

A Review on Pathophysiological Factor of Hypertension in Pakistan, its Regulation and Management

Uzma Bashir^{1*}, Ahsan Zahid¹, Muhammad Hasnain¹, Misbah Firdous¹

Abstract

Hypertension is a major health issue that affects people all over the world. It has a significant effect on the patient's quality of natural life and existence due to the associated morbidity and mortality issues. Blood pressure control that is optimized has been found to expand global health results. There is a scarcity of current data on the dominance of hypertension in Pakistan's residents. The cross-sectional study is based on records collected between 2008 and 2015 during numerous health screening camps organized in the countryside of central Punjab, Pakistan. The overall prevalence of high blood pressure was 35.1 percent, with a 34.4 percentage-standardized prevalence. 62.3 percent of patients with HTN were aware that they had high blood pressure, and 75.3 percent were already receiving medication for it. In recent decades, various dietary modules such as salt, Potassium (K), calcium (Ca), and magnesium (Mg) have been extensively investigated. While some of these nutrients have strong evidence to support their use, others are contentious and are still being researched. Dietary changes are frequently conferred through patients and can have a significant impact on blood pressure control. Blood pressure was managed in 32.3 percent of individuals taking hypertension medication. Nearly a third of patients at rural central Punjab health screening camps have hypertension. These patients had a low rate of blood pressure control.

Keywords: Hypertension, Morbidity, Dietary component, Medication, Health

1 Introduction

In the created world, hypertension is a significant medical problem. Hypertension is frequently asymptomatic for a long time, although it can sometimes arise in an intense forceful structure. Raised blood vessel pulse is an essential gamble of untimely vascular ailment, prompting cerebrovascular occasions, ischemic coronary illness, and fringe vascular infection, as indicated by an epidemiological review. Pulse, similar to tallness and weight, is a singular character with critical interindividual variety and a ceaseless distribution (Smith et al., 2013).

Hypertension, which is ordinarily characterized as a steady pulse (BP) of 140/90 mm Hg in the clinical office, is one of the main sources of untimely dreariness and mortality in the United States. Hypertension, then again, is expected to increment in pervasiveness by 60% by 2025, influencing 1.56 billion individuals universally. Financially developing nations will have an ascent of 80% (from 639 million to 1.15 billion). Hypertension is a significant local area medical problem, with a worldwide breadth of 40.8 percent and a 32.3 percent control rate (Gitinkwi et al., 2020).

¹ Islamia University of Bahawalpur, Pakistan

*Corresponding author's E-mail: uzma.bashir8926@gmail.com

Received: 2 January 2024; Received in revised form: 06 December 2024; Accepted: 27 December 2024.

Available online: 31 December 2024.

This is an open-access article.

Condition	Systolic blood pressure (mm Hg)		Diastolic blood pressure (mm Hg)
Normal	≤120	and	<80
Pre-hypertension	120–139	or	80–89
Stage 1 hypertension	140–159	or	90–99
Stage 2 hypertension	≥160	or	≥100

Figure 1. Hypertension and its related Diagnoses

Hypertension is a significant gamble for an assortment of huge sicknesses, including coronary illness, stroke, and persistent kidney infection. Hypertension-related outcomes are liable for 9.4 million fatalities around the world, as well as 45% of the death from coronary supply route illness and 51 percent of the theater stroke (González-Gómez et al., 2018). Hypertension is wider in low-pay nations, where cardiovascular infection represents generally 80% of all death. In Pakistan, two enormous epidemiological examinations observed hypertension predominance paces of 19.1 percent and 14 percent, separately, in light of the 1990-1994 National Health Survey and provincial northern segments of the country. These examinations, in any case, are not characteristic of the momentum illness trouble because the information was gathered 15-20 years prior. Populace development, age and changes in social risks have all been connected to worldwide expansions in the commonness of hypertension after some time, as indicated by studies from different countries. Punjab is Pakistan's most crowded territory. In the course of the most recent eight years, a nephrology department of a tertiary care medical clinic in rural Punjab has held an enormous number of wellbeing screening camps to further develop wellbeing and bring issues to light about hypertension, diabetes, and ongoing kidney illness among the overall population. In light of information acquired during these wellbeing screening camps, this study expects to give updated information on the predominance, mindfulness,

management, and control of hypertension (Feist et al., 2021).

All medical care professionals go over individuals who could profit from lower circulatory strain consistently. Patients with confirmed hypertension and pre-hypertension (systolic 120-139 mm Hg) had a higher gamble of cardiovascular occasions than those with ideal (120/80 mm Hg) or typical (120-129/80-85 mm Hg) BPs show in figure 1. More individuals may almost certainly become a possibility for antihypertensive treatment before long as clinical preliminaries show the advantages of treatment (even pre-hypertension) and pharmacological methodologies become more secure and more viable (Lule et al., 2019). Besides pharmacological treatment, most of the people more than 40 years of age would profit from the way of life changes. A hypothetically protected general well-being way to deal with bringing down circulatory strain that moves the expenses of treatment (whether diet, work out, or both) from the medical services framework to the singular. A considerable lot of the restorative way of life changes that lower pulse or slow the pace of circulatory strain rise ought to be embraced into everybody's way of life at the earliest opportunity (Deepak et al., 2021). This study analyzes the latest epidemiological information on hypertension predominance, mindfulness, treatment, and control with verifiable information from Pakistan to differentiate the customary and perhaps future meanings of hypertension. The risks of having hypertension are recorded. A few places of BP estimation that are right now

accessible and recommended are talked about under (Shaheen et al., 2021).

