] Tea garden population, an ethno-linguistic minority, is primarily rural in nature and estimated to be around 6 million (60 lakhs) or 17% of Assam's total population.[12] They are found mainly in those districts of Upper Assam and Northern Brahmaputra belt where there is high concentration of tea gardens like Kokrajhar, Udalguri, Sonitpur, Nagaon, Golaghat, Jorhat, Sivasagar, Dibrugarh, Tinsukia.[13] Tea gardens are highly capitalistic industries. A large number of unskilled male and female workers are engaged in tea gardens for tea plantation, plucking of tea leaves and other works. In spite of their dedicated service and contribution to revenue generation of tea industries, the workers in particular women workers do not enjoy any special kind of rights and privileges.

The tea growing populations are marginalized, have higher MMR than the state.[14] Thus it is seen that they have a poor access to health care facilities. In recent years, there has been a marked change in life-style caused by economic growth, affluence, urbanization and dietary westernization contributing to various NCDs.

No studies of diabetes mellitus in tea garden population in Assam have been conducted. Information on this issue would provide evidence based data to gauge the magnitude of diabetes in this important group of Assam's population. It would also help in preparation of guidelines and policies on this subject by public policy makers and make the health system respond in an appropriate way.

With the above points in mind, this study was conducted with the following objectives:

Objectives of the study

1. To estimate the prevalence of type 2 diabetes mellitus among adults in tea garden areas of Dibrugarh district.
2. To assess the dietary risk factors associated with type 2 diabetes mellitus among adults in tea garden areas in Dibrugarh district.

METHODS

Study area

Tea garden areas of Dibrugarh distict of Assam.

Period of study

One year from June 2016 to May 2017.

Study universe

All adults aged 20-59 years residing in tea garden areas of Dibrugarh district.

Type of study

Community based cross-sectional study.

Eligibility criteria

Inclusion criteria: All adults 20-59 years of age who gave consent

Exclusion criteria: Known type I diabetes mellitus due to secondary cause.

Sample size

The sample size (n) was calculated using the following formula,

$$n = z^2 pq/d^2$$

Where z = 1.96 at 5% level of significance
       p = anticipated prevalence
       q = 1-p
       d = allowable error

As no previous study was found on prevalence of type 2 diabetes mellitus among adults of tea garden, so considering the prevalence to be 50% and taking 10% relative error with 95% confidence interval, the sample size calculated comes out to be 400.

Sampling design

There are seven developmental blocks in Dibrugarh District having a total of 144 tea gardens.[15] Out of the following 7 blocks one developmental block (Lahowal block) was randomly selected for the study.

Lahowal block has 18 tea gardens from which 5 tea gardens were selected randomly for the study. The required sample size was divided equally among the five tea gardens. 80 individuals were selected from each tea garden.

In each tea garden the study participants were interviewed by house-to-house visit. The residential area of each tea garden was visited. The first household was randomly selected. There after subsequent households were selected consecutively. All eligible study subjects in selected household were included and the process continued till desired sample size was achieved.

Data collection technique

Before conducting interview, the study participant was carefully briefed regarding the purpose of the study so as to obtain their full cooperation for the study and written informed consent was obtained.

Data was collected by interview method using a pre-designed and pre-tested proforma.

Data collection tools

Fasting blood glucose

Blood sugar was estimated using Accu-chek glucometer, uses dependent glucose oxido-reductase mediator reaction.

Food frequency questionnaire method

Food frequency questionnaires (FFQ) has been used to assess dietary intakes in populations.

Statistical analysis

Statistical analyses were done by using percentages, mean and standard deviations. Appropriate statistical tests were done wherever necessary. Bivariate logistic regression analysis was performed. Statistical significance was considered as $p<0.05$. Standard statistical softwares, MS Excel and SPSS version 16 were used for data analysis.

Definition: ADA criteria for testing for diabetes in asymptomatic adult individuals.

