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## A systematic literature review on hypertension: Understanding the classification, causes and dietary management

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### Abstract

The risk of cardiovascular disease doubles in various age groups. Stroke and coronary heart disease risk have been positively and progressively correlated with blood pressure levels. To reduce blood pressure levels, DASH (Dietary Approaches to Stop Hypertension) dietary pattern, which is high in fruit, vegetables, and low-fat dairy foods, significantly lowers low-density lipoprotein (LDL) and improves high-density lipoprotein (HDL) cholesterol. Reducing excess calories and improving dietary composition may prevent many primary and secondary cardiovascular events. Governments should focus on cardiovascular disease as a global threat and enact policies and interventions that will reach all levels of society and create a food environment wherein healthy foods are accessible, affordable, and desirable. Each nation should assess the energy needs of different age groups, particularly the pediatric population, about the daily maximum intake value of 2 grams of sodium for adults.

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### Introduction

An international risk factor for the burden and mortality of cardiovascular disease is hypertension. It is a condition linked to unhealthy lifestyle choices like smoking, eating poorly, being overweight or obese, drinking alcohol, lack of exercise, and leading a sedentary lifestyle. In 2021, worldwide 48.1% of adults (119.9 million) have hypertension, which is indicated by a systolic blood pressure of more than 130 mmHg or a diastolic blood pressure of more than 80 mmHg, or by the use of hypertension medication and 22.5% (27.0 million) of adults with hypertension are under control.

In India, the overall prevalence of hypertension was 29.8%. Between rural and urban areas, there were significant variations in the prevalence of hypertension 27.6% and 33.8%. According to regional estimates, the prevalence of hypertension was as follows: in rural areas in north, east, and west India, it was 14.5%, 31.7%, 18.1%, and 21.1%; in urban areas, it was 28.8%, 34.5%, 35.8%, and 31.8%, respectively. In general, the prevalence estimates for rural Indians were 25.3%, 25.1%, and 10.7%, while for urban Indians they were 42.0%, 37.6%, and 20.2%.

Some risk factors for hypertension, such as smoking, food, and excess weight are changeable, while others, such as advanced

age and genetic predisposition, are not changeable. People must be aware that they are at risk for hypertension to be able to undertake voluntary lifestyle adjustments, which may minimize the burden of hypertension. Systolic pressure is measured as the heart pumps. Diastolic pressure is expressed as blood rushes back into the heart between each heartbeat, and the diastolic pressure is measured. The term "high blood pressure," or "hypertension," is known as the "silent killer" since it has no symptoms and might go unnoticed. Blood vessels eventually become damaged by untreated hypertension. Other health issues like a stroke, kidney failure, blurred vision, heart attack, or heart failure can occur in hypertensive patients. Therefore, it is important to constantly monitor and frequently check blood pressure readings.

### Types of Hypertension

Essential hypertension, also known as primary hypertension, is high blood pressure that has no recognized cause and may be brought on by both heredity and a bad lifestyle. Poor diet (high sodium, low fruit, and vegetable intake), tobacco use, insufficient physical activity, stress, and overweight/obesity are some lifestyle factors that may be at play.

Secondary hypertension is hypertension that develops as a side effect of another illness, most frequently one involving the endocrine system (the glandular system of the body that secretes confusion, anxiety, and seizures are all possible symptoms. Scleroderma, kidney disease, spinal cord injuries, adrenal gland tumors, usage of illicit drugs like cocaine, and some medications like birth control pills are just a few of the illnesses that can lead to this disorder. The blood pressure returns to normal when the underlying disease is treated. The cause of isolated systolic hypertension is unknown. This particular form of hypertension is brought on by aging and a poor diet. A high systolic number with a normal diastolic number occurs when the arteries stiffen. Only when a person's blood pressure is taken in a clinical setting does white coat hypertension develop. Blood pressure is typical outside of a medical facility. These patients reportedly experience significant tension whenever they go to a clinic or doctor's office. When three drugs fail to effectively treat the illness, the condition is referred to be resistant hypertension [25].

### Classification of Hypertension

Blood pressure category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Normal	<120	<80
Elevated	120 – 129	<80
Stage 1 hypertension	130 – 139	80 – 89
Stage 2 hypertension	140 and above	90 and above

(AHA, 2018) [1]

### Risk Factors for Hypertension

Obesity, diabetes, high salt and/or fat diet, hormones). Treatment for primary hypertension may alleviate secondary hypertension (Carolyn. 2009) [3].

