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HYPERTENSION: A SYSTEMATIC AND COMPREHENSIVE REVIEW

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ABSTRACT

Hypertension, commonly referred to as high blood pressure, is a critical global health issue, contributing significantly to cardiovascular disease morbidity and mortality. Despite advancements in diagnosis and treatment, hypertension remains a major risk factor for heart attacks, strokes, and kidney diseases. This manuscript provides a comprehensive analysis of hypertension, covering its epidemiology, pathophysiology, diagnostic criteria, treatment options, and management strategies. Additionally, it explores the impact of lifestyle modifications, pharmacological interventions, and emerging therapies in managing hypertension. This resource aims to equip healthcare professionals and researchers with a thorough understanding of hypertension to improve patient outcomes. The etiology of hypertension involves a complex interplay of environmental and pathophysiological factors alongside genetics, diet, lifestyle, and other coexisting medical conditions. Treatment typically involves medication and lifestyle adjustments such as dietary changes, regular exercise, weight management, and stress reduction to pharmacological interventions involving drugs like diuretics, beta-blockers & ACE inhibitors to lower blood pressure. The pathogenesis of hypertension is linked to endothelial dysfunction, vascular remodelling, sympathetic nervous system activation, and the renin-angiotensin-aldosterone system. Diagnosis is made by measuring blood pressure using a sphygmomanometer, with stages including pre hypertension, stage 1 hypertension, and stage 2 hypertension. Effective management of hypertension requires lifestyle modifications such as dietary changes, regular exercise, weight control, and reduced alcohol consumption, alongside pharmacological interventions. As hypertension continues to be a leading cause of death and disability globally, understanding and addressing these factors are crucial for mitigating the widespread impact of hypertension on public health.

KEYWORDS: Hypertension, Blood Pressure, Cardiovascular Disease, Epidemiology, Pathophysiology, Diagnosis, Treatment, lifestyle modifications, non-communicable condition, pharmacological interventions, public health.

INTRODUCTION

Systemic arterial hypertension (hereafter referred to as hypertension) is characterized by persistently high blood pressure (BP) in the systemic arteries. BP is commonly expressed as the ratio of the systolic BP (that is, the pressure that the blood exerts on the arterial walls when the heart contracts) and the diastolic BP (the pressure when the heart relaxes).[1] High blood pressure is also known as hypertension. It can cause serious health problems and increase the risk of heart disease, stroke, and even death. The force exerted by a person's blood on the walls of their blood vessels is referred to as blood pressure. This pressure is determined by the resistance of the blood arteries and the amount of work required by the heart.[2]

The leading cause of mortality, responsible for roughly one-third of all deaths globally, is cardiovascular disease. The majority of these events are caused not by one single cardiovascular risk factor, but rather a mixture of several factors. The most important of these in industrialized countries is not only hypertension, but also high levels of blood lipids, obesity, physical inactivity, smoking, glucose

intolerance/diabetes and age. High blood pressure certainly represents a modifiable risk factor. In the year 2000 it is estimated that nearly one billion people (~26% of the adult population worldwide) had hypertension. The number patients with hypertension increases every year and by 2025 is expected to rise to 29% of the population.[3]

Since 2003, the World Health Organization's Global Burden of Disease Study has identified hypertension as the preeminent worldwide risk factor contributing to both morbidity and mortality. Even among those who are presumed to have well controlled hypertension, less than one-third are safeguarded against subsequent strokes and heart attacks. The WHO World Report on Blood Pressure, released in 2023, highlights the staggering statistics surrounding the prevalence of high blood pressure, noting that nearly 1.3 billion adults were estimated to be living with the condition by 2019. This report shows that only 54% of adults with high blood pressure have been diagnosed; only 42% are receiving treatment, and only 21% have their blood pressure adequately controlled. The current state of practice is manifestly in adequate; an insufficient number of individuals who are at risk due to hypertension are being accurately diagnosed and effectively treated. An additional factor contributing to the complexity of hypertension's etiology is its multifactorial nature. As a result, significant advancements are required in both population-wide and individual strategies for the prevention and management of hypertension.[4]

