# **Systematic Review**

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# Risk factors of hypertension in Indian adults: a systematic review (1994-2014)

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#### **ABSTRACT**

Hypertension is among the most common non-communicable diseases globally. In India the incidence of hypertensive cases has been on the rise. Among the last few decades not only hypertension has become common in elderly but recently many cases have been reported in the young adults in India. Despite this emerging as one of the future public health concerns, there has been limited research regarding the factors that may be responsible for causing hypertension involving young and middle-aged adults and the findings remain inconclusive. The main aim of this study was to identify the risk factors responsible for developing hypertension in Indian adults. A systematic review of the available literature around the research question was carried out. Total 9 primary studies were identified after a thorough search of databases and screening strategy. Studies published between the years 1994 to 2014 and looking into risk factors of hypertension in the Indian adult population were considered. Data from each of the 9 included studies was extracted using MS Excel spreadsheets. The main risk factors of hypertension found in adults were smoking and chewing tobacco, alcohol consumption, obesity, sedentary activities, excessive salt intake and lifestyle. Along with these risk factors illiteracy, unawareness of diseases, neglecting attitude towards health and male dominating culture were also significant risk factors. Hypertension is increasing health problem in adults in India especially in this era of urbanization. People are adapting to the western culture and hence the lifestyle is changing drastically. The main risk factors leading to hypertension are smoking, alcohol consumption, obesity and excessive salt intake. This signifies that there is a need to improve the knowledge and attitudes of the people related with Hypertension prevention and management in order to live a better and healthy life.

**Keywords:** Hypertension, India, Young adults, Risk factors

# **INTRODUCTION**

Hypertension among young and middle-aged adults is becoming a major public health problem since last few decades globally. Prevalence of high blood pressure is increasing and this is one of the key reasons for overall morbidity and mortality. In 2008, 28% of the total adult population had uncontrolled hypertension in the world. Moreover, researchers are predicting that global burden of hypertension will rise during next decades and more

than 1.56 billion people will be suffering from hypertension until year 2025.<sup>3</sup> Hypertension is one of the serious causes which can lead to heart diseases, stroke, kidney diseases or kidney failure. In 2001, around 7.6 million people died because of high blood pressure. This number is approximately 13.5% deaths out of total deaths.<sup>2,4</sup>

Many epidemiological studies have been done about hypertension all over the world.<sup>5</sup> (WHO, 2003). These

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studies have found a strong link between high blood pressure and many serious disorders like stroke, coronary heart disease, congestive heart failure and chronic kidney disease or impaired renal function.<sup>6</sup> Also studies have shown risk factors like smoking and chronic alcoholism increase the risk of hypertension in youngsters.<sup>7</sup> Few studies have stated that physical activities have no relation with hypertension.<sup>8</sup> However some stated sedentary activities can lead to hypertension.<sup>9</sup>

Although India is the second largest country in the world by population only a few studies have been done recently to calculate the prevalence of hypertension among young and middle-aged adults in India.10 Additionally, this country has experienced rapid changes in economic development and urbanization during the last decade. The lifestyle of an Indian person and dietary patterns have changed dramatically.<sup>11</sup> One study reported that today's Indian are consuming fatty and oily food, more salt intake meat products whereas consumption carbohydrates, fruits and vegetables is less. Moreover, they engage in less physical activities<sup>12</sup>. As per India's rapid epidemiologic changes in cardiovascular diseases, evidence show that increasing hypertension in adults is needed to be considered for control of cardiovascular diseases.13 Furthermore, researchers predict that in developing countries like India, factors such as economic consequences will increase the NCD related health problems and it is more likely to shift the disease pattern from communicable to non-communicable conditions like hypertension.1

The aim of this systematic review is to study the risk factors which are responsible for developing hypertension among young and middle-aged adult population in India.

### **METHODS**

This study has been done using systematic review methodology. Systematic review studies are mostly used when there are any doubts or dissimilarities in available data of the literatures.

# Steps for systematic review

The steps for systematic review are as follows: question framing, identifying relevant publications, quality evaluation of the studies, summarizing evidences and interpreting the findings.

# Formulating research question

The research study title clearly states the aim for identification of risk factors of hypertension and targeted subjects are the young and middle-aged adults. Moreover, it specifies the place which is India.