In this study FPG $\geq$126 mg/dl is used to define Diabetes in the study population

RESULTS

Mean age was found to be 40.70±11.18 years. Out of the 400 study participant majority were in the age group 40-49 years. 63.5% of the study participants were males and 34.5% were females. The whole study populations were Hindu (100%) by religion. Among the study participants, majority were OBC (80.5%), followed by general (14.8%), and SC (4.7%). Majority belong to joint family (55.8%). Socio-economic class V (51.7%) was common among the study participants, followed by class IV (39.5%). Educational status was up to primary level is 57% while 32.5% were illiterate. Majority of the study participants were daily wage earner (81.8%). Most of the study populations were married (81.8%). The overall prevalence of diabetes was found to be 7.5%.

Among 400 study participants, 85% of the study participants took rice daily. Most of the study participants took roti 1-3 days/week (52.5%), 52.8% took dals and soya 4-6 days/week. Among the study participants most of them took green leafy vegetables 1-3 days/week (82%). Majority of them took roots and tubers 4-6 days/week (48.5%).Most of the study participants took other vegetables 1-3 days/week (74%). Majority of the study participants took fruits only <1 day/week (74%) and 5% never took fruits at all.57.5% took milk and milk products <1 day/week. Most of the study participants took egg 1-3 days/week (37.5%) and 26.8% never took egg. Majority of the study participants took fish 1-3 days/week (80%). Meat was eaten by the study participants mostly 1-3 days/week (60.3%). 32.8% took

ghee <1 day/week and 65% never took ghee. Majority of them took chocolate and sweets <1 day/week (71.5%). Daily use of mustard oil was seen in 85% of the individuals. Most of then use refined oil 1-3 days/week (80%). Daily intake of tea was seen in 90% of individuals. High daily intake of salted tea was seen among the study participants (53.2%).

Table 1: Distribution of participants according to Socio demographic profile.

Variables		Total	%
Age group (years)	20-29	96	24
	30-39	50	12.5
	40-49	133	33.2
	50-59	121	30.2
Sex	Males	267	66.8
	Females	133	33.2
Caste	OBC	322	80.5
	SC	19	4.7
	General	59	14.8
Religion	Hindu	400	100
Types of family	Joint	223	55.8
	Nuclear	177	44.3
Educational status	Illiterate	130	32.5
	Primary	228	57
	Secondary	42	10.5
Marital status	Married	327	81.8
	Unmarried	73	18.2
Socio economic status	Class III	35	8.8
	Class IV	158	39.5
	Class V	207	51.7
Occupation	Daily wage earner	327	81.8
	Business	23	5.7
	Unemployed (including housewives)	50	12.5

Table 2: Prevalence of diabetes among the study participants.

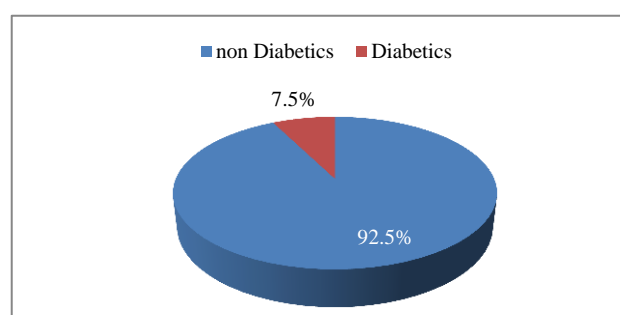| Participants	Number	Percentage (%)
Diabetics	30	7.5
Non diabetics	370	92.5
Total	400	100

Figure 1: Prevalence of diabetes.

Table 3: Distribution of study participants according to intake of different food items based on 7 days food frequency questionnaire.