Over the past decade the management of hypertension has changed with the recognition that there is no threshold below which elevated blood pressure causes no threat to health. Recent guidelines, including those of the British Hypertension Society, make it clear that treatment of isolated systolic hypertension is as important as that of systolic and diastolic hypertension. The threshold above which hypertension should be treated to prevent long-term complications is now 140/90 mm Hg. Indeed, in Stage 1 hypertension, treatment of isolated systolic hypertension (systolic 140–159 mm Hg, diastolic <90 mm Hg), reduces the prevalence of left ventricular hypertrophy a predictor of future morbidity and mortality. There is also a 42% reduction of the risk of stroke and a reduction in the risk of dementia.[5]

Blood Pressure Ranges

- Identification and effective management are crucial for reducing morbidity and mortality.[6]

Types of Hypertensions

Hypertension, or high blood pressure, can be classified into two main types based on the underlying cause of the condition.

1. Primary (essential) hypertension: This is the most common type of hypertension, also known as essential hypertension. Primary hypertension develops gradually over time and has no identifiable cause. It is often related to lifestyle factors such as obesity, a diet high in salt and saturated fats, physical inactivity, and stress.

2. Secondary hypertension: This is type of hypertension is caused by an underlying medical condition such as kidney disease, adrenal gland disorders, thyroid problems, or obstructive sleep apnoea. Treatment of the underlying condition may help to lower blood pressure.[7]

Our initial understanding of central aortic pressure and therefore blood pressure dates back to 1733 when Stephen Hales directly measured intra-arterial pressure in a horse. Subsequently, it took almost a century to develop sphygmomanometric devices that could potentially measure blood pressure noninvasively and these devices were introduced into clinical practice in the late 1800s and early 1900s. Although the variability of blood pressure in response to various physical/emotional stimuli and sleep/wake periods gained attention even in the 1940's it is significance became more evident towards the end of the 20th century when mercury manometers were replaced with electronic devices making blood pressure measurements safe and accessible. As early as 1906, insurance companies in the United States were the first to conduct initial studies identifying the risks associated with high blood pressure and in the1920's several studies not only concurred with their findings but further identified that HTN is often associated with co-morbidities such as insulin resistance and central obesity.[8]

The annual Update and Perspectives will be held against his year. This is a popular project in which articles accepted for publication in Hypertension Research during the year are summarized for readers by dividing them into the following themes.

1. Digital Hypertension
2. Blood pressure (BP) variability/Phenomenon
3. BP management/BP monitoring
4. Obesity/Diabetes mellitus/Metabolism/Liver
5. Vascular property
6. Kidney
7. Heart
8. Brain/Stroke/Dementia
9. Preeclampsia/Pregnant/offspring
10. Primary Aldosteronism/Mineralcorticoid receptor
11. Lifestyle modification (Salt/Na/Nutrition, exercise, sleep, etc.)
12. Antihypertensive drugs
13. Renal Denervation
14. Basic research
15. Implementation science
16. Others related to BP (pulmonary hypertension, ocular hypertension, etc.)

Now, let me introduce highly reliable and cutting-edge members of the Editorial Board to readers .Comprising seasoned veterans to young researchers, they hail from 21 countries internationally, actively contributing to submissions, peer reviews, and more. We sincerely

appreciate their valuable contributions. We have focused on seven themes and publishing special issues; Asian Study: Current evidence and perspectives for hypertension management in Asia.[9]

