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STUDY ON PREVALENCE AND RISK FACTORS ASSOCIATED WITH HYPERTENSION IN DIABETES MELLITUS

E. Raja Sree[1]*, J. Uma Bharathi[1], K. Sowjanya[1], G. Sravani[1], A. Veena Reddy[1], A. Reena Mary[1], M. Vanitha[1]

[1]Department of Pharmacology, Bojjam Narasimhulu Pharmacy College for Women.

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***Corresponding Author**
E. Raja Sree
Department of Pharmacology, Bojjam Narasimhulu Pharmacy College for Women.

ABSTRACT

Diabetes mellitus type 2 (also known as **type 2 diabetes**) is a long term metabolic disorder that is characterized by high blood sugar, insulin resistance, and relative lack of insulin.[3] Common symptoms include increased thirst, frequent urination, and unexplained weight loss. Symptoms may also include increased hunger, feeling tired, and sores that do not heal.[4] To assess the prevalence of hypertension and diabetes and the status of known risk factors. The study was conduct between 2017 and 2018. The study design including study instruments and informed consent form, were approved by the IRB of the Moving Academy of Medicine and Biomedicine both from scientific and ethical angles. Altogether, the six tribal Padas (tribal hamlet) in this study consisted of 37 families, with a total population of 68 and women to men ratio of 0.94. Adults accounted for 52.5% of the population. Two-thirds of the adults (51/68), of which 53.4% (27/81) were women, participated in the study. All families were approached. Only one family of four adults refused to participate in the study. They were not included in the study. In this study, the overall prevalence of systolic hypertension was found to be 16% and 17.8% in women and men, respectively. Prevalence progressively increased with age and the trend of age versus hypertension was highly significant statistically in both sexes. Hypertension was present in more than half of the participants above 60 years of age. DBP showed a similar trend in our study performed in Telangana State.

INTRODUCTION

Diabetes mellitus type 2 (also known as **type 2 diabetes**) is a long term metabolic disorder that is characterized by high blood sugar, insulin resistance, and relative lack

of insulin.[3] Common symptoms include increased thirst, frequent urination, and unexplained weight loss. Symptoms may also include increased hunger, feeling tired, and sores that do not heal.[4] Often symptoms come on slowly.[3] Long-term complications from high blood sugar include heart disease, strokes, diabetic retinopathy which can result in blindness, kidney failure, and poor blood flow in the limbs which may lead to amputations.[1] The sudden onset of hyperosmolar hyperglycemic state may occur; however, ketoacidosis is uncommon.[5][6]

Type 2 diabetes primarily occurs as a result of obesity and not enough exercise.[1] Some people are more genetically at risk than others.[3] Type 2 diabetes makes up about 90% of cases of diabetes, with the other 10% due primarily to diabetes mellitus type 1 and gestational diabetes.[1] In diabetes mellitus type 1 there is an absolute lack of insulin due to breakdown of islet cells in the pancreas.[7] Diagnosis of diabetes is by blood tests such as fasting plasma glucose, oral glucose tolerance test, or A1C.[4]

Type 2 diabetes is partly preventable by staying a normal weight, exercising regularly, and eating properly. Treatment involves exercise and dietary changes.[1] If blood sugar levels are not adequately lowered, the medication metformin is typically recommended.[8][9] Many people may eventually also require insulin injections.[10] In those on insulin, routinely checking blood sugar levels is advised; however, this may not be needed in those taking pills.[11] Bariatric surgery often improves diabetes in those who are obese.[12][13]

Rates of type 2 diabetes have increased markedly since 1960 in parallel with obesity.[14] As of 2013 there were approximately 368 million people diagnosed with the disease compared to around 30 million in 1985.[15][16] Typically it begins in middle or older age,[3] although rates of type 2 diabetes are increasing in young people.[17][18] Type 2 diabetes is associated with a ten-year-shorter life expectancy.[19] Diabetes was one of the first diseases described.[20] The importance of insulin in the disease was determined in the 1920s.[21]

Type 2 diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion. See Clinical Findings in Diabetes Mellitus, a Critical Images slideshow, to help identify various cutaneous, ophthalmologic, vascular, and neurologic manifestations of DM.Your pancreas makes a hormone called insulin. It's what lets your cells turn glucose from the food you eat into energy.

