

# Review of Blood Pressure Lowering-Benefits of Physical Activity, Weight-Loss and Dietary Modifications in Blood Pressure Control among US Minority Communities

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**Abstract:** *Background:* Hypertension develops in individuals irrespective of age, gender, national origin or ethnic grouping. However, there are some differences regarding the extent to which each ethnic population distribution is involved. This review utilized the Health Belief Model (HBM) to design an approach to promote knowledge, beliefs, and modify health behavior of African-Americans with borderline high blood pressure risk factors toward hypertension.

*Methods:* To meet the study objectives, we searched MEDLINE from January 2011 through December 2013, using the medical subject headings of *physical activity and health, nutrition, exercise/leisure-time activity, hypertension, stroke, and cardiovascular disease*. Twenty-five peer-reviewed scientific articles which met our research inclusion criteria were identified and reviewed.

*Results:* On overweight, obesity and sedentary lifestyles, as comorbid factors for hypertension and other CVDs, many researchers concluded that the combination of excessive nutrient intake and sedentary lifestyle has been the major causes for the rapid acceleration of obesity in today's US population. While hypertension is more prevalent and severer in African Americans than other US populations, these authors believe that the major process in high blood pressure control, therefore, lies in the concept of primary and secondary prevention interventions involving sustained efforts in behavior, lifestyle changes, and therapeutic compliance via the HBM at the pre-hypertension stage.

*Conclusion:* The risk of hypertension in the US general population and its unabated disproportional representation in minority communities, especially African Americans, remains a major health challenge. Hence, reviewing and understanding research studies on hypertension, behavioral risk factors and lifestyle changes may prove useful and beneficial for high blood pressure and comorbid conditions intervention programs.

**Keywords:** African Americans, other US minorities, hypertension, comorbid conditions, primary & secondary preventions.

## INTRODUCTION

Hypertension or high blood pressure (HBP) is a major public health problem that confronts a large segment of the US population. This condition which is an independent risk-factor for cardiovascular disease (CVD), can also give rise to heart failure, cerebrovascular accident (stroke), end-stage renal disease, peripheral vascular disease as well as dementia and, is a chief contributor to adult disability and death [1]. Although effective therapy has been available for more than 50 years, most persons with hypertension do not have their blood pressure (BP) under control [2]. The US Department of Health and Human Services "Healthy People 2010 National health objective" include: reducing the proportion of adults with HBP to 16% (baseline: 28%); increasing the proportion of adults with hypertension who are taking action to control it to 95% (baseline: 82%), and increasing the proportion of adults with controlled BP to 50% (baseline: 18%) [3, 4]. Recent national epidemiological

studies reveal a hypertension prevalence rate of 217 per 1000 (over 1 in 5) or over; currently, 50 million Americans are hypertensive [5]. Accordingly, Vasan, Beiser, and Seshadri [4] in recent time reported that although more than 65 million Americans have hypertension, individuals who have normal blood pressure at age 55 will have a 90% lifetime risk of developing hypertension. In addition, only 45.3% of those with hypertension are being treated while less than 30% of the population have controlled blood pressures [5]. These untreated individuals, according to the report, are at risk for cardiovascular complications and/or death. This present situation is also unacceptable because it failed to meet either the *US Healthy People 2010* or will ever meet the current *Healthy People 2020 National Priority Objectives* on hypertension. The relationship between cardiovascular events and hypertension is continuous and linear: the higher the BP, the greater the risk. Research reveals that each incremental rise of 20 mm Hg in systolic BP or 10 mm Hg in diastolic BP doubles the risk of CVD across the entire BP range, from 115/75 mm Hg to 185/115 mm Hg [6]. Reducing elevated BP with lifestyle modification and antihypertensive therapy has been associated with a 50% lower risk of heart failure,

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a 35% to 40% reduced risk of stroke, and a 25% reduced risk of myocardial infarction [2].

Other studies have also shown that although the exact cause of primary hypertension is unknown, individuals who have had high blood pressure or died from its complications, often have had one or several of the following risk factors or living habits: (a) overweight and obesity, (b) sedentary lifestyle or physical inactivity, (c) lack of exercise, (d) emotional stress, (e) high salt intake, (f) hyperlipidemia and (g) family history of hypertension [2-7]. In order to effectively review the beneficial effects of exercise, weight loss and dietary modification in hypertension intervention, it is necessary to briefly discuss the roles of overweight/obesity, sedentary lifestyle and high sodium intake in high blood pressure causation.

