



PREVALENCE OF HYPERTENSION AND ITS RISK FACTORS IN A TEA GARDEN COMMUNITY OF DARJEELING DISTRICT, WEST BENGAL

Dr. Sudipan Mitra	Assistant Professor, Dept Of Medicine, North Bengal Medical College & Hospital, Sushruta Nagar, Darjeeling, West Bengal, India.
Dr. Ujjwal Pattanayak	Associate Professor, Dept Of Community Medicine, KPC Medical College & Hospital, Kolkata, West Bengal, India.
Dr. Pasang Lahmu Sherpa	Associate Professor, North Bengal Medical College & Hospital, Sushruta Nagar, Darjeeling, West Bengal, India.
Dr. Sandip Saha*	Assistant Professor, Dept Of Medicine, North Bengal Medical College & Hospital, Sushruta Nagar, Darjeeling, West Bengal, India. *Corresponding Author
Dr. Rajib Sikder	Final Year PGT, Dept Of Community Medicine, KPC Medical College & Hospital, Kolkata, West Bengal, India.
Alankar Pattanayak	Final Year MBBS Student, KPC Medical College & Hospital, Kolkata, West Bengal, India.

ABSTRACT **BACKGROUND:** Hypertension is a major Non Communicable Disease (NCD) having a major hand in causation of coronary artery diseases, stroke, renal disorders and various other vascular complications, thus, posing a great threat to the health of people, community and country at large. Though it affects about 20% of the population in most communities, prevalence rate varies in different areas and communities. This study was done with objective to assess prevalence of hypertension and its risk factors in a Tea Garden Community of Darjeeling District, West Bengal. **METHODS:** This cross sectional study was done in Darjeeling District, West Bengal, during July to December 2019. A total of 300 participants were selected. A self-administered questionnaire was used to collect data and the data was summarized using descriptive statistics. A p value of <0.05 was considered significant. Participants were interviewed and examined for the assessment of socio-demographic detail, behavioral and lifestyle risk factors of hypertension and blood pressure was measured according to standard protocol. Template was generated in MS excel sheet and analysis was done on SPSS 20.0 software. **RESULTS:** Among 300 study participants, 120 (40%) were male and 180 (60%) were female. The prevalence of hypertension was observed to be 35 (11.67%). Out of hypertensive subjects newly diagnosed hypertensive were 19 (54.3%) and 16 (45.71%) were pre-hypertensive. It was found to be more common in males. Prevalence increased as the age increased (7.50% amongst age group of 18-45 years, 10.19% amongst age group of 46-60 years and 20.83% amongst the age group of 60 years and above). The prevalence of hypertension was high among obese and those consuming more than 2 spoons of salt every day. **CONCLUSIONS:** Around 50% of the hypertensive subjects remain undetected and unaware of the risk and about 50% don't take medicines regularly. In this study out of hypertensive 54.3% were newly diagnosed and 37.50% didn't take medicines regularly. So the workers should be tracked regularly to monitor the blood pressure and should counselled to take medicine regularly and to stop smoking and take low salt diet.

KEYWORDS : Hypertension, Modifiable Risk Factors, Tea Garden Community, West Bengal

INTRODUCTION

Hypertension or high blood pressure is defined as abnormally high arterial blood pressure. According to the Joint National Committee 7 (JNC7), normal blood pressure is a systolic blood pressure (BP) <120 mmHg and diastolic BP <80 mmHg.

Hypertension is defined as systolic BP level of ≥ 140 mmHg and/or diastolic BP level ≥ 90 mmHg. The grey area falling between 120 to 139 mmHg systolic BP and 80 to 89 mmHg diastolic BP is defined as "prehypertension".^{1,2}

Hypertension is a non-communicable disease (NCD) that affects about 20% of the population in most communities. Hypertension has a major hand in causation of coronary artery diseases, stroke and various other vascular complications, and renal disorders.³

Hypertension is responsible for at least 45% of deaths due to heart disease, and 51% of deaths due to stroke.^{4,5}

The prevalence of hypertension ranges from place to place, in the African region prevalence of hypertension is 46% amongst the adults aged 25 and above, and 35% is found in the Americans. Contrary to the popular belief, high-income countries have a lower prevalence of hypertension (35%), than other groups at 40%.^{6,7}