Other less common types of hypertension include; malignant hypertension is an abrupt and severe rise in blood pressure. Body numbness, eyesight issues, excessive exhaustion, high intake of alcohol, cigarette smoking, sedentary lifestyle, stress, family history of hypertension, age, gender, and race (non-modifiable risk) are the risk factors for primary hypertension.

Renal diseases (renal parenchymal disease, polycystic kidney, urinary tract obstruction), renovascular hypertension (renal artery stenosis), connective tissue disease, glomerulonephritis, hormone and steroid intake, oral contraceptives, estrogen replacement therapy, a steroid medication, Cushing syndrome, endocrine disorders (hyperthyroidism and hypothyroidism, acromegaly), brain tumor raised intracranial pressure and usage of prehypertensive substances (alcohol, cyclosporine and tacrolimus, erythropoietin) are the risk factors of secondary hypertension (IRAQ, 2013) [21].

One of the main risk factors for heart attacks is high blood pressure. The arteries supply the heart muscle with blood that carries oxygen. Plaque accumulates in the arteries due to high blood pressure, constricting and hardening them. Chest pain, or "angina," can occur if the heart cannot pump enough oxygen-rich blood. A heart attack happens when a blood clot or plaque in the arteries stops the blood flow to a certain area of the heart [25].

The leading risk factor for congestive heart failure (CHF) is high blood pressure. Over time, the heart muscle becomes weaker due to high blood pressure. A dangerous illness called CHF prevents the heart from pumping enough blood to meet the body's requirements [25].

### Consequences of Hypertension

Blood pressure measurements are dangerously high, the majority of people with high blood pressure do not exhibit any symptoms. A few high blood pressure sufferers could have symptoms like headaches, breathing difficulty, and nosebleeds. These symptoms are generally not specific. They typically don't show up until high blood pressure has reached to the point where it's dangerous or life-threatening. Untreated, high blood pressure increases the risk of heart attack, stroke and other serious health problems (IRAQ, 2013) [21].

There are a number of consequences for hypertension. As people age, their arteries become harder throughout their bodies, particularly those in their hearts, brains, and kidneys. These "stiffer" arteries are linked to high blood pressure. Thus, the heart and kidneys have to work harder as a result. A heart attack, stroke, or other problems may result from artery hardening. Stroke is another consequence of hypertension. When brain cells are denied oxygen, results in a stroke [25].

Vision impairment is also one of the consequences of hypertension. High blood pressure can eventually lead to the rupture or bleeding of blood vessels in the eye. Blindness may occur as a result of clouded or compromised vision [25].

The kidneys serve as filters to remove waste from the body. Over time, thickening and constriction of the kidney's blood arteries can be caused by high blood pressure leading to kidney damage. Less fluid can be filtered by the kidneys, and blood waste accumulates. Thus, the kidneys may completely stop working overtime. A kidney transplant or medical treatment (dialysis) may be required when this occurs [25].

### Hypertension management and prevention

Altering one's lifestyle and taking prescribed medicine can reduce hypertension. Despite the availability of drugs to treat hypertension, research has shown that little dietary and lifestyle modifications can often help treat, delay, or even prevent high blood pressure (Nicoll *et al.*, 2010) [14]. Moderate physical activity for 30-45 minutes a day is advised

in addition to maintaining a healthy weight, abstaining from cigarette use, and limiting alcohol intake.

One of the most popular dietary changes for lowering blood pressure and the risk of cardiovascular disease is the Dietary Approaches to Stop Hypertension (DASH) dietary eating pattern which has a low saturated fat content and helps to reduce the risk of cardiovascular diseases. LDL cholesterol is seen to be lower in a DASH diet than in a regular diet which emphasizes fruit and vegetables, low-fat dairy foods and whole grains (Sacks *et al.*, 2001) [16]. The effectiveness of dietary interventions is highly influenced by the level of adherence.