Dietary items		Frequency of intake	Number	Percentage (%)
Cereals	**Rice**	Never	-	-
		<1 day/week	4	1
		1-3 days/week	5	1.2
		4-6 days/week	51	12.8
		Daily	340	85
	Roti	Never	3	0.8
		<1 day/week	5	1.2
		1-3 days/week	210	52.5
		4-6 days/week	96	24
		Daily	86	21.5
Pulses	**Dals and soya**	Never	2	0.5
		<1 day/week	5	1.3
		1-3 days/week	5	1.3
		4-6 days/week	211	52.8
		Daily	177	44.1
Vegetables	**Green leafy vegetable**	Never	-	-
		<1 day/week	43	10.8
		1-3 days/week	328	82
		4-6 days/week	29	7.2
		Daily	-	-
	Roots and tubers	Never	-	-
		<1 day/week	44	11
		1-3 days/week	138	34.5
		4-6 days/week	194	48.5
		Daily	24	6
	Other vegetables	Never	-	-
		<1 day/week	2	0.5
		1-3 days/week	296	74
		4-6 days/week	102	25.5
		Daily	-	-
Fruits		Never	20	5
		<1 day/week	237	59.2
		1-3 days/week	140	35
		4-6 days/week	3	0.8
		Daily	-	-
Milk and milk products		Never	143	35.8
		<1 day/week	230	57.5
		1-3 days/week	25	6.2
		4-6 days/week	2	0.5
		Daily	-	-
Animal food	**Egg**	Never	107	26.8
		<1 day/week	134	33.5
		1-3 days/week	150	37.5
		4-6 days/week	9	2.2
		Daily	-	-
	Fish	Never	2	0.5
		<1 day/week	6	1.5
		1-3 days/week	320	80
		4-6 days/week	43	10.8
		Daily	29	7.2

Dietary items		Frequency of intake	Number	Percentage (%)
	Meat	Never	16	4
		<1 day/week	141	35.2
		1-3 days/week	241	60.3
		4-6 days/week	2	0.5
		Daily	-	-
Fats and sugar oil	**Ghee**	Never	260	65
		<1 day/week	128	32
		1-3 days/week	9	2.3
		4-6 days/week	3	0.7
		Daily	-	-
	Chocolate and sweets	Never	39	9.8
		<1 day/week	286	71.5
		1-3 days/week	70	17.5
		4-6 days/week	5	1.2
		Daily	-	-
	Mustard oil	Never	-	-
		<1 day/week	4	1
		1-3 days/week	6	1.5
		4-6 days/week	50	12.5
		Daily	340	85
	Refined oil	Never	-	-
		<1 day/week	21	5.2
		1-3 days/week	320	80
		4-6 days/week	53	13.2
		Daily	6	1.6
Beverages	**Tea/Coffee**	Never	6	1,5
		<1 day/week	-	-
		1-3 days/week	3	0.7
		4-6 days/week	31	7.8
		Daily	360	90
	Salted tea	Never	4	1
		<1 day/week	13	3.2
		1-3 days/week	91	22.8
		4-6 days/week	79	19.8
		Daily	213	53.2

Table 4: Bivariate analysis of various food items with prevalence of diabetes mellitus.

Variables (frequency per week)			Diabetes		OR	95% CI	P value
			Yes	No			
Cereals	**Rice**	1-3 days	2	3	1	-	-
		Never/<1 day	1	3	2.00	0.11-35.80	0.110
		>3 days	27	364	13.48	2.59-70.01	0.002*
	Roti	1-3 days	5	205	1	-	-
		Never/<1 day	1	7	0.17	0.01-1.66	0.121
		>3 days	24	158	0.16	2.32-16.68	0.003*
Pulses	**Dals**	1-3 days	2	3	1	-	-
		Never/<1 day	4	3	0.50	0.04-5.15	0.565
		>3 days	24	364	10.11	1.68-21.20	0.011*
Green leafy vegetable		1-3 days	8	320	1	-	-
		Never/<1 day	15	28	0.04	0.01-0.11	0.951
		>3 days	7	22	0.07	0.03-0.67	0.015*
Roots and tubers		1-3 days	8	130	1	-	-
		Never/<1 day	8	36	0.27	0.09-0.78	0.011*
		>3 days	14	204	0.89	0.36-2.19	0.811