1.1 Epidemiology and Risk

Presently, medical practitioners and individuals seeking healthcare seldom prioritize the reduction of elevated blood pressure solely for the purpose of mitigating specific symptoms or maladies correlated with this condition. Instead, because of the increased risk of long-term morbidity and mortality associated with hypertension, as well as the knowledge that antihypertensive medication avoids some (but not all) of these occurrences, hypertension is routinely and adequately treated (Hartle et al., 2016). Several epidemiological investigations established in 1948 through the Framingham Heart Study and continuing to the present day have demonstrated the hazards associated with high blood pressure. In both Western and Eastern populations, meta-analyses of collective data have established the robust, constant association between blood pressure and cerebrovascular syndrome and coronary heart syndrome (Andersson et al., 2019). Left ventricular hypertrophy, heart failure, peripheral vascular disease, carotid atherosclerosis, end-stage renal disease, and "subclinical CV disease" are all linked to high blood pressure. Hypertensive patients are substantially more expected than normotensive individuals to suffer from type II diabetes or dyslipidemia particularly raised triglycerides and low high-density lipoprotein cholesterol (HDL-C) (Wollert et al., 2017).

1.2 Hypertension with Age

The elderly is the world's fastest-growing population segment. The hypertension prevalence rate increases with age, according to data collected over 30 years. This hypertensive subgroup also has a higher risk of coronary artery disease, stroke, dementia, prolonged renal disease, and congestive cardiac failure. Cardiovascular specialists and other practitioners have a therapeutic conundrum when it comes to

hypertension in the elderly (Corrada et al., 2017). Before the findings of the Systolic Hypertension in Europe Trial were released, the prevailing medical belief was that blood pressure values should not be reduced in the same way that they were in younger patients to avoid ischemic events and poor organ oxygenation (brain, heart, kidney) (Corrada et al., 2017).

1.3 Gender and Hypertension

It is commonly known that as people get older, the prevalence of hypertension varies between men and women. A cross-sectional survey was carried out in several parts of Pakistan. The researchers gathered information on sociodemographic and clinical factors. A total of 9442 people aged 15 and up were counted. Mother's tongue identified different regional sub-groups including, Punjabi, Muhajir, Pashtun, Sindhi and Baloch (Jafar et al., 2004). Baluchi (25.3 and 41.4 percent in men and women) had the highest age-standardized prevalence of hypertension, followed by Pashtuns (23.7 & 28.4 percent in men & women), Muhajirs (24.1 & 24.6 percent in men and women), Punjabis (17.3 & 16.4 percent in men and women), and Sindhis (17.3 & 16.4 percent in men and women) (19.0 & 9.9 percent in men and women). In cities, hypertension was more than in rural areas. After controlling for socio-demographic, nutritive and clinical risks however, ethnic differences remained (Afzal et al., 2013).

1.4 Race/Ethnicity and Hypertension

This broad geographic designation obscures the region's incredible national and cultural variety to the point that it's largely irrelevant. East Asia is made up of three countries: Japan, Korea, and China, all of which are culturally distinct in many ways. Even among Taiwanese aborigines (who are akin to South Pacific Islanders), Hakka (Han subgroup), and Minnan, there are significant distinctions (Taiwanese). One commonality appears to be a high intake of dietary salt, which is

linked to an increased risk of heart failure. Calcium antagonists and diuretics appear to be the most effective treatments for hypertension in such people. East Asians tend to have a higher incidence of cough related to ACE inhibitor use (Deere et al., 2020).

The term "South Asian" ignores the vast differences that exist inside India and between India and other countries in the region. Pakistan is a good example of this, as it is made up of four states with very varied cultures. Women from Baluchistan, Pashtuns, Muhajirs, Punjabis, and Sindhis have the highest frequency of hypertension. The researchers were unable to pinpoint a cultural explanation for the disparities (Saleem et al., 2010).

2 Regulation of Blood Pressure

2.1 Neurogenical

The vasomotor center includes the nucleus tractus solitarius in the dorsal medulla, a posterior region of the ventral medulla, and other centers in the Pons and midbrain. Arterial baro-receptors afferent impulse activity increases in response to distension of the artery wall. This raises vagal tone and decreases efferent sympathetic activity. The outcome is bradycardia and vasodilation (Moore et al., 2011).