This is the first study evaluating the relationship between hypertension awareness, blood pressure control status, and subsequent prognosis in a real-world setting. The following three points are noteworthy of this study.
1. Almost half of the hypertensive patients were unaware of their condition and did not receive any antihypertensive therapy.
2. Most of the patients with unawareness and untreated hypertension were younger than other hypertensive patients, had less co-morbidity, had more cardiovascular risk factors accumulation, and had a higher risk of developing major cardiovascular events.
3. By lowering the blood pressure of hypertensive patients to an optimal level, the risk of MACEs and death could be reduced to the same level as that of normal blood pressure subjects. In this study, approximately half of the subjects were untreated for hypertension, and 41% of the subjects were unaware of their condition, which was almost the same as reported by the WHO.[10]

Treatment

Non-Pharmacological: Modification in the lifestyle is the key process to prevent the onset of hypertension and is necessary therapy for those who are suffering from hypertension. Lifestyle modifications should be introduced, whenever appropriate, in all patients, including those who require drug treatment. The main goal is to lower BP, to control cardiovascular risk factors and to reduce the number or the doses of antihypertensive drugs to a minimum level. These modifications include weight reduction in overweight or obese patients, physical activity, controlled sodium intake, the adoption of the Dietary Approaches to Stop Hypertension (DASH) diet, controlled alcohol consumption, and reduction in smoking. According to these guidelines, patients who are SBP (Systolic BP) and DBP (Diastolic BP) falls between 130 and 139 mmHg and 80 and 89 mmHg, respectively, should modify their lifestyle to control BP but the effect of this therapy should be observed for maximum of 3 months. If it is not working then the patient should move towards pharmacological treatment.[11]

Weight Loss

Weight loss has a clear benefit in term of reducing of blood pressure and also reduce the number of prescribed medicine so weight loss if the patient is overweight or obese. Long term weight loss studies have indicated that 10 kg weight loss is associated with average reduction of systolic BP 6 mmHg and diastolic BP is 4.6 mmHg.[12]

Intermittent fasting (IF) is an effective way to lose weight and thus helps lower blood pressure. The mechanism by which IF lowers BP may be due to a brain-derived neurotrophic factor (BDNF)-induced increase in parasympathetic activity. Increased excretion of nor epinephrine and increased sensitivity of insulin and natriuretic peptides also play a role. The activation of glutamatergic receptors produces BDNF. IF also stimulates the release of BDNF. BDNF, in turn, stimulates the cholinergic neurons to release acetylcholine, which via the vagus nerve, controls the cardiac function to the senatorial (SA) node, causing a reduction of heart rate. Also, blood vessels are expanded by the neurotransmitter, leading to a reduction in BP. The pathogenesis of blood pressure lowering by activation of the parasympathetic nervous system involves the role of the cerebrospinal stem in the activation of cholinergic neurons. However, cardiovascular health benefits have only been observed to last as long as the IF diet lasted and pressures returned to initial values after the completion of the IF diet. Toledo et al. performed a study in Germany in which 1422 participants on the IF diet were followed up for one year. These participants had a fasting period of four to 21 days, which involved 200-250 kcal daily meals. In participants who fasted for a longer time, a reduction of SBP and DBP was observed.[13]

Diet

The dietary intervention to reduce hypertension. Diet is one of the most preferred measures to combat hypertension as it doesn't take an account any pharmacological involvement. Preference for specific kinds of diet endures enhanced benefits compared to other diet systems. People with vegetarian food habits are 32% less likely to develop coronary heart disease (Crowe et al., 2013). Such food habit systems include various fruits and vegetables like kiwis, apples, walnut, etc. Kiwi fruit has been reported to be effective in reducing both systolic and diastolic 24-hour blood pressure compared to apples for patients with moderately elevated blood pressure (Svendsen et al., 2015). Similarly, in an investigation on office and senior people, blood pressure was better regulated in the group with prolonged walnut consumption (about 2 years). Also, such people needed less medication up-titration compared to others. Therefore, the consumption of walnuts regularly lowers systolic blood pressure in senior people, especially in those with moderate hypertension (Dom`enech et al., 2019). Consumption of fruits and vegetables aids in the reduction of blood pressure. Despite some critics opposing fruits and vegetables being worthwhile, this study reveals that higher consumption of whole fruits over the long term may lower the chance of developing hypertension (Borgi et al., 2016). Similarly, a non-vegetarian diet also plays an important role to combat hypertension. Among three groups of mild essential hypertensive individuals supplemented with propranolol drug and fish oil for 36 weeks with doses (80 mg/day and 9 g/ day, respectively) given at an interval of 4 weeks, it was observed that the group with fish oil could reduce the blood pressure to a substantial level compared to the drug or a combination of them.[14]

