

Prevalence of Hypertension Among Tribal Population in India: A Systematic Review and Meta-Analysis

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ABSTRACT

Hypertension is an important worldwide public-health challenge and it is accountable for 7% of Disability Adjusted Life Years (DALY) loss, and by the end of 2025 about 29% of world's population is likely to suffer from hypertension. Tribal population constitute about 8% of the total population in India. Among tribal population, study on hypertension will provide an interesting outcome because studies across the world have shown a lower prevalence. The objective of the study was to estimate the pooled prevalence of hypertension among adult tribal populations in India and also to analyse the possible sources of heterogeneity in the estimate. A systematic search was performed in PubMed, Google scholar, Scopus, Embase MEDLINE, and journals for articles published between 2001 and 2020. This is a systematic review and meta-analysis done on hypertension among tribal populations of India. Three authors independently reviewed the articles, performed quality assessment and data was extracted. Pooled estimate of hypertension was calculated. Subgroup analyses was performed. A total of 26 articles with a total number of subjects of 75,543 were included in the study. The pooled estimate of hypertension prevalence was 25.1% (95% CI: 24.7, 25.4). There was significant heterogeneity among the studies ($I^2 = 98.2$ and $Q = 1289.37$). It is essential to conduct larger cohort studies and randomised controlled trials to determine the causes of the increased prevalence of hypertension among the tribal population. The prevalence of hypertension among tribal population are essential as a source of primary information and for rational planning of health services and will help public-health policy-makers to assign sufficient priority and resources for its management and prevention.

Keywords: Hypertension, Tribal health, non-Communicable disease, Hypertension, Prevalence

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INTRODUCTION

Non-communicable diseases are the most important causes of mortality and morbidity in India.¹ Data from the Registrar General of India, World Health Organization and Global Burden of Disease (GBD) Study have reported that cardiovascular diseases (CVD) are the most important causes of death and disability. According to WHO, the mortality rate of non-communicable diseases is 74% of all deaths globally.² According to a report by Ministry of Health and Family welfare, the prevalence of NCDs has increased from 30% of the total disease burden—measured in "disability-adjusted life years" (DALYs)—in 1990 to 55% in 2016 and from 37% of all fatalities in 1990 to 61% in 2016. This demonstrates the epidemiological transition and a shift in the burden of disease to NCDs.³ Hypertension is a global public-health challenge and it is accountable for 7% of Disability Adjusted Life Years (DALY) loss, and by the end of 2025 about 29% of world's population is likely to suffer from hypertension.^{4,5} According to WHO, the mortality from hypertension has increased to about 12.8% of the total of all the deaths.⁶

Tribal population constitute about 8% of the total population in India.⁷ non-communicable diseases are on the rise due to growing acculturation and the expansion of the world into tribal populations, such as tourism. Among tribal population, study on hypertension will provide an interesting outcome because studies across the world have shown a lower prevalence.^{8,9} But, neoteric studies have noted high prevalence of hypertension among the tribal people in India.^{10,11} Also, due to the disintegrated and wandering nature of living of the tribal people they are unapproachable for scientific study and health care. So accurate estimates of the prevalence of hypertension among tribal population are essential as a source of

primary information and for rational planning of health services and will help public-health policy-makers to assign sufficient priority and resources for its management and prevention.^{5,12}

However, the data on this is scarce and this necessitates the need for national wide data, also, tribe specific data as each tribe are unique, despite commonalities. The prevalence of hypertension among tribal people has increased as a result of modernization and urbanisation, and there has been a ten-year gap in the statistics. So, this systematic review and meta-analysis will estimate the most recent pooled prevalence of hypertension among various tribal groups in India for the period 2001 to 2020, and to analyse possible sources of heterogeneity in the estimate.

METHODOLOGY

This is a systematic review and meta-analysis done on hypertension among tribal populations of India between 2001 to 2020. This was done by Department of Community Medicine of Mysore medical college and research institute, Mysuru, Karnataka.

Search strategy: We performed a systematic review from Pubmed, Google Scholar, Scopus, Embase, MEDLINE using the MeSH terms. The search strategy has been attached in the supplementary file 1. We included studies conducted among Tribal population with HTN and published in the English language between January 2001 to July 2020.

