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COMMUNITY BASED STUDY ON INCIDENCE OF TYPE 2 DIABETES AND HYPERTENSION AMONG NOMAD TRIBAL POPULATION OF RAJASTHAN, INDIA

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ABSTRACT
A pilot study, consisting of a total sample of three hundred and ten comprising both non-tribals (44.2%) and tribal (55.8%) subjects of age ≥18 years, was conducted. All subjects lived in different locations of Jhunjhunu district of Rajasthan. Blood glucose levels, blood pressure, height, weight, waist girth, and hip circumference were measured. The crude prevalence of type 2 diabetes was 5.2% among tribal population and 0.7% in non–tribal subjects. Prevalence of pre-hypertension and hypertension was found to be 36.4% and 19.7% among tribals and 23.5% and 17.5% in non- tribal population. The risk for diabetes was equal in both tribesmen (3.0%) and tribeswomen (2.8%), while that for high blood pressure was higher in females (20.9%) as compared to males (15.8 %). The percentage of participants with BMI between 23-25 (for non-tribal) was 7.3 % and for >25 was 16.8%. Among the tribal population the percentage of participants with BMI between 23-25 was 19.7% and for >25 it was 15.0%. Females were found to have a higher BMI as compared to males in both the groups. Prevalence of liquor consumption was (57.6 %) among tribal population and 42.4 % in non-tribal category. The results of our screening suggest that large scale epidemiological studies be undertaken to ascertain the causes of the rising T2DM epidemic, for either halting or possibly even reversing this trend by concerted preventive measures taken by public health policy makers through the active support of all concerned stakeholders.

KEYWORDS: Nomad Tribal Population, Rural Population, Type 2 Diabetes, Screening, Hypertension, Body Mass Index (BMI).

INTRODUCTION

Widespread poverty, lack of health education, poor sanitation, lack of personal hygiene, inaccessibility and affordability to health services, poor maternal and child health services, illiteracy, malnourished, and various unknown factors have been identified as conditions responsible for the deprived health status of the Nomads. Tribal settlements tend to be segregated at various places and isolated from the urbanization[1], In India, roughly twelve per cent of population is nomadic. Inspite of such large numbers, Nomads or indigenous population have not been given much attention by the policy makers. Being illiterates and ignorant they were the most sufferers and almost ruined by urbanization and modernization technology due to lack in skilled proficiency.

As citied in the article of Sayeed *et al* [2] that Diabetes is on the rise in almost all over the developing States in various South east Asian countries.[3] Even the similar trend was seen among the Tribal or Aboriginal population that showed an increase prevalence in the development of this disease i.e. Type 2 DM.[4] As Nomads or tribal population normally keep on moving from one place to another in search of employment and they were ignorant about this disease because of the lack of awareness and accessibility to medical facilities. Tribal population of other States like America, Alaska, Canada and the aborigines of Australia had also shown an increase in the rising status of this disease and also it was noticed that this population have a high prevalence of metabolic syndrome [5, 6, 9].Similar findings have been noticed among tribal populations from northern Sudan, [10] United Arab Emirates [11] and Taiwan.[12]

One study conducted in 2004, on Raica tribe of Rajasthan State by Aggrawal *et al*, [13] 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. Review of literature revealed that very few studies are available in this context regarding the prevalence of diabetes among the different Nomads Tribal population of Rajasthan. Keeping this in mind we studied the prevalence of diabetes and hypertension in different castes of tribal population covering Natt, Sapera and the Banjara communities and compared them with non-tribal population from the same geographical region.