People with type 2 diabetes make insulin, but their cells don't use it as well as they should. Doctors call this insulin resistance.

At first, the pancreas makes more insulin to try to get glucose into the cells. But eventually it can't keep up, and the sugar builds up in your blood instead.

Usually a combination of things cause type 2 diabetes, including.
Genes. Scientists have found different bits of DNA that affect how your body makes insulin.
Extra weight. Being overweight or obese can cause insulin resistance, especially if you carry your extra pounds around the middle. Now type 2 diabetes affects kids and teens as well as adults, mainly because of childhood obesity.

Metabolic syndrome. People with insulin resistance often have a group of conditions including high blood glucose, extra fat around the waist, high blood pressure, and high cholesterol and triglycerides.

Too much glucose from your liver. When your blood sugar is low, your liver makes and sends out glucose. After you eat, your blood sugar goes up, and usually the liver will slow down and store its glucose for later. But some people's livers don't. They keep cranking out sugar.

Bad communication between cells. Sometimes cells send the wrong signals or don't pick up messages correctly. When these problems affect how your cells make and use insulin or glucose, a chain reaction can lead to diabetes.

Broken beta cells. If the cells that make the insulin send out the wrong amount of insulin at the wrong time, your blood sugar gets thrown off. High blood glucose can damage these cells, too.

EPIDEMOLOGY

Globally as of 2010 it was estimated that there were 285 million people with type 2 diabetes making up about 90% of diabetes cases.[19] This is equivalent to about 6% of the world's adult population.[99] Diabetes is common both in the developed and the developing world.[19] It remains uncommon, however, in the underdeveloped world.[7]

The aim of the study is To assess the prevalence of hypertension and diabetes and the status of known risk factors. The objective of this study was to generate data on the status of hypertension and diabetes

MATERIALS AND METHODS

The study was conduct between 2017 and 2018. The study design including study instruments and informed consent form, were approved by the IRB of the Moving Academy of Medicine and Biomedicine both from scientific and ethical angles.

Before starting the project, informal group discussions were held with the inhabitants of the Padas, and they were acquainted with the details of the project. It was emphasized that the study would not interfere in any way in their daily routine and that participation would be entirely voluntary. Anyone was free to withdraw at any time in the course of the study. Before starting the project, informed consent was obtained from each participant. At no stage, there was any coercion and no incentives financial or in kind were given to the participants. After the group discussion with members of the research team (expert from the academy and students) made house to house visits and again explained the project emphasizing the fact that the participation was entirely voluntary. The nature of the project was explained orally, and informed consent was obtained in the IRB-approved "informed consent form" which was in the local language.

IRB-approved prOformas were used to get information on sociodemographic variables, economic status, educational levels, substance abuse related to tobacco and alcohol, and dietary pattern including the main source of protein (vegetarian or nonvegetarians) and intake of green leafy vegetables and fruits from the participants. Only verbal information provided by the participants was recorded.

Classification of systolic BP (SBP) and diastolic BP (DBP) was done according to the recommendations of JNC 7 report into normal (<120/< 80 mmHg) prehypertensive (120–139/80–89 mmHg) and hypertension (≥140/≥90 mmHg).[16] Fasting capillary blood glucose (CBG) was measured after an overnight fast using ACCU-CHEK glucometer, Roche Diagnostics, Germany.[17] As per the recommendation of the Indian Council of Medical Research (ICMR) working group, fasting CBG of <110 mg/dl, 110–125 mg/dl and ≥126 mg/dl were considered as normal, prediabetic and diabetic, respectively.[8] Serum cholesterol was measured on fasting samples using an enzyme-based method and expressed as mg/dl of serum.[18] The measurements were made using autoanalyzer and ErbaLachema (Karasek, Czech Republic) enzymatic kit. Hypercholesterolemia was defined as serum cholesterol of ≥200 mg/dl.