Study Eligibility Criteria:

Inclusion criteria: Only Cross-sectional studies among tribal population in India were included in this review.

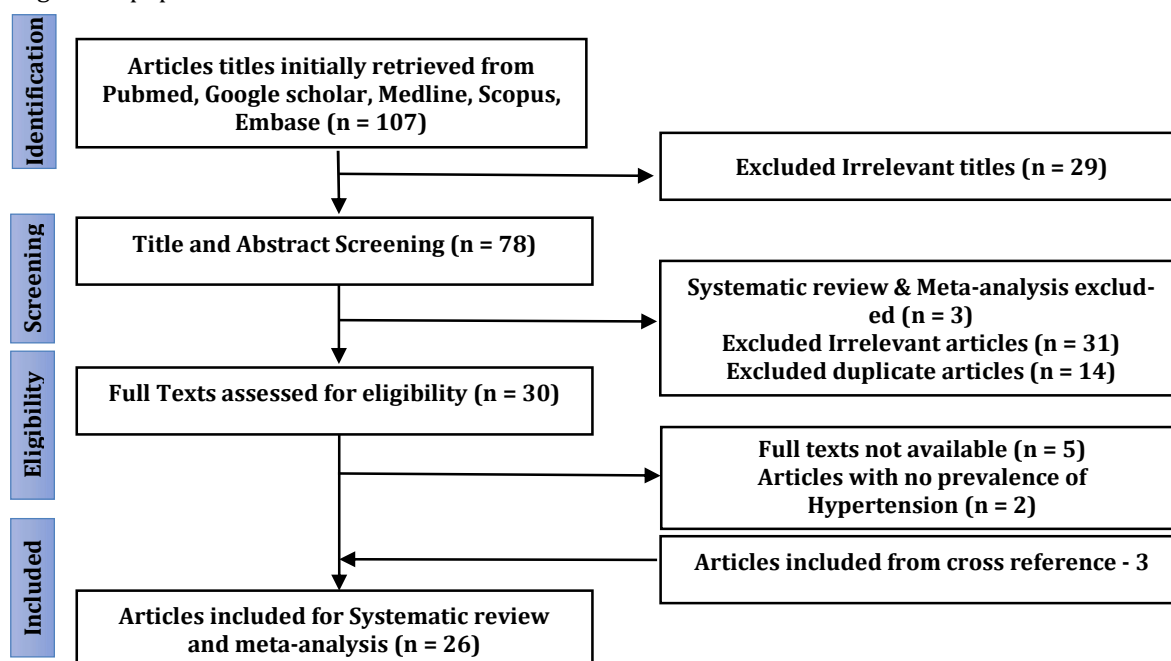


Figure 1: Flow chart of Selection of Studies

Exclusion criteria: We also excluded case series, individual case reports, editorials, commentaries, because they did not have original data. We excluded systematic review and meta-analysis also. We excluded the genetic studies as these were stand-alone studies with small sample size to generalize the findings to the Indian population.

Quality criteria: The quality assessment was done by three authors and was scored based on sample size, sampling strategy, use of standard screening criteria. We defined Hypertension as systolic BP of at least 140 mmHg and or diastolic BP of at least 90 mmHg.

Data extraction: Data was extracted based on Study variables (first author, place of study, year of publication - representing year of study, sampling method, sample size, BP apparatus, number of BP readings, and classification cut-offs), participant characteristics (age group, tribe name), and prevalence were extracted into Excel sheets separately by three authors. This review is presented according to the PRISMA/MOOSE statement.

Due to restrictions in the number of columns, studies done by Tiwari et al³⁷ and Vivek et al³⁸ were removed from the table but included in the analysis.

Statistical Analysis: Subgroup analyses were done for region, migratory and non-migratory population and quality of the studies. Meta-analysis was done in

Microsoft Excel Version 16.48. Heterogeneity between studies was examined using I² and Cochrane's Q statistics.