METHODOLOGY

The present study was conducted during September to November 2009 in the Jhunjhunu district of Rajasthan, one of the thirty two districts in this state. The initial contact with tribals' living conditions and life styles was through elders of tribal community and other people living in and around tribal habitations. Nearby villages with same living environment were selected to screen as general rural population for comparison. These villages had sparsely scattered houses. The local villagers were also used as interpreters, as required. The objectives and procedural details of the study were explained to the subjects in their local language. 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 their written consent

Diabetes Survey and Data Collection

For the purpose of the 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 schedule was planned and got it finalized after field trial. The parameters included age of respondents, gender, edification, profession, annual family earnings, and members in the family, culture, caste, and living condition. 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 interview 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 pressure, fasting plasma glucose and/or random plasma glucose test. 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 taking standing height, the measurement has been taken with the help of stadiometer. 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.[14]

RESULT

The present study was carried out in 310 subjects comprising of 173 tribal and 137 non tribal. Tribal population consisted of 91 females (mean age, 41.48±17.46) and 82 males (mean age, 35.67±16.19 and non-tribals consisted of 86 females (mean age, 55.80±14.69) and 51 males (mean age 63.27 ±11.68) respectively. Table 1 shows demographic, anthropometric and other clinical characteristics of both the tribal and non-tribal categories.

TABLE 1. Baseline characteristics of study participants

Variables	Tribal, N =173		Non-Tribal, N = 137	
	Females, N=91	Males, N = 82	Females, N = 86	Males, N = 51
Age (in yr)	41.48+17.46	35.67 ± 16.19	55.80 ± 14.69	63.27 ± 11.68
Height (cm)	153.38+7.53	164.11 ± 6.51	158.29 ±7.68	167.58 ± 10.2
Weight (Kg)	51.32+10.779	56.77 ± 9.90	53.34 ± 12.8	54.62 ± 11.6
Hip Circumference (cm)	82.59 ±11.57	84.57 ±10.1	88.70 ±13.69	85.59 ±10.27
Waist Circumference (cm)	74.09 ±12.55	75.64 ±11.59	78.22 ±13.2	76.19 ±13.26
BMI (Kg/m2)	21.79 ±4.44	21.19 ±3.23	21.30 ±4.93	19.41 ±3.46
SBP (mm/Hg)	126.46 ±21.42	126.15 ±15.66	123.80 ±18.11	119.58 ±16
DBP (mm/Hg)	81.27 ±13.23	80.40 ±10.71	81.01 ±12.6	75.58 ±12.6
Liquor Consumption (ml)	0.00	356.71±192.57	0.00	431.37±234.93
FBG levels (mg/dl)	109.55±36.31	104.44±30.61	103.38±16.66	107.73±15.86

TABLE 2. Prevalence of Obesity and Overweight among Tribal and Non tribal population

		Body mass index[#]				
		18 – 22.9 (Normal)	23 – 25 (Over weight)	Over 25 (Obese)	below 18 (under weight)	Total
Population	Non-Tribals	66 (48.2%)	10 (7.3%)	23 (16.8%)	38 (27.7%)	137
Gender	Male	30 (24.6%)	1 (3.7%)	5 (8.6%)	15 (14.1%)	51
	Female	36 (41.4%)	9 (6.3%)	18 (14.4%)	23 (23.9%)	86
	Tribals	80 (46.2%)	34 (19.7%)	26 (15.0%)	33 (19.1%)	173
	Male	44 (53.7%)	16 (19.5%)	8 (9.8%)	14 (17.1%)	82
	Female	36 (39.6%)	18 (19.8%)	18 (19.8%)	19 (20.1%)	91

[#] (Misra A, 2003)

Table 2 presents the prevalence of obesity and overweight among tribals and non-tribals. In tribals prevalence of underweight, normal, overweight and obese individuals was 19.1%, 46.2%, 19.7% and 15.0 % respectively. There was almost equal representation of underweight and overweight individuals among the tribals (19.7% vs. 19.1 %).

In non-tribal population prevalence of underweight, normal, overweight, and obese individuals were 27.7%, 48.2%, 7.3 % and 16.8 %). There were almost equal percentages of obese individuals among the tribals and non-tribals i.e. 15.0% vs 16.8 % respectively, but there were more overweight individuals in tribal population (19.7%) as compared to non-tribal population (7.3%).