### **Obesity: A Comorbid Factor for HBP**

Obesity is a complex, multifactorial condition in which excess body fat may put an individual at risk of developing major health problems. Increasing evidence suggests that obesity is not a simple problem of will power or self-control but a complex disorder involving appetite regulation and energy metabolism that is associated with a variety of comorbid conditions [7-9]. Although its etiology is not firmly established, genetic, metabolic, biochemical, cultural and psychosocial factors contribute to obesity. Some individuals may become overweight or obese partly because they have a genetic or biologic predisposition to gain weight readily. In most cases, however, the increasing prevalence of overweight and obesity reflects societal changes and unhealthy behaviors of Americans over the past three decades [10].

National data indicate that the prevalence of obesity in the United States is increasing in children and adults [10, 11]. Reversing these trends requires changes in individual behavior and lifestyle, and the elimination of societal barriers to healthy lifestyle choices. Basic treatment of overweight and obese patients requires a comprehensive approach involving diet and nutrition, regular physical activity, and behavioral change, with an emphasis on long-term weight management rather than short-term extreme weight reduction [11]. Physicians and other health professionals including nurse practitioners have an important role in promoting preventive measures and encouraging positive health behavior and lifestyle choices as well as identifying and treating obesity-related comorbidities, including hypertension. Health practitioners also have a role in

counseling patients about safe and effective weight loss and weight maintenance programs, as well as, measures to effect acceptable blood pressure levels.

### **RATIONALE FOR THE REVIEW**

Hypertension develops in individuals irrespective of age, gender, national origin or ethnic grouping. However, there are some differences regarding the extent to which each ethnic population distribution is involved. In recent national surveys by the Centers for Disease Control and Prevention on hypertension [10, 12] age-adjusted prevalence of hypertension was 40.5% among African-Americans, 27.4% among non-Hispanic whites, and 25.1% among Mexican Americans. Of those with high blood pressure (HBP), 63.4% (CI = 59.4%--67.4%) had been told that their BP was high. The proportion of those who were aware of their high blood pressure states was greater among those aged  $\geq 40$  years (73.5% versus 48.7%), and this proportion was higher among women than men (69.3% versus 59.4%). Among adult populations with hypertension, the proportion those who were aware they had high blood pressure were 70.3% among non-Hispanic blacks, 62.9% among non-Hispanic whites, and 49.8% among Mexican Americans. Among those with hypertension, 45.3% (CI = 45.3%--52.8%) had been treated with antihypertensive medication. The study also revealed that percentages of those treated for HBP were higher among women than men (56.1% versus 45.2%) and were increased with age. The age-adjusted proportion of those who reported treatment was 55.4% among African-Americans, 48.6% among non-Hispanic whites, and 34.9% among Mexican Americans. Accordingly, only 29% of U.S. adults with hypertension had controlled blood pressure levels (<140/90 mm Hg), and the proportion of hypertensive adults who had controlled their BP varied significantly by age group: 17.6% of those aged 20 - 39 years, 40.5% of those aged 40--59 years, and 31.4% of those aged  $\geq 60$  years. The proportion with controlled BP was similar among African-Americans (29.8%) and non-Hispanic whites (29.8%) but significantly lower among Mexican Americans (17.3%) [10, 12].

The findings of the research reported here further demonstrate the immensity of high blood pressure problem/co-morbid conditions in the US population and the continuing racial/ethnic disparities in the prevalence of hypertension as well as in the proportion of those with HBP who are aware of, are being treated for, and are in control of their high blood pressure conditions.

In the context of over-weight, obesity and sedentary lifestyle as comorbid factors for hypertension and other cardiovascular diseases, many researchers conclude that the combination of an excessive nutrient intake and sedentary lifestyle are the main causes for the rapid acceleration obesity in the US society between the last quarter of the 20<sup>th</sup> century and the present [5, 11]. Further, despite the widespread availability of nutritional information in schools, physician offices, on the internet and in groceries [5], it is evident that over-eating remains a substantial problem. For instance, over-reliance on energy-dense fast-food meals tripled between 1977 and 1995, and caloric intake quadrupled over the same period [5, 12]. However, dietary intake in itself is quoted as being insufficient to explain the phenomenal rise in the level of obesity in much of the industrialized society during recent years. Of course, an increasingly sedentary lifestyle still remains a significant factor in hypertension manifestation [11, 13].

