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Original Research Article

Screening of Type 2 Diabetes Mellitus and Its Associated Risk Factors among Select Tribes of Rajasthan

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ABSTRACT

Background: India is facing diabetic explosion. The cause may be both nature and nurture. As per King et al. (1998) incidence of diabetes in India will increase by 95% in 2025 and the sufferers will be young age individuals. The disease is affecting at an alarming rate, both rural and urban populations in India (Ramachandran et al., 1998, 2001; Mohan et al., 2001, 2006).Objective: This study aimed at to determine the prevalence rate of type 2 diabetes mellitus disease and its associated risk factors among select tribal populations of Rajasthan. Methods: 1296 persons (599 males and 697 females) aged ≥18 years were examined from a cluster of three districts i.e. Jhunjhunu, Sikar and Churu. All subjects lived in different locations of these districts of Rajasthan. Blood glucose levels, blood pressure, height, weight, waist girth, and hip circumference were measured. Results: The overall prevalence rate of diabetes and prediabetes was 3.9 % and 6.6% among select tribal populations. It was found that the Natt tribe (39.2%) showed higher prevalence rate of type 2 DM disease followed by the Banjara tribe (33.3%) and then the Sapara tribe (11.8%) and so on. Male tribal populations (5.2%) had higher incidence rate of type 2 DM disease as compared to female tribal populations (2.9%) in all the tribes. Chi-square and linear regression analysis revealed that sex, age, body mass index, waist circumference and blood pressure levels were associated significantly with the prevalence ($p<0.01$). Conclusion: Prevalence rate of type 2 DM disease were found to be higher in all tribes except Gujjar tribe with zero prevalence rate.

Key words: Sreening, type 2 diabetes mellitus, risk factors, nomad tribes

INTRODUCTION

Globally in 2003 it was estimated that there were 150 million people with type 2 diabetes. [1] The incidence varies substantially in different parts of the world, almost certainly because of environmental and lifestyle factors, though these are not known in detail. [2] In the United States there are 23.6 million people (7.8% of the population) with diabetes with 17.9 million being diagnosed, [3] 90% of whom are type 2. [4] With prevalence rates doubling between 1990 and 2005, Centers for disease control and prevention has characterized the increase as an epidemic. [5] Traditionally considered a disease of adults, type 2 diabetes is increasingly diagnosed in children in parallel to rising obesity rates [6] due to alterations in dietary patterns as well as in life styles during childhood. [7]

Nomadic communities make up about 7 percent of India's population. They thus constitute a substantial portion of our population. Yet, despite their large numbers, policy makers have largely ignored them. Nomads they are the wanderers who settle homes wherever they stop .They are the most colorful and exotic wanderers in the ruins of desert, who keep moving from one village to another in search of work, money, living and livelihood. It was found that each group had been affected by modernisation and was into increasing conflict with sedentary villagers, with whom they no longer seemed to share a symbiotic relation. And also as a result of the changing times, the value of their occupation had gone down. Increasingly, nomadic people were turning to the labour markets or construction sites for jobs. As they are affected by the modernization, their life style and dietary pattern has also been changed .As it has been already discovered the prevalence rate of type 2 DM diseases is on the increase at both the rural and urban population levels since these population has also seen living within these population and adapting their life styles as they no longer have their previous occupation and lifestyle. One study conducted in 2004, on Raica tribe by Aggrawal et al, [8] reported a very low incidence (<0.5%) in this particular tribe. The group attributed this to consumption of camel milk which is believed to have some protective effect against diabetes. Keeping in mind the above facts an attempt is being made to study the incidence rate of type 2 DM disease among select nomad tribes of Rajasthan state, India. Not a single study has been done so far on these select tribes.

METHODS AND MATERIALS

Present search was limited to tribal populations of three districts of Rajasthan state in India. Since there was not the exact census record of these populations. Data was collected through snow and ball method of sampling. It took twelve to sixteen rounds and collected data of nearly twelve hundred and ninety-six participants. Out of which four hundred and thirty-five were Banjara, four and eighteen were Natt, one hundred and fifty were Sapara, fifty-five were the Bawariya , seventy two were Sansui, whereas Bhopa were one hundred and twenty and the Gujjar were forty-six in numbers. The study was approved by the institutional human ethics committee at BITS, Pilani and performed according to the Declaration of Helsinki. All study members received detailed explanation of the study in their regional language before giving consent. A survey questionnaire was designed and finalized after a field trial. Men and women ≥18 years of age were considered eligible except pregnant women, seriously ill subjects, and those who were on herbal medication or on drugs such as corticosteroids and oral contraceptive pills.