There was a statistically significant difference (X2 = 10.936, p <0.012) in the distribution of BMI among tribal and non-tribal subjects. It was found that a higher number of females were overweight in both tribal and non tribal population i.e. 6.3% and 19.8% as compared to males in both population i.e. 3.7% and 19.5%. Similarly higher numbers of obese females were observed i.e.14.4% and 19.8% respectively in both population as compared to males i.e. 8.6% and 9.8 %. Thus, a significant relation was observed between gender and body mass index. (Chi-square = 9.421, p<0.024). Prevalence of hypertension among tribals and non tribals was analyzed according to ADA guidelines as shown in Table 3. In non-tribal population the prevalence of early high blood pressure and high blood pressure was 23.4% and 17.5%, whereas in tribal population the prevalence of early high blood pressure and high blood pressure was 36.4% and 19.7% .Chi-square was found to be significant.(X2= 7.925,p=0.019). The prevalence of hypertension according to gender is also presented in Table 3. Females were found to be at a marginally higher risk than males and the trend was similar in both the tribal and non tribal populations.

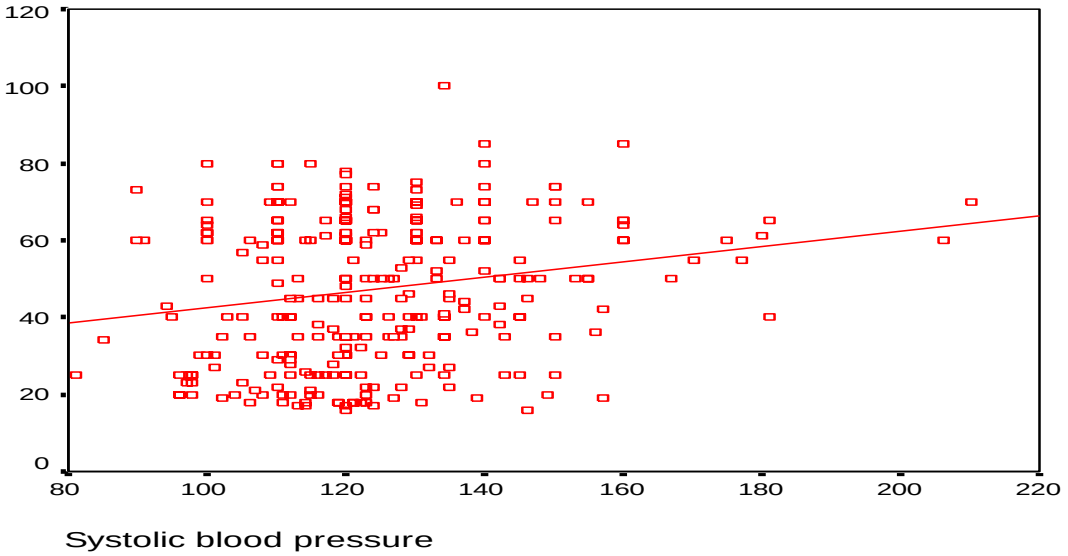
TABLE 3. Prevalence of hypertension among tribals and non-tribals in different sexes

		Blood pressure		
		Healthy blood pressure N (%)	Early high blood pressure N (%)	High blood pressure N (%)
Population	Non-tribal category (N =137)	81 (59.1%)	32 (23.4%)	24 (17.5%)
	Tribal category (N = 173)	76 (43.9%)	63 (36.4%)	34 (19.7%)
Gender	Male (N = 133)	68 (51.1%)	44 (33.1%)	21(15.8%)
	Female (N =177)	89 (50.3%)	51 (28.8%)	37 (20.9%)

TABLE 4. Prevalence of prediabetes (risk zone) and diabetes among tribal and non tribal population

		Random Blood Glucose test		
		Negative< 200 mg/dl N (%)	Positive > 200 mg/dl N (%)	At risk zone(>140 , <200 mg/dl) N (%)
Population	Non-tribal category (N = 137)	131 (95.6%)	1 (.7%)	5 (3.6%)
	Tribal category (N =173)	154 (89.0%)	9 (5.2%)	1 0 (5.8%)
Gender	Male (N= 133)	122 (91.7%)	4 (3.0%)	7 (5.3%)
	Female (N=177)	164 (92.7%)	5 (2.8%)	8 (4.5%)