#### Inclusion and exclusion criteria

In this analysis following inclusion criteria are applied to identification of study

Study populations were between the ages of 20 years to 60 years. Study populations were diagnosed or suffering from hypertension. Study participants were Indian nationals and residing in India.

In this analysis following studies are not included

The study participants aged above 60 years and below 20 years. Study related with secondary hypertension were also excluded from this analysis.

# Types of outcome

Factors which were directly or indirectly responsible for developing hypertension in young and middle-aged adults were considered as risk factors. The outcome which is related with only old patients or not related with adults was not considered as genuine outcome. Additionally, outcomes which are associated with hypertension as well as other medical conditions were considered depending on the situations.

### Types of studies

During initial screening procedure of studies for risk factors of hypertension in Indian young and middle-aged adults, almost all study design literatures were found. However, to make inclusion exclusion criteria more rigorous only studies which had appropriate study designs for this result were included. Cross sectional, case control, cohort and RCTs were included. Studies which were published in English language after the year 1995 were selected in inclusion criteria.

# The key words used for this study

Risk factors, Causes, Hypertension, High Blood Pressure, adults, Young adults, Youngsters, and India.

#### **Boolean operators**

Keywords were combined with Boolean operators as follows: (risk factor or cause) and (hypertension or high blood pressure) and (adults or young adults or youngsters) and (India).

#### Searched electronic databases

To discover literatures, following databases were searched with the time duration from 1994 to 2014 year: "AMED" (Allied and Complimentary Medicine database), "PubMed", "CINAHL", "PsycINFO", The Cochrane Library" and University of Bedfordshire library's "Discover" database. In these databases with combined key words and Boolean operators search was

performed. Resulting in huge amount of literature, few of them were selected after skimming.

## Online search/reference lists and e-mailing the authors

Apart from searching literatures in above mentioned databases, search engines like google and google scholar were also used.

# Screening strategy

After searching for literatures on different databases, next step is the screening process. Screening process is mainly consisted of two steps; first step is the title or abstract screening and second step is full text reading.

After screening titles, abstracts and summaries from different databases and search engines, the next step was full text reading. Total 56 studies were sorted for full text reading after title and abstract screening. Finally, after complete full text reading, 9 articles were finalized within the strict inclusion and exclusion criteria for critical review in this study.

#### Data extraction

MS excel spreadsheet was used to extract data from each selected study under the headings: study design, headings like titles, author(s), years, references (Journal), purposes, strategy etc. The sample of data extraction has been provided in appendices.

# Quality appraisal

The studies chosen for review should have minimum level of quality or standards. To fulfill these minimum requirements, a quality appraisal exercise was performed. The quality assessment was basically characterized in three categories i.e., poor, moderate and strong studies. These categories were based on points which were decided with different aspects like study design, quality of the study, method, bias and results.

Total 9 studies were selected for the review which were related to the research topic and passed the inclusion

criteria. The Table 1 given below will show the quality assessed for all included studies.

**Table 1: Quality appraisal evaluation.** 

Citation	Quality
Reddy et al 2005 <sup>15</sup>	Medium quality
Manimunda et al, 2010 <sup>18</sup>	High quality
Singh et al, 1997 <sup>21</sup>	Medium quality
Singh et al, 2011 <sup>23</sup>	High quality
Chaudhry et al, 2012 <sup>20</sup>	Medium quality
Shankarishan et al, 2012 <sup>17</sup>	High quality
Meshram et al, 2012 <sup>19</sup>	Medium quality
Soudarssanane et al, 2008 <sup>14</sup>	Medium quality
<b>Sathish et al, 2012<sup>29</sup></b>	High quality

#### Ethical consideration

As per the university regulations, ethical consideration was necessary for conducting this systematic review. In order to complete the ethical approval form, discussion had been done with the personal supervisor and supervisor approved ethical form was submitted to the Institute of Health Research (IHR) department, University of Bedfordshire. This ethical form is the declaration that there will not be directly dealing with patients and only those studies would be reviewed which are ethically undertaken in the past. Additionally, it is an assurance for all included studies and authors would be acknowledged as well as plagiarism would be totally avoided.