Diabetes Survey and Data Collection:

For the purpose of the present study the data have been drawn from primary

sources. For collection of primary data the household was the primary unit of the sample. A detailed survey questionnaire was planned and got it finalized after field trial. The parameters included age of respondents, gender, schooling, type of work, annual family income, family members, culture, caste, and living status. Men and women ≥ 18 years of age were considered eligible except pregnant women, seriously ill subjects and those who were on some medication or drugs like oral contraceptives pills, corticosteroids, etc.

Intensive information was taken from each participant to know about their jobs, various sources of income, family members, housing, and incidence of type 2 DM in the family, history of blood pressure in the family and their status of physical activities and other kinds of diseases was also taken into account for this study. Other investigations included anthropometry, systolic and diastolic blood pressures, fasting plasma glucose > 126 and/or random plasma glucose test >200 accompanied by the classic symptoms of increased thirst, urination, and fatigue. Body mass index (BMI) is a measure of body fat based on height and weight that applies to adult men and women. Height weight and circumferences were taken with light outfit and without shoes .For height, the subject stood in an erect posture vertically with the occiput, back, hip, and heels touching the wall behind while gazing horizontally in front and keeping the tragus and lateral orbital margin in the same horizontal plane. Hip circumference was measured at the widest point and waist circumference measured at narrowest point of abdomen or at the belly button or just above it. Blood pressure was taken after a 10-min rest using a digital blood pressure machine. Classification of hypertension was based on American Diabetes Association guidelines. Healthy blood pressure was taken to be <120/80, early high blood pressure was taken to be between 120/80 and 140/90 while blood pressure 140/90 or higher was considered to be hypertension. For diabetes also the diagnostic criteria of the American Diabetes Association were used. [9]

RESULTS AND DISCUSSION

The present study was carried out in 1296 subjects comprising of 599 males (mean age, 42.68+19.31) and 697 female (mean age, 43.42+17.06) Nomad tribal populations. Table 1 shows demographic, anthropometric and other clinical characteristics of Nomad tribal populations.

Table 1. Baseline characteristics of study participants

	Males	**Females**	**Total**
Parameters	Mean±SD	Mean±SD	Mean±SD
Age of respondents	42.68±19.31	43.42±17.06	43.08±18.13
weight	56.92±11.06	51.55±10.85	54.04±11.26
height	165.10±8.05	155.75±7.39	160.07±9.00
Waist circumference	76.10±12.16	74.48±12.18	75.23±12.19
Body mass index	20.92±3.70	21.29±4.38	21.12±4.08
Hip circumference	84.20±10.50	83.64±12.33	83.90±11.52
Systolic blood pressure	129.35±17.99	125.22±19.17	127.13±18.74
Diastolic blood pressure	81.00±12.67	79.91±12.54	80.41±12.61
Glucose test	109.97±27.17	110.05±25.91	110.02±26.49

Screening for type 2 diabetes mellitus among select nomad tribes was given below as shown in Table 2. It was found that the Natt nomad tribes (39.2%) showed highest prevalence rate of type 2 DM disease followed by the Banjara tribes (33.3%) and so on. In the Gujjar tribal population there was not found a single case positive for type 2 DM disease

Table 2. Prevalence of prediabetes (risk zone) and diabetes among few select tribal populations.

		Blood Glucose test (RBG)*			
		Negative< 200	Positive>200	At risk zones <140,>200	Total
Tribes	Banjara	396	17	22	435
		34.1%	33.3%	25.9%	33.6%
	Natt	372	20	26	418
		32.1%	39.2%	30.6%	32.3%
	Sapara	140	6	4	150
		12.1%	11.8%	4.7%	11.6%
	Bhawariya	50	1	4	55
		4.3%	2.0%	4.7%	4.2%
	Sansui	65	5	2	72
		5.6%	9.8%	2.4%	5.6%
	Bhopa	95	2	23	120
		8.2%	3.9%	27.1%	9.3%
	Gujjar	42	0	4	46
		3.6%	.0%	4.7%	3.5%
	Total	1160	51	85	1296
		100.0%	100.0%	100.0%	100.0%

RBG*: Random Blood Glucose test, Chi-Square=44.318, p=0.001

Table 3 presents the prevalence of obesity and overweight among few select nomad tribal populations. It was found that the Banjara (38%, 35.1%) and the Natt nomad tribals (35.2%, 28.8%) showed maximum percentages distribution of BMI i.e. (overweight and obesity) as compared to other tribal populations. Further analysis was done to find out the correlation between body mass index (BMI) and random blood glucose test (RBG) a positive relationship (r=0.072) was observed based on the t-value (2.583) and p-value (0.01), we can conclude that this relationship is statistically significant Fig.1.