Therefore, because of the serious complications and associated comorbid risk-factors in hypertension, greater emphasis must be placed on intervention efforts geared towards (a) increasing the population basic knowledge and understanding of the high blood pressure disease, (b) changing inappropriate behavior and lifestyle choices in respect to dietary habits, physical activity or sedentary lifestyle, and (c) developing a pattern of living in early childhood and adolescence which would reduce hypertension and cardiovascular risk factors from becoming a problem in later years.

## CONCEPTUAL FRAMEWORK

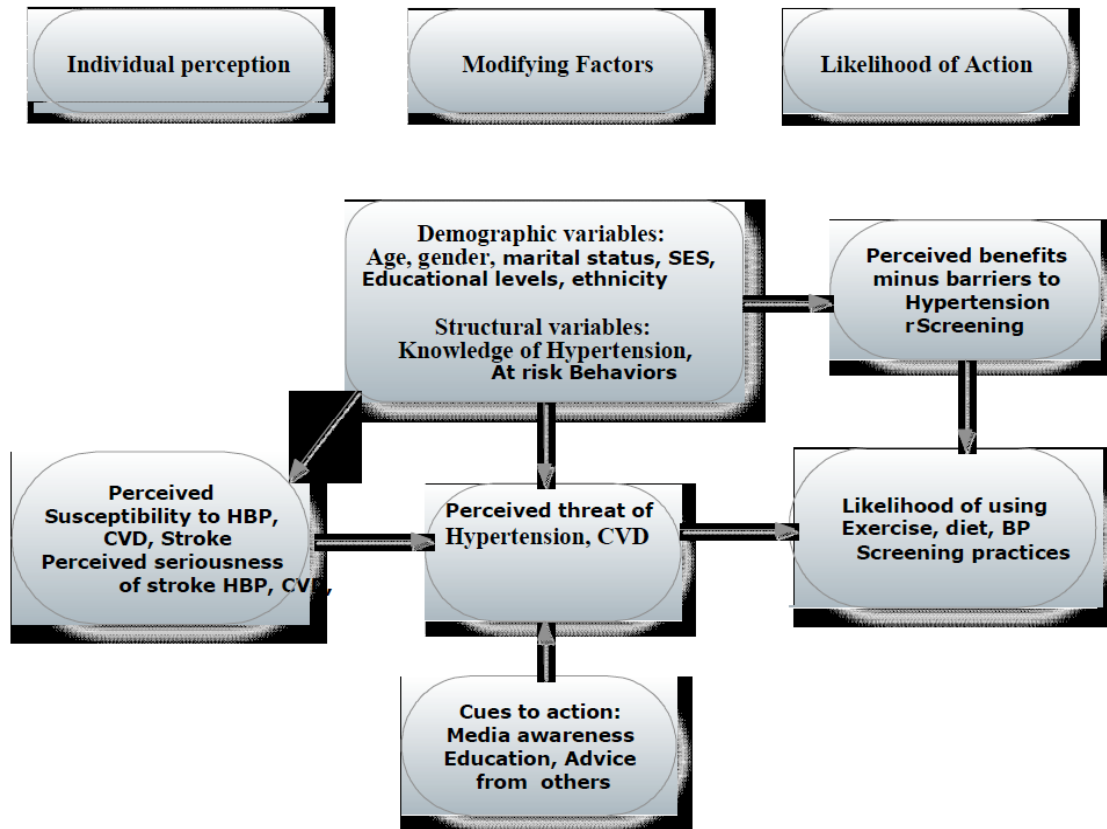
The high level risk of hypertension in the US general population and its unabated disproportional representation in the minority community, especially among African Americans, continues to be a major health concern. Although there is considerable information regarding these disease trends, much of the major underpinnings of the etiology of hypertension remains unclear. The excess mortality in the African American community due to heart disease, renal failure, end-stage renal disease and stroke, are clearly related directly to the excess burden of hypertension. Amid the recent findings about the pathophysiology of hypertension, some clear differences on the effects of overweight, salt sensitivity, and vascular biology emerge along ethnic lines [13, 14]. These differences may shed some light on the development of more effective prevention and treatment strategies. Based on our current knowledge, an aggressive management of

hypertension among US minority groups as well as in the general population is critical and ongoing. Therefore, the purpose of this review was to highlight what is known about various factors affecting hypertension, its effects on other disease conditions and the roles and benefits of exercise, physical activity, diet modification and weight-loss maintenance intervention practices in high blood pressure control.

