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Research Article

**THE CAUSES OF ESSENTIAL HYPERTENSION: RANDOM
CONTROLLED STUDY**¹Dr Bilal Hussain,²Dr Ahmad Ilyas,³Dr Muhammad Ahmad Naseer
^{1,2,3}MBBS,Ameer u din Medical College, Lahore.**Article Received:** December 2019 **Accepted:** January 2020 **Published:** February 2020**Abstract:**

The purpose of this research is to assess the determinants and prevalence of essential hypertension in Pakistan. This content not only focuses on the reasons, causes and various factors behind essential hypertension, but also focuses on how people treat this condition, what are their reactions to it and how they opt to cure it. In this paper, you are going to read about the survey conducted in Lahore, the statistical details of the survey, biological elaboration of essential hypertension, it's etiological known causes, how to examine and treat it.

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INTRODUCTION:**Hypertension:**

Hypertension is a severe, age-related disorder that if remains persistent can provoke sapping cardiovascular and renal complications. Blood pressure is something that is usually observed along with a combination of other heart-related diseases. From the pathophysiological point of view, the inability of the kidneys to excrete sodium and maintains its desirable levels in the body under normal blood pressure defines the nature of hypertension; primary or secondary. No doubt dysregulation of blood pressure does exist under normal conditions, but various complicated quantitative traits are affected by genetic and environmental factors which ultimately become the reason of hypertension.¹

For instance, the function of the heart is to pump blood through the circulatory system and during this, the blood exerts pressure on artery walls. When there is high blood pressure, more strong oppositional force is exerted by the artery walls, which in turn forces the heart to pump the blood with more force through the body. This is the primary or essential hypertension as it is characterized by undefinable causes. If this situation prolongs then it weakens the heart and artery walls.²

It is observed that when large arteries, microcirculation, central nervous system, and identifiable endocrine factors play their role in blood pressure disorder, then it is secondary hypertension. Secondary hypertension is less common than essential hypertension.¹

Several methods, like medicines and change in lifestyle, are discovered to manage essential hypertension. It is important to treat this condition because if it is left unchecked it can lead to heart failure and death. A report of the World Health Organization (WHO) showed that hypertension alone is the dangerous risk factor for accounting about 13% mortality rate all around the globe.³

Survey Conduction

Table 1: Selected factors to check essential hypertension percentage in participants n= 400

Diet Concious	Red Meat consumers	BMI 18.4-24.5	BMI >24.5	Family History	Stress	Lifestyle
289	135	265	105	78	79	35
72.75%	34.5%	67%	26%	19.25%	28%	8.75%

Table 2: Essential Hypertension percentage and red meat consumers

B.P	Males N=72	Males N= 40	Females N= 12	Females N= 15
Systolic B.P \pm 5 mm Hg	128	147	125	142
Diastolic B.P \pm 5 mm Hg	69	83	73	86

A survey was conducted in Lahore in August 2019. People from hospitals, malls, offices and markets were targeted. A questionnaire in local languages was designed and the target group with age between 25 to 75 were asked to fill this paper. Further on, the results were analyzed via SPSS 22 software.

More than 400 people, including both male and female, participated in the survey. The results were astonishing.

RESULTS:

40.5% of the participants were hypertensive. Their history revealed that the most prominent reasons behind their essential hypertension was obesity, high salt intake, poor diet, lack of exercise, deficiency of minerals and stress. In comparison to males, females' history defined stress as the major reason behind hypertension. Moreover, not just the medical and physical reasons are hyping the situation, negligence is also the biggest contributor to this condition. 70% of the individuals were unaware of the severity of hypertension, these were also not conscious about their health or lifestyle and were not willing to accept that their negligence was adding more risk to their health.

Out of 400 participants, 105 males and females had BMI more than 25 and 32% of these 105 individuals had BP readings that fall in the hypertension category. Participants with normal BMI (18.4- 24.5) showed complete normal BP history. Results also revealed that males with persistent high BP issue had hypertension running in their family in comparison to those who had no such family history.

Among the participants, smokers and sedentary people also showed high BP issues. 36% participants had high blood pressure issue who consume red meat regularly with no exercise at all. People who were diet conscious and had regular physical activity were healthy and safe from essential hypertension issues.

