

Systematic Review

Incidence of hypertension and its risk factors: a systematic review

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ABSTRACT

Hypertension is a persistent, metabolic condition indicated by elevated blood pressure levels. Since hypertension comes with no warning signs, mostly people are not aware of it. The aim of the study was to assess the change in the prevalence of hypertension among adults of Punjab and Haryana and to investigate its risk factors. Medline, Web of Science and Scopus databases from 2009 to 2023 were searched for ‘prevalence, burden, awareness, and control of blood pressure (BP) or hypertension (≥ 140 SBP and or ≥ 90 DBP) among Indian adults’ (≥ 18 years). The incidence of hypertension varied from 32.4 to 88.2 percent in male subjects and 30 to 84.7 percent in female subjects. Hypertension was more prevalent among males of Punjab and Haryana. Whereas females were more hypertensive in different districts of Haryana. The considerable upward trend has been observed over the time, among males and females in both Punjab and Haryana, yet awareness and control rates are comparatively low. Various researchers have discovered that younger the age of beginning of hypertension, the higher the decline in life expectancy if raised blood pressure is not managed.

Keywords: Hypertension, Risk factors, Prevalence, Punjab, Haryana, Lifestyle

INTRODUCTION

High blood pressure, also known as hypertension, is the greatest health challenge of the 21st century. Elevated blood pressure is a symptom of a persistent metabolic illness called hypertension. Based on data from the world health organization (WHO) global health observatory (2015), high blood pressure was the cause of about 12.8% (7.5 million) of all deaths globally.¹ High systolic blood pressure has been connected to roughly 10.2 million deaths globally in 2017, making it the most prevalent cause of mortality.² According to the reports of WHO, global burden of disease study and non-communicable disease risk factor collaboration showed the increased trend of hypertension globally, with more than 1 billion people currently suffering from this problem.^{3,4}

It is a condition that arises when the arterioles are reduced, enabling the blood to exert a great deal of pressure against the blood vessel walls, prompting the

heart to work hard so as to maintain the pressure.⁵ Primary hypertension is caused by factors such as excessive salt intake, high alcohol consumption, sedentary habits, a dependence on cigarettes and nicotine products, aggression, obesity and poor stress handling abilities, whereas secondary hypertension is induced by excessive use of contraceptive pills, hormonal treatments used in infertility, appetite suppressants, decongestants, non-steroidal anti-inflammatory medications and antidepressants.⁶

Hypertension symptoms and signs vary from person to person making it worse silently. These symptoms of hypertension include headaches, neck pain, impaired vision, ringing in the ears, and nosebleeds.⁷ According to the WHO, neglected and unmanaged high blood pressure can result in a number of consequences, including cardiac and kidney failure, retinal haemorrhage, stroke, vision impairment, peripheral vascular disease, and the dementia.⁸

Recently published data from the global health advocacy incubator (GHAI), Punjab, which has a hypertension prevalence rate of 35.7%, significantly higher than the national average of 25.3%, made it an ideal testing ground for last-mile innovations.⁹ In recent years, no systematic reviews on the prevalence of hypertension and its risk factors in Punjab and Haryana have been published. Hence, this study aims to provide a Prevalence of hypertension and its related risk factors in the states of Punjab and Haryana. Moreover, this study is going to focus on the gaps that have been observed during the literature review.

METHODS

Search strategy

Between 2009 to 2023 we comprehensively searched on hypertension among adults using electronic search engines PubMed, Google Scholar and Web of science. Cross-references from the chosen papers were also used to locate more pertinent papers. Combined search phrases relevant to the outcomes with free text words that included exposure-related terms (such as prevalence, hypertension, elevated blood pressure, Punjab and Haryana) should be selected. In cases where full texts were not available, the title of the paper and abstracts were reviewed for relevance before extracting potentially relevant full text papers.