RESULTS

The method of selection of articles is shown in Figure 1. A total of 26 articles were finally included in the study. All included articles were cross-sectional studies. The total number of people included were 75,543. Table 1 summarizes the major study characteristics. Quality assessment revealed that 16 studies were of high quality. Based on regions, 9 studies were from southern region, 6 from east, 4 from west, 2 from north, 3 from central region. Different type of tribes with different characteristics were investigated in these studies. The pooled prevalence of hypertension in tribal population in this study is 25.1% (95% CI: 24.7, 25.4) (Figure 2). All the Studies had variations in methodology. Most of the articles had adopted a random sampling strategy, had used mercury sphygmomanometer, recorded BP multiple times, and used a 140/90 mm Hg as the cut-off. The Prevalence of hypertension for both male and female together (n = 17 studies) ranged from as low as 10.7% in a study done by Sunil Kumar et al³⁰, in Himachal Pradesh in 2015 with a sample size of 401 to as high as 48.3% by Sajeev et al²⁸, done in 2015-2016 in Kerala with 680 participants.

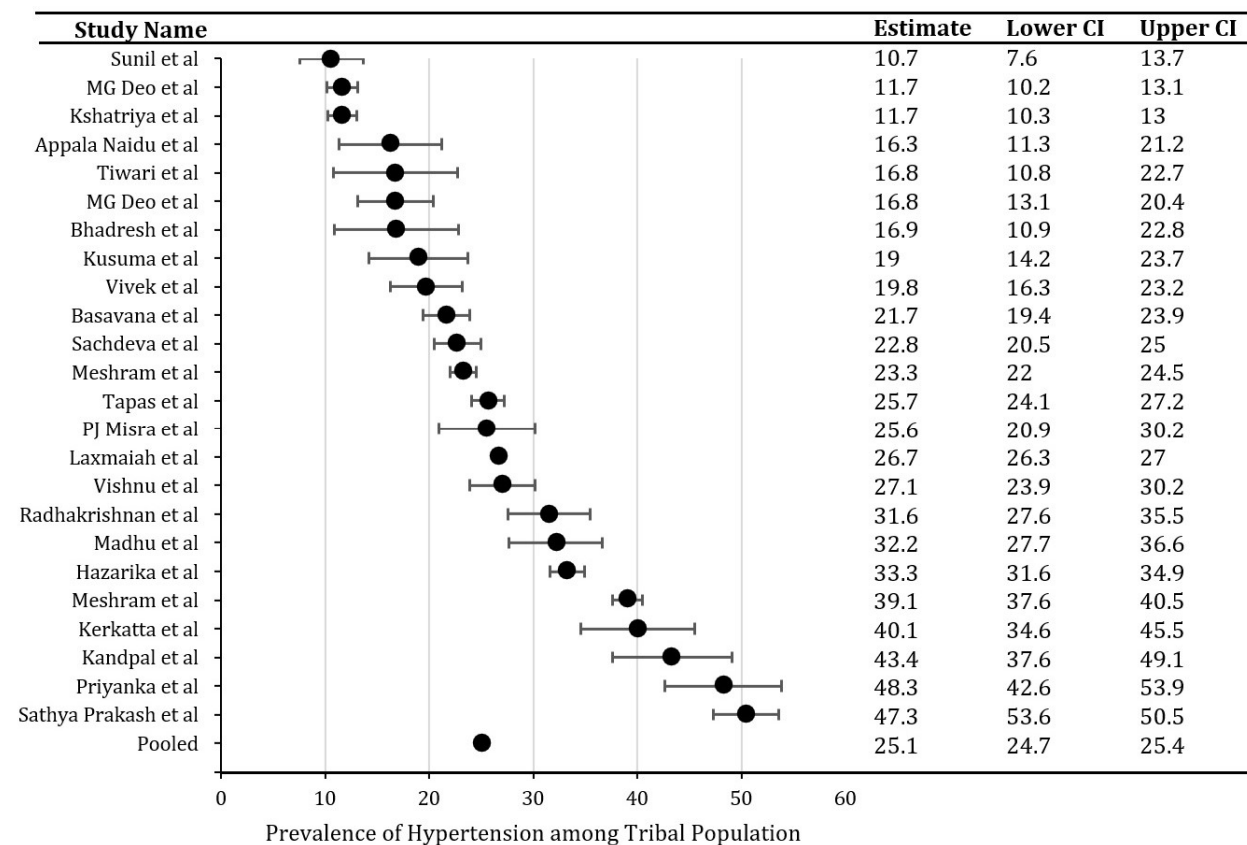


Figure 2: Forest plot of the studies on Hypertension Prevalence among Tribal population

Table 1: Characteristics of the Study Population included in the review.