# Analysis

The analysis was conducted by narrative synthesis in this study. The meta-analysis was not possible mainly because of variety of variables, study designs, different outcomes and statistics. However, it was easier and less complex with narrative synthesis.

# **RESULTS**

Total nine studies were selected after rigorous screening by inclusion and exclusion criteria. To make a clear picture of results and findings, all studies are described in Table 2.

Table 2: Name, methods and findings of included studies.

Study	Methods	Findings
<b>Reddy et al</b> 2005 <sup>15</sup>	Cross Sectional Study Area: Tirupati city, Andhra Pradesh Sample size: 1000 Age group: 20-60 years Study period: 2003	The significant risk factors found in this study were age, body mass index ratio (BMI), smoking, alcohol consumption, diabetes, family history of hypertension, history of previous cardio-vascular or cerebrovascular diseases and less physical activities. Further, males were more prone to hypertension than females and out of the total sample around 10% males and 8% females were hypertensive. Additionally, saturated fat intake, non-vegetarian food, salt intake were associative risk factors.
Chaudhry et al, 2012 <sup>20</sup>	Cross Sectional Study Area: Jawaharlal Nehru	Body mass index, WHR, WC and family history of HTN were significantly higher in prehypertensive group. Prehypertensive

Continued.

Study	Methods	Findings
	Medical College, Wardha, Maharashtra, India Sample size: 150 Age group: 18-25 years (female) Study period: 2006-08	group also had an exaggerated BP response to exercise stress testing and higher BP during recovery. Additionally, family history of blood pressure was also found as a significant risk factor for hypertension among the sample.
Soudarssanane et al, 2008 <sup>14</sup>	Cohort Study Area: Jawaharlal Institute of Post graduate Medical Education and Research, Puducherry Sample size: 756 Age group: 19-24 years Study period: 2002-06	This study showed significant association between hypertension and age, parental history, gender, physical activity, lifestyle, salt intake and BMI. However, association between hypertension and social classes was not significant.  Subjects who had parental history of hypertension showed substantial increase in mean systolic blood pressure (120 mmHg) as well as mean diastolic blood pressure (80 mmHg). Again, with increasing weight and BMI, the values of mean systolic BP and diastolic BP were found high. Furthermore, less physical activities, salt intake and alcohol consumption were also found as significant risk factors, the average salt intake was 15 g/day in hypertensive subjects and 10 g/day in normotensives
Manimunda et al, 2010 <sup>18</sup>	Cross Sectional survey Area: Nicobar island, India Sample size: 975 Age group: ≥18 years Study period: 2007-09	Males and females were in almost same ratio about hypertension disease. Significant risk factors in this population were tobacco (88%), alcohol consumption (54%), and obesity (37%). Additionally, illiteracy (30%) and awareness (12%) were also substantial determinants for hypertension.
Meshram et al, 2012 <sup>19</sup>	Cross Sectional Study Area: Kerala Sample size: 4193 Age group: ≥20 years Study period: 2007-08	The mean age of the participants in this study was 43. The risk factors for hypertension found in this study were illiteracy, alcohol consumption, salt intake and sedentary activities duration of smoking or chewing tobacco. These risk factors were almost common for both men and women sexes. It was seen that obese men and women were more prone to develop hypertension as well as BMI was one of the significant determinants. Age also had important role in developing high blood pressure, more increased blood pressure was observed in more aged participants. Only 10% people were aware of their hypertension and 8% were on regular medicine. Less at risk of hypertension were those with higher socio-economic status as they were aware and had regular treatments.
Singh et al, 2011 <sup>23</sup>	Cross Sectional Survey Area: Kolkata, Nagpur, Mumbai, Thiruvananthapuram and Moradabad Sample size: 6940 Age group: 20 -65 years Study period: 1993-1996	More responsible risk factors for HTN for urban population were age, central obesity, high BMI and sedentary activities. Higher salt consumption, alcohol intake and more usage of contraceptives were found as risk factors in urban females. However, fruits and vegetables use in diet indicated reverse association.
Singh et al, 1997 <sup>21</sup>	Cross Sectional Survey Area: Moradabad Sample size: 1806 Age group: 20 -65 years Study period: Not mentioned	This study showed that age, body mass index, higher socioeconomic status and central obesity were significantly associated with hypertension in males as well as females. Furthermore, sedentary activities, high fat diet and salt intake showed weak but significant association with hypertension. The analysis revealed age, lifestyle, BMI and waist-hip ratio had strong association between both sexes.
Soudarssanane et al, 2008 <sup>14</sup>	Cross Sectional Survey Area: Assam Sample size: 700 Age group: ≥20 years Study period: Not mentioned	This study showed the alcohol consumption was more predominant habit in HTN cases as compared to control group. Moreover, tobacco use in the form of chewing or smoking was seen more in HTN cases than control group. There was dose response between the alcohol consumption per day and cigarette smoked per day. This study revealed strong association between tobacco consumption and alcohol consumption as determinants of hypertension. Findings from this study showed tobacco and alcohol consumption as potential risk factors.