Height was measured using a wall-mounted stadiometer, a prototype of Seca model SE 206 (Seca, UK). A suitable flat spot was selected in every house where the tape was mounted against a wall. The participants were asked to take out shoes and stand erect with their backs to the wall, heels together and looking straight. The height was recorded in cm. Digital balance (Venus), which was standardized every week, was used to record the weight in kg to the nearest decimal place. The machine was kept on a horizontal flat surface. In every house, the zero was adjusted before recording weight. Participants were asked to put on only light clothes. Body mass index (BMI) was calculated using height and weight and expressed as mass in kg/m^2. Study population was categorized as per the WHO norms into severely underweight (BMI <16 kg/m^2), underweight (16–18.4 kg/m^2), normal (BMI 18.5–24.9 kg/m^2), overweight (BMI 25–29.9 kg/m^2), and obese (BMI ≥30 kg/m^2).[15] BP was recorded in sitting posture in the left arm using Omron digital BP apparatus (SEM-1 model, Omron Health Care Co., Ltd. Japan). BP was recorded always after 10 min of rest. Two readings were taken at 10 min interval and the mean was recorded as the BP in mmHg to the nearest full number. All study instruments and laboratory procedures were validated periodically by academy's experts. Clinical data were cross-checked by the visiting consultant.

Statistical analysis

The sample size was calculated using the following standard formula for finite population.Datawere summarized into numbers, percentages, mean and standard deviation. The Chi-square test was applied to assess the trend as well as gender wise difference in study variables. Student's *t*-test was applied to compare the difference in means of two categories. The trend, as well as the difference, was said to be significant if $P < 0.05$.

SPSS (Statistical Package for the Social Sciences) version 20 software (IBM Corp Armonk, NY, USA) was used for statistical analysis.

RESULTS

Altogether, the six tribal Padas (tribal hamlet) in this study consisted of 37 families, with a total population of 68 and women to men ratio of 0.94. Adults accounted for 52.5% of the population. Two-thirds of the adults (51/68), of which 53.4% (27/81) were women, participated in the study. All families were approached. Only one family of four adults refused to participate in the study. They were not included in the study. Tribals have a large floating population as both men and women generally leave Pada in search of jobs in the

morning and return after few days. Only those who were present at the time of visit were enrolled in the project.

General features and anthropometric measurements

Information obtained on sociodemographic parameters, economic status, educational level, dietary patterns, and habits of the study population is shown in Table 1. More than 95% of the participants were "Yellow card" holders, an indication that they were below the poverty line by the criteria used by the Government of India. Three-fourth of the tribal women and about 60% men were illiterate – they could not even sign their names. The majority of tribals were on vegetarian diet, which was their main source for proteins and calories. Green leafy vegetable and fruits were taken irregularly once or twice a week only by 60% of the families. Tobacco smoking/chewing was a widely prevalent habit being present in 57.4% and 64.9% women and men, respectively. Twenty percent women and half of men consumed "country-made" liquor regularly. Almost all participants were manual laborers mostly at construction sites, in brick factories or farms, putting them in the category of "vigorous activity."

Table 1: Socioeconomic, educational, and dietary pattern in study population.

	Women (27) (%)	**Men (24) (%)**	**P value**
Income			
Below BPL (yellow card)*	(96.8)	(95.8)	NS
Above BPL	(3.2)	8 (4.2)	
Occupation			
Manual labor	27(100.0)	24 (100.0)	
Education			
Illiterate	(77.2)	(57.6)	<0.001
Literate	(22.8)	(42.4)	
Primary	(17.3)	(22.0)	
Secondary	(5.5)	(18.3)	
Junior College	-	(2.1)	
Tobacco habits (smoking/chewing)			
No	(42.5)	(35.1)	NS
Yes	(57.5)	(64.9)	
Chewing	126	(both)	
Smoking	-	-	
Areca nut/gutka			
No	(75.8)	(73.8)	NS
Yes	(24.2)	(26.2)	
Alcohol			
No	(81.9)	(58.5)	<0.001