2.2 Renin-angiotensin system

All angiotensin peptides come from angiotensinogen, the renin substrate. While some exploration infers angiotensinogen substrate is abundant in human plasma when contrasted with renin, others recommend that adjustments of plasma angiotensinogen levels can fluctuate the Renin-angiotensin system relative movement. For instance, a human Alanine:glyoxylate Aminotransferase quality variety connected to more noteworthy plasma levels of angiotensinogen has additionally been connected to the improvement of hypertension. Moreover, quality titration tests in transgenic mice with 0 to 4 duplicates of the AGT quality uncovered a positive connection between the quantity of AGT quality duplicates, plasma levels of angiotensinogen, and circulatory strain. Besides, a new report uncovers that oxidative pressure-actuated modifications in the design of the angiotensinogen particle can radically change the energy of renin breakage. These discoveries recommend that oxidative pressure might apply free control on the action of the RAS by advancing the development of angiotensin I (Lu et al., 2016).

Angiotensinogen enters the course

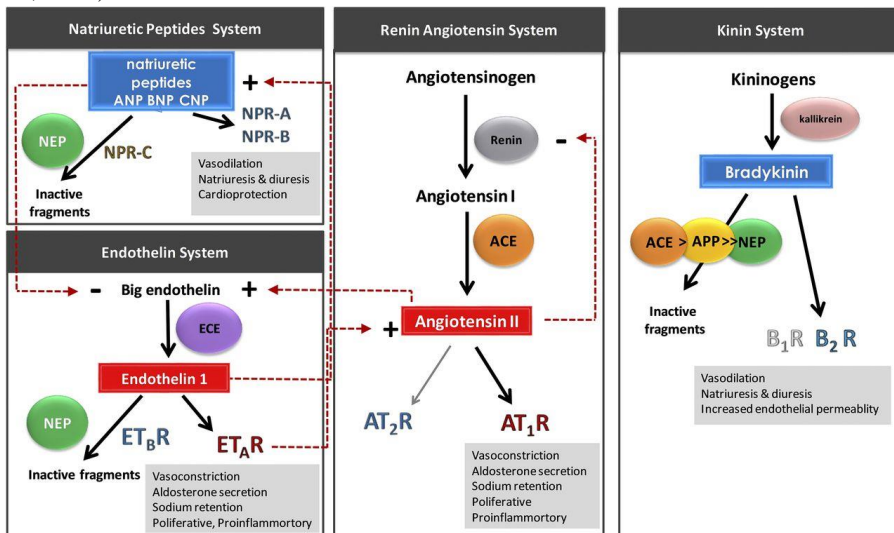


Figure 2. Renin-Angiotensin System and associated peptides in hypertension

prevalently by liver creation, despite even though additionally made by different organs including the mind, resistant framework, and kidney show in figure 2. Changes in angiotensinogen levels in these tissues might impact the movement of neighborhood renin-angiotensin frameworks through instruments that are random to angiotensinogen levels in the flow. Angiotensin II, for instance, may improve angiotensinogen amalgamation in the proximal tubule of the kidney as a component of a nearby, intra-renal RAS that is controlled autonomously of the fundamental by RAS. This evident "feed-forward" framework could impact epithelial cell action along the nephron, improving salt reabsorption and hypertension. In patients with hypertension and different types of constant renal illness, pee angiotensinogen might be used to assess RAS initiation in the kidney (O'Shea et al., 2017).

2.3 Atrial Natriuretic Peptide

Atrial granules discharge atrial natriuretic peptide (ANP). It causes natriuresis, diuresis, and a little drop in pulse, while additionally bringing down plasma renin and aldosterone levels. Osmoreceptor synaptic transmission is additionally impacted by natriuretic peptides. The feeling of atrial stretch receptors causes the arrival of ANP. Raised filling tensions and people with

blood vessel hypertension and passed on ventricular hypertrophy to improve ANP focuses on the ground that the left ventricle divider adds to ANP discharge (Fu et al., 2018).

2.4 Eicosanoids

Arachidonic corrosive metabolites influence pulse by impeding the autonomic sensory system, the renin-angiotensin-aldosterone framework, and other humoral pathways through direct consequences for vascular smooth muscle tone and communications with other immense administrative frameworks. Vascular endothelial cell disappointment in hypertension people might bring about a reduction in endothelium-inferred loosening up factors like nitric oxide, prostacyclin, and endothelium-determined hyperpolarizing factor, as well as an expansion in contracting factors like thromboxane A2 and endothelin-1 (Grona et al., 2020).

2.5 Kallikrein-Kinin Systems

Vasoactive peptides are formed when tissue kallikreins interact with kininogen. The vasodilator bradykinin is the most important. Kinins are involved in the regulation of renal blood flow, as well as the excretion of water and sodium. ACE inhibitors prevent bradykinin from being broken down into inactive peptides (McCarthy et al., 2021).