Table 3. Prevalence of Obesity and Overweight among few select nomad tribal populations

		Body mass index				
		18 - 22.9 (normal)	23 - 25 (over weight)	BMI of 25 or greater (obesity)	below 18 (under weight)	Total
Nomad Tribal populations	Banjara	199	54	73	109	435
		31.9%	38.0%	35.1%	33.9%	33.6%
	Natt	198	50	60	110	418
		31.7%	35.2%	28.8%	34.2%	32.3%
	Sapara	80	14	16	40	150
		12.8%	9.9%	7.7%	12.4%	11.6%
	Bhawariya	36	0	9	10	55
		5.8%	.0%	4.3%	3.1%	4.2%
	Sansui	36	6	4	26	72
		5.8%	4.2%	1.9%	8.1%	5.6%
	Bhopa	55	13	35	17	120
		8.8%	9.2%	16.8%	5.3%	9.3%
	Gujjar	20	5	11	10	46
		3.2%	3.5%	5.3%	3.1%	3.5%
	Total	624	142	208	322	1296
		100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square=47.397, p=0.001

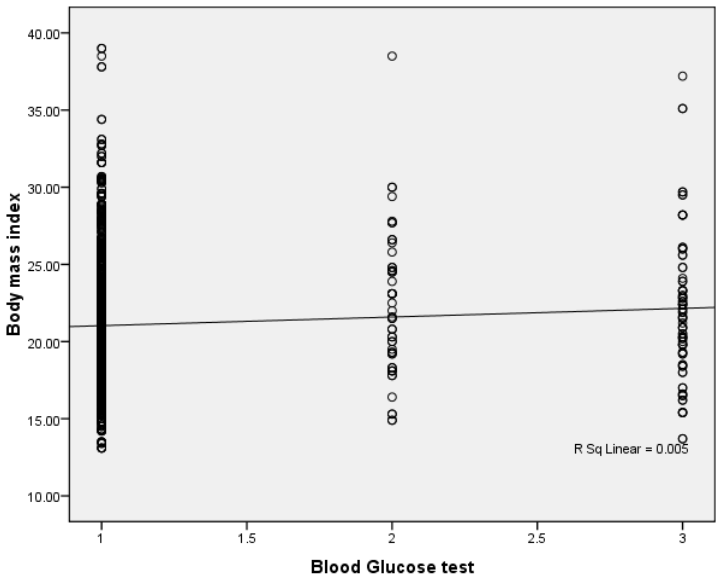

Fig. 1. Correlation between BMI of respondents and RBG among select tribal populations

In order to find out the relationship between central adiposity and type 2 DM disease, a linear regression analysis was done between waist circumference and positive blood glucose test. A positive relationship (r=0.085) was found based on the t-value (3.072) and p-value (0.01). It can again be concluded that this relationship was found to be statistically significant as seen below in Fig.2.

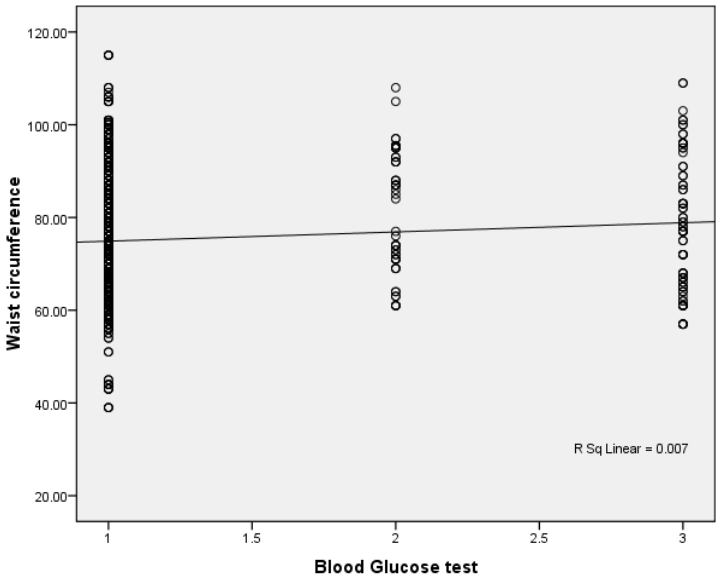

Fig. 2. Scatter plot diagram to show the correlation between Waist circumference and blood glucose test.