A diet with a high intake of vegetables, fruits, and whole grains is recommended. Other recommendations include consuming low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils, and nuts; and limiting intake of sweets, sugar-sweetened beverages, and red meat. This dietary pattern should be adapted to appropriate calorie requirements, personal and cultural food preferences, and nutritional therapy for other medical conditions, including diabetes mellitus. One way to achieve this is by following plans such as the Dietary Approaches to Stop Hypertension (DASH) diet, the U.S. Department of Agriculture (USDA) Food Patterns, or the AHA diet. Compared with a typical American diet of the 1990s, the DASH diet lowers systolic blood pressure by 5 to 6 mm Hg and diastolic blood pressure by 3 mm Hg.9-11. The USDA Food Patterns offer lacto-ovo vegetarian and vegan adaptations. The DASH diet is based on the AHA diet and emphasizes consuming less red meat, sweets, and sugar-sweetened beverages. More information about these diets is available at http://fnic.nal.usda.gov/diet-and-disease/heart-health.[15]

Alcohol Consumption

Numerous epidemiologic cross-sectional researches have shown that higher average alcohol intake is associated with an increase in the prevalence of hypertension, and longitudinal studies have shown a positive correlation between changes in alcohol consumption and changes in blood pressure. Clinical studies showing the use of counselling or low-alcohol replacements for risky drinkers have shown that a drop in blood pressure occurs days to weeks after reducing alcohol intake. Studies show that this effect occurs among dependent, heavy drinkers, with an average overall drop in SBP of about 5 mm Hg and an average reduction in DBP of about 3 mm Hg over the first month of treatment. More noteworthy, this drop seemed to be restricted to people whose baseline systolic or diastolic pressure was higher than usual. These people saw average systolic pressure reductions of 12 mm Hg and diastolic pressure reductions of 8 mm Hg. Generally, individuals with the highest beginning pressure experienced the biggest reduction due to the dependency of BP reduction on the baseline. This result is in line with earlier studies that claimed that only about half of strong drinkers experience a presser effect and that the majority will see a decrease in blood pressure with less drinking. Such reductions should increase survival if they are sustained over the long term. In groups who are dependent on alcohol, this could exaggerate life expectancy improvements that are anticipated with decreased drinking or sobriety.[16]

Exercise

Increased physical activity has been advocated as the first-line intervention for preventing and treating patients with pre hypertension and as a treatment strategy for patients with stage 1 or stage 2 HTN, according to the Duthe American College of Sports Medicine, the United States Joint Nations Committee on Prevention, Detection, Evaluation, and Treatment of High BP, the World Health Organization and International Society of Hypertension, and The National Heart Foundation. Exercise can consequently help prevent pre hypertension from progressing and can help reduce or stop medications prescribed for the treatment of stage 1 HTN.