2.6 Endothelial System

The vasodilation caused by

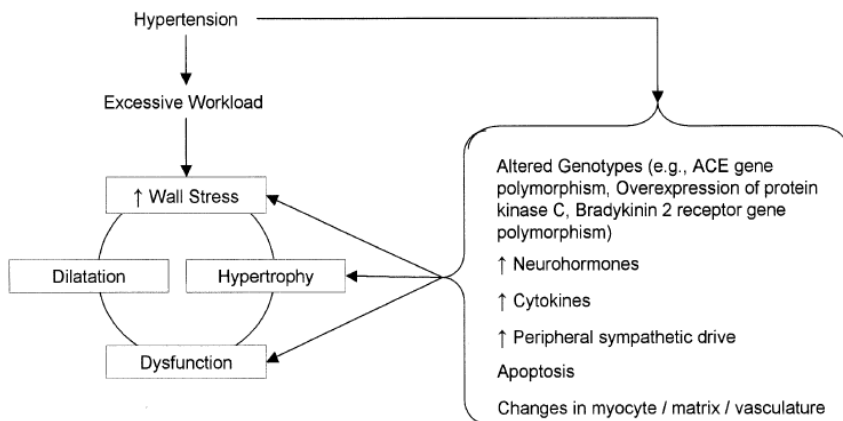


Figure 3. Mechanism of action of cardiac hypertrophy in hypertension

bradykinin, acetylcholine, nitrates and sodium nitroprusside is controlled by nitric oxide. In individuals with hypertension, endothelial-mediated relaxation is reduced. The endothelium produces the most potent vasoconstrictors, endothelins. The production and awareness of endothelin-1 are similar in hypertensive and normotensive persons. Nevertheless to hypertensive endothelial damage, the vascular effects of endothelin-1 endogenous may be exacerbated by decreased nitric oxide production. (Konukoglu et al. , 2016).

2.7 Adrenal steroids

Glucocorticoids and mineralocorticoids increase heartbeat. Enhanced vascular response or salt and water retention can counteract this impact. In addition, both increase vascular tone by activating pressor chemical receptors such as angiotensin-2 (Lightman et al., 2008).

2.8 Renomedullary Vasodepressor

Medullipin I is discharged by adrenomedullary interstitial cells, which are generally found in the renal papilla. This lipid is changed over to medullipin II in the liver. This medication has a dependable hypotensive effect, which might be because of direct vasodilation, a decrease of thoughtful drive in light of hypotension, and a diuretic impact. The movement of the adrenomedullary framework is believed to be constrained through the renal medullary bloodstream (Abe et al., 1977).

2.9 Sodium & Water Discharge

An expansion in the pulse is connected to sodium and water maintenance. It is felt that sodium delivers an expansion in intracellular calcium in the major cell-like; vascular single and multi-unit smooth muscle, bringing about higher vascular activity, through the calcium-sodium trade process. An inappropriate connection among tension and sodium discharge brought about by diminished renal

bloodstream, lower nephron mass, and raised angiotensin or mineralocorticoids might be the significant reason for salt and water maintenance (Shuang et al., 2019).

3 Hypertension and Left Ventricular Remodeling

The most prevalent cause of LVH is systemic hypertension, which causes a continuous increase in workload on the left ventricle. In vivo, this structural alteration can be detected using an ECG or echocardiography. Expanded adequacy, width, and indenting of the QRS intricate left pivot deviation, repolarization (ST-T wave) changes, and LA anomalies are largely indications of LVH. Albeit the specificities of a few ECG rules for the analysis of LVH, for example, the Sokolow-Lyon, Romhilt-Estes, and Cornell voltage rules are for the most part high (above 90%), their awarenesses range from 7% to 60%. The awareness of the ECG standard is changed by both biologic (stoutness and cigarette smoking diminish responsiveness) and methodologic factors (age and seriousness of LVH upgrade awareness) (expanded when LV mass was ordered to body surface region rather than tallness). Mechanism of action of cardiac hypertrophy in hypertension show in figure 3. Quantitative echocardiography has shown to be a more solid and accurate proportion of chamber mass, divider thickness, and plan during the most recent 20 years, giving a repeatable strategy for painless assessments of ventricular engineering. Just 1.3 percent of the people in a new Framingham research displayed affirmed LVH by ECG measures, although 19% of men and 24 percent of ladies met the echocardiographic standards for LVH (Bornstein et al., 2021).

4 Pathophysiological Underpinnings of Hypertension

1. Expanded sensory system action
2. Surplus of sodium-holding chemicals

3. Vasoconstrictor drugs
4. Excessive sodium consumption for a long time
5. Expanded or improper renin emission
6. Lacks of sodium-holding chemicals and vasoconstrictors
7. Varieties in articulation of the kallikrein-kinin framework
8. Diabetes mellitus and obesity
9. Pulse, inotropic attributes of the heart, and vascular tone are totally impacted by changes in adrenergic receptors, as well as changed cell particle transport (Daiber et al., 2019).