Globally, the prevalence of raised blood pressure in female aged 18 and over was around 20% and males around 24%. The proportion of the world's population with high blood pressure, or uncontrolled hypertension, fell modestly between 1980 and 2008. However, because of population growth and ageing, the number of people with

uncontrolled hypertension rose from 600 million in 1980 to nearly 1 billion in 2008.⁸ In 2002, 10.9% of all deaths in the developed countries were attributable to hypertension, making it the second major risk factor of overall death just below tobacco use (12.2%) but over high cholesterol (7.6%), alcohol use (9.2%) and obesity (7.4%).³ In addition, about half of all cardiovascular disease (mortality and morbidity combined) is attributable to high blood pressure. Fortunately, it is widely considered as one of the most preventable causes because of the availability of effective antihypertensive drugs. According to the World Health Organization use of these drugs effectively, every 20 mmHg decrease of systolic blood pressure and 10 mmHg decrease of diastolic blood pressure could potentially lead to a 50% reduction of the risk of cardiovascular disease.⁹

Compared to no treatment, antihypertensive have demonstrated to reduce the risk of major cardiovascular events with 27%.¹⁰ Although high blood pressure has long been identified as an important medical condition, until 1964, the most important strategy for decreasing a patient's blood pressure was a low salt diet.¹¹

High blood pressure (BP) is a major public health problem in India and its prevalence is rapidly increasing among both urban and rural populations. In fact, hypertension (17.5% of all deaths) is the most prevalent chronic disease in India.¹²

The prevalence in India as per the study by Indian Council of Medical Research (ICMR) was 25% among urban population and 29% among rural population when systolic BP of 140 and above and/or diastolic BP of 90 or above were considered as hypertension.¹³ According to NCD risk factor survey conducted by Integrated Disease Surveillance

Project (IDSP), during 2007–2008, the prevalence of hypertension in India varied between 17% and 20%.¹⁴ Anchala et al have found 29.8% prevalence of hypertension in India in year 2013 along with 27.6% and 33.8% prevalence of hypertension in rural and urban populations respectively.¹⁵

Though prevalence of hypertension and their associated risk factors have been studied extensively in India but very few studies have been done on the population of tea garden workers. The tea garden workers are a closed community having same common characteristic supposed to have less knowledge about their health.

As very few tea garden based studies on hypertensive had been conducted^{16,17,18}, so this study was performed with the objectives of finding the prevalence and risk factor of hypertension amongst the Tea Garden Community of Darjeeling District, West Bengal.

MATERIAL AND METHODS

This community-based cross sectional study was carried out among adults who were aged 18 years and above over a period of 6 months from July 2019 to December 2019. The study was carried out in a tea garden community of Central Dooars Tea State in Darjeeling District of West Bengal.

Optimal sample size was calculated to be 300 on the basis of prior prevalence rate of hypertension of 25.9%.¹⁹ Study was initiated after obtaining approval from institutional ethics committee. Simple random sampling technique was used. Tea garden had total 1160 tea workers (398 male and 762 female permanent and temporary tea workers). Adults aged 18 years or above who gave consent to participate in the study were interviewed and examined for the assessment of behavioral and lifestyle risk factors of hypertension. A semi structured questionnaire containing questions like age, gender, religion, education, marital status, occupation, family type, socioeconomic class, tobacco use, alcohol use, Physical activity, quantity of salt intake, BP and blood pressure measurement was used in the study. As alcohol and tobacco use was not quantified so yes/no option was taken. Socio-economic status (SES) was calculated based on Prasad's scale of social stratification for rural areas.

HTN was defined as sustained elevation of systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg, and also included study subjects who were on antihypertensive medication (JNC 7).

Blood pressure measurements: A properly calibrated and validated sphygmomanometer with appropriate cuff size was used. After a rest for five minutes blood pressure was measured in both the arms with sitting position with the arms supported at the level of the heart. Higher of the two was noted as the measured BP. Phase 1 Korotkoff sound (appearance of tapping sound) was taken as the systolic pressure and phase 5 (disappearance) was taken as the diastolic pressure. If the muffled sound persisted (phase 4) and did not disappear, the point of muffling was taken as the diastolic pressure.²⁰

Statistical Analysis: Data was entered in Microsoft excel and analysed using SPSSv20. Pearson's Chi square test was applied. P value < 0.05 was considered significant.

Inclusion criteria

All subjects of age 18 years and above in the tea garden community of Darjeeling, all subjects of age 18 years and above who consented to participate in the study were included.