Study inclusion and exclusion criteria

The review covered studies conducted on populations (those over 18) which were published after 2009. The first step was to look for papers related to incidence of hypertension in both the states, and the second step was to search for each district's specific contributory risk factors. To ascertain the outcome of interest and other inclusion requirements, authors did the title screening, a thorough abstract screening, and a full-text review. The following were the inclusion criteria for the study: (i) cross-sectional or survey research (ii) Sample size of more than 100 subjects (iii) Full-text article in English. Exclusion criteria were case studies, animal studies, conference proceedings, protocol studies, and non-peer-reviewed works. Studies with >100 subjects were also excluded.

Study selection

The titles as well as the abstracts of the initially discovered studies were reviewed to see if they met the selection criteria. All selection-related disputes were settled after having discussion with authors. Full-text papers were found for these elected titles. To confirm that the retrieved studies met the requirements for inclusion, they underwent another evaluation.

Data extraction

The first author's last name, publishing year, age groups,

study design, sample size, area of study, prevalence of hypertension and the risk variables were all taken from the studies that were considered to be eligible. The discrepancies were rectified by discussion with the authors. The extracted data is shown in the Table 1-4.

RESULTS

The initial 350 references from the PubMed and Google Scholar were followed by the exclusion criteria of duplicate articles that were 60 in number. We excluded 100 unrelated publications after carefully reviewing each of the remaining 290 studies on the occurrence of hypertension for the following reasons: unrelated titles and abstracts, conference proceedings, missing data, protocol studies, case studies and non-peer-reviewed works and 190 papers were identified as relevant. Then again 153 not meeting the criteria of full-text articles were excluded. There were 37 full-text articles on the incidence of hypertension and associated risk factors, but only 34 of them were potentially relevant excluding the studies that had sample size less than 100 subjects (Figure 1). The review included 33 cross-sectional and one community-based study in different districts of Punjab and Haryana.

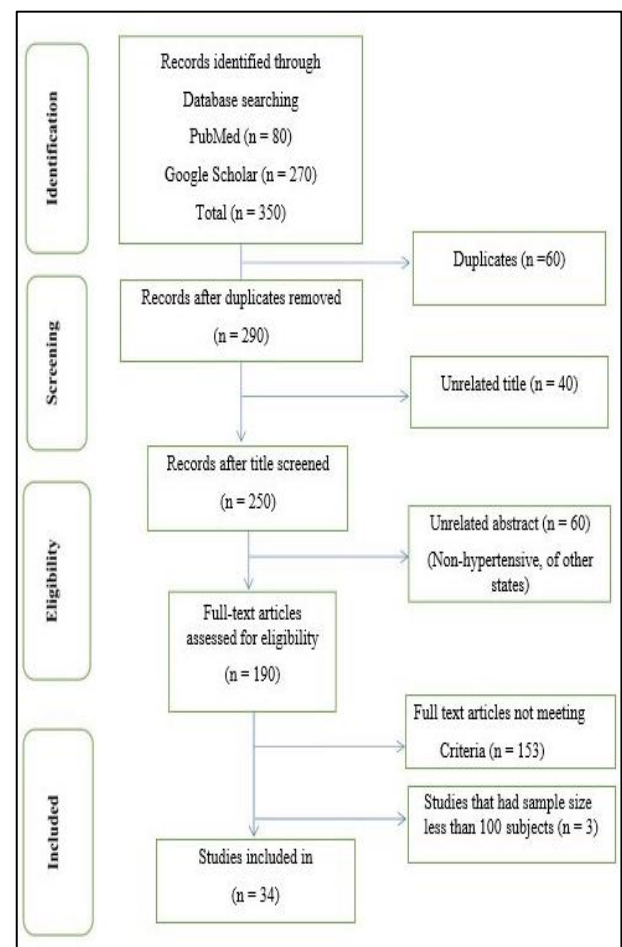


Figure 1: Number of studies identified, excluded for various reasons and type of studies included in review.