- **Statistical Representation**

Table 3: Hypertension ratio in people with variable BMI; obese, overweight, underweight

B.P	Males having BMI <18.5	Females having BMI <18.5	Males having BMI >24.5	females having BMI >24.5	Males with normal BMI	Females with normal BMI
No of individuals	38	30	64	98	98	72
Systolic B.P ±5 mm Hg	125	142	126	147	122	142
Diastolic B.P ±5 mm Hg	64	81	80	86	74	84

Table 4: Hypertension observed in people with/ without a family history

B.P	Males with family history	Males without family history	Females with family history	Females without family history
No of individuals	55	109	80	156
Systolic B.P ±5 mm Hg	142	123	143	141
Diastolic B.P ±5 mm Hg	85	73	84	85

Table 5: Hypertension observed in people with/ without stress/ depression

B.P	Males with stress	Males without stress	Females with stress	Females without stress
No of individuals	70	92	76	162
Systolic B.P ±5 mm Hg	133	138	137	143
Diastolic B.P ±5 mm Hg	81	82	76	82

Table 6: Blood pressure scale of people with poor lifestyle (smokers)

B.P	Males	Females
No. of individuals	34	7
Systolic B.P ±5 mm Hg	144	146
Diastolic B.P ±5 mm Hg	88	76

Now, after having a look at the statistical data of the survey, it has become mandatory to elaborate that what essential hypertension is and what are its known causes. By having a keen look at these details it might will be easy to fight this elevating disorder with great care.

Definition of Primary or Essential Hypertension

Blood pressure (BP) is a highly variable quantitative trait. Studies show the unremitting relation between BP and the risks of myocardial infarction, stroke, heart failure, renal disorders, and death. This correlation is more bent towards the systolic BP than towards the diastolic pressure.⁴ No specific BP level is recorded for the cause of the above-mentioned risks, thus the definition of essential hypertension requires practical reasons and analysis for proper identification of the causes and its treatment.

The diagnosis of hypertension can be made when the average of 2 diastolic readings with 2 subsequent visits is greater than or equal to 90mm Hg or when the average of 2 systolic readings with consistent 2 visits is greater than or equal to 140mm Hg. When it is systolic hypertension it is

defined with the readings as diastolic BP <90mm Hg and systolic BP ≥140mm Hg.⁴

When the secondary causes like renovascular diseases, aldosteronism, renal failure, pheochromocytoma or other monogenic issues are absent then the issue is defined as essential or primary hypertension. Essential hypertension covers 95% of the cases all around the globe and secondary hypertension only accounts for 5%. Essential hypertension patients' cases differ from one another, with each having its own medical history and causes that lead to increased blood pressure disorders.

After the complete understanding of essential hypertension, let's now move towards knowing the etiological factors and causes of essential hypertension. By knowing these factors, it is somehow easy for the physicians and patients to

control this issue before it turns out to be something extremely dangerous and out of the hands.

Known Etiological Causes of Essential Hypertension

In spite of the fact that it is stated by researchers and doctors that the causes and factors responsible for essential hypertension are not known, but this is the partial truth. This is because without any doubt very little knowledge and research are present on genes and genetic variations that under or overexpress themselves along with the phenotypes which regulate issues to cause essential hypertension.⁵

Moreover, there is a number of factors known for increasing blood pressure and causing essential hypertension. These are given below:

1. Genetic alterations
2. Obesity
3. Insulin resistance
4. High alcohol intake
5. High salt intake
6. Aging
7. Sedentary lifestyle
8. Stress
9. Low potassium intake
10. Low calcium intake

Now, let's talk about these causes in a little depth:

1. Genetic Alterations

The reasons behind genetic alterations that are responsible for inherited primary hypertension are not known, but various studies have shown some possible facts. When the medical history of different families was studied deeply it revealed that there are many genetic traits (phenotypes) which might be responsible for inherited blood pressure, like low urinary kallikrein excretion, high-density LDL subfractions, high sodium, and lithium countersport, high fasting plasma insulin conc., body mass, and fat patterns.⁶

The very first report was published showing polymorphism in the angiotensinogen gene, which was connected with essential hypertension in two siblings who were living in France and Utah. This polymorphism comprises a thymidine substitution for cytosine in nucleotide sequence 704, which causes methionine to become a substitute for threonine at sequence 235 (M235T). These substitution replacements were found linked with essential hypertension.⁶

The researches have also found that 2 phenotypes that determine the peripheral resistance, cardiac output and blood pressure are in turn controlled and driven by intermediary phenotypes. These intermediary phenotypes include body fluid volume, renal functions, autonomic nervous

system, hormones (vasopressor/ vasodepressor), cardiac system structure and much more. The former 2 phenotypes are the reason behind the complicated development of hypertension, but at the same time intermediary phenotypes, which are drivers of 2 phenotypes, are somehow also controlled by the blood pressure itself. Thus, there are many genes that can be responsible for essential hypertension.