4.1 Pathophysiology of Hypertension

Continuously pulse amplification that harms end organs in addition to increasing morbidity and mortality is called hypertension. Blood pressure is the primary vascular resistance and cardiovascular outcome. Individuals with hypertension may therefore have a rise in cardiac yield, underlying vascular blockage or both. The heart yield is much of the time improved in more youthful patients, while in more established patients, expanded vasculature firmness and expanded fundamental vascular obstruction play a significant effect. Expanded-adrenoceptor initiation or expanded arrival of peptides such as endothelins or angiotensin can deliver an expansion in vascular tone. In the last step, calcium in the vascular smooth muscle promotes vasoconstriction. A few maturation chemicals, such as endothelins and angiotensin, which promote an increase in vascular smooth mass, are responsible for the vascular remodelling. Due to an increase in both vascular stiffness and basic vascular blockage, the layer on the left ventricle grows, resulting in hypertrophy of the left ventricle and diastolic instability. Young people have relatively low left ventricular blood pressure, and the waves echoed by peripheral blood vessels primarily occur after systole ends. This causes the early portion of diastole to be more stressful and improves heart perfusion. The aorta's

hardening and flexible passageways widen the pulse pressure as we age. Early diastole gives way to late systole in reflected waves. This contributes to left hypertrophy and increases left ventricular afterload. Growing older and experiencing an enlarged heartbeat is a strong sign of coronary heart disease (Beevers et al., 2001).

The circulatory strain guideline engages the autonomic sensory system. Patients with hypertension have been shown to exhibit both increased fringe sensitivity to norepinephrine and increased norepinephrine discharge. Furthermore, there is an additional notable resistance to upsetting upgrades. There are two distinct features of blood vessel hypertension: the baroreflexes being reset and the baroreceptors being less sensitive. In the presence of essential hyperaldosteronism, the renin-angiotensin system is inhibited and is linked to at least some forms of hypertension, such as renovascular hypertension. People of color tend to have low-renin hypertension more often. Others are more likely to experience cardiac dead cells and other cardiovascular problems because they have high-renin hypertension (Kur et al., 2012).

In human primary hypertension and trial hypertension, the volume link between pulses and sodium excretion is hindered. Evidence suggests that one of the key factors contributing to the management of hypertension is the restoration of pressure natriuresis. In individuals with fundamental hypertension, the resetting of strain natriuresis is characterized by a reduction in the slope of pressure natriuresis and salt-related hypertension, or by an equal shift towards more serious hypertension (Kario et al., 2014).

5 Management of Hypertension

5.1 Prevention of Hypertension

5.1.1 Eating a healthy diet in routine:
Limit how much sodium (salt) you consume and build how much potassium

Table 1 Herbs used in Management of Hypertension

Herbs	English Name	Concentration/ Dose	References
<i>Allium sativum</i>	Garlic	3mg/ml	(Al Disi, Anwar, & Eid, 2016)
<i>Andrographis paniculata</i>	King of Bitter	0.7-2.8g/kg	(Al Disi et al., 2016)
<i>Apium graveolens</i>	Celery	1ml/kg	(Al Disi et al., 2016)
<i>Camellia sinensis</i>	Tea	5g/kg	(Al Disi et al., 2016)
<i>Coptis Chinensis</i>	Goldthread	150mg/kg	(Al Disi et al., 2016)
<i>Coriandrum sativum</i>	Coriander	200mg/kg	(Al Disi et al., 2016)
<i>Crocus sativus</i>	Saffron	20-80mg/kg	(Al Disi et al., 2016)
<i>Hibiscus sabdariffa</i>	Roselle	2mg/ml	(Al Disi et al., 2016)
<i>Zingiber officinale</i>	Ginger	0.05mg/ml	(Aiyeloja & Bello, 2006)
<i>Cymbopogon citratus</i>	Lemongrass	100 mg/kg	(Aiyeloja & Bello, 2006)
<i>Nigella sativa</i>	Black Cumin	0.6 ml/kg/day	(Aiyeloja & Bello, 2006)
<i>Salviae miltiorrhizae</i>	Chinese Sage	5 g/twice a day	(Aiyeloja & Bello, 2006)

is in your eating regimen to assist with dealing with your circulatory strain. Eating low-fat food varieties, as well as an adequate number of organic products, vegetables, and entire grains, is likewise useful. The DASH eating plan is an illustration of an eating regimen that can support pulse decrease.

5.1.2 Getting regular activity: Exercise can assist you with keeping a sound load while likewise bringing down your circulatory strain. Something like 2 and 30 minutes of moderate-power high-impact movement, or 1 hour and 15 minutes of lively for oxygen-consuming activity, should be finished every week. Any activity that makes your heart beat faster and your body consume more oxygen than expected is delegated vigorous activity.

5.1.3 Maintaining a solid weight: Obesity or being overweight raises yotheospossibility hypertension. Keeping a sound weight can support the administration of hypertension and the

counteraction of other wellbeing concerns.

5.1.4 Drinking with moderation: Too much liquor could cause your circulatory strain to rise. It additionally adds more calories, possibly prompting weight gain. Men should restrict themselves to two beverages every day, while ladies should restrict themselves to one.

5.1.5 No smoking: Cigarette smoking lifts circulatory strain and builds your gamble of coronary failure and stroke. Try not to begin smoking on the off chance that you don't as of now. Assuming you smoke, talk with your medical care doctor about the best strategy to stop.

5.1.6 Dealing with pressure: Learning to unwind and oversee pressure can assist you with feeling far improved genuinely and truly, as well as lower your circulatory strain. Working out, standing by listening to music, zeroing in on something quiet or peaceful, and pondering are for the most part

compelling pressure the executives draws draw (Diaz et al., 2013).