The reviewers believe that utilizing the Health Belief Model (HBM) conceptual framework approach by health-care providers in counseling patients will be effective in promoting an understanding, change knowledge, and attitudes and thereby modify health behavior of Americans with high blood pressure. The Health Belief Model (HBM) is a major paradigm that has guided research into modification of risk-factors in different disease states, and bringing about disease prevention behaviors [15, 16].

Hypertension is more prevalent and severer among African-Americans than other population groups in the United States. Reporting on the findings of the NIH National Committee on High Blood Pressure (HBP) Detection, Prevention, Evaluation and Treatment Services, Reusser and McCarron [17] revealed a 50% increase cardiovascular mortality risk, 80% higher mortality rate for stroke, and 320% of end-stage renal disease mortality rate for hypertensive African Americans compared with those of other US ethnic groups. Apart from the genetic make-up of African-Americans, which may predispose them to hypertension, this health problem may be related to the individuals' non-compliance with the prescribed anti-hypertensive treatment regimen, the lack of preventive health practices and inaccessibility to preventive health care.

This study utilized the Health Belief Model (HBM) to design an approach to promote knowledge and beliefs, and modify health behavior of African-Americans with borderline high blood pressure risk factors toward hypertension. The Health Belief Model (HBM) is a major paradigm that has guided research towards modification of cardiovascular disease risk factors, including hypertension and other disease prevention behaviors [14, 15]. This model further explains that the desire to take preventive action would occur if the individual perceives the severity of a disease to be high enough to produce serious physical, organic or social complications. The perceived benefit is the patient's beliefs that a given treatment will cure the illness or help prevent it. The perceived cost is the complexity,



**Figure 1:** Schematic Presentation of Health Belief Model (HBM) on Blood Pressure lowering benefits of exercise, weight loss & diet among AA women.

**Source:** Glanz K, Rimer BK, Lewis FM. *Health Behavior & Health Education: Theory, Research and Practice*. San Francisco, CA, Jossey-Bass, Inc; 2005.

duration, and accessibility of the treatment. In essence, HBM deals with *health, illness and sick role behavior* and identifies three intervention domains as shown in Figure 1. (*Schematic Presentation of Health Belief Model*). The first domain is an individual context of perception, which has two basic constructs: *perceived susceptibility*, and *perceived severity* to disease conditions. Perceived susceptibility – which involves individuals' subjective perception of risk of contracting a health condition or disease and in this case, *hypertension*; while in perceived severity – the individual understands the magnitude or severity of the disease or condition, including fear of disability or injury, of dying or other negative consequences and complications of due to high blood pressure.

The second domain is classified as *modifying factors*, which strongly influence the decision to act. The *modifying factors* comprise three constructs – *demographic variables, socio-psychological factors, and structural variables*. The third is *likelihood to action*, which addresses motivation to act while allowing the person to make decision based on factors

not otherwise defined in the first two domains. In sum, the balance between the individual's perceived positive and negative forces, which include peer-pressure, determines the domain of action. A second construct of this domain is appraisal of susceptibility while a third construct is the individual's estimation of both benefits and perceived barriers to action. Bandura [16] added to these, the construct of *self-efficacy*, which he defined as: "the conviction that one can successfully execute the specific behavior required to produce the identified outcome." In possessing self-efficacy, the person has the conviction that he can successfully execute the behavior required to produce the desired outcomes. For example: for an obese person to lose weight, he/she must believe that losing weight will benefit his/her health and also he/she is capable of losing weight. Obesity is a major risk factor in HBP manifestation.

Accordingly, Becker, in Polit and Beck [14] believes that the effectiveness of the Health Belief Model as an intervention strategy depends on the following three factors:

- First, the individual readiness to consider behavioral changes and avoid disease or minimize health risk;
- Second, the existence and powers of forces in the individual's environment that urge the change and make it possible; and
- Third, the behaviors in themselves.