Yes	(18.1)	(41.5)	
Green leafy vegetables/week			
No	(20.5)	(8.4)	NS
Yes	(79.5)	(91.6)	
Once a week	(21.0)	(18.8)	
Twice a week	(34.7)	(37.7)	
Thrice a week	(16.4)	(26.7)	
Four times a week	(7.4)	(8.4)	
Citrus fruit			
No	(35.6)	(51.8)	<0.001
Yes	(64.4)	(48.2)	
Protein intake vegetable pulses/milk			
No	(26.5)	(44)	<0.001
Yes	(73.5)	(56)	
Protein intake nonvegetable egg, meat**			
No	(23.3)	(9.4)	<0.002
Yes**	(76.7)	(90.6)	

Graph 1: Socioeconomic, educational, and dietary pattern in study population.

There was no difference in average age between women (34.1 ± 13.49 years) and men (34.1 ± 12.96 years). Average women height, weight, and BMI were 148.9 ± 7.66 cm, 42.2 ± 7.59 kg, and 19.2 ± 3.74 kg/m^2 respectively [Table 2]. In comparison, men were taller (159.9 ± 6.82 cm) and heavier 50.9 ± 8.99 kg and also had better BMI (19.9 ± 3.50 kg/m^2). These differences were statistically significant. The mean SBP and DBP in women/men were 125 ± 19.9/129 ± 19.0 and 79 ± 11.91/80 ± 12.21 mmHg, respectively. Average CBG in women was 102 ± 29.52 almost same as that in the men. Average serum cholesterol showed a similar trend (women 130 ± 36.47 and men 125 ± 40.3 mg/dl).

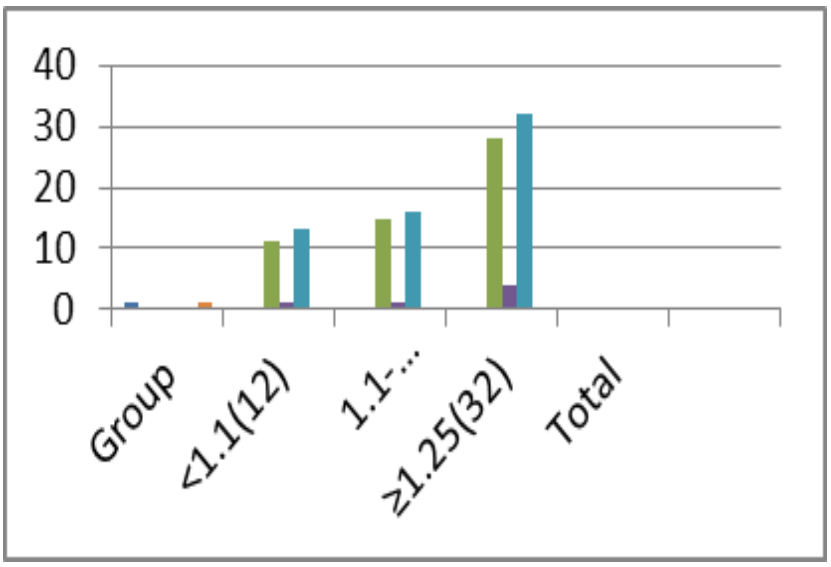
Table 2: Anthropometric parameters, blood pressure, fasting capillary blood glucose, and serum cholesterol in the study population.