Author/Year	State/Region	Age(y)	Special Group	Sampling Method	Risk Factors	Prevalence of HTN (males)%	Prevalence of HTN (females)%	Combined Prevalence (%)	Quality
Hathur et al ¹³	Karnataka (South)	20-60	shepherd tribe	-	Age, sex, SES	28.20%	16.5	21.7	poor
Hazarika et al (2004) ¹⁴	Assam (east)	>30	Native rural	StR	Smoking, alcohol, Obesity, Increasing age, marital status, extra salt intake	33.2	33.4	33.3	good
Mandani et al (2005) ¹⁵	Gujarat (west)	>20	-	SR	age, sex, BMI, smoking, alcohol	-	-	16.9	good
Kusuma et al (2008) ¹⁶	Orissa (east)	>18	Urban, Rural, Tribal	None	Obesity, hypertension	24.8	13.4	19.1	poor
Kerkattaet al (2006) ¹⁷	Orissa (east)	>60	LangiaSaora, Paudi Bhuiyan, KutiaKondh, DongriaKondh	Not given	-	31.8	42.2	40.1	poor
Meshram et al (2007-2008) ¹⁸	Kerala (south)	>20	-	MR	-	44.8	35.8	40	good
Laxmaiah et al (2007-08) ¹⁹	Odisha, Kerala, Gujarat (9 states)	>20	-	MR	-	21.7	26.4	24.1	good
Meshram I et (2007-09) ²⁰	Maharashtra (south)	>20	-	PPS	Smoking, alcohol, tobacco, obesity, salt intake	27.70%	19.3	23	good
Sathya Prakash (2007-09) ²¹	Car Nicobar Island	>18	aboriginal tribe	TSR	age, education, tobacco, alcohol, tobacco dependency, nutrition	-	-	-	good
Kapoor et al (2010) ²²	Madhya Pradesh (Centre)	18 - 60	Saharia	Not given	-	-	-	-	poor
PJ Misra et al (2011) ²³	Assam (east)	25-64	mishing	MC	obesity, hypertension	27.9	22.9	25.6	good
B Sachdevaa (2011) ²⁴	Rajasthan (west)	18-87	-	Not given	Age, Obesity Overweight, visceral adiposity, type of blood grp	-	-	22.80	Poor
Badaruddoza et al (2012) ²⁵	Punjab (North)	10- 90	Lobana	Convenience	age, height, weight, waist circumference, hip - circumference, skinfold (biceps, triceps, subscapular, suprailiac)	-	-	-	poor
M G Deo et al (2012-14) ²⁶	Maharashtra (south)	>18	katkari	Not given	obesity, hypertension, DM, lipid	18%	16	16.8	poor
MG Deo at al (2012-16) ²⁷	Maharashtra (South)	>18	-	Not given	obesity, hypertension, DM	-	10.4	-	poor
Sajeev et al (2014) ²⁸	Kerala (South)	25-64	kani	CS	alcohol, tobacco, physical activity	-	-	48.3	good
Appala Naidu et al (2014) ²⁹	Andhra Pradesh (South)	15-49	-	MR	age, debts, caste	-	16.3	-	good
Sunil kumar et al (2015) ³⁰	Himachal Pradesh (North)	>20	Panghwals, Lahaula,bhot	TSS	Smoking, alcohol, tobacco, obesity	12.9	6	10.7	good
Radhakrishnan et al (2015) ³¹	Tamilnadu (South)	>40	-	SR	smoking, alcohol, family history	36	26	-	good
Vishnu k Gupta (2015-16) ³²	Madhya Pradesh (Centre)	20-65	-	MR	Smoking, alcohol, Physical activity, Overweight	27.70%	26.6	27.1	good
Kandpal et al (2016) ³³	Uttarkhand	20-60	Rang Bhotias	Purposive	Smoking, alcohol, Physical activity, Overweight	57.7	35.3	43.4	good
Tapas Chakma et al (2017) ³⁴	Madhya Pradesh (Centre)	>30	Gonds	TSC	Smoking, alcohol, tobacco, obesity, salt consumption, red meat consumption	28.2	23.6	-	poor
Kshatriya (2018) ³⁵	Multicentre-3 states (west, east)	20-60	-	MR	age, sex, BMI, underweight	SBP 126.7±19.3, DBP 78.1±11.83	127.6 ± 21.4, 81.9 ± 13.2	127.1 ± 20.4, 80.0 ± 12.7	good
Madhu et al (2019) ³⁶	Karnataka (south)	>30	Soliga	Random	Smoking, alcohol, tobacco, obesity	-	-	20.7	good