This model further maintains that the desire to take preventive action would occur if the individual perceives the severity of a disease to be high enough to produce serious physical, organic or social complications, such as hypertension or other forms of CVD including coronary heart disease (CHD). Among the modifying factors that have been identified in the HBM are *personality variables, patient satisfaction, and socio-demographic factors* all of which will be utilized in our review to change attitudes and modify behaviors of the US minority populations towards hypertension prevention and control.

## METHODOLOGY

This was a retrospective data gathering review involving an extensive literature search of related areas, and the compilation of reports on hypertension (high blood pressure) and the roles of various high risk behavioral factors in the causation, prevention and control of hypertension. The major objective of this review was to assess the effectiveness of physical activity, dietary restriction, and weight-loss maintenance programs as essential components in self-management, prevention and control of hypertension, and comorbid condition in the US population. To better understand hypertension, its related conditions, risk factors, and the roles of physical activity and weight-loss in high blood pressure causation, we searched MEDLINE from January 2011 through December 2013, using the medical subject headings of *physical activity, nutrition, exercise, leisure-time activity, hypertension, stroke, and cardiovascular disease*. Search was also conducted on the US Surgeon General report on physical activity and health [18] as well as the contents of the *US Healthy People 2010/20 National Priorities* [19] on the health of American community. Twenty-five peer-reviewed journal articles which met our inclusion criteria on physical activity and health, hypertension and stroke as well as overweight and obesity were identified and accordingly reviewed. Inclusion criteria were English language reports of any case control study in which

physical activity (leisure-time activity), weight loss or reduction, cardiorespiratory fitness and dietary modifications were emphasized toward prevention and control of hypertension.

## BENEFITS OF HYPERTENSION PREVENTION AND INTERVENTION PRACTICES

Reviewing and understanding research studies on hypertension behavioral risk factors and lifestyle changes may prove useful and beneficial for high blood pressure intervention programs as well as comorbid conditions. In this context, this paper reviews the blood pressure lowering benefits of lifestyle changes in relation to (a) weight loss and weight control, (b) nutritional factors (*food, sodium, potassium, & other nutrients intake*) and (c) physical activity in high blood pressure control.

### Weight Loss and Weight Control

Data from the National Institutes of Health (*National Heart, Lung, and Blood Institute*) have revealed that approximately 64% of US adults are either overweight or obese [7]. Accordingly, epidemiologic studies have shown close correlation between overweight/obesity, and hypertension and that obesity, specifically, is believed to account for 78% and 65% of essential hypertension, respectively, in men and women as revealed in Framingham study [19, 21]. Medical scientists maintain that for an individual to be considered as overweight or obese, he or she must have had a body mass index in excess of 25 kg/m<sup>2</sup> and ≥30 kg/m<sup>2</sup>, respectively [22]. Studies have shown that overweight is a major risk factor for high blood pressure occurrence and for each 10-kg increase over ideal body weight, systolic BP would rise 2 to 3 mm Hg with corresponding diastolic blood pressure increases from 1 to 3 mm Hg [20]. Accordingly, loss of excess weight has been known to reduce both systolic and diastolic blood pressure in hypertensive patients [13, 23].

Moreover, researchers' belief that loss of excess body weight is an effective intervention strategy in primary prevention of hypertension, They, therefore, opine that physicians and other health care practitioners including nurse practitioners should promote weight loss for all overweight patients and discourage weight gain among others that could result in hypertension [23]. Further, a meta-analysis of randomized control trials of weight reduction in normotensive ≥ 45 years old persons revealed a net reduction of 2.8mm and 2.3mm Hg in systolic and

diastolic blood pressure, respectively at a six month follow-up [7]. However, based on the overwhelming evidence from other clinical trials and meta-analysis, Sandhu and associates feel that weight reduction should be recommended as an important intervention for primary prevention of hypertension. They also maintain that since sustained weight reduction is difficult to attain, more emphasis should be directed at the prevention of weight gain, particularly among adolescents with high normal blood pressure and in families with high prevalence of hypertension [20].