Prevalence of hypertension in Punjab

Eleven studies on the prevalence of hypertension with sample sizes ranging from 300 to 28616 were published between 2012 and 2022 in different districts of Punjab. Most recent studies have shown an increase in the prevalence of adult hypertension over the World.¹⁰⁻¹³ Similar results were also reported in data from recent articles among adults of Punjab in Table 1. The latest community-based paper of Punjab demonstrated the prevalence of hypertension as 24.3 percent among adults aged between 30-60 years or above but the prevalence increased to 40.1% in the same year surveyed by Thakur et al among the individuals of 18-69 yrs.^{14,15} The incidence of hypertension showed in Table 1, varied from 32.4 to 88.2 percent in male subjects and 30 to 84.7% in female subjects.

Prevalence of hypertension in Haryana

In the current review, 17958 individuals were examined from different districts of Haryana. The prevalence of hypertension showed variation from 17.26 to 59% among the subjects of Haryana that are presented in Table 3. Survey conducted by Thakur et al reported that the prevalence of hypertension was 26.2 percent among the

subjects of Haryana but it was increased to 28.1 percent according to the recent paper of Haryana.^{15,16} Ten studies in Table 2, reported that hypertension was more prevalent among males of Haryana. Whereas females were more hypertensive according to five studies conducted in different districts of Haryana.

Risk factors of hypertension in Punjab

A number of original research publications and population-based investigations have found a link between anthropometric measurements and high blood pressure in adults.¹⁷⁻¹⁹ Moreover, obesity and overweight were found to be substantial risk factors for high blood pressure and other coronary heart diseases.²⁰⁻²³ It has been observed that subjects with high blood cholesterol and triglyceride levels had one and half times more risk of developing hypertension as compared to normal ones.^{21,24} It has been observed that the rate of hypertension also depends on the stress levels and anxiety. Recent research conducted in Fatehgarh sahib found that the incidence of anxiety and depression was high among hypertensive women.²⁵ According to research from Punjab, the prevalence of hypertension rises substantially with age.^{18,22,26} Other factors that were responsible for hypertension in adults of Punjab shown in Table 3.

Table 1: Prevalence of hypertension in Punjab.

Authors	Years	Age groups (In years)	Sample size	Area	Overall (%)	Male (%)	Female (%)
Kaur et al ⁴⁰	2012	18-69	300	Amritsar	86.6	88.2	84.7
Badaruddoza et al ¹⁷	2014	20-65	455	Amritsar and Gurdaspur	33	-	33
Singh et al ²⁴	2014	20-60 above	1089	Amritsar	35.9	40	30
Goyal et al ²¹	2017	30-71 above	2832	Ludhiana	26.5	-	-
Mitra et al ¹⁸	2017	18-69	1000	Amritsar	33.2	32.4	34
Tripathy et al ²²	2017	18-69 above	5055	Punjab	40.1	46.1	34.9
Vikramaditya et al ⁴¹	2017	40-70 above	324	Ludhiana	61.1	68.9	53.4
Vimesh et al ¹⁹	2017	18-69	612	Pathankot	42.8	-	42.8
Mitra et al ⁴⁹	2021	18-69	500	Amritsar	33.60	34.40	32.80
Jaacks et al ¹⁴	2022	30-60 above	11,322	Punjab	24.3	-	-
Thakur et al ¹⁵	2022	18-69	5127	Punjab	40.1	47.4	31.5

Table 2: Prevalence of hypertension in Haryana.

Authors	Year	Age groups (In years)	Sample size	Area	Overall (%)	Male (%)	Female (%)
Jamatia et al ³⁴	2009	≥40	545	Faridabad	21	23	3.4
Kaur et al ²⁷	2012	40-70	600	Ambala, Rohtak, Gurgaon, and Hissar	35.66	-	35.66
Gupta et al ³⁹	2011	20-70	2295	Ambala	38.2	59.2	40.8
Verma et al ³²	2015	20-60	1080	Jhajjar	18.9	18.7	19.1
Bali et al ⁴⁵	2017	60-75	660	Ambala	44.5	20.45	24.09
Das and Chandel ²⁸	2017	≥60	206	Palwal	29.61	-	29.61
Jhawar et al ⁴²	2018	18-75	2672	Ambala	41.21	21.59	19.61
Parkash et al ³³	2019	20-50	450	Rohtak	36.4	36.4	-

Continued.