StR Stratified Random, SR Simple Random, MR Multistage Random, PPS Population Proportion Size, TSR Two Stage Random, MC Multistage Cluster, CS Cluster Sampling, TSC Two Stage Cluster

Table 2: Subgroup analysis of the studies

All Studies Subgroup analysis	Mean Percent	95%CI	I ²	Cochrane's Q
Overall	25.1	24.7, 25.4	98.2	1289.37
Quality				
High Quality (n=16)	26.1	25.7, 26.4	98.3	920.9
Low Quality (n=10)	19.2	18.3, 20.1	96.2	187.6
Region				
Centre	25.9	24.3, 27.5	98.2	491.2
North	15.6	12.6, 18.6	98.3	60.1
South	23.1	22.3, 23.9	98.5	560.8
East	29.5	27.9, 31.1	93.7	63.5
West	14.5	13.3, 15.7	94.3	53.2
Migratory/ Non-Migratory				
Migratory	24.2	21.9, 26.5	95.2	41.8
Non-migratory	25.1	24.6, 25.4	98.5	1102.6

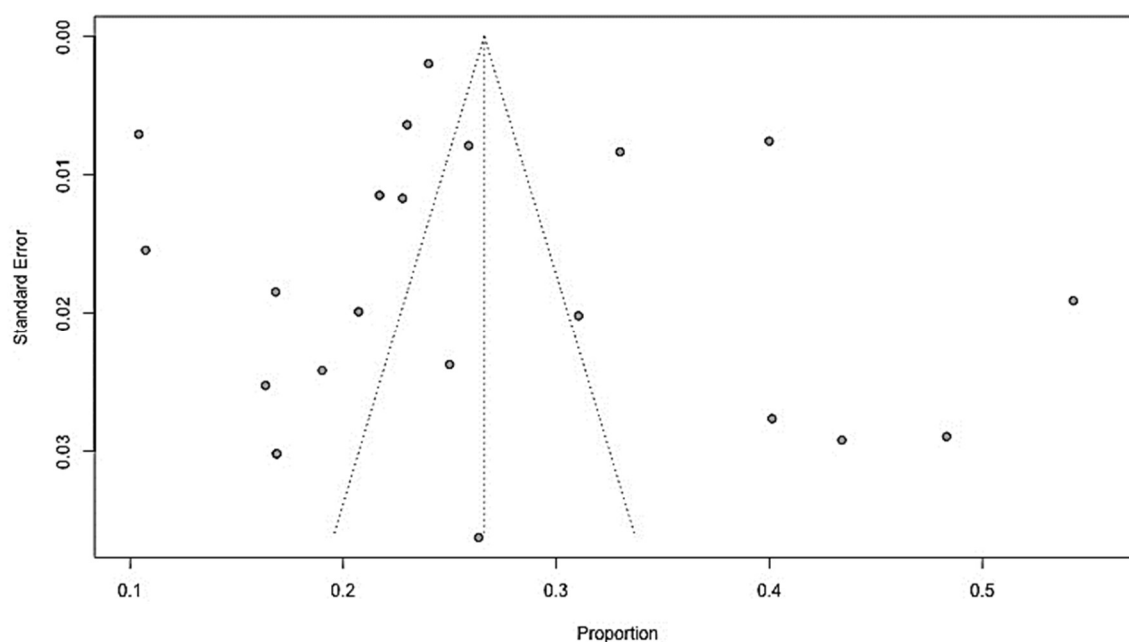
**Figure 3: Funnel plot of the studies on Hypertension Prevalence among Tribal population**