Exclusion criteria

Adults who refused to participate in the study and not a worker of the tea garden were excluded.

Statistical analysis: The data were tabulated in Microsoft Excel 2016 and analyzed by using Statistical Package for the Social Sciences (SPSS) version 20.0 software for proportions and chi-square tests as test of significance.

RESULTS

A total of 300 study subjects were interviewed and examined for the survey. Out of these, 120 (40%) were male and 180 (60%) were female subjects. **Table 1** shows that overall prevalence of hypertension in this study is 35 (11.67%). Hypertension was found to be more common in male as compared to female. out of 120 males 21 (17.50%) were hypertensive while out of 180 females 14 (7.78%) were hypertensive.

Among the 35 hypertensive subjects 16 (45.71%) were already diagnosed hypertensive earlier. Thus new diagnosed hypertensive were 19 (54.29%).

Table 2 shows that amongst the known hypertensive 10 (62.50%) were under regular medication and 6 (37.50%) were under irregular medication.

Table 3 shows the socio-demographic characteristics of the respondents in the study. It can be seen that majority of the study subjects were 18–45 years of age 120 (40%) followed by 46–60 years 108 (36%) and age and more than 60 years of age 72 (24%).

Most of the study subjects 186 (62%) in this study were Hindu by religion followed by Buddhist 62 (20.67%) and Christian 52 (17.33%). It has been seen that hypertension is not related significantly with the religion. Although its more common among divorced or widowed persons 10 (27.78%), there is no statistically significant relation. A statistically significant relation was found between socioeconomic status and hypertension. Hypertension was found more in socioeconomic class II 11 (17.19%) followed by 12 (15.79%) in class I and 8 (14.81%) in class III. Though hypertension was found in every class of society.

Table 4 shows the risk factors associated with hypertension. As seen in the table, tobacco use in any form is strongly associated with hypertension. 29.17% of tobacco users were hypertensive as compared to 6.14% of non users. In this study alcohol use was not seen to be significantly associated with high blood pressure. Hypertension was found in 11.44% of alcohol users and 12.50% in non users. Other factors significantly associated with hypertension were less physical activity, high BMI and increased salt intake. Prevalence of hypertension among sedentary persons was 26.67% while in active people it was only 9.02%. People who were pre-obese and obese have high BP in 16.67% and 44.44% subjects respectively while in normal persons it was only in 8.93%. As far as salt intake is concerned, 53.57% of the respondents were having high BP who consumed more than 2 spoons of salt per day.

The prevalence of hypertension was increased as the age increased ($p < 0.05$) as indicated in the **table 5**.

DISCUSSION

India is a developing country and like other developing countries, it is going through a rapid demographic and epidemiological transition. Prevalence of hypertension is different in different parts of the country. The prevalence of hypertension in our study was found to be 35 (11.67%) which is less than that found by Singh et al in central India (17%).²¹ Another study done by Ananthachari found much higher prevalence of hypertension i.e. 25.9% in rural Mandya, Karnataka.²² In the study done by Ditipriya et al in Darjeeling West Bengal, overall prevalence of hypertension among 172 participants was 22.1%.¹⁶ Study conducted by Bhattacharjee S et al in Siliguri city of West Bengal found prevalence of hypertension 17.8%.¹⁷ In a study conducted by Mahanta TG et al in Dibrugarh District, Assam overall prevalence of hypertension among 530 tea garden workers was found 33.3%.¹⁸

Almost all including our study revealed the prevalence of hypertension was increasing as the age increased.²³⁻²⁵

In our study a significant association was observed between hypertension and gender (17.50% in male and 7.78% in females). Similar association was found in study conducted by Ditipriya et al in Darjeeling District of West Bengal found that 44.6% men and 38.2% women were hypertensive.¹⁶ Study conducted by Mahanta TG et al in Dibrugarh District, Assam found that hypertension was found in 34.15% in males and 31.44% in females.¹⁸ Study conducted by Bhattacharjee S et al in Sub Himalayn region of West Bengal found that 15.7% of males and 20.9% of females were hypertensive.¹⁷ Observation was opposite in the study conducted by Kokiwar et al which reported higher prevalence among females (23.4%) compared to males 14.4%). Studies conducted by Bansal et al., among rural adults in Uttarakhand (30.9% in males and 27.8% in females), Gupta et al, among rural adults in Haryana (59.2% and 40.8% among males and females, respectively), Srinivas et al, in rural adult population of Andhra Pradesh (85.22% in males and 14.77% in females) reported higher prevalence of hypertension in males compared to females.²⁵⁻²⁸