Sex	Age groups	Participants (*n*)	Result are expressed as mean±SD							
			Age (year)	Height (cm)	Weight (kg)	BMI (kg/m^2)	SBP (mmHg)	DBP (mmHg)	CBG* (mg/dl)	Serum cholesterol* (mg/dl)
Women	<40	15	27.1±5.98	149.0±8.19	42.3±7.48	19.2±3.80	120±16.24	76.5±11.59	110 (156)±21.05	126 (134)±37.94
	40-59	9	46.0±5.70	149.3±6.85	42.3±7.89	19.0±3.68	131±19.44	83±9.82	112 (28)±61.21	138 (35)±32.76
	≥60	3	63.4±4.68	145.9±5.52	41.1±8.11	19.3±3.46	149±25.09	88±11.19	103 (21)±14.48	143 (19)±27.81
	All ages	27	34.1±13.49	148.9±7.76	42.2±7.59	19.2±3.74	125±19.9	79±11.91	102 (205)±29.52	130 (188)±36.47
Men	<40	8	26.9±5.75	160.4±6.32	50.6±8.69	19.7±3.36	126±14.59	77±10.50	101 (129)±15.28	121 (110)±38.87
	40-59	7	45.6±5.66	158.2±7.91	52.7±9.01	21.1±3.50	135±22.42	87±13.10	135 (24)±80.89	135 (36)±46.56
	≥60	9	64.6±4.52	160.7±7.30	47.8±11.19	18.5±4.13	136±28.69	81±15.51	110 (9)±17.49	120 (8)±22.26
	All ages	24	34.1±12.96	159.9±6.82	50.9±8.99	19.9±3.50	129±19.00	80±12.21	106 (162)±35.87	125 (154)±40.3
Overall	<40	23	27.0±5.86	154.2±9.31	46.1±9.06	19.4±3.61	123±15.79	77±11.09	100 (285)±18.64	124 (244)±38.3
	40-59	16	45.8±5.64	154.1±8.65	47.9±9.94	20.1±3.71	133±22.26	85±11.78	123 (52)±71.18	136 (71)±40.09
	≥60	12	63.9±4.58	151.7±9.54	43.7±9.85	18.9±3.69	144±26.91	85±13.39	105 (30)±15.49	136 (27)±27.96
	All ages	51	34.1±13.23	153.9±9.21	46.2±9.35	19.5±3.65	127±19.64	79±12.04	116 (367)±36.40	128 (342)±38.32

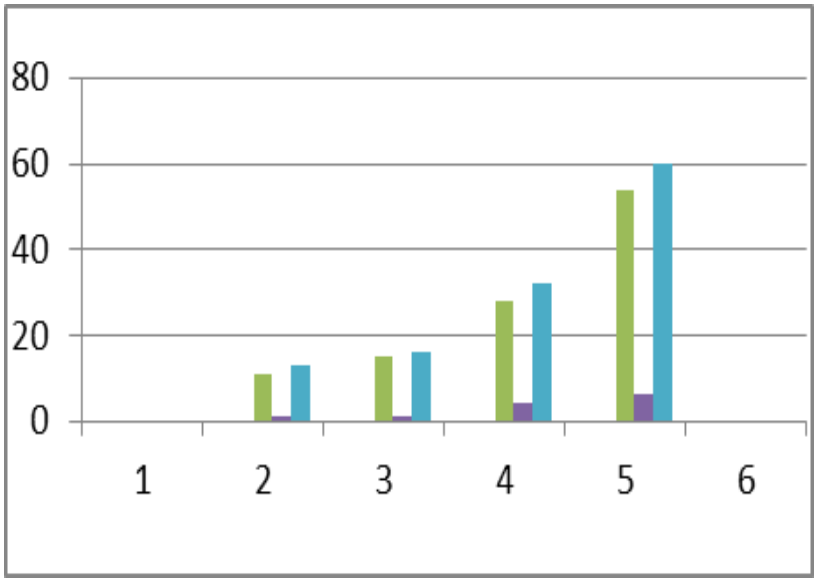
As judged by the BMI, about 50%, 7%, and 1% women were underweight, overweight, and obese, respectively. Men, in general, were better nourished; only one-third (36.7%) had BMI <18.5 kg/m^{2}and about 2% were obese. In χ^2 analysis for trend both in men and women, overweight and obesity were found to be independent of age [Table 3].