Table 2 shows the subgroup analysis of the studies. Among the quality of the studies, 16 studies which were of quality showed a pooled prevalence of 26.1% (95% CI 25.7-26.4, $I^2 = 98.3$ and Cochrane Q of 920.9). Among the regions, Eastern population had a prevalence of 29.5% (95% CI 27.9-31.1), $I^2 = 93.7$ and Cochrane Q of 63.5 followed by Central states had a prevalence of 25.9% (95% CI 24.3-27.5), $I^2 = 98.2$ and Cochrane Q of 491.2. Migratory and Non-migratory population had a prevalence of 24.2% and 25.1 respectively.

Figure 3t shows the linear regression test of funnel plot asymmetry. The test result is $t = 0.65$, $df = 20$, p -value = 0.5235. It indicates that there is no publication bias as the test eggert test for funnel symmetry is non-significant.

DISCUSSION

To the best of our knowledge, many systematic reviews and meta-analysis of prevalence of hyperten-

sion among general population is available but there is scarcity of multicentric studies/meta-analysis of hypertension among tribal population in India. The pooled hypertension prevalence (25.1%) from this meta-analysis was lower the prevalence of hypertension in the general population which varied from 13% to 41% across the globe.³⁹ The tribal hypertension prevalence of this meta-analysis is at par with the National prevalence rate of the general population (29%).⁴⁰ In a meta-analysis on Hypertension in India among general population by Anchala et al reported a pooled prevalence of 27.6% in rural area and 33.8% in urban parts of India.⁴¹ This is also almost similar with prevalence of hypertension of tribal people. Though the lifestyle is different between general population and tribal people, over the years the gap between them has narrowed and tribal people are adopting a similar lifestyle as the general population. According to Indian Tribal health report 2017, the prevalence of hypertension among tribal adults was 24.1% which is almost similar to the pooled prevalence of this meta-analysis.⁴² The hypertension prevalence mentioned in the tribal report

was from the 9 states National Nutrition Monitoring Bureau (NNMB) Tribal study which was carried out in 2008-2009.⁴² In the NNMB tribal study it was found that one out of every four tribal adults suffered from hypertension. The report also stated that 27% men and 26% women of the tribal group suffered from hypertension.⁴²

Rizwan et al (2014) in his systematic review reported a pooled prevalence of hypertension in Indian tribes as 16.1%.⁴³ The difference was because of more sample size in this study and also because of the advancing time. The association between advancing time and increasing prevalence is mainly due to modernization among the tribal population.⁴⁴ In this study, there is no direct association with modernization, but it can be predicted that modernization has expanded over the years, and it is the main ground for the increased prevalence. The prevalence of hypertension has increased significantly among tribal population mainly due to increased consumption of tobacco, alcohol and sedentary lifestyle.⁴² In this study the prevalence varied from 10.7% to 48.3%. Prevalence of hypertension of 10.7% was reported in study done by Sunil Kumar et al in Himachal Pradesh. The prevalence was low in this area as it was a High altitudinal region and people had hypobaric hypoxia which was considered as a protective effect on blood pressure.³⁰ Prevalence of hypertension of 48.3% was reported in study done Sajeev et al in Kerala. The reason for high prevalence in this area was because of increased alcohol and tobacco consumption among the tribes and also, they were not aware about the burden of the disease, treatment and control status.²⁸ The tribal report also stated that in 10 District Level Household Survey (DLHS) states, the prevalence of hypertension among tribals was almost similar to non-tribal people. In states like Maharashtra, Himachal Pradesh and Sikkim, the prevalence was high among the tribal people than the general population.⁴²