As far as life style factors are concerned, a significant association was found in this study between hypertension and any form of tobacco use (29.17% of tobacco users were hypertensive as compared to 6.14% of non users). In the study conducted by Bhattacharjee S et al in Sub Himalayn region of West Bengal found that 57.5% of hypertensive were smokers.¹⁷ Study conducted by Mahanta TG et al in Dibrugarh District, Assam found that 30.2% smokers and 76.7% of tobacco users were hypertensive.¹⁸ Similar findings reported from study by Agarwal et al in a rural community in rural Pune other study (16% among the tobacco users).²⁹

In our study no significant association was reported with hypertension and alcohol (Hypertension was found in 11.44% of alcohol users and 12.50% in non users) which is supported by similar findings by Kokiwar et al whereas a study by Kannan et al, among adults in rural Tamil Nadu reported significant association between alcohol consumption and hypertension.^{26,30} Study conducted by Bhattacharjee S et al in Sub Himalayn region of West Bengal found that 12.5% of hypertensives were alcoholic.¹⁷ Study conducted by Mahanta TG et al in Dibrugarh District, Assam found that 78.4% hypertensive consume alcohol.¹⁸

In our study 53.57% of hypertensive consume salt more than 2 spoon. A study done by Gupta et al, on prevalence and predictors of essential hypertension in the rural population of Haryana, reported a similar findings as our study and observed a significant association between hypertension and salt intake. Whereas no significant association was reported from Kumar et al, in a study on prevalence of hypertension among rural and urban adults in Jaipur district (prevalence of hypertension was observed to be 25.8% amongst the persons using salt ≥ 6 g/day).^{28,31}

In our study there was significant association between hypertension and obese individuals based on BMI (People who were pre-obese and obese have high BP in 16.67% and 44.44% subjects respectively while in normal persons it was only in 8.93%). Similar findings were reported from the study conducted by Bansal et al, among rural adults in Uttarakhand.²⁷ Study conducted by Ditiptiya et al in Darjeeling

District of West Bengal found that obesity showed 11.9 times and 5.9 times higher odds of hypertension.¹⁶ Study conducted by Bhattacharjee S et al in Sub Himalayn region of West Bengal found that obesity was present in 20.2% of hypertensives.¹⁷

CONCLUSION

Prevalence of hypertension varies in different part of the country and various factors like increase in age, obesity and use of tobacco were observed to be associated with occurrence of hypertension. Majority of the hypertensive subjects remain undetected and therefore unaware of the risks they face. This points to the need for greater awareness of hypertension in the marginalized community of tea garden in far off places. Strategies should be identified to diagnose hypertension and trace as early as possible. As sample size was small the prevalence (11.67%) was below national prevalence (14.8%, NFHS 4). Hence large sample size is required. As 37.50% of the known hypertensive were under irregular medication they should be counselled and explained that these are lifelong medication and they should checkup regularly and take medicines regularly. The pre hypertensive subjects and subjects having various risk factors should be tracked regularly.

Table 1: Prevalence of hypertension in the study subject.

Sex	Hypertensive (%)		Non hypertensive		Total		Newly diagnosed hypertensive	
	No.	%	No.	%	No.	%	No.	%
Male	21	17.50	99	82.50	120	40.00	12	34.29
Female	14	7.78	166	92.22	180	60.00	7	20.00
Total	35	11.67	265	88.33	300	100	19	54.29

Table 2: distribution of known hypertensive subjects according of intake of hypertensive drugs. (n=16)

Intake of medication	Male		Female		Total	
	No.	%	No.	%	No.	%
Under regular medication	6	66.67	4	57.14	10	62.50
Under irregular medication	3	33.33	3	42.86	6	37.50
Total	9	100	7	100	16	100

Table 3: Sociodemographic factors related to hypertension.