Variables (frequency per week)		Diabetes		OR	95% CI	P value
		Yes	No			
Other vegetables	1-3 days	22	274	1	-	-
	Never/<1 day	1	1	0.08	0.05-0.97	0.074
	>3 days	7	95	1.08	0.37-2.21	0.841
Fruits	1-3 days	6	134	1	-	-
	Never/<1 day	23	234	0.45	0.18-1.14	0.161
	>3 days	1	2	0.08	0.01-1.13	0.041*
Milk and milk products	1-3 days	4	21	1	-	-
	Never/<1 day	25	348	2.65	0.84-8.32	0.095
	>3 days	1	1	0.19	0.03-3.71	0.274
Ghee	1-3 days	3	6	1	-	-
	Never/<1 day	26	362	6.96	1.64-29.43	0.116
	>3 days	1	2	1.00	0.06-15.98	0.986
Chocolate and sweets	1-3 days	8	62	1	-	-
	Never/<1 day	21	304	1.86	0.79-4.40	0.153
	>3 days	1	4	0.51	0.05-5.20	0.575
Mustard oil	1-3 days	1	5	1	-	-
	Never/<1 day	1	3	0.60	0.02-13.58	0.212
	>3 days	28	362	2.58	0.29-22.90	0.393
Refined oil	1-3 days	18	302	1	-	-
	Never/<1 day	3	18	0.35	0.75-10.37	0.125
	>3 days	9	50	0.33	0.14-0.77	0.011*
Egg	1-3 days	12	138	1	-	-
	1-3 days	12	138	1	-	-
	Never/<1 day	16	225	1.22	0.56-2.66	0.611
	>3 days	2	7	0.30	0.05-1.63	0.164
Fish	1-3 days	20	300	1	-	-
	Never/<1 day	3	5	0.11	2.00-40.38	0.104
	>3 days	7	65	0.61	0.65-3.97	0.029*
Meat	1-3 days	22	219	1	-	-
	Never/<1 day	7	150	2.15	0.89-5.16	0.082
	>3 days	1	1	0.01	0.60-16.73	0.117
Tea/Coffee	1-3 days	1	2	1	-	-
	Never/<1 day	1	5	2.50	0.09-62.60	0.577
	>3 days	28	363	6.48	0.57-73.71	0.131
Salted tea	1-3 days	11	80	1	-	-
	Never/<1 day	4	13	0.44	0.61-8.09	0.213
	>3 days	15	277	2.53	0.75-9.08	0.026*

By bivariate analysis it was found that prevalence of diabetes was significantly higher with increase intake of rice and dals and lower with increased intake of intake of roti, green leafy vegetables, fruits, refined oil and fish and decrease intake of roots and tubers, diabetes was significantly higher with increase intake of salted tea.

DISCUSSION

In the present study the overall prevalence of diabetes was found to be 7.5%. A study done in 1988 in Chennai by Ramachandran et al., reported a prevalence of 8.2 per cent in the urban areas.[16] In 1999, a study conducted by Shah et al., Prevalence of 8.2 per cent was reported from Guwahati.[17] A community based cross sectional study was conducted by Koria et al., in Ahmedabad city by house to house survey from duration March 2009-April

2010. The overall revalence of diabetes in Ahmedabad City was found to be 7.33%.[18] In 2014 a study conducted by Medhi et al, the overall prevalence of diabetes was found to be 9.71 reported from Dibrugarh.[19]

In the present study diabetes was significantly associated with intake of rice, roti, dals, green leafy vegetables, roots and tubers, fruits, refined oil, fish and salted tea.

The role of diet in the etiology of T2DM was proposed by Indians who observed that the disease was almost confined to rich people who consumed oil, flour, and sugar in excessive amounts.[20]

In contrast, in a study by Villegas, Shu, Gao, Yang, Elasy, Li, et al, among Chinese women an inverse result was observed between intake of vegetables and T2DM.

Consumption of fruits and vegetables may protect the development of T2DM, as they are rich in nutrients, fiber and antioxidants which are considered as protective barrier against the diseases.[21]

In 2010 a study by, Nanri, Mizoue, Noda, Takahashi, Kato, Inoue, et al, in Japanese women, a report revealed that elevated intake of white rice was associated with an increased risk of T2DM.[22]

CONCLUSION

The overall prevalence of diabetes was found to be 7.5%.Out of the 30 diabetics, 14 (5.2%) were males and 16 (12%) were females. Of all age groups, prevalence was highest in 50-59 years (15.7%). In the Dietary profile it is found that diabetes was significantly associated with intake of rice, dals, roti, roots and tubers, green leafy vegetables and fruits, refined oil, fish and salted tea.

Limitation of study

- There was constrain of time and resources, so all aspects of the study matter could not be covered in details.
- Dietary pattern was assessed by using food frequency questionnaire. So, some recall bias may occur.
- Blood tests for HBA1c, PPBS and RBS could not be performed.

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