Authors	Year	Age groups (In years)	Sample size	Area	Overall (%)	Male (%)	Female (%)
Rani et al ²⁹	2019	20-55	309	Sonipat	39.8	26.8	12.9
Singh et al ²³	2019	18-60	719	Punjab and Haryana	37.7	42.7	34.1
Verma et al ⁴⁶	2019	20-60	1080	Rohtak	18.3	18.1	18.5
Akhtar et al ⁴³	2020	17-40	400	Ambala	37.5	20	17.5
Gupta et al	2020	60-75	386	Faridabad	50.3	46	53.3
Narang et al ³⁷	2020	19-60	365	Faridabad, Gurgaon, Palwal and Kurukshetra	17.26	13.15	4.10
Singh et al ³⁰	2020	25-40	300	Ambala	46	-	46
Silan et al ³¹	2022	30-60	100	Sonipat	59	39	20
Thakur et al ¹⁵	2022	18-69	5078	Haryana	26.2	29.5	22.1
Sindhvani et al ¹⁶	2023	20-80	713	Hissar	28.1	32.1	25.5

Table 3: Risk factors of hypertension in Punjab.

Authors	Years	Age group (In years)	Area	Study design	Risk factors
Singh et al ²⁴	2014	20-60 above	Amritsar	Cross-sectional	Higher levels of cholesterol and triglycerides
Badaruddoza et al ¹⁷	2014	20-65	Amritsar and Gurdaspur	Cross-sectional	WC, WHR and BMI.
Thakur et al ²⁰	2016	18-69	Punjab	Cross-sectional	Tobacco, alcohol consumption, physical inactivity, overweight, obesity, salt intake and DM
Mitra et al ¹⁸	2017	18-69	Amritsar	Cross-sectional	Age and BMI
Tripathy et al ²²	2017	18-69	Punjab	Cross-sectional	Age, marital status, alcohol consumption, obesity and salt intake
Vimesh et al ¹⁹	2017	18-69	Pathankot	Cross-sectional	BMI, family history and table salt consumption.
Kaur et al ²⁶	2019	30-50	Ludhiana	Cross-sectional	Age
Singh et al ²³	2019	18-60	Punjab	Cross-sectional	Obesity and inadequate physical activity
Shergill et al ²⁵	2022	18-69	Fatehgarh Sahib	Cross-sectional	Anxiety and depression.

Diabetes mellitus-DM, Body mass index-BMI, Waist-to-hip ratio-WHR, Waist circumference-WC.

Table 4: Risk factors of hypertension in Haryana.

Authors	Year	Age group (In years)	Area	Study design	Risk factors
Jamatia et al ³⁴	2009	Above 40	Faridabad	Cross-sectional	High fat intake, sedentary activity, alcohol consumption, smoking and overweight
Kaur et al ²⁷	2012	40-70	Ambala, Gurgaon, Hissar and Rohtak	Cross-sectional	WC and BMI
Verma et al ³²	2015	20-60 above	Jhajjar	Cross-sectional	Age, occupation, education and higher SES
Das and Chandel et al ²⁸	2017	60 above	Palwal	Cross-sectional	WC and WHR
Parkash et al ³³	2019	20-50 above	Rohtak	Cross-sectional	Age, years of service, education and their position.
Rani et al ²⁹	2019	20-50 above	Sonipat	Cross-sectional	Alcohol consumption, BMI and pickle intake.
Singh et al ²³	2019	18-60 above	Punjab and	Cross-sectional	Central and generalised

Continued.

Authors	Year	Age group (In years)	Area	Study design	Risk factors
			Haryana		obesity
Thakur et al ³⁶	2019	18-69 above	Haryana	Cross-sectional	Tobacco, alcohol consumption, physical inactivity, overweight, obesity
Narang et al ³⁷	2020	19-60	Faridabad, Palwal, Gurgaon and Kurukshetra	Cross-sectional	Overweight and obesity
Singh et al ³⁰	2020	25-40	Ambala	Cross-sectional	BMI, WC and WHR
Goel et al ³⁸	2022	20-80	Ambala	Cross-sectional	Inadequate physical activity, fewer sleeping hours, alcoholism, smoking, overweight and diabetes
Silan et al ³¹	2022	30-60 above	Sonipat	Cross-sectional	Family genetics, BMI, physical inactivity, diabetic, smoking and alcohol consumption.