Variables	Category	Total	Hypertensive		Non hypertensive		χ^2	P value
			No.	%	No.	%		
Age Years	18-45	120	9	7.50	111	92.50	6.002	0.047
	46-60	108	11	10.19	97	89.81		
	More than 60	72	15	20.83	57	79.17		
Sex	Male	120	21	17.50	99	82.50	5.578	0.024
	Female	180	14	7.78	166	92.22		
Religion	Hindu	186	18	9.68	168	90.32	1.162	0.62
	Budhist	62	14	22.58	48	77.42		
	Christian	52	3	5.77	49	94.23		
Education	Illiterate	122	13	10.66	109	89.34	0.731	0.872
	Primary (class IV)	102	10	9.80	92	90.20		
	Secondary (Class X)	60	7	11.67	53	88.33		
	College and above	16	5	31.25	11	68.75		
Marital status	Married	212	20	9.43	192	90.57	5.018	0.07
	Unmarried	52	5	9.62	47	90.38		
	Divorced or widowed	36	10	27.78	26	72.22		
Occupation	Permanent employee	12	4	33.33	8	66.67	4.24	0.372
	Temporary employee	288	31	10.76	257	89.24		
Family type	Nuclear	124	13	10.48	111	89.52	1.016	0.324
	Joint	176	22	12.50	154	87.50		
Number of family members	1-5	186	22	11.83	164	88.17	0.068	0.818
	≥ 6	114	13	11.40	101	88.60		
Socioeconomic class	I	76	12	15.79	64	84.21	12.82	0.021
	II	64	11	17.19	53	82.81		
	III	54	8	14.81	46	85.19		
	IV	54	2	3.70	52	96.30		
	V	52	2	3.85	50	96.15		

Table 4: Prevalence of hypertension by health and life style practices.

Variables	Category	Total	Hypertensive		Non hypertensive		χ^2	P value
			No.	%	No.	%		
Tobacco use (Guthka, Biri, Khaini)	Nonusers	228	14	6.14	214	93.86	5.086	0.028
	Users	72	21	29.17	51	70.83		
Alcohol use	Nonusers	64	8	12.50	56	87.50	1.158	0.272
	Users	236	27	11.44	209	88.56		

Physical Activity	Inactive	45	12	26.67	33	73.33	5.026	0.032
	Active	255	23	9.02	232	90.98		
BMI	Underweight	28	2	7.14	26	92.86	11.824	0.012
	Normal	224	20	8.93	204	91.07		
	Preobese	30	5	16.67	25	83.33		
	Obese	18	8	44.44	10	55.56		
Salt intake	< 1 spoon	142	8	5.63	134	94.37	8.256	0.0186
	1-2 spoon	130	12	9.23	118	90.77		
	> 2 spoon	28	15	53.57	13	46.43		

Table 5: Prevalence of hypertension as per age in the study subject.

Age	Prevalence of Hypertensive (%)
18-45	7.5
46-60	10.19
> 60	20.83

ACKNOWLEDGEMENTS

Authors would like to acknowledge Mr Sanjay Bagchi, Secretary, Dooars Branch ITA Binnaguri Jalpaiguri for his support and also the patients who participated in this research study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