Similarly a linear regression analysis was done to find out the correlation between age of respondents and positive blood glucose test and a positive relationship (r=0.086) was found based on the t-value (3.114) and p-value (0.01). It was found to be statistically significant. Fig. 3.

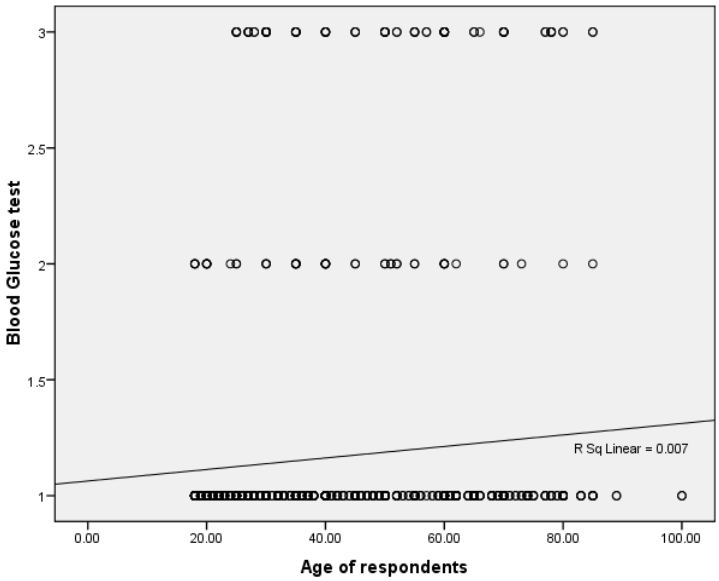

Fig.3. Correlation between age of respondents and RBG among few select tribal populations.

It has been observed that males were suffering from this disease more as compared to females in all the select nomad tribal populations. Although the data reveals that the female populations were more at risk zone for having type 2 DM disease as compared to males as shown below in Table 4

Table 4. Frequency distribution of type 2 DM disease among select nomad tribals in different sexes

		Blood Glucose test			
		Negative<200	Positive>200	At risk zones>140,<200	Total
Sex of respondents	Males	536	31	32	599
		89.5%	5.2%	5.3%	100.0%
	Females	624	20	53	697
		89.5%	2.9%	7.6%	100.0%
	Total	1160	51	85	1296
		89.5%	3.9%	6.6%	100.0%

Chi-Square=6.865, p=0.032

It was noticed that the Banjara and the Natt tribal populations suffered more from prehypertension (30.4%,29.1%) and hypertension (39.5%,22.7%) problem as compared to other nomad tribal groups as shown in data given below in Table 5

Table 5. Incidence of blood pressure among few select nomad tribal populations.

			Blood pressure			
			healthy	prehypertension	hypertension	Total
Nomad Tribal Populations	Banjara	Count	167	150	118	435
		% within ada	33.2%	30.4%	39.5%	33.6%
	Natt	Count	206	144	68	418
		% within ada	41.0%	29.1%	22.7%	32.3%
	Sapara	Count	46	70	34	150
		% within ada	9.1%	14.2%	11.4%	11.6%
	Bhawariya	Count	16	24	15	55
		% within ada	3.2%	4.9%	5.0%	4.2%
	Sansui	Count	26	32	14	72
		% within ada	5.2%	6.5%	4.7%	5.6%
	Bhopa	Count	32	48	40	120
		% within ada	6.4%	9.7%	13.4%	9.3%
	Gujjar	Count	10	26	10	46
		% within ada	2.0%	5.3%	3.3%	3.5%
Total		Count	503	494	299	1296
		% within ada	100.0%	100.0%	100.0%	100.0%

Chi-Square=52.976, p=0.001

Table 5 showed the positive association between blood pressure and blood glucose test. It had been observed that 3.2 % of individual diagnosed for prehypertension and 7.4 % of individual having hypertension found to be positive for type 2 DM disease as compared to 2.6% of healthy individual .Similar status had been found in prediabetic individuals

Table 6. Association between Blood pressure and RBG test among select nomad tribal populations

		Blood Glucose test (RBG)			
		Negative<200	Positive>200	At risk zone<140, >200	Total
Blood Pressure	Healthy	462	13	28	503
		91.8%	2.6%	5.6%	100.0%
	Prehypertension	443	16	35	494
		89.7%	3.2%	7.1%	100.0%
	Hypertension	255	22	22	299
		85.3%	7.4%	7.4%	100.0%
Total		1160	51	85	1296
		89.5%	3.9%	6.6%	100.0%

Chi-Square=14.002, p=0.007

A linear regression analysis was done to seen the correlation between blood pressure and RBG and a positive correlation was observed based on t value= 2.196 (r=0.061, p=.028) as shown below in Fig.4.