2. Obesity and Insulin Resistance

The main hypertensinogenic factor is obesity, specifically abdominal obesity. In the Framingham study, it was found that every 10% weight gain is linked with a 6.5 mm Hg rise in systolic blood pressure.⁷ Obesity not only causes BP but also causes insulin resistance, hyperlipidemia, left ventricle hypertrophy, adult diabetes mellitus, and atherosclerotic disorders. Thus, obesity is the root cause of many cardiovascular diseases and this risk is rapidly increasing in industrialized countries.⁷

Body fat and blood pressure is not specifically linked with morbidly obese, rather, it depends upon the overall body weight. Studies have found a direct relation between essential hypertension and Basal Metabolic Index (BMI) by observing the population from early childhood to old age. BMI less than 25 is normal, but as it increases between 26 to 28, then the risk of hypertension also increases by 180% and insulin resistance risk increases by >1000%. Thus, insulin resistance is present in patients with essential hypertension and obesity issues.⁷

3. High Alcohol Intake

According to the U.S Department of Health, higher alcohol intake is dangerous for health and is considered one of the causes among others for essential hypertension. The latest clinical and epidemiological research has demonstrated that high alcohol intake, for instance, more than 30g ethanol (3 drinks), is linked with the increased risk of cardiovascular diseases and essential hypertension. The recorded magnitude of blood pressure in chronic alcohol drinkers was about 5 to 10mm Hg with persistent high systolic pressure than diastolic pressure.

In the Framingham cohort, when a comparison was made between normal people and heavy drinkers, an increase of 7mm Hg in mean arterial pressure was observed in the former ones.

4. High Salt Intake

The American Heart Association stated in its research that excessive salt consumption, 2300mg per day can become one of the starter causes of essential hypertension. High salt levels increase the water retention in the body which in turn affects the blood volume and ultimately becomes the reason for high blood pressure.

The kidneys play a crucial role in the pathophysiology of blood pressure. The issue of blood pressure began to rise when the kidney needs more than normal blood pressure to balance its extracellular fluid level within the normal range. Vasomotor tone, fluids, and sodium balance are extremely important in regulating blood pressure. But here a point must be considered, that the above-mentioned balances are controlled by genetic as well as environmental factors, hormones, nervous system, and intracellular feedback loops. All these factors are affected by age and reflect haemodynamic alterations that lead to high and persistent blood pressure rest of the life of the patient.

5. Aging

The National Health and Nutrition Examination survey has revealed that 70% of older people have hypertension in comparison to adults age between 40- 59 among which only 32% faces hypertension issues. Moreover, the Institute of Medicine published an article in 2010 stating that, “Although, hypertension is easy to prevent, diagnose and inexpensive to treat, but still it remains the second largest leading cause of death, and it is right to call hypertension a neglected disease.”

After the age of 69, the risk of essential hypertension rises to 50%, although the rise in BP is not inevitable in elderly people but the risk still remains there. In a survey of the population aged between 65 to 74 conducted by the National Health and Nutrition Examination showed that prevalence of stage 1 hypertension was 49.6% with the scale 140–159/90–99 mm Hg, for stage 2 it was 18.2% with scale 160–179/100–109 mm Hg, and for stage 3 it was 6.5% with scale >180/110 mm Hg.⁸

The prominent effects of the normal aging process, specifically concerning the cardiovascular system, include the changes in the systemic vasculature and the aorta. With the age, the walls of arteries and aorta thicken, become weak and their elasticity decreases. These changes lead to the elevation of peripheral vascular resistance and increase blood pressure upon the walls.⁸

Another prominent aspect of aging is the fall in plasma rennin, which is part of the rennin angiotensin system. Rennin is the enzyme produced by the kidneys and it controls the arterial blood pressure. In other words, rennin is closely linked with the essential hypertension disorder. An increase or decrease in the rennin levels in the body increases the risk of essential hypertension development. In older people, the body's capacity to excrete sodium out of the body and the rennin response to salt intake decreases, which ultimately increases the water retention and blood pressure.