5.2 Nutritional Factors in Hypertension Management

In the treatment of hypertension, dietary changes play a fundamental part. Solid information backs up the suggestion of a potassium-rich, moderate-liquor, and high-fiber diet. All in all, a DASH design diet wealthy in , vegetables, entire grains, natural products, low-fat dairy items, fish, nuts, sugar-improved food, drinks and fats as well as wealthy in vegetables and products of the soil in creature protein, ought to be investigated. It isn't prescribed to utilize drug enhancements to accomplish these dietary objectives. Proficient associations, by and large, empower sodium limitation; by and by, given the proof of related expected adverse consequences and its shifted adequacy in different patient populaces, this ought to be painstakingly perceived and custom-made. As far as expanded calcium, magnesium, fish oil, and garlic consumption, the solution is ambiguous. Unpredictable espresso consumers and licorice clients have a higher possibility creating hypertension; consequently these propensities ought to be stayed away from high-risk patients (Nguyen et al., 2013).

5.3 Herbs used in Management of Hypertension

Table I shows the herbs used in the management of hypertension.

5.4 Classes of Drugs for the Management of Blood Pressure

- Beta-blockers
- Alpha-blockers
- ACE inhibitors
- Calcium channel blockers
- Diuretics
- Angiotensin II receptor blockers
- Central agonists
- Vasodilators

5.4.1 Diuretics

Diuretics aid in the removal of excess water and salt from the human body in addition to the regulation of pulse. They frequently go together with other drugs

that have been prescribed by doctors (Hermida et al., 2016).

Table 2 Diuretic medications

Generic Name	Common Brand Name
Furosemide	Lasix.
Bumetanide	Burinex
Spirolactone	Aldactone
Hydrochlorothiazide	Aquazide
Amiloride	Midamor

5.4.2 Beta-blockers

Beta-blockers lower the pulse by bringing down the pulse, exertion, and blood result of the heart (Hermida et al., 2016).

Table 3 Beta-blocker medication

Generic Name	Common Brand Name
Acebutolol	Sectral
Oxprenolol	Tractor
Pindolol	Visken
Bisoprolol	Concor
Celiprolol	Edsivo

5.4.3 ACE inhibitors

Angiotensin is a hormonal substance that causes artery narrowing, mostly in your kidneys but also in other parts of the body. The peptide known as angiotensin-converting enzyme changes angiotensin-I into angiotensin-II. By assisting the body in producing less ACE assist the blood vessels relax and open up, decreasing blood pressure (Hermida et al., 2016).

Table 4 ACE inhibitors medication

Generic Name	Common Brand Name
Imidapril	Hipertene
Captopril	Capoten
Zofenopril	Zocardis
Cilazapril	Inhibace
Ramipril	Altace

5.4.4 Angiotensin II receptor blockers

Angiotensin-changing over chemical inhibitors (ACEIs) block the impacts of angiotensin, a substance that makes supply routes restricted. To contract a

vein, angiotensin requires a receptor-a substance "opening" to squeeze into or bond with. Angiotensin-changing over compound inhibitors (ARBs) block receptors, keeping angiotensin from tightening veins(Hermida et al., 2016).

Table 5 Angiotensin II receptor blockers medication

Generic Name	Common Brand Name
Candesartan	Atacand
Telmisartan	Micardis
Irbesartan	Avapro
Losartan potassium	Cozaar

5.4.5 Calcium channel blockers

This medication inhibits the entry of calcium into the heart and smooth muscle cells in conduits. In these areas, calcium provides a more notable and robust compression as a result, adding calcium leads the heart to contract less forcefully. Calcium channel blockers relax and widen constricted veins, lowering heart rate and blood pressure (Rothwell et al., 2010).

Table 6 Calcium channel blocker medication

Generic Name	Common Brand Name
Isradipine	Dynacirc,
Nifedipine	Adalat cc
Nisoldipine	Sular

5.4.6 Alpha-blockers

These drugs lower artery resistance by loosening up the blood vessel dividers' solid tone(Bittar et al., 1995).

Table 7 Alpha-blockers medication

Generic Name	Common Brand Name
Terazosin hydrochloride	Hytrin
Doxazosin mesylate	Cardura
Prazosin hydrochloride	Minipress

5.4.7 Central agonists

Focal agonists additionally help to diminish the capacity of veins to tense or contract. Focal agonists work through an unexpected neuronal pathway in comparison to alpha and beta-blockers, yet they all work to bring down the pulse(Bittar et al., 1995).

Table 8 Central agonists medication

Generic Name	Common Brand Name
Rilmenidine	Albareil
Methyldopa	Hypergen
Clonidine	Catapres
Guanfacine hydrochloride	Tenex

5.4.8 The vasodilators

Vasodilators, also known as blood vessel dilators, cause the arterioles and other blood vessel walls to relax, causing the vessel to broaden . Blood flows more easily as a result of this (Bittar et al, 1995).