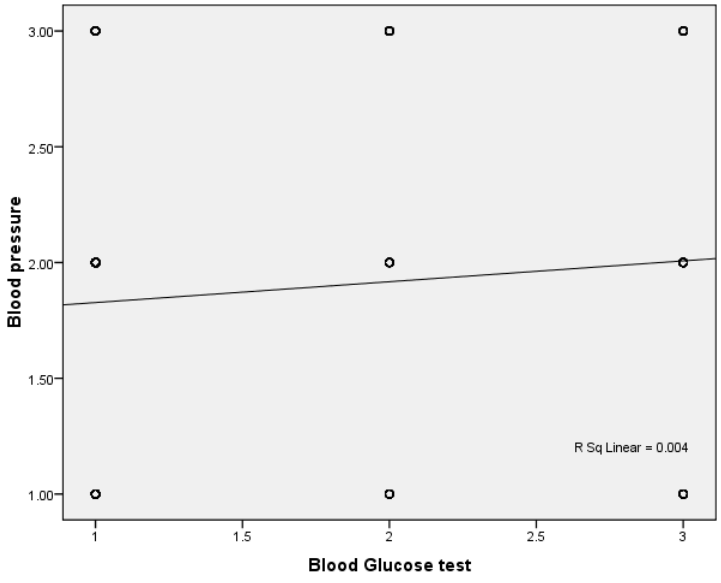

Fig. 4. Scatter plot figure showed the correlation between Blood pressure and Type 2 DM disease.

DISCUSSION

The first national study on the prevalence of type 2 diabetes in India was done between 1972 and 1975 by the Indian Council Medical Research (ICMR, New Delhi). [10] Screening was done in about 35,000 individuals above 14 yr of age, using 50 g glucose load. Capillary blood glucose level >170 mg/dl was used to diagnose diabetes. The prevalence was 2.1 per cent in urban population and 1.5 per cent in the rural population while in those above 40 yr of age, the prevalence was 5 per cent in urban and 2.8 per cent in rural areas. Subsequent studies showed a rising trend in the prevalence of diabetes across different parts of India. [11-15] The present study also revealed that the prevalence rate of type 2 DM among different tribes of Rajasthan was (4%).Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) collectively called as prediabetic states, have a high risk of conversion to diabetes. Several studies have shown that these prediabetic states are also high risk stages for cardiovascular disease. [16, 17] Hence data on IGT and IFG are also urgently needed as they are indicators of future diabetes prevalence and burden on the nation. The NUDS results indicate that the prevalence of IGT was higher than that of type 2 diabetes in four out of six cities studied. [18] Similarly this study also shown increased prevalence of prediabetes individuals more as compared to type 2 DM. The prevalence of IGT was 16.8 per cent in Chennai, 14.9 per cent in Bengaluru (formerly Bangalore), 29.8 per cent in Hyderabad, 10 per cent in Kolkatta, 10.8 per cent in Mumbai and 8.6 per cent in New Delhi. The ADEPS done in Kerala showed that 11.2 per cent of the subjects had either IFG or IGT17. The PODIS reported that the prevalence of IGT was significantly high in both rural and urban populations. [19] The screening result of the present study also reported the increased prevalence rate of prediabetes (6.6%) among few select tribal populations. .

Increase in the prevalence of type 2 diabetes may also result due to migration (a move from one environment to another, either external or internal), which brings with it marked social and cultural changes. Misra and colleagues [20] reported that migration from rural areas to urban slums in a metropolitan city in India led to obesity, glucose intolerance, and dyslipidaemia. Many epidemiological studies on diabetes in migrant populations, mostly in people originating from developing countries, have reported a higher prevalence of diabetes than the host populations of those countries. Our study also supported the above fact that due to migration of this population from their originality leads to changing their lifestyles patterns led to type 2 DM and associated risk factors like obesity, hypertension.

CONCLUSION

The incidence rate of type 2 DM and prediabetes were on the increase among these populations .Previously these populations were free of such kind of lifestyle oriented diseases. But now days the lifestyle patterns of these populations follows the rural and urban lifestyles. The reason as quoted above was lack of their own occupation and were forced to adopted new lifestyles resulting in falling a prey to new kind of diseases

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