All these changes in the human body due to aging are responsible for decreased heart rate, low cardiac output, diastolic dysfunction, left ventricle hypertrophy and decreased myocardial contractility. Weak blood regulation induces poor renal functioning, declined renal perfusion and poor glomerular filtration rate all of which at the ends lead and become the cause of essential hypertension.

6. Sedentary Lifestyle

The very prominent factor for the development of essential hypertension besides all other medical reasons is the sedentary lifestyle. People who are less active are likely to become obese with reduced muscle mass. Fewer activities mean no exercise, no sweating and poor blood regulation in the body and poor internal organs' activities.

When a person does some exercise, heart rate increases, blood circulation increases and more oxygen reach each and every cell of the body. Exercise also stimulates the growth and production of new and healthy cells, this will increase the growth of blood vessels and make them strong by helping the body quickly remove and replace the old cells with the new one. Thus, the blood pressure decreases and the risk of essential hypertension development also reduces.

7. Stress

Stress is the root cause of multiple diseases and essential hypertension is one of them. When a person takes stress, the central nervous system releases certain vasoconstricting hormones in the body, these hormones increase the blood pressure. Increased blood pressure weakens the vessel walls and this persistent condition can cause essential hypertension.

8. Low Potassium Intake

Potassium is a key mineral upon which the body heavily depends for its proper functioning. It acts as a sodium salt balancer in the body by countering its negative effects. Kidneys aid in controlling BP by maintaining the normal body fluid level, if the fluid level is high, then the blood pressure will also be high.

Kidneys carry out their filtration process of blood by sucking extra fluid and transporting them to the bladder which is then excreted out. During this whole process, delicate sodium and potassium ion balance are maintained to pull the water from the bloodstream across a cell wall into a tubular channel that collects this extra water in the bladder.

Consuming more salt and less potassium means wrecking this delicate balance and increase blood volume due to more water retention and increased blood pressure. This situation can be balanced by consuming more fruits and vegetables, but if this

situation is not checked then it can cause essential hypertension.

9. Low calcium Intake

Calcium intake has a direct impact and relation to calcium-related hormones, calcium-related vasoactive properties, and rennin angiotensin system. Low calcium and high salt intake have an altered impact on these hormones and systems.⁹ If calcium intake is low, it will impact the efficiency of calcium-related hormones and the rennin system. When the rennin system is affected there will eventually be increased or decreased renin secretion and this whole thing will ultimately impact the blood pressure, thus causing conditions that will lead to essential hypertension.⁹

Diagnosis of Essential Hypertension

• Early Evaluation

The aim of the initial evaluation is to diagnose the baseline of blood pressure; to check for any organ damage, possible causes, and factors for essential hypertension, identification of hypertensinogenic factors and other cardiovascular risks. After early assessment and evaluation, the patient can then be facilitated with the choice of therapy.

• Medical History

It is extremely important to take a complete medical history of the patient with great care. Along with medical history, the physical examination is also very important before starting the treatment of essential hypertension. The assessment should be able to define the elements like absence or presence of target organs damaged by hypertension, remediable causes of increased blood pressure and identification of all other CVD conditions.

• Lab Tests and Other Procedures

The most common lab tests include; complete blood count, urinalysis, blood chemistry like sodium, calcium, potassium, creatinine, HDL and glucose levels, and a 12-lead ECG.

Other tests are available for the identification of secondary hypertension like uric acid, calcium, 24-hour urinary protein, microalbuminuria measurement, glycosylated hemoglobin, plasma-rennin activity, fasting triglycerides and many more.

CONCLUSION:

Despite the fact that many researchers have worked and published their findings, but they still exist uncertainty regarding the factors and causes of essential hypertension. Scientists are stating that the discovery of the causative gene with a sole pathophysiological mechanism can bring substantial advancements in the cure of essential

hypertension, but its not just the genes that are elevating the disorder. Many environmental and medical factors are also playing a critical role.

By carefully considering the above mentioned etiological causes, one can reduce the risk of getting essential hypertension by more than 40%. Proper diet and exercise is the key to a healthy life. Patients that are already facing this issue can opt for nonpharmacological strategies to reduce blood pressure. Treatments like an antihypertensive drug can decline hypertension complications.

Many drugs and treatments are available that if not completely eradicate the disorder, do show a reduction in complications caused by essential hypertension. As this condition is named as a silent killer, the very first step towards cure lies in spreading the word of awareness among people regarding their lifestyle. Because if there is no awareness, no medicine or treatment can diminish the problem.

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