Table 3: Body mass index distribution in various age groups,

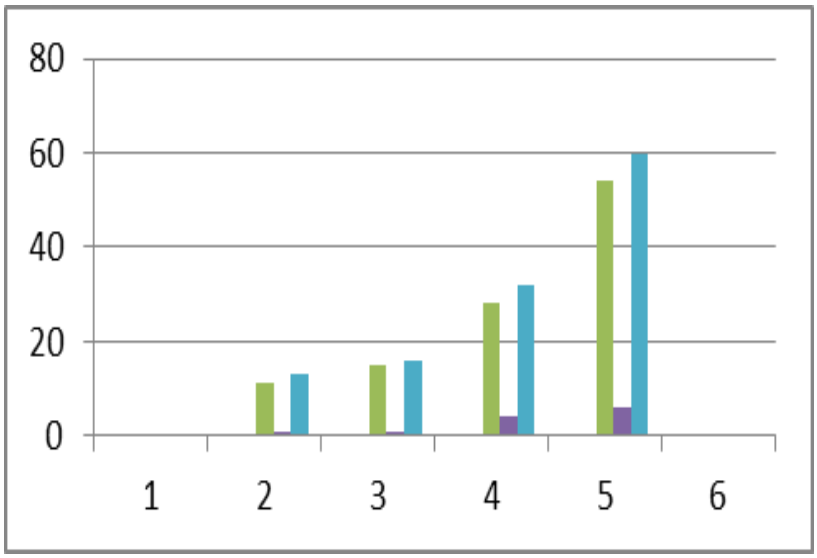
Sex	Age group	Participants (*n*)	BMI (kg/m^2)				
			<16	16-18.4	18.5-24.9	25-29.9	≥30
			Number of persons (%)				
Women	<40	15	24 (15.2)	51 (32.2)	69 (43.7)	12 (7.6)	2 (1.3)
	40-59	9	8 (20.5)	12 (30.8)	16 (41.0)	3 (7.7)	-
	60	3	-	12 (54.5)	9 (40.9)	-	1 (4.6)
	All ages	27	32 (14.6)	75 (34.3)	94 (42.9)	15 (6.8)	3 (1.4)
Men	<40	8	6 (4.5)	44 (33.3)	71 (53.8)	9 (6.8)	2 (1.6)
	40-59	7	-	12 (26.7)	28 (62.2)	4 (8.9)	1 (2.2)
	60	9	5 (35.7)	3 (21.4)	4 (28.6)	2 (14.3)	-
	All ages	24	11 (5.8)	59 (30.9)	103 (53.9)	15 (7.8)	3 (1.6)
Overall	<40	23	30 (10.3)	95 (32.8)	140 (48.3)	21 (7.2)	4 (1.4)
	40-59	16	8 (9.5)	24 (28.6)	44 (52.4)	7 (8.3)	1 (1.2)
	60	12	5 (13.9)	15 (41.7)	13 (36.1)	2 (5.6)	1 (2.7)
	All ages	51	43 (10.5)	134 (32.7)	197 (48.0)	30 (7.3)	6 (1.5)



Graph 3: Body mass index distribution in Women.



Graph 3: Body mass index distribution in Men.



Graph 3: Body mass index distribution in Overall.

Hypertension and diabetes

The overall prevalence of hypertension was 16% and 17.8% in women and men, respectively. The prevalence increased proportional to age in both sexes. The increase was statistically highly significant (χ^2 analysis for trend age vs. hypertension: $P < 0.0001$ in both sexes). Overweight emerged as a significant risk factor for hypertension in both the sexes.

Table 4: Systolic blood pressure and capillary blood sugar in the study population.

SBP (mmHg)				CBG (mg/dl)				
Participants number	Normal (<120)	Prehypertension (121-140)	Hypertension (>140)	Participants number	Normal (≤110)	Prediabetes (110-125)	Diabetes (≥126)	
	Number of persons (percentage in parentheses)				Number of persons (percentage in parentheses)			
Women								
<40	15	97 (61.4)	47 (29.7)	14 (8.9)	156	138 (88.5)	10 (6.4)	8 (5.1)
40-59	9	14 (35.9)	18 (46.1)	7 (18.0)	28	24 (85.6)	2 (7.2)	2 (7.2)
60	3	1 (4.5)	8 (36.4)	13 (59.1)	21	16 (76.2)	4 (19.0)	1 (4.8)
All ages	27	112 (51.1)	72 (32.9)	35 (16.0)	205	178 (86.8)	16 (7.8)	11 (5.4)
Men	8							
<40	7	49 (37.1)	68 (51.5)	15 (11.4)	129	103 (79.8)	17 (13.2)	9 (7.0)
40-59	9	12 (26.7)	20 (44.4)	13 (28.9)	24	15 (62.5)	3 (12.5)	6 (25)
60	24	5 (35.7)	3 (21.4)	6 (42.9)	9	7 (77.8)	1 (11.1)	1 (11.1)
All ages	23	66 (34.6)	91 (47.6)	34 (17.8)	162	125 (77.2)	21 (13.0)	16 (9.8)
Overall both sexes	16							
<40	12	146 (50.3)	115 (39.7)	29 (10.0)	285	241 (84.6)	27 (9.5)	17 (5.9)
40-59	51	26 (31.0)	38 (45.2)	20 (23.8)	52	39 (75.0)	5 (9.6)	8 (15.4)
60	15	6 (16.7)	11 (30.5)	19 (52.8)	30	23 (76.7)	5 (16.7)	2 (6.6)
All ages	9	178 (43.4)	163 (39.8)	69 (16.8)	367	303 (82.6)	37 (10.1)	27 (7.3)