The pathogenesis of HTN involves oxidative stress. Another mechanism involved is the decreased bioavailability of nitric oxide (NO). Physical exercise could be a potential lifestyle intervention to treat HTN due to its beneficial effects on endothelial function and oxidative stress. Exercise exerts an anti-inflammatory action via the hypothalamic-pituitary-adrenal axis and via the sympathetic nervous system, thus affecting BP directly. The physiologic effects of exercise are further divided into acute, post-exercise, and chronic. Aerobic exercises like speed walking, jogging, running, cycling, dancing, and swimming have been shown to decrease resting BP and BP reactivity to stressors. A study by Ozemek et al. revealed the following about how diverse types of exercises affect BP: (1) Aerobic exercise of 90 to 150 minutes per week with 65%-75% heart rate reserve has been shown to impact SBP by −5/8 mm Hg in hypertensive individuals and by −2/4 mm Hg in normotensive individuals. (2) Dynamic resistance exercise of 90 to 150minutes per week with 50%-80% one rep maximum, six exercises, three sets/exercise, and ten repetitions/set has been shown to decrease SBP by 4 mm Hg in hypertensive individuals and 2 mm Hg in normotensive individuals. (3) Isometric resistance exercise of 4 × 2 min (hand grip), 1 min rest between exercises, 30%-40% maximum voluntary contraction, and three sessions per week for 8-10 weeks have been shown to lower SBP by 5 mm Hg in hypertensive individuals and 4 mm Hg in normotensive individuals.

The following four randomized controlled trials have been conducted to show that exercise helped lower both systolic and diastolic BP in participants: In the meta-analyses of randomized controlled trials conducted by Fagard et al., 72 trials have been conducted with an average of 40 participants per trial, which involved a 16-week study of 40 minutes of exercise sessions three times/week with an average intensity of65% of heart rate. This study showed a decrease in SBP of 6.9 mm Hg and a lowering of DBP of 4.9 mmHg. In 27 randomized controlled trials by Lee et al. with 1842 participants, the exercise regimen involved walking for 26.5 min/day for 4.4 days/week for a mean of 19 weeks. This study shows that there is a larger effect with more intense and frequent exercise regimens for a longer duration. There was a mean decrease in SBP of 5.2 to 11 mm Hg and in DBP of 3.8 to 7.7 mm Hg. In the meta-analysis of randomized control trials performed by Cornelissen et al., 15 trials with 633 participants involving the exercise of 30-60 min, two to five times/week, at 50% to 75% HR reserve for six to 52 weeks showed a daytime decrease in SBP of 3.2 mm Hg and in DBP of 2.7 mm Hg. However, no blood pressure reduction was seen at night. The meta-

analysis of randomized controlled trials performed by Cornelissen and Smart included 105 trials with 3957 participants. This study concluded that moderate aerobic exercise involving walking and jogging for 30 to 60 min/session three to five times/week for four to 52 weeks showed a reduction in SBP of3.5 mm Hg and in DBP of 2.5 mm Hg. *Practicality of Implementation* Patients may be initially motivated to engage in exercise programs but can find it challenging in long-term maintenance, which may lead to weight regain. In order to achieve effective weight loss, apart from exercise, individuals should follow caloric restrictions. Furthermore, patients may feel discouraged if they do not achieve desired weight loss despite exercising; therefore, clinicians should explain and strongly encourage patients regarding long-term adherence to exercise training programs despite the achieved amount of weight loss as regardless of achieving weight loss, exercise helps achieve cardiovascular benefits.[17]

Quit Smoking

Acute increase in heart rate and blood pressure associated with cigarette smoking. One of the first studies on this topic, which looked at the reactions of heavy smoking (in every 15 minutes for an hour they took one cigarette) on heart rate and blood pressure in a group of normotensive smokers, found that in taking time off conditions, the first cigarette caused a noticeable and immediate increase in heart rate and blood pressure with the remaining three cigarettes producing similar results.13 The hemodynamic impacts were so long-lasting that heart rate and blood pressure were stead fastly lesser during the non-smoking hour than during the smoking hour, indicating that heavy smoking is connected with an escalating in blood pressure that lasts for more than 15 minutes after smoking one cigarette, as well as an connected in blood pressure variability. On the other literature have shown that the acute escalating in heart rate and blood pressure caused by cigarette smoking is connected with an increase in plasma catecholamines, implying that the effect is interceded by adrenergic nervous.[18]