- Kumar MR, Shankar R, Singh S. Hypertension among the adults in rural Varanasi: a cross-sectional study on prevalence and health seeking behaviour. *Indian J Preventive Social Med.* 2016;47:78-83.
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure, Hypertension. 2003;42(6):1206-52.
- WHO Technical Report Series 862, 1996. World Health Organization. Available at http://apps.who.int/iris/bitstream/10665/38276/1/WHO_TRS_862.pdf. Accessed on 12 January 2020.
- World Health Organization. Global status report on non-communicable diseases 2010. Geneva, World Health Organization, 2011.
- Causes of Death 2008. Geneva, World Health Organization. Available at: http://www.who.int/healthinfo/global_burden_disease/cod_2008_sources_methods.pdf. Accessed on 2 January 2020.
- Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012;380(9859):2224-60.
- World Health Organization. Global Health Observatory Data Repository. Geneva, World Health Organization, 2008. Available at: <http://apps.who.int/gho/data/view.main>. Accessed on 30 May 2020.
- Raised blood pressure, Global health observation data. World Health Organization; 2008. Available from http://www.who.int/gho/ncd/risk_factors/bloodpressure_prevalence_text/en/. Accessed on 30 May 2020.
- Cardiovascular disease, The Atlas of Heart Disease and Stroke, World Health Organization; 2006. Available at https://www.world-heart-federation.org/wpcontent/uploads/2017/05/Global_CVD_Atlas-min-1.pdf. Accessed on 30 May 2020.
- Psaty BM, Lumley T, Furberg CD, Schellenbaum G, Pahor M, Alderman MH, et al. Health outcomes associated with various antihypertensive therapies used as first-line agents: a network meta-analysis. *JAMA.* 2003;289(19):2534-44.
- Jones DW. Dietary sodium and blood pressure. *Hypertension.* Am Heart J. 2004;43(5):932-5.
- Gupta R, Gupta S. Strategies for initial management of hypertension. *Indian J Med Res.* 2010;132(5):531-42.
- Ministry of Health & Family Welfare, Government of India and World Health Organization. National Cardiovascular disease data base. Available at: http://www.searo.who.int/india/topics/cardiovascular_diseases/NCD_Resources_National_CVD_data_base-Final_Report.pdf?ua=1. Accessed on 12 January 2020
- Gupta R. Trends in hypertension epidemiology in India. *J Hum Hypertens.* 2004;18:73-8.
- Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Angelantonio ED, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens.* 2014;32(6):1170-77.
- Ditipriya Bhar et al (2019) 'Prevalence and Associated Factors of Hypertension Among Rural Tribal Adults in a Subdivision of Darjeeling District, west Bengal', *International Journal of Current Advanced Research*, 08(05), pp. 18561-18566.
- Bhattacharjee S, Datta S, Roy JK, Chakraborty M. 2015. A cross-sectional assessment of risk factors of non-communicable diseases in a sub-himalayan region of West Bengal, India using who steps approach. *The Journal of the Association of Physicians of India* 63:34-40.
- T. G. Mahanta et al (2008). Prevalence of Hypertension and its Risk Factors in a Tea Garden Community of Dibrugarh District, Assam. *LPH*, 2008;52(1):45-47.
- Ananthachari KR, Harish BR. The prevalence of hypertension and its associated risk factors among adults in rural Mandya, Karnataka, India. *Int J Community Med Public Health.* 2016;3:2369-72.
- The cardiovascular system. Alastair Innes J, Dover AR, Fairhurst K, eds. *Macleod's Clinical Examination*. 14th ed. Amsterdam, The Netherlands: Elsevier; 2018:46, chap 4.
- Singh PS, Singh PK, Zafar KS, Sharma H, Yadav SK, Gautam RK, et al. Prevalence of hypertension in rural population of Central India. *Int J Res Med Sci.* 2017;5:1451-5.
- Ananthachari KR, Harish BR. The prevalence of hypertension and its associated risk factors among adults in rural Mandya, Karnataka, India. *Int J Community Med Public Health.* 2016;3:2369-72.
- World Health Organization. Hypertension control. WHO Technical report series 862. Geneva: WHO; 1996. Available at: whqlibdoc.who.int/trs/WHO_TRS_862.pdf.

Accessed on 30 May 2020.

- Pooja, Mittal Y. Prevalence of hypertension among rural population of doiwala block, Dehradun, Uttarakhand India. *Recent Res Sci Tech.* 2013;5(1):21-4.
- Srinivas S, Satyavaraprasad K, Ramdas R, Krishna CP, Tajuddin T, Rao RP. Prevalence of prehypertension in adult population of rural Andhra Pradesh. *Asian J Biomed Pharm Sci.* 2013;3:45-8.
- Kokiar RP, Sunil S, Gupta SS, Durge MP. Prevalence of hypertension in a rural community of central India. *J Asso Physicians India.* 2012;60:26-9.
- Bansal SK, Saxena V, Kandpal SD, Gray WK, Walker RW, Goel D. The prevalence of hypertension and hypertension risk factors in a rural Indian community: a prospective door-to-door study. *J Cardiovasc Dis Res.* 2012;3:117-23.
- Gupta S, Bimal K, Agarwal, Prabodh K, Sehajapal, Rajesh K. Prevalence and predictors of essential hypertension in the rural population of Haryana, India-an hospital based study. *J Rural Trop Public Health.* 2011;10:29-34.
- Agrawal VK, Bhalwar R, Basannar DR. Prevalence and determinants of hypertension in a rural community. *Med J Armed Forces India.* 2008;64(1):21-5.
- Kannan L, Satyamoorthy TS. An epidemiological study of hypertension in rural household community. *Sri Ramachandra J Med.* 2009;2(2):813.
- Kumar K, Kothari RP, Kothari K, Garg S, Khandelwal MK, Gupta R. Prevalence of hypertension in an urban and rural area of Jaipur District. *Int J Healthcare Biomed Res.* 2013;1(3):120-6.