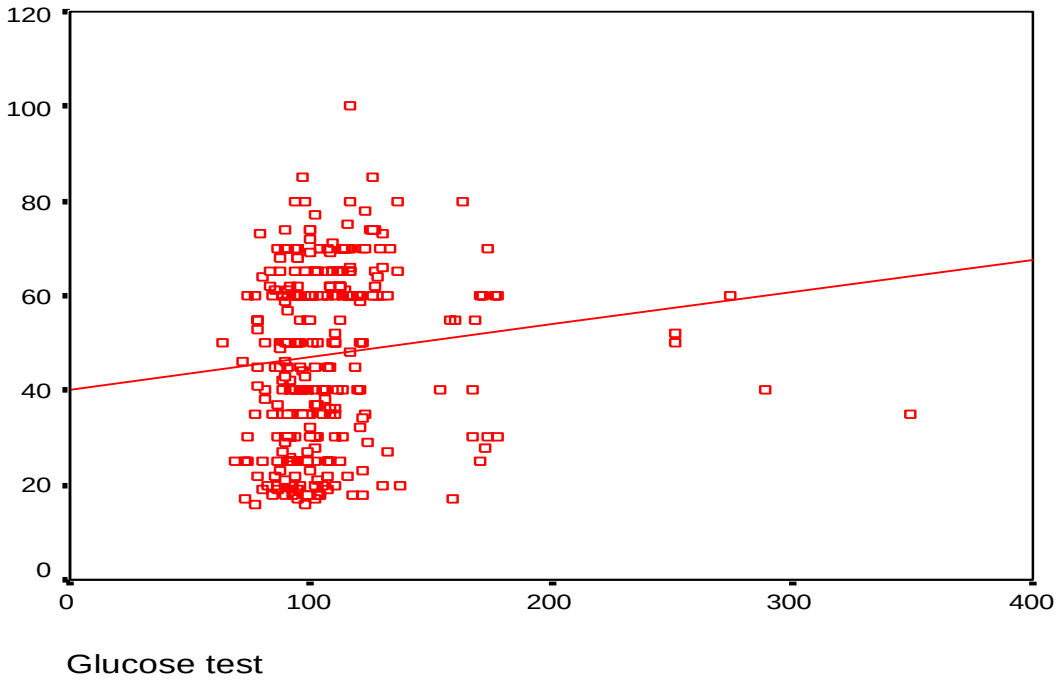
Figure 1. Correlation between age of respondents and systolic blood pressure among tribals and non-tribals



X, Y Scatter plot

These are plots of X; Y coordinates showing positive correlation(r=0.199) p-value (0.001), between age of respondents and systolic blood pressure.

FIGURE 2. Correlation between increasing age and prevalence of prediabetes and diabetes among tribal and non-tribal population



X, Y Scatter plot

These are plots of X; Y coordinates showing positive correlation(r = .115), p-value (0.001), between age of respondents and glucose positive test.

Linear regression was done to find out the correlation between age and systolic blood pressure and a positive relationship (r=0.199) was observed between systolic blood pressure and age and based on the t-value (3.511) and p-value (0.001), we can conclude that this relationship is statistically significant. (Figure 1).

As can be seen from Table 4 the prevalence of prediabetes and diabetes in tribals was 5.2% and 5.8% respectively. The prevalence of prediabetes and diabetes in non-tribals was 0.7% and 3.6% respectively. Ch-square was calculated between tribal and non tribal group and it was found to be statistically significant X2 = 5.821, $p < 0.05$. Table 4 also presents the prevalence of prediabetes and diabetes according to gender among tribals and non tribals. It was found that there was equal representation of both prediabetes and diabetes test in both sexes. (Males vs. Females chi-square =.316, p = .854).

Correlation analysis was calculated to find out the positive relationship between increasing age and prevalence of prediabetes and diabetes among tribal and non-tribal population. There was found a strong positive correlation between the age of respondents and prevalence of T2DM disease. (r = .115, p= .001). (Fig 2). The prevalence of liquor consumption among tribal and non-tribal population was found to differ with tribal males consuming more liquor, (57.6%) as compared to non-tribal males, (42.4%).