Potassium Intake

The common potassium supplementation interventions in hypertensive individuals include increasing potassium intake from fruit and vegetables or using potassium supplements Studies examined the effects of potassium-rich diet (e.g. DASH diet) and combined interventions that promoted potassium-rich diet, physical activity, and salt reduction on blood pressure. A study conducted in a primary care unit in Finland investigated the effect of a behavioural intervention consisting of a nurse-led counselling session to increase intake of dietary potassium, promote physical activity, and reduce salt intake on blood pressure among hypertensive patients. They found no significant effects of the intervention on potassium intake and blood pressure. Most of the potassium supplementation trials were conducted in controlled clinical settings rather than in primary care settings. Therefore, there is a dearth of information relating to the implementation and cost of potassium supplementation interventions in primary care. Cohn et al., in their review, discussed the challenges of potassium supplementation interventions in clinical practice. Before providing potassium supplementation, several factors related to the patients should be accounted for, including patients' serum potassium levels at the time of supplementation, presence of underlying medical conditions, and use of medications that alter potassium levels, dietary patterns, and ability to adhere to a dietary regimen. For example, a higher blood-pressure-lowering effect was observed among those who had a lower (< 90 mmol/day) potassium intake at baseline. Furthermore, there is a U-shaped relationship between potassium intake and blood pressure, indicating that both low and high potassium intake could result in an increased blood pressure level. Patients with a co-morbid condition such as congestive heart failure or chronic kidneys diseases who need to strictly maintain a given potassium level and those who use non–potassium-sparing diuretics should take precautions before commencing with potassium supplementation. Recently, potassium-enriched salt substitutes were found to be effective in reducing high blood pressure. A study conducted in sample of 20,995 adults found that low-sodium high-potassium salt substitute not only reduced blood pressure by on average 3.34 mmHg but also reduced the risk of stroke and cardiovascular morbidity and mortality during the five-year follow-up. Potassium-enriched salt substitute is a promising strategy to deal with both high dietary sodium intake and low potassium intake, while ensuring higher patient adherence, compared with low salt-high potassium diets. However, further studies are required to confirm its safety and long-term benefits in the context of hypertension.[19]

Stress Relief

Mental health issues in the elderly are mainly depression and anxiety. For depression, a meta-analysis of five prospective cohort studies involving 9647 participants found no significant link between hypertension and an increased risk of depression in older adults, with a relative risk of 1.16 (95% CI 0.91–1.42). In the subgroup analysis, BMI emerged as a key variable that moderated the relationship between hypertension and risk of depression. Current evidence indicates a bidirectional relationship between depression and anxiety with hypertension. Depression and anxiety are associated with poor BP control, non adherence to treatment, and increased cardiovascular morbidity and mortality in the elderly.

Unlike depression, anxiety appears to be a risk factor for developing high BP. A meta-analysis of eight studies involving over 80,000 participants demonstrated that anxiety increased the risk of hypertension (hazard ratio 1.55, 95% CI 1.24–1.94). In addition, in a study of 1389 elderly French adults, those with higher anxiety scores were three to seven times more likely to develop

hypertension, independent of other health factors. Conversely, a study of 3000 elderly German adults found that while depression increased the odds of hypertension by 76%, anxiety did not show a similar association. Despite these findings, there is still a lack of comprehensive reviews specifically exploring the link between anxiety and hypertension in the elderly.

Sleep is another factor associated with hypertension. Afternoon napping is common among the elderly in Taiwan, and a meta-analysis found that daytime napping was associated with a 1.17-fold increased risk of hypertension. Most previous studies define significant napping as more than 30–60 min a day. Another meta-analysis demonstrated that poor sleep quality was also associated with a higher likelihood of hypertension, with an odds ratio of 1.48 (P =0.01). Although the differences in BP between poor and normal sleepers were not statistically significant, those with hypertension had worse sleep quality scores. Addressing insomnia has been shown to potentially reduce BP in hypertensive patients. Interestingly, the total amount of sleep does not seem to affect the risk of hypertension in older adults. A recent study suggested that mindfulness-based stress reduction (MBSR) is effective in reducing BP in people with hypertension or elevated BP. A meta-analysis of 12 randomized controlled trials showed that MBSR significantly reduced office SBP and DBP but not 24-h ambulatory BP. MBSR was also shown to reduce symptoms of depression, anxiety, and stress, although the quality of these studies was generally low and long-term data were lacking. Another meta-analysis of 7 trials with 429 participants indicated that MBSR may lower SBP compared to waitlist controls and DBP compared to active controls, although the quality of evidence was low. High-quality trials are needed to establish the efficacy of MBSR in the management of hypertension.