Table 9 Blood vessel dilators medications

Generic Name	Common Brand Name
minoxidil	Loniten
hydralazine hydrochloride	Apresoline

6 Conclusion

Various epidemiological examinations like Framingham Heart Study in 1948 and proceeding to the current day, have shown the risks related to hypertension. Hypertension is associated with left ventricular hypertrophy, cardiovascular breakdown, fringe vascular sickness, end-stage renal illness, cardiovascular diseases and carotid atherosclerosis. Multiple studies have demonstrated that treating hypertension in the elderly is not only safe, but significantly reduces the risk of stroke, heart failure, myocardial infarction, and death. Established dietary guidelines and some herbs have been shown to help lower blood pressure and, as a result, hypertension-related

comorbidities and overall mortality. More research on the impact of nutrients, counselling and herbal medications in preventing and treating hypertension complaints in unique populations is needed.

Conflicts of interest

The authors have nothing to disclose.

Consent for publication

All author agree for submission of manuscript in this journal

Availability of supporting data

Manuscript supporting data is available

Funding

For the research or publication of this work, the authors received no financial funding.

Conflict of interests

Authors declared that there is no conflict of interest.

Acknowledgments

The authors would also like to thank the Islamia University of Bahawalpur, Pakistan for moral support and complete the study.

Author contributions

All authors have equally contributed in research work and manuscript proofreading. All authors have read and agreed to the version of the manuscript.

References

- Afzal, S., Mehboob, R., & Bukhari, M. H. (2013). Hypertension and low birth weight babies in females sterilized with quinacrine in Faisalabad from 1995 to 2005. *Annals of King Edward Medical University*, 19(4), 317-317.
- Al Disi, S. S., Anwar, M. A., & Eid, A. H. (2016). Anti-hypertensive herbs and their mechanisms of action: Part I. *Frontiers in Pharmacology*, 6, 323. <https://doi.org/10.3389/fphar.2015.00323>
- Andersson, C., Johnson, A. D., Benjamin, E. J., Levy, D., & Vasan, R. S. (2019). 70-year legacy of the Framingham Heart Study. *Nature Reviews Cardiology*, 16(11), 687-698. <https://doi.org/10.1038/s41569-019-0177-4>
- Beevers, G., Lip, G. Y., & O'Brien, E. (2020). The pathophysiology of hypertension. *BMJ*, 322(7291), 912-916. <https://doi.org/10.1136/bmj.322.7291.912>
- Bornstein, A. B., Rao, S. S., & Marwaha, K. (2021). Left ventricular hypertrophy. In *StatPearls* [Internet]. StatPearls Publishing. <https://www.statpearls.com>
- Corrada, M. M., Hayden, K. M., Paganini-Hill, A., Bullain, S. S., DeMoss, J., Aguirre, C., ... Kawas, C. H. (2017). Age of onset of hypertension and risk of dementia in the oldest-old: The 90+ study. *Alzheimer's & Dementia*, 13(2), 103-110. <https://doi.org/10.1016/j.jalz.2016.09.008>
- Daiber, A., Kröller-Schön, S., Frenis, K., Oelze, M., Kalinovic, S., Vujacic-Mirski, K., ... Steven, S. (2019). Environmental noise induces the release of stress hormones and inflammatory signaling molecules leading to oxidative stress and vascular dysfunction—Signatures of the internal exposome. *Biofactors*, 45(4), 495-506. <https://doi.org/10.1002/biof.1692>
- Deepak, G. (2021). Big data analytics on health care dataset with production cluster setup in GCP. *Unpublished manuscript*.
- Deere, B. P., & Ferdinand, K. C. (2020). Hypertension and race/ethnicity. *Current Opinion in Cardiology*, 35(4), 342-350. <https://doi.org/10.1097/HCO.0000000000000727>
- Diaz, K. M., & Shimbo, D. (2013). Physical activity and the prevention of hypertension. *Current Hypertension Reports*, 15(6), 659-668. <https://doi.org/10.1007/s11906-013-0393-4>
- Feist, S. E. (2021). Salinisation in the Bengal delta, Bangladesh—Implications