DISCUSSION

It has been now the known fact, that the diabetes is increasing all over the sphere at an alarming rate.[15] Over the past so many years diabetes considered to be the disease of old aged people but the actual facts of today's that it has been seen in the young and middle aged population especially the type 2 DM and is the major cause of mortality and morbidity among them.[16] India is considered to be one among with the largest cases of type 2 diabetic subjects thus having the lead position of being termed the " Diabetes capital of the World". Presently India has around 40 million cases of diabetes and if urgency about the prevention has not declared the cases of type 2 Diabetes mellitus is expected to increase to 70 million by 2025.[17] According to Deepa *et al* [18] that the Asian Indians Phenotype has unique clinical and biochemical abnormalities which include insulin resistance, greater abdominal adiposity i.e. higher waist circumference despite lower body mass index, lower adiponectin and higher C-reactive protein level were more prone to diabetes and premature coronary heart diseases as citied in Chandramohan and Mohan. Editorial [19]

Our study addressed the prevalence of prediabetes, diabetes prehypertension and hypertension among the indigenous tribal and non-tribal population in Rajasthan. The prevalence of prediabetes (5.8%), diabetes, (5.2%), prehypertension (36.4%) and hypertension (19.7%) among tribal population observed in this study is comparable to the prevalence found in Alaskan Natives,[7] Canadian Saskatchewan First Nations, [8] Danagla community of Sudan [10] and those of Bedouin origin in the Arab Emirates.[11] The incidence of prediabetes, diabetes and hypertension was higher in the tribal than the non- tribal population owing to stressful living in a disowned territory and adoption of significant lifestyle changes different from ancestral indigenous lifestyle.

It is noteworthy that tribal ancestral lifestyle was dependent on hunting and gathering food together with cultivation of limited food crops. They have now been

forced to adopt a lifestyle based on cultivation of different crops, low-wage livelihoods in business, service, and other mixed occupations like mazdoori or labor etc. Among the investigated risk factors, increasing age, general obesity (BMI), and consumption of liquor were found to have a higher contribution to risk for developing diabetes and hypertension. These findings are consistent with other tribal and non tribal populations.[7-11, 20 - 22] It has been noticed that the prevalence of diabetes rises considerably throughout the world. The percentage of its incidence varies from place to place and region to region. It has been reported that the prevalence of type 2 DM varied between 2.4% [23] and 4.9% [24] for rural areas and 3.2% [25] and 15.4% [26] for urban areas in different parts of India as reported in Kokiwar *et al* 2007 [27] that was based upon different criteria of diagnosing type 2 DM. Sayeed *et al* found a prevalence of 4.3% in rural Bangladesh used 1997 ADA diagnostic guidelines.

Our study showed a higher prevalence of type 2 diabetes mellitus as compared to other studies from rural India. With growing urbanization and sedentary lifestyle tribal population are also residing in and around villages and have adopted a lifestyle similar to them, and for that reason they have similar prevalence as rural population as shown in other studies.

The results of our screening suggest that large scale epidemiological studies be undertaken to ascertain the causes of the rising Type 2 DM epidemic, for either halting or possibly even reversing this trend by concerted preventive measures taken by public health policy makers through the active support of all concerned stakeholders.

CONCLUSION

The prevalence of prediabetes and diabetes in the tribal population was found to be higher than that in non-tribal population in Rajasthan. The relative independent contribution of excess adiposity, as indexed by measures of weight and square of height i.e. BMI known to be an modifier risk factor for obesity related ill health. Advancing age and liquor consumption might play associated role in the development of Type 2 diabetes mellitus and hypertension. The prevalence rate of diabetes and its complications is increasing continuously among these communities due to lack of access to diabetes care and knowledge. Based on the study results, we expect that health care professionals and planners should develop strategies to overcome this problem and make diabetes care accessible and affordable to the tribal population

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