Effective management of hypertension in the elderly involves a focus on treatment adherence, co-morbidity management, and identification of depressive symptoms. Depression in hypertensive patients can increase non adherence to treatment, consequently worsening hypertension and increasing the risk of vascular disorders and severe depression in the elderly population. Detecting and managing depression can enhance medication adherence, reduce depressive symptoms, and improve BP control. Persistent poor adherence often indicates a mismatch between patient and physician treatment goals.

In summary, understanding the complex interplay between mental health, sleep, and hypertension is essential for developing comprehensive management strategies tailored to the specific needs of the elderly population, ultimately improving their overall health outcomes and quality of life. MBSR may also be a beneficial non-pharmacological intervention.[20]

Sodium Restriction

Most controlled studies of moderate Na restriction, down to 2 g/d, (88 mM), have shown a modest fall in blood pressure (MacGregor, 1985). Some fail to find an effect, partly because their patients had minimally elevated pressures: as is true of all effective therapies for hypertension, the higher the starting pressure, and the greater the fall. Others have used too-rigid Na restriction, which, by activating the renin-aldosterone and sympathetic nervous systems, may be counterproductive. Beyond methodological problems, only a portion of the overall hypertensive population are 'Na sensitive', i.e. will have a significant fall in pressure with Na deprivation or a significant rise with Na loading (Bittle *et al.* 1985). Nonetheless, moderate Na restriction is easy to accomplish and totally without risk. Those who have raised the spectre of paradoxical rises in pressure or stunting of growth (Brown *et al.* 1984) misuse the experimental evidence. The studies in rats they quote involved the use of 1:l00 to 1:400 the usual intake of Na in the rat diet, hardly applicable to the human experience. Although moderate Na restriction will likely lower pressure on its own, it will also likely potentiate the effect of various antihypertensive drugs, with the possible exception of calcium-entry blockers (Morgan ***et al.*** 1986).[21]

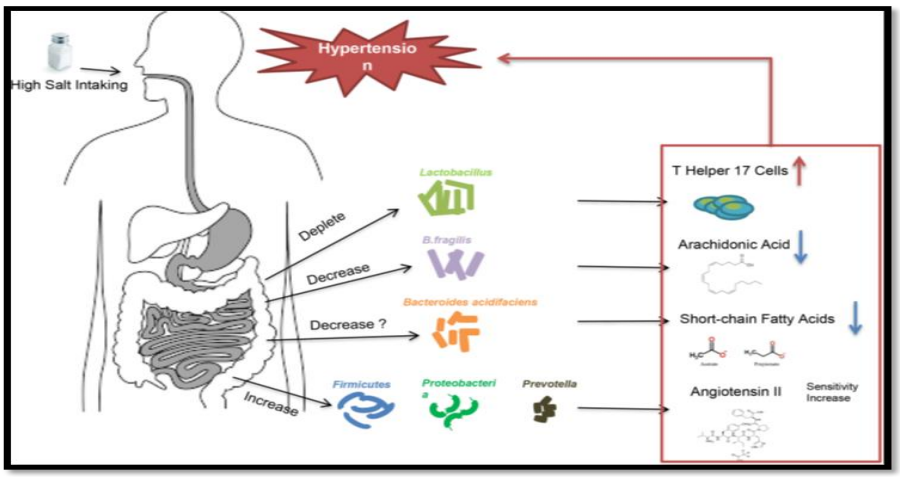

Figure-1: High salt intake triggers high blood pressure through intestinal flora.[22]