Continued.

Study	Methods	Findings
Sathish et al, 2012 <sup>29</sup>	Cohort Study Area: Thiruvananthapuram district, Kerala Sample size: 297 Age group: ≥20 years Study period: 2003-2010	Age showed more relative risk in developing hypertension followed by smoking and central obesity. BMI, diabetes, high cholesterol was also found as significant risk factors. Additionally, awareness, treatment and control were found to have important roles in controlling blood pressure. Overall rural sample showed high incidence of hypertension due to lack of awareness (43%), treatment (23%) and control (11%).

#### **DISCUSSION**

Though the selected studies show almost same results, there are few different findings also. The key findings suggest that the main risk factors for developing hypertension in Young and middle-aged Indian adults are; smoking or chewing tobacco, alcohol consumption, obesity, family history, age, excessive salt intake, diabetes and BMI. Some of the studies in their findings have shown waist hip ratio, socio-economic status, central obesity, high cholesterol, sedentary activities, waist hip ratio, lifestyle, diet, illiteracy, awareness, gender and history of cerebro- vascular diseases. These findings are discussed and compared with available evidences and earlier literatures in the following passages.

#### Excessive salt intake

Excessive salt intake is a major risk factor for developing hypertension in adult as well as adult age groups. This risk factor has been found in multiple reviewed studies. The studies performed in India found people who consumed 10 gm or more salt per day in their diet, they are at high risk to develop hypertension.  $^{14,15}$ . In these studies, participants were taking excessive salt and it was one of the key risk factors which they found with their analyzed data (P < 0.001). Powles et al (2013) Asian diet contains more sodium diet as compared to other country's population  $^{16}$ . Taking too much salt in diet has become a major risk factor in Indian population, so strategies and awareness for reducing salt intake would be beneficial in Indian population.

# Alcohol consumption and smoking

Alcohol consumption and smoking are the most increased risk factors in adults now-a-days. 15,17,18 Shankarishan et al (2012); Manimunda et al (2010) and Reddy, Prabhu (2005) have found these risk factors were more responsible to develop hypertension in their studies. Alcohol consumption and smoking are the significant risk factors in Indian adult population. The P value for smoking and alcohol consumption in Reddy and Prabhu (2005) study was <0.01 and <0.001 respectively with OR 3.8 and 3.1 respectively. Manimunda et al (2010) shows 88% of the participants were smokers and 54% were alcohol drinkers. As per Meshram et al (2012), in India people use tobacco for smoking as well as for chewing also. 19 Most of the participants were tobacco chewers and it was common in males and females. Findings suggested tobacco use in any form was risk for developing hypertension in both youngsters and adults. Public awareness, new policies and few restrictions on alcohol and tobacco will be beneficial to reduce the risk of these diseases in young adults in India.

# Obesity/BMI/waist hip ratio

Obesity, overweight, high BMI and waist hip ratio are the risk factors for hypertension and other non-communicable diseases. Overweight and obese are the similar terms and waist hip ratio and body mass index (BMI) are the measurements to calculate the level of obesity. Study performed in India by Chaudhry, Diwan and Mahajan (2012); Singh et al (1997), found obesity or increased BMI were highly risky for young females to develop hypertension.<sup>20,21</sup> 58% of their total study participants were suffering from hypertension and most of them had high BMI or waist circumference. Similarly, Manimunda et al (2010) found obesity or being overweight is a big risk factor in adults<sup>18</sup>. 37% of their study participants were obese who had hypertension and it was the only risk factor for them (OD 2.86, p value <0.001). The body mechanism between obesity and hypertension is still obscure and it is still under research. However, Kotsis et al (2010) states obesity causes the expansion of body fluid resulting in extra volume of blood which develops hypertension.<sup>22</sup>