Risk factors of hypertension in Haryana

The major contributing factors responsible for hypertension among adults of Haryana shown in Table 4. are waist circumference, waist-hip ratio, and body mass index.²⁷⁻³¹ Papers from Haryana reported that the prevalence of hypertension rises with age.^{32,33} In present study people with higher rank were more prone to hypertension. The reason for the increased prevalence of hypertension with rank may be linked to greater workloads and liabilities, as well as probably rising age among the subjects.³³ Most studies have reported that overweight and obesity were highly associated with raised blood pressure.^{23,34-38}

DISCUSSION

This is the very first comprehensive investigation on the incidence of hypertension and its associated risk factors among adults of Punjab and Haryana. We were unable to perform a meta-analysis due to the high degree of heterogeneity among studies. In this review, we have highlighted the trends in the abundance of hypertension in Punjab and Haryana based on region and gender.

Prevalence of hypertension

First, the research carried out in both the states revealed that adult males had a substantially greater prevalence of hypertension than females.^{16,22-24,29,31,34,37,39-44} However, six studies reported that the frequency was higher among females in both Punjab and Haryana.^{18,32,45-48} Incidence of hypertension in Punjab was 40.1%. More prevalence was seen among adult males than females aged between 18-69 yrs.²² Another paper from the district Ludhiana showed that the prevalence of hypertension was 61.1% among the adults aged between 40-70 years. Moreover, the incidence was higher among the males of Ludhiana than females i.e. 68.9 percent and 53.4 percent.⁴¹

A paper from Pathankot demonstrated the overall prevalence of hypertension among the adult females aged between 18-69 years was 42.8 percent.¹⁹ Moreover, the prevalence was higher among the females of Rohtak than males i.e. 18.5 percent and 18.1%.⁴⁶ In the Ambala district, the prevalence of hypertension was 20 percent in men and 17.5 percent in women aged 17-40 years.⁴³ Another paper from district Faridabad reported that the overall prevalence of hypertension was 50.3%. Moreover, the adult females (53.3%) were more prone to hypertension than the males (46%) of district Faridabad.⁴⁷ Another study found that the overall prevalence of hypertension was 17.26% in districts of Faridabad, Palwal, Gurgaon, and Kurukshetra. Furthermore, adult males in Haryana were more likely to have hypertension than females.³⁷ According to one study, the prevalence of hypertension in Ambala females aged 25-40 years was 46%.³⁰

Another paper from district Amritsar reported that the overall prevalence of hypertension was 33.60 percent. Moreover, the adult males (34.40%) were more prone to hypertension than the females (32.80%) of Amritsar.⁴⁹ Another paper from district Faridabad reported that the overall prevalence of hypertension was 22.5 percent. Moreover, the adult females (29.7%) were more prone to hypertension than males (19.5%) of district Faridabad.⁴⁸

Risk factors of hypertension

The risk factors for hypertension are usually changeable and non-modifiable. Age has been identified as a significant independent risk factor for hypertension. Papers from Punjab and Haryana reported that the prevalence of hypertension rises with age.^{18,22,24,32,33,49} Moreover, a systematic review as well as meta-analysis performed in India noted poorer control rates among males than females.⁵⁰ It was also observed that adults with high blood pressure and a family record of hypertension were found to have high blood cholesterol

and triglyceride levels.^{19,31,39,48} Uneducated or illiterate persons were positively associated with hypertension in a meta-analysis undertaken in Southeast Asian countries, which may be attributed to a lower level of awareness among them.⁵¹ Higher education, on the other hand, may promote health literacy and the value of leading a healthy lifestyle, which includes regular physical activity, a well-balanced diet, and regular screenings to reduce the likelihood of developing hypertension.⁵² According to the present review, people with higher rank were more prone to hypertension. The reason for the increased prevalence of hypertension with rank may be linked to greater workloads and liabilities, as well as probably rising age among the subjects.³³