Table 5: Gender wise distribution of body mass index, hypertension, and diabetes

Sex	BMI (kg/m^2)	Systolic hypertension (SBP >140 mmHg)		Diabetes (CBG >126 mg/dl)	
		Total number	Hypertensive, *n* (%)	Total number	Diabetes, *n* (%)
Women	<18.5	12	15 (14)	12	11 (10.8)
	18.5-24.9	7	13 (13.9)	7	6 (7.3)
	>25	8	6 (33.3)	8	4 (23.5)
Men	<18.5	7	9 (12.6)	7	8 (14)
	18.5-24.9	12	16 (15.5)	12	15 (16.9)
	>25	5	9 (50)	5	6 (37.5)
Overall	<18.5	20	24 (13.6)	20	19 (11.9)
	18.5-24.9	14	31 (15.7)	14	21 (12.3)
	>25	13	15 (41.7)	13	10 (30.3)

The overall prevalence of diabetes (CBG ≥126 mg/dl) was 5.4% and 9.8% in women and men, respectively. However, these differences were not statistically significant. Overall prevalence of diabetes (pooled data of both sexes) was 7.3%. The prevalence was not influenced by age in women (χ^2 analysis for trend) and only weakly so in men. Overweight did not affect prevalence of diabetes in both sexes.

Awareness about the hypertension was very low. Only 4 out of 24 men (2.1%) and 6 out of 27women (2.7%) were aware that they were suffering from hypertension. Situation about diabetes was worse as no affected subject was aware that he/she was suffering from the disease.

DISCUSSION

More than 40% and 60% men were addicted to alcohol and tobacco (mostly smoking) respectively. Addiction to alcohol was not a major issue in women. However, that was not the case with tobacco usage (mostly chewing) which was present in more than 50% women. Although both SBP and DBP were recorded in all participants, discussion in this communication is focused on the former as between the two SBP is a more important cardiovascular risk factor. Overall prevalence of hypertension and diabetes was modest except in the age group of ≥60 years, in which 50% were hypertensive. The average SBP was in the range of prehypertension in all age groups in both sexes.

There are wide variations in sociocultural, dietary pattern, and substance abuse in STs in different parts of India. However, this study indicates that nonvegetarian food articles are not

a regular part of their daily diet because meat items are not regularly available and very costly for them.

Two-third of men and more than 50% of women were addicted to tobacco. These figures are much lower than 94% reported by Misra *et al*.[10] in Mishing tribes in Assam.[10] On the other hand, only 34% of Saharia tribe in Madhya Pradesh were addicted to tobacco.[19] Although only 40% men accepted addiction to alcohol, this was a gross underestimation.

Prevalence of alcohol addiction, in this study, is similar to that reported by Misra *et al*.[10] but higher than that observed in some tribes in Madhya Pradesh and Gujarat.