# Diet

Unhealthy diet and increasing craze of fast food are one of reasons behind hypertension in Indian population. Moreover, as per Reddy and Prabhu (2005) recently Indian people consume more oil and fatty food which may increasing the chances of obesity. Maximum hypertensive people eat unhealthy diet which contains fewer proteins, carbohydrate and more saturated fat.<sup>15</sup> Singh et al (2011) shows an increased rate of hypertension because of unhealthy diet and less fruits and vegetables in Indian diet. Lifestyle and less physical activities are also key risk factors for hypertension.<sup>23</sup> In these studies most of the people's lifestyle included less activity, alcohol consumption, smoking and less fruits and vegetables in daily diet. More oily and fatty food, less physical activities and no exercises results in being overweight or obese hence the chances of developing hypertension with obesity are more. Indian food is not healthy food as compared to other countries. To avoid this, education programmes awareness is needed about healthy diet.

#### Family history

Family history is very common for carrying different characters from parents to the offspring. These characters carriage occurs through genes. Many diseases are known which transfer from parents to their child. These diseases may occur in their child or may not. Scientists are still researching on it about how this transfer occurs. Some diseases appear in the offspring in early life and some can occur in their old age. As per Qiu et al (2003), hypertension is also a disease which can be transfer through the genes.<sup>24</sup> Parents who have chronic hypertension their children are more prone to develop this disease. This means if parents have hypertension and children exposes to the other risk factors like smoking, alcohol consumption, fatty food and sedentary lifestyle then they are at more risk than a normal person to get hypertension. Reddy And Prabhu (2005) study show a strong relation between hypertension and family history (OD 6.0, P<0.001).<sup>15</sup> In this study, approximately 25% hypertensive participants had family history of hypertension and there was less exposure to the other risk factors with these participants. Chaudhry, Diwan and Mahajan (2012) is one of the recent studies which has been done on young female participants. In this study all participants were between 18 years to 24 years and 58% of them were suffering from hypertension.<sup>20</sup> The major risk factors between them were obesity and family history. This correlates with family history and obesity connection with hypertension. Many young females in this study had high BMI and waist circumferences. Additionally, they have family history of hypertension so this made them more susceptible for hypertension. Parental history is known about hypertension up to some extent but more researches and details are needed to know in deep about these things. With more information and knowledge genetically transfer of these diseases can be restricted and many people can be saved from premature deaths as well as from being disabled.

#### Gender

Gender has some complex role in hypertension. As we know there are many differences in male and female body mechanism because of physiological differences, psychological factors and hormones. Out of reviewed studies, Meshram et al found more females affected by hypertension in their studies.<sup>19</sup> In this study 45% were males and 55% were females of hypertensive subjects. This study was carried out in 120 villages so there are possibilities for more female hypertensive patients because mostly females in rural area are housewives. Being at home only and with less physical activities there are more chances of developing hypertension to them. Indian culture is a male dominance culture. Females are mostly not allowed to work outside of the house and they are neglected about their health issues. 25,26 (Roy and Chaudhuri 2008; Pande 2003). These factors could be more responsible for increase in female ratio for hypertension as well as other non-communicable diseases. Changing this male dominant culture is a cumbersome work but awareness for female's health and some separate policies for them could be useful in improving their health as well as decreasing the burden of diseases. However, Reddy, Prabhu (2005) and Shankarishan et al (2012) found more ratio with male subjects. Logically, the male ratio in these studies may be the effect of participants. In these studies, alcohol and smoking were the key risk factors in participants, In India smoking and drinking alcohol mainly seen in males. There are chances these risk factors were the influences for developing hypertension in male subjects.