A number of original research publications and population-based studies have revealed a link between anthropometric measurements and high blood pressure in adults. However, the major contributing factors for hypertension among adults is body mass index, waist circumference and waist-hip ratio.^{17-19,27-31,39,40,47,48,53}

In the current review, waist circumference and body mass index were revealed to be superior predictors of high blood pressure in Haryanvi Baniyas. On the other hand, Jatts of Haryana had a higher body mass index and waist-to-hip ratio which are the major risk factors of hypertension.³⁰ In addition, some studies have found that the two indices combined, high waist circumference and high body mass index are more effective at predicting hypertension than either one used alone.⁵⁴⁻⁵⁶ Most studies have reported that overweight and obesity were highly associated with raised blood pressure and other coronary heart diseases.^{20,23,34,35-38,41,54}

The studies done by Thakur et al indicated that low physical activity and little vigorous activity is one of the major factors responsible for the epidemic of overweight and obesity.²⁰ Though Punjab is an agriculture state even then the level of physical activity among the inhabitants is less than others states; because now the people of Punjab mainly rely on immigrant labors for agriculture. But still the physical activity index is high among rural population as compared to urban ones. This is because of fact that even now rural farmers do farming physically whereas the urban society mainly rely on machines and vehicles.²⁰

Moreover, meta-analysis performed in Southeast Asian countries reviewed that pathophysiology is caused by an increase in sodium reabsorption in the renal tubules, which hinders pressure natriuresis and is a key factor in the development of obesity-related hypertension. Three variables contribute to impaired kidney function and elevated blood pressure when obesity-related hypertension develops: (1) The fat around the kidneys physically compresses the kidneys. (2) Renin-angiotensin-aldosterone system activation. (3) Sympathetic nervous system activation is increased. With continued obesity and the onset of target organ disease, particularly kidney damage, controlling obesity-related

hypertension becomes more difficult. As a result, many antihypertensive medications as well as the therapy of additional modifiable risk factors are frequently needed.⁵² A recent study in Fatehgarh sahib found a high frequency of depression and anxiety among hypertensive women.²⁵ It was also observed that the rate of hypertension also depends on stress levels and anxiety.^{26,49} Diabetes mellitus has been identified as a risk factor for hypertension by several authors from Punjab and Haryana.^{20,31,36,38}

CONCLUSION

Several districts in Punjab and Haryana have shown a significant increase in the abundance of hypertension over time. Males in Punjab were found to have higher prevalence rates than females. We were unable to evaluate the overall trend because studies were only reported from Ludhiana, Amritsar, Gurdaspur, Pathankot (Punjab), Sonapat, Faridabad, Ambala, Gurgaon, Hissar, Palwal, Kurukshetra, Rohtak, and Jhajjar (Haryana), while other districts were not surveyed during this time period. States may organize studies to collect data at regular periods, allowing us to better understand prevalence rates across state districts. Extensive comparison of prevalence in urban and rural areas is required to assess different risk factors in these 2 regions. This information can be used to advise and guide policies and programmes in Punjab and Haryana that particularly target the primary causes of uncontrolled hypertension and its related risk factors. In Punjab, there is a lack of awareness and over sight of hypertension. High-quality studies on hypertension and its treatment among Punjab and Haryana residents are necessary to develop the most effective hypertension management programmes.

Recommendations

There are few limitations and merits in our systematic review. We looked for peer-reviewed papers in two databases only. As a result, we may have overlooked some studies that were available elsewhere. Besides that, we only determined the incidence of hypertension among adults leaving behind the adolescents or teenagers and had made no urban-rural comparison, which are the major limitations of the study. Authors were not able to perform meta-analysis due to the significant degree of heterogeneity among research findings. The primary strength of this systematic review is that it is the first thorough systematic evaluation of occurrence of high blood pressure and its related risk factors from different districts of Punjab and Haryana. We urge that a comprehensive programme be implemented to strengthen infrastructure for better patient care and research, as well as imparting knowledge at all levels in hypertension.

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