Good Sleep Habits

Certain sleep disorders, especially sleep apnoea, are associated with hypertension. Insufficient sleep may raise blood pressure in patients with hypertension and place them at increased risk of heart disease and death. Moreover, increased levels of adrenalin hormone due to sleeplessness can activate the sympathetic nervous system.[23]

Coffee and Tea

Most guidelines recommend moderate intake of coffee and tea and discourage but provide different thresholds for what is considered as excess intake. There are over 1000 chemical compounds in coffee. The most studied ones such as caffeine can influence BP in both directions: whilst caffeine is known to have an acute effect on increasing BP, long term moderate caffeine consumption may have beneficial CV effects and it is not completely discouraged in any guideline. However, the conclusions on long term effects derive mainly from observational studies with very few randomized, controlled studies or meta-analyses. Green or black tea consumption may also have a small but significant BP-lowering effect and some guidelines mention them as part of non-lifestyle dietary modifications.[24]

Controlling hypertension is associated with a reduction in mortality and adverse cardiovascular outcomes and both non-pharmacological and pharmacological interventions are essential to treatment. Non-pharmacological interventions include reducing dietary sodium, increasing consumption of fruits and vegetables a high-protein low-carbohydrate diet and losing weight all of which should be included throughout the treatment period.

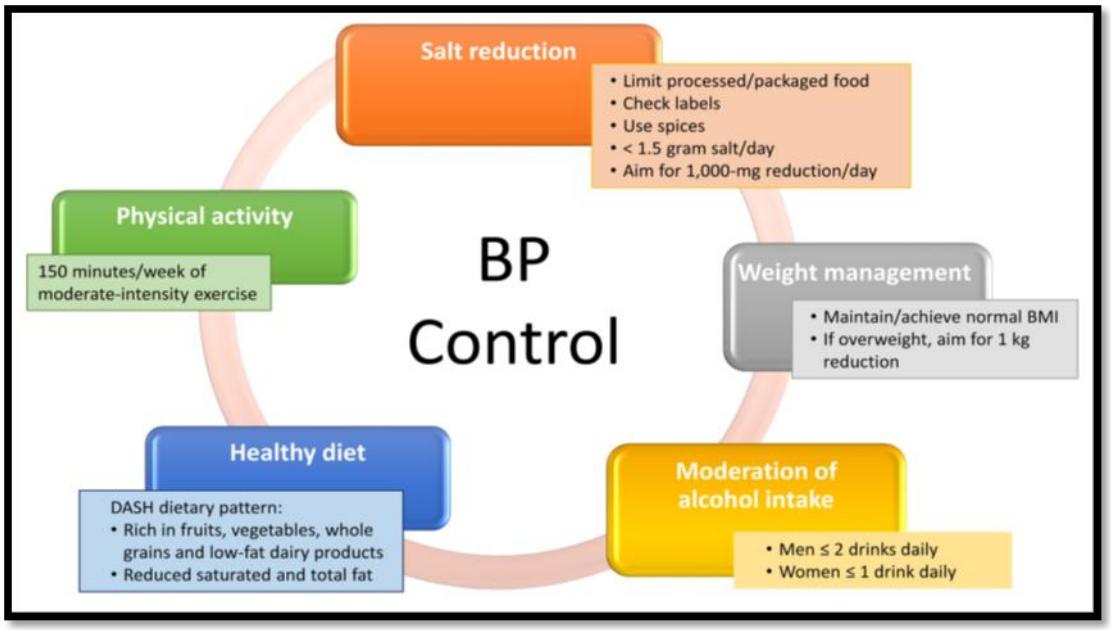

Figure 2: Non-pharmacological approaches to hypertension treatment. Attention to diet, salt and alcohol reduction, and physical activity need to be part of the therapeutic approach for all patients.[25]

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