# *Illiteracy*

Meshram et al (2012) performed study in tribal area of the India. In tribal population they found more illiteracy in participants and it was the main risk factor in this population for hypertension.<sup>19</sup> Illiteracy is one of the major challenges in India for hypertension and other noncommunicable diseases.<sup>27</sup> It causes unawareness, malnutrition, and acute as well as chronic diseases in most of the countries. Illiteracy and poverty are the commonly seen problems in India and all low-income countries. These factors are interrelated with each other, one increases the chances of another.<sup>28</sup> Educational programmed established by government are not maintained and standardized. Moreover, as stated above male dominance culture is the reason for female rate of illiteracy and they are more prone for diseases. Education could be advantageous to control these diseases in Indian population. Also, Poverty and education both need to be considered in view of controlling the disease burden and premature deaths.

# Awareness on hypertension

Awareness plays an important role in prevention as well as in complications of the hypertension. Sathish et al (2012) states, only 43% of their participants were aware of their disease and rest participants did not have any knowledge about hypertension.<sup>29</sup> It states many of people don't know the seriousness of their disease and that makes it worst. Unawareness could cause serious complications and death also occur in these patients. Another study, Meshramet al. (2012) which shows awareness as a main risk factors in hypertensive patients.<sup>19</sup> This study had above four thousand participants and most of their hypertensive were unaware of this condition. Awareness issue is more in tribal and rural area and it could be because of illiteracy. These studies are performed in rural and tribal areas where they show illiteracy also. Illiteracy in these people make them unaware of the diseases. To avoid this, education and awareness programmes should be arranged together. These two risk factors are interrelated and they can increase or decrease the incidence and prevalence of hypertension drastically.

#### Socio-economic status

Socio-economic status can have two-way relations as a hypertension risk factor. As per Singh et al (1997) states more hypertensive patients are in middle and upper class in India.<sup>21</sup> These people are more likely to become obese and there are more chances for getting hypertension or other non-communicable diseases in them. The male and female ratio in this class about hypertension is the same and both are at same level of risk. Higher socio-economic group may be at more risk because mostly their works are sedentary works. The healthy diet and sedentary activities could be the main factors in higher socioeconomic group. This can make these people obese and obesity may lead to develop hypertension and other diseases like cardiovascular diseases or stroke. However, hypertension can be seen in lower socioeconomic groups as well. Mostly lower socioeconomic people are unable to have healthy food and they are less educated and aware about hypertension. Without proper fruits and vegetables in daily diet could lead to less potassium intake and more salt in diet which causes hypertension. Moreover, illiteracy and awareness about the disease and risks make them more susceptible.

#### Stress/anxiety

Relation between stress and hypertension is still obscure but some researches show people who are suffering from stress and anxiety for long time causes essential (primary) hypertension (Chow 2013).30 In young adult's stress is one of the important risk factors like alcohol consumption, smoking and obesity. The prevalence of stress and anxiety is increasing in India with day by day and it is more likely to increase in coming decades.<sup>31</sup> (Sahoo and Khess 2010). Rapid urbanization and competition to survive have made youngsters and adults life more stressful in India. Because of over competition, many educated youngsters are jobless and they have no income sources. Short term stress may not be harmful but suffering for long time can lead to essential hypertension and other serious diseases. Counselling centres for stress in adults and encouragement for techniques like meditation could be helpful to reduce the stress in youngsters.

#### Strength and limitations

Though this study topic had very few researches available, the search strategy in method section was done very precisely. Articles and evidences were screened twice and inclusion, exclusion criteria was performed properly as per protocol. Despite of every effort to avoid bias and precise outcome, there were some limitations during conducting this study. The study population for this study was Indian adults who were aged between 20 to 60 years however, there are very few studies conducted on this age group in India especially about hypertension and its risk factors. Moreover, these studies were conducted in few areas only as India has very huge land

area and it is a multicultural country, these results may not be generalizable for the total population. There were chances of biases in reviewed studies also because in few studies inclusion exclusion criteria was not clear and, in some studies analysis, and results were not very clear. Additionally, in some studies the number of participants were not enough to generalize those results for entire Indian population.

#### CONCLUSION

Hypertension in Indian adults and their risk factors are the important issues and they need to be explored more. There are very few researches have done on risk factors of hypertension in India especially in young adults. Also, this study is an indication for future researches in this field as well as better management of hypertension and its related risk factors. The NPCDCS and Ayushman Bharat programme needs to be implemented in full swing to cover every aspect of management of HTN and its complications with special focus on young adults.

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