Dietary patterns and quality are the most thorough metrics for evaluating eating behaviors, and they include exploratory techniques like principal component analysis and cluster analysis as well as indices based on a priori scoring, such as the Alternative Mediterranean diet score (aMED), Alternative Healthy Food Index (AHEI), and Dietary Approaches to Stop Hypertension (DASH) diet score (Kant, 1996) [8]. Studies of individual nutrients cannot capture potential food and nutrient interactions; therefore, a holistic review of the diet is helpful (Hu, 2002) [6]. High aHEI, aMED, and DASH scores were consistently linked to a 20% reduction in CVD mortality in the Women's Health Initiative. According to Sotos-Prieto *et al.* (2015) [17] improvement in these scores, was similarly linked to a lower risk of total and CVD mortality in two sizable cohorts. Surviving Myocardial infarction patients have revealed similar results. Lopez Garcia *et al.* (2014) [11] discovered that following a Mediterranean-style dietary pattern was linked to lower all-cause mortality among people with CVD, and Li *et al.* (2013) [10] discovered that a greater increase in the AHEI score from pre to post MI was significantly associated with lower cardiovascular mortality.

Systolic and diastolic blood pressure levels significantly drop when daily caloric intake is reduced. The DASH diet may aid in controlling daily caloric intake and may lower blood pressure more effectively than a low-fat diet alone. Losing weight should be the main objective in addition to pharmacological therapy. Maintaining a healthy weight may cut down on the time and number of medications required to manage blood pressure (Mahan *et al.*, 2012) [12].

Lower sodium levels, which make up a large portion of salt, are linked to lower blood pressure. The current dietary guidelines advise limiting sodium intake to 2,300 mg per day. It is specifically recommended that people with high blood pressure who are African Americans, middle-aged, or elderly limit their daily sodium intake to 1,500 mg (Mahan *et al.*, 2012) [12]. It has been demonstrated that adopting the DASH eating plan and ingesting fewer than 1,500 mg of sodium daily can lower and maintain normal blood pressure. For those trying to cut back on salt intake, choosing less processed meals, reading sodium levels on food labels, and using alternate seasonings are recommended (Martha and Marie, 2006) [13].

For adults (who are 16 years of age and older), WHO advises limiting sodium intake to less than 2 grams of sodium (or 5 grams of salt) per day in order to lower blood pressure and lower the risk of cardiovascular disease, stroke, and coronary heart disease. Each nation should assess the energy needs of different age groups, particularly the pediatric population, about the daily maximum intake of 2 grams for adults.

The equilibrium of water in the body is regulated by potassium and sodium. A high potassium-to-sodium ratio has

been linked to a higher possibility of maintaining normal blood pressure, according to research. Adults should consume 4.7 grams of potassium each day (Mahan *et al.*, 2012) [12]. Evidence does not, however, support the recommendation that people with high blood pressure take potassium supplements. Rather, daily consumption of potassium-rich foods including bananas, leafy green vegetables, root vegetables like potatoes and carrots, and fruit are advised. Increasing calcium and magnesium consumption may help lower blood pressure, especially if done with the DASH eating plan. There are currently no particular calcium and magnesium recommendations because the data is not conclusive (Duyff, 2006) [4].

Current recommendations for dietary fat include decreasing the intake of saturated fat and trans-fat as well as the overall intake of dietary fat. These recommendations are geared towards healthy weight maintenance (Carolyn, 2009) [3]. Although research concerning the effects of omega-3 fatty acids has not shown any beneficial effect towards lowering blood pressure, it is still an essential fat to incorporate into one's diet (Mahan *et al.*, 2012) [12]. According to a meta-analysis of 22 cohort studies, individuals who adhered to a heart healthy diet the most, had a 31% lower risk of cardiovascular disease (CVD) than those who adhered the least, whereas a Western food pattern was linked to a 14% higher risk. The causative importance of a high-quality diet in CVD prevention is supported by the consistency of findings from cohort studies conducted in numerous nations for diverse dietary components and indices and similar results from intervention trials (US Department of Agriculture, 2010) [22].

DASH was outpatient-controlled feeding research that examined the effects of two experimental food patterns on blood pressure in comparison to a control dietary pattern that is representative of the diets of many Americans. Both diets comprised different kinds of carbohydrates from the control diet (Jenkins *et al.*, 1997) [7]. The DASH data can be utilized to establish the effects of a reduced-fat, increased-carbohydrate diet on blood lipids under circumstances of stable weight in two sizable but under studied populations because 50% of the 459 DASH participants were women and 60% were African Americans (NIH 1993) [20]. This knowledge is important because triacylglycerol may be a risk factor for cardiovascular disease independent of HDL. After all, LDL and HDL cholesterol are separate risk factors for coronary heart disease programs for preventing sickness (Austin *et al.*, 1998) [2].