- for Asian delta systems. *University of Portsmouth*.
- Fu, S., Ping, P., Wang, F., & Luo, L. (2018). Synthesis, secretion, function, metabolism and application of natriuretic peptides in heart failure. *Journal of Biological Engineering*, 12(1), 1-21. <https://doi.org/10.1186/s13036-018-0133-9>
- Gitinkwi, Y. M. (2020). Effectiveness of a community-based intervention to reduce behavioral risks targeting mothers' knowledge, attitude, and associated households' awareness towards salt intake reduction to prevent hypertension in Dodoma, Tanzania. *The University of Dodoma*.
- González-Gómez, S., Meléndez-Gomez, M. A., & López-Jaramillo, P. (2018). Fixed-dose combination therapy to improve hypertension treatment and control in Latin America. *Archivos de Cardiología de México*, 88(2), 129-135. <https://doi.org/10.1016/j.acmx.2017.06.001>
- Gronda, E., Jessup, M., Iacoviello, M., Palazzuoli, A., & Napoli, C. (2020). Glucose metabolism in the kidney: Neurohormonal activation and heart failure development. *Journal of the American Heart Association*, 9(23), e018889. <https://doi.org/10.1161/JAHA.120.018889>
- Hartle, A., McCormack, T., Carlisle, J., Anderson, S., Pichel, A., Beckett, N., ... Heagerty, A. (2016). The measurement of adult blood pressure and management of hypertension before elective surgery: Joint guidelines from the Association of Anaesthetists of Great Britain and Ireland and the British Hypertension Society. *Anaesthesia*, 71(3), 326-337. <https://doi.org/10.1111/anae.13349>
- Hermida, R. C., Ayala, D. E., Smolensky, M. H., Fernández, J. R., Mojón, A., & Portaluppi, F. (2016). Chronotherapy with conventional blood pressure medications improves management of hypertension and reduces cardiovascular and stroke risks. *Hypertension Research*, 39(5), 277-292. <https://doi.org/10.1038/hr.2016.38>
- Jafar, T., Levey, A., White, F., Gul, A., Jessani, S., Khan, A., ... Chaturvedi, N. (2022). Ethnic differences and determinants of diabetes and central obesity among South Asians of Pakistan. *Diabetic Medicine*, 21(7), 716-723. <https://doi.org/10.1111/j.1464-5491.2004.01343.x>
- Kario, K., Sun, N., Chiang, F.-T., Supasyndh, O., Baek, S. H., Inubushi-Molessa, A., ... Zhang, J. (2014). Efficacy and safety of LCZ696, a first-in-class angiotensin receptor neprilysin inhibitor, in Asian patients with hypertension: A randomized, double-blind, placebo-controlled study. *Hypertension*, 63(4), 698-705. <https://doi.org/10.1161/HYPERTENSIONAHA.113.03064>
- Konukoglu, D., & Uzun, H. (2016). Endothelial dysfunction and hypertension. In *Hypertension: From Basic Research to Clinical Practice* (pp. 511-540).
- Lightman, S. L., Wiles, C. C., Atkinson, H. C., Henley, D. E., Russell, G. M., Leendertz, J. A., ... Conway-Campbell, B. L. (2008). The significance of glucocorticoid pulsatility. *European Journal of Pharmacology*, 583(2-3), 255-262. <https://doi.org/10.1016/j.ejphar.2008.01.071>
- Lu, H., Cassis, L. A., Vander Kooi, C. W., & Daugherty, A. (2016). Structure and functions of angiotensinogen. *Hypertension Research*, 39(7), 492-500. <https://doi.org/10.1038/hr.2016.48>
- Lule, A. S. (2019). Investigating the impact of early-life, life-course and genetic factors on blood pressure among young Africans. *London School of Hygiene & Tropical Medicine*.
- McCarthy, C. G., Wilczynski, S., Wenceslau, C. F., & Webb, R. C. (2021). A new storm on the horizon in

- COVID-19: Bradykinin-induced vascular complications. *Vascular Pharmacology*.
<https://doi.org/10.1016/j.vph.2021.106985>
- Moore, J. P., Hainsworth, R., & Drinkhill, M. J. (2011). Reflexes from pulmonary arterial baroreceptors in dogs: Interaction with carotid sinus baroreceptors. *The Journal of Physiology*, 589(16), 4041-4052.
<https://doi.org/10.1113/jphysiol.2011.221343>
- Nguyen, H., Odelola, O. A., Rangaswami, J., & Amanullah, A. (2013). A review of nutritional factors in hypertension management. *International Journal of Hypertension*, 2013, 1-10.
<https://doi.org/10.1155/2013/357126>
- O'Shea, P., Griffin, T., & Fitzgibbon, M. (2017). Hypertension: The role of biochemistry in the diagnosis and management. *Clinica Chimica Acta*, 465, 131-143.
<https://doi.org/10.1016/j.cca.2017.06.019>
- Saleem, S., McClure, E. M., Bux, R., Shaheed, A., Goldenberg, R. L., & Pappas, G. (2010). Pregnancy behavior of Pakistani women over their reproductive life span. *Al Ameen Journal of Medical Sciences*, 3(3), 228-236.
- Shaheen, G., Noor, R., Zafar, F., Younus, M., Syed, S., Yasmeen, Z., ... Sattar, S. F. A. (2021). Hypertension, a review: Therapeutic potential of medicinal plants for management of hypertension. *Plant Cell Biotechnology and Molecular Biology*, 22(1-2), 103-122.
- Shuang, T. (2019). The interaction among hydrogen sulfide, estrogen, and insulin-like growth factor-1 in vascular smooth muscle cells. *Laurentian University of Sudbury*.
- Smith, D. L., Barr, D. A., & Kales, S. N. (2013). Extreme sacrifice: Sudden cardiac death in the US Fire Service. *Extreme Physiology & Medicine*, 2(1), 1-9. <https://doi.org/10.1186/2046-7648-2-13>
- Wollert, K. C., Kempf, T., & Wallentin, L. (2017). Growth differentiation factor 15 as a biomarker in cardiovascular disease. *Clinical Chemistry*, 63(1), 140-151.
<https://doi.org/10.1373/clinchem.2016.258309>