Among 26 studies, 16 studies were of high quality and 10 studies were of low quality. The difference was mainly because the high-quality studies had adopted proper sampling techniques whereas low quality studies had not used any appropriate methods. Another main concern is two out of three tribal adult men and women are not aware of the signs of symptoms of hypertension and only 5% of men and 9% of women who are suffering from hypertension are aware of their hypertensive status.⁴² Also, hypertension has a strong implication for the increased prevalence of undernutrition and overweight/ obesity. Very few studies have investigated the association between undernutrition and hypertension. One such study done by Kshatriya et al, stated that there was increased prevalence of hypertension among the undernourished Indian tribes and also indicated the epidemiological transition and also causing cardiometabolic health risks. The reasons for association between hypertension and undernutrition stated in the study by Kshatriya et al were, maternal undernutri-

tion which affects the intra-uterine development of kidney and affecting the blood pressure and renal function, increased and prolonged prevalence of undernutrition and prolonged stress during the developmental period of life also caused hypertension in the later stages.³⁵ The prevalence was almost similar among the migratory (24.2%) and non-migratory population (25.1%). This implies that both the populations might have adopted similar lifestyle. So, the hypertension prevalence is already high among the tribal population and other non-communicable diseases are also increasing and deserve attention. It could be attributed to their high-altitude residency, stress, genetics, increased smoking and alcoholism, as well as high salt intake. Due to this increasing trend in prevalence of hypertension, the government should commence curative and preventive measures to control the increasing health problems among the tribal population. Due to different lifestyle and cultural practices among the different tribal groups, it is difficult to study and pool the data of the tribal people, so a common Protocol must be planned for conducting the studies at multicenter level for all the tribal groups.

CONCLUSION & RECOMMENDATIONS

Due to Urbanization, lifestyle changes and cultural shift among the Indian tribes, the non-communicable diseases are increasing at an alarming rate when compared to general population. As the prevalence of hypertension among tribal population is almost similar to general population, Tribal health must be given importance in the general NCD surveillance. Also, there is need for a separate wing for Tribal people in the National Programme for Prevention and Control of Cancer, Diabetes Cardiovascular Diseases and Stroke (NPCDCS). It is essential to conduct larger cohort studies and randomized controlled trials to determine the causes of the increased prevalence of hypertension among the tribal population. The estimation of prevalence of hypertension among tribal population is necessary because it is essential for rational planning of health services. It will also be helpful for the public health policy makers for allocating sufficient resources or its prevention and management. This study will be helpful for the policy makers for changing the health needs among the tribal people in India.

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Search Strategy

Search Strategy

- #1 **((Hypertension [Title/Abstract]) AND (prevalence [Title/Abstract])) AND (tribal [Title/Abstract]) AND (non-communicable diseases)**
 "Hypertension"[Title/Abstract] AND "prevalence"[Title/Abstract] AND "tribal"[Title/Abstract] AND ("noncommunicable diseases"[MeSH Terms] OR ("noncommunicable"[All Fields] AND "diseases"[All Fields]) OR "noncommunicable diseases"[All Fields] OR ("non"[All Fields] AND "communicable"[All Fields] AND "diseases"[All Fields]) OR "non communicable diseases"[All Fields])
- #2 **((Hypertension) AND (tribal population)) AND (prevalence) AND (India)**
 ("hypertense"[All Fields] OR "hypertension"[MeSH Terms] OR "hypertension"[All Fields] OR "hypertension s"[All Fields] OR "hypertensions"[All Fields] OR "hypertensive"[All Fields] OR "hypertensive s"[All Fields] OR "hypertensives"[All Fields]) AND (("tribal"[All Fields] OR "tribally"[All Fields] OR "tribals"[All Fields]) AND ("populate"[All Fields] OR "populated"[All Fields] OR "populates"[All Fields] OR "populating"[All Fields] OR "population"[MeSH Terms] OR "population"[All Fields] OR "population groups"[MeSH Terms] OR ("population"[All Fields] AND "groups"[All Fields]) OR "population groups"[All Fields] OR "populations"[All Fields] OR "population s"[All Fields] OR "populational"[All Fields] OR "populous"[All Fields])) AND ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms] OR "prevalance"[All Fields] OR "prevalences"[All Fields] OR "prevalence s"[All Fields] OR "prevalent"[All Fields] OR "prevalently"[All Fields] OR "prevalents"[All Fields]) AND ("india"[MeSH Terms] OR "india"[All Fields] OR "india s"[All Fields] OR "indias"[All Fields])

#3 #1 and #2

In Google scholar 15 pages were searched.