The vast variations in dietary culture and taste preferences may restrict the use of the DASH diet in Asian nations. It has been demonstrated that a modified DASH diet, which is designed for Asian food culture but has the same nutritional makeup as a normal DASH diet, effectively lowers blood pressure and is more well-tolerated by Asian populations (Kawamura *et al.*, 2016) [9]. If more data is found to support this, it might be offered as an alternate method in Asian nations. Some Asian dietary patterns have also been reported to reduce the risk of hypertension, in addition to the DASH diet. In Chinese female adults, the likelihood of developing hypertension is inversely correlated with the frequency of eating spicy cuisine (He *et al.*, 2019) [5]. However, further research is necessary to determine their underlying mechanisms and whether the results may be generalized to other groups. As the primary dietary pattern to lower blood pressure, adhere to the DASH diet's principles until more

evidence comes to support them.

### Dash Eating Plan

The DASH diet (Dietary Approaches to Stop Hypertension) emphasizes fruits and vegetables, low-fat milk products, and whole grains. It is a Mediterranean diet full of nutrients that are good for the heart and good for health. When combined with other lifestyle modifications, the DASH eating plan can help you prevent and manage high blood pressure. If your blood pressure is not excessively high, modifying the eating habits, dropping weight if you are overweight, engaging in regular physical exercise, and consuming less alcohol may

allow you to completely regulate it. Along with lowering blood pressure and LDL ("bad") cholesterol, the DASH diet plan has additional advantages that may minimize your chance of developing heart disease [16]. This eating plan is for 1,800 calories per day. Switching from a higher-sodium diet to a lower-sodium diet can modestly reduce blood pressure in people who have normal blood pressure. When the sodium intake is lowered from 4000 to 2000 mg per day, blood pressure falls by 2 to 3 mmHg. This reduction may be as great as 10 mmHg over several years and can substantially lower the risk of heart disease. The sample menu provided is based on this plan [16].

**Table 1: Sample Menu for DASH Diet [23]**

Menu	Amount
<b>Early Morning</b>	
Roasted Flax seeds / Sunflower seeds	1 tsp
Tea (without sugar)	1cup
OR Avocado smoothie	1 cup
<b>Breakfast</b>	
Stuffed Carrot/spinach paratha (whole wheat flour)	2 small
Curd (Avoid adding salt, you can add jeera powder)	1 cup / 50 gm
<b>Or</b>	
2 Egg White Omelets with capsicum	(2 egg white)
Multigrain Dosa / 1 Roti	2 no. / 1 no.
<b>MID Morning</b>	
Apple / Banana / Guava / Grapefruit / Orange	1 med (50- 60 gm)
Green Tea (No Sugar)	1 cup
<b>Lunch</b>	
Vegetable brown rice pulao / Vegetable Oats Upma	1 soup bowl (50 gm uncooked)
Cucumber, carrot, beetroot, and onion raita	1 bowl
Mix veg salad	1 bowl
<b>Or</b>	
Chappati / Phulka (little or no fat)	3 medium-size
Capsicum/ladys finger/ toran / Bottle gourd veg	1 med bowl
Dal/drumstick sambar	1 med bowl
Salad	1 med bowl
10 minutes, walk post-lunch + 1 cup warm water with lemon / Green tea (no sugar)	
<b>Evening</b>	
Green tea / Tea / Coffee (without sugar) / beetroot juice	1 cup
Puffed Rice (unsalted) / 2 wheat rusks/watermelon	1 bowl
<b>Dinner</b>	
whole wheat flour chapati / phulka	3 medium-sized
Mix veg / drumstick / palak vegetable	1 med bowl
Curd / dal	1 small bowl
10 minutes, walk post-lunch + 1 cup warm water with lemon / Green tea (no sugar)	
<b>Bedtime</b>	
Cow's Milk (no sugar)	1 cup
Soaked almonds	4 Nos