Distribution of BMI, in our study, shows that about half of tribal women and one-third of men are underweight (BMI <18.5 kg/m^2). These figures are almost similar to those reported in the National Family Health Survey 3 (NFHS-3)[22] in which 46.4% and 41.4% tribal women and men respectively had BMI <18.5 kg/m^2. As compared to these populoation, smaller proportion of urban and rural women and men are underweight.[23,24]

Obesity is now seen in epidemic proportion in urban India.[25] The problem of overweight can no more be ignored even in rural India.[26] However, obesity is still not a problem in tribals.[11,22] Only 3% tribals (women 2%; men 4%) had hypercholesterolemia (total serum cholesterol >200 mg/dl), an indication of blood lipid levels (based on the analysis of data in Table 2).

Diabetes is now a major global health problem. Some 380 million people (5% of the world population) suffer from diabetes.[27] China, India, and the US in that order together account for half of the global burden for diabetes.[9] The mean prevalence of diabetes, which shows wide fluctuation in urban and rural populations, is 12.9% and 6.5%, respectively.[9] There are very limited data on the prevalence of diabetes in STs.

Upadhyay *et al*.[12] have recently conducted meta-analysis of the publications till 2012 on burden of diabetes in STs in India. Of 113 articles published on diabetes in Indian STs, only seven fulfilled the criteria for inclusion in the analysis, which speaks for paucity and the questionable quality of published data in the field.[12] Some major problems in the interpretation of the data were: heterogeneity in diagnostic criteria, lack of uniformity in sampling and restriction of the studies to certain regions.

Sample size in most of the publication was modest except in the studies done by Sachdev where number of participants' was 1296.[28] However, a close scrutiny shows that the study was done on seven nomadic tribes. Sample size in individual tribe varied from 46 to 435. The average estimated prevalence of diabetes in the meta-analysis was 5.9% (range 0.7%–10.1%) which is slightly lower than that observed in this study.

In this study, the overall prevalence of systolic hypertension was found to be 16% and 17.8% in women and men, respectively. Prevalence progressively increased with age and the trend of age versus hypertension was highly significant statistically in both sexes. Hypertension was present in more than half of the participants above 60 years of age. DBP showed a similar trend (data not shown). NNMB has published a special report on hypertension in tribals in nine states covering an adult population of more than 50,000.[14] However, despite the numbers, many epidemiological details are lacking, and in certain regions the sample size is modest.[13] There are wide variations in combined (both men and women) prevalence rates in different states. For example, the prevalence in Gujarat is as low as 7.9% as opposed to Orissa where it is 51.5%. Within the state also there are variations.

Of the seven regions in Madhya Pradesh where the survey was conducted the prevalence varied between 8.7% and 33.3%. Madhya Pradesh is the number one state in terms of population of STs and has many tribes. The differences could be due to variation in the type-specific prevalence. However, the report does not provide such data.[13,14]

Recently, Rizwan *et al*. made meta-analysis of 20 studies that included 53 sub-populations and more than 60,000 subjects.[13] There was wide variation in the prevalence in different publications. The overall average estimated prevalence on the basis of the meta-analysis was 16.1%. The variables that influenced the results were the year of study, acculturation status, and BP measurement techniques. Prevalence of hypertension in our study is lower than that reported for urban as well as rural areas.[7,8] Whereas our studies showed a robust influence of age on prevalence of hypertension that was not the case with the meta-analysis in which there was only weak correlation between age and hypertension.[13] This may be because only four studies in the meta-analysis had some sort of age stratification that too was restricted to two categories namely ≤45 and ≥45 years. However, age, in general, is considered to be a risk factor both for diabetes and hypertension.[29]

Over the years prevalence of both hypertension and diabetes is progressively increasing. This is most evident in urban areas but is also witnessed now in the rural population. Of the numerous risk factors overweight, body fat distribution, hyperlipidemia, unhealthy imbalanced diet (diet rich in fat) and sedentary lifestyle are the most important risk factors for both diabetes and hypertension. None of these are present in tribals in this study.

CONCLUSION

In this study, the overall prevalence of systolic hypertension was found to be 16% and 17.8% in women and men, respectively. Prevalence progressively increased with age and the trend of age versus hypertension was highly significant statistically in both sexes. Hypertension was present in more than half of the participants above 60 years of age. DBP showed a similar trend in our study performed in Telangana State.

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