**Table 2**

Avoid these foods	Try these foods instead
Cured and smoked foods like bacon, sausage, smoked fish and meats, hot dogs, ham, lunch meats, corned beef, and pickles	Fresh chicken, and lean beef
Canned fish (tuna, sardines)	Unsalted tuna or sardines
Canned meats	Fresh unprocessed meats, vegetable protein, and fish Frozen and canned meats, vegetable protein, and fish that are labelled "low-sodium"
Salted pretzels, crackers, potato chips, tortilla chips, and nuts	Low-sodium and unsalted versions of these foods
Most cheeses	Low-sodium cheeses (check label for actual sodium content)
Sauces (tomato and cream, etc), tomato juices	Low-sodium versions of these foods, such as low- sodium tomato juice
Processed, instant, and convenience foods like frozen dinners, packaged meals, canned soups, and boxed pasta blends	Cook and freeze your own low-sodium meals, soups, and broths
	Use convenience or processed foods, read the labels. Choose items with 140 to 200 mg of sodium per serving

	For an entire convenience meal (frozen dinner), try to find options with less than 500 to 600 mg of sodium
	Canned foods, look for those labelled "sodium-free." Or you can rinse the canned food under water to lower the sodium content
Fast foods and foods prepared at restaurants (unless without cheese, sauces, or added salt)	Fresh foods and foods with sauces on the side

### Sodium Restriction in DASH Diet plan <sup>[24]</sup>

Salt/sodium-free	Less than 5 mg of sodium per serving
Very low sodium	35 mg or less of sodium per serving
Low sodium	140 mg or less of sodium per serving
Reduced sodium	At least 25% less sodium than the regular product
Light or lite in sodium	At least 50% less sodium than the regular product
No salt added or unsalted	No salt is added during processing, but these products may not be salt/sodium-free unless stated

### Other lifestyle changes for maintaining hypertension

The best method to avoid and control high blood pressure is to make other lifestyle changes while adhering to the DASH diet plan. If necessary, reduce weight while adhering to DASH. DASH is a simple diet to modify to help weight loss because it is rich in lower-calorie items like fruits and vegetables. You can reduce calories even further by substituting more fruits and vegetables for higher-calorie foods like sweets. The best strategy to lose weight is gradually over time, with increased physical activity and calorie restriction (NIH, 2015) <sup>[19]</sup>.

Clinical experiments and observational research have shown a direct, dose-dependent link between alcohol intake and blood pressure, especially as consumption rises over two drinks per day. Importantly, it has been demonstrated that this association is unaffected by possible confounders including age, obesity, and salt intake. According to a study conducted by Piano M R (2017) <sup>[15]</sup>, it has been demonstrated that the association between alcohol and hypertension also includes mild consumption (two drinks per day), this is the range in which alcohol may lower the risk of coronary heart disease. A recent meta-analysis of 15 randomized controlled trials found that lowering alcohol consumption (median drop in self-reported alcohol consumption, 76%; range, 16% to 100%) decreased systolic and diastolic blood pressure by 3.3 and 2.0 mmHg, respectively. BP reductions were similar in people with and without hypertension. Importantly, the association between the mean proportion of alcohol consumed and the fall in blood pressure was dosage-dependent (Xin *et al.*, 2001) <sup>[18]</sup>.

The limited long-term success of intensive behavioral intervention programs emphasizes the significance of environmental modifications that encourage widespread population adoption of desirable lifestyle changes. Indeed, given the strong cultural factors, societal conventions, and commercial interests that promote a sedentary lifestyle, a poor diet, and excessive calorie consumption, even motivated individuals find it challenging to sustain behavior change. Despite these obstacles, the evidence from efficacy studies is convincing enough to support dietary changes as a way to control blood pressure and consequently avoid BP-related cardiovascular disease in both non-hypertensive and hypertensive people.

### Conclusion

Hypertension has no symptoms, and over half of those with this condition are not currently treated. Untreated

hypertension may lead to many health problems, including damage to blood vessels that may lead to heart failure. It is possible to control high blood pressure through a healthy diet and lifestyle that includes physical activity, avoiding tobacco, and limiting alcohol consumption.

Following the DASH dietary pattern is an important dietary recommendation for preventing or managing hypertension. Additional recommendations include following a low-sodium diet, regulating caloric intake, reducing dietary fat, and increasing potassium, calcium, and magnesium through a diet rich in fruits and vegetables.

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