### Physical Activity & Hypertension

Lifestyle patterns are influenced by an overabundance of energy-dense food choices and decreased opportunities and motivation for physical activity [1-5]. According to the U.S. Surgeon General Reports, approximately 25 percent of American adults are completely sedentary, and more than 60 percent are not regularly active at the recommended level of 30 minutes per day [23]. The Centers for Disease Control and Prevention maintains that regular physical activity is associated with decreased risk for obesity, hypertension, heart disease, diabetes, certain cancers and premature mortality [10]. In this connection, the Centers for Disease Control and the American College of Sports Medicine recommend that adults should engage in at least 30 minutes of moderate physical activity on most days and preferably, on all days of the week [2, 10, 23]. In addition, reducing racial and ethnic health disparities in chronic disease prevention outcomes, physical activity, is an overarching national goal of the *Healthy People 2020 Objectives* on hypertension intervention control [19].

The following are citations from a recent report by the Centers for Disease Control and Prevention on the benefits of physical activity on hypertension and other cardiovascular problems [18]:

- (a) Higher levels of regular physical activity are associated with lower mortality rates for both older and younger adults. In addition, individuals who are moderately active on a regular basis have lower mortality rates due to hypertension and other comorbidities than those who are least active;
- (b) Regular physical activity or cardio-respiratory fitness decreases the risk of cardiovascular disease mortality in general, and of coronary heart disease mortality and hypertension in

particular. However, existing data are not conclusive regarding a relationship between physical activity and stroke;

- (c) The level of decreased risk of coronary heart disease attributable to regular physical activity is similar to that of other lifestyle factors, such as keeping free from cigarette smoking;
- (d) Regular physical activity prevents or delays the development of high blood pressure, and exercise reduces blood pressure in people with hypertension.

Biomedical literature has linked physical inactivity and sedentary lifestyles to high blood pressure development. An aerobic exercise-trial meta-analysis in normotensive individuals by Whelton, Chin, Xin and He [24] revealed a 4.04-mm and 2.33 mm Hg decrease in systolic and diastolic blood pressures, respectively. Additional benefit of regular physical activity, according to Sandhu and associates [20], include weight loss, enhanced sense of well-being, improved functional health status and reduced risk of cardiovascular disease and mortality from all causes.

Accordingly, Nesbitt [13] maintains that when compared with the fit and active peer, the sedentary and out-of-condition normotensive person typically has a 20% to 50% increase in risk of hypertension and that physical activity reduces both systolic and diastolic BP in both normotensive persons and those with hypertension. Another study, for example, showed that regular physical activity, including brisk walking, swimming, cycling, or treadmill, for at least 30 minutes daily for most days of the week, can be very effective in HBP control and therefore, should be recommended for primary prevention of essential hypertension [25]. The authors however, opined that an isometric such as weight lifting can have a *pressor* effect on blood pressure and should be avoided.

### NUTRITIONAL FACTORS-DIETARY MODIFICATION

Nutritional or dietary factors not only contribute a great deal to the burden of preventable illness in the United States but also are responsible for four of the ten leading causes of death – coronary heart disease, certain types of cancer, stroke and type-2 diabetes [2]. A randomized clinical trial (RCT) dietary approaches to stop hypertension revealed a reduction in blood pressure of 3.5/2.1 mm Hg in normotensive individuals on fruit and vegetarian diet combined with reduced fat

and cholesterol intake [26, 27]. In a similar RCT study, researchers compared the effects of consuming DASH diet (comprising 4 – 5 servings of fruit, 4 – 5 servings of vegetables, 2 – 3 servings of low-fat dairy per day, and <25% fat ) with a typical high fat diet among 459 adults with normal or elevated blood pressure. Among 133 patients with hypertension, the DASH diet reduced systolic and diastolic blood pressure by 11.4mmHg and 5.5 mm Hg, respectively when compared with the control diet. The study also revealed more beneficial effects among African American subjects because the DASH diet reduced their systolic and diastolic blood pressure by 13.2 mm Hg and 6.1 mm Hg, respectively [17].

### Reduction in Dietary Sodium

A number of randomized-controlled clinical trials and observational studies among populations, over the past decades have convincingly shown causal relationship between dietary salt intake and elevated blood pressure [28]. In a meta-analysis of 12 randomized controlled clinical trials in 1,689 normotensive individuals, an average reduction of 77 mmol/day in dietary sodium intake resulted in 1.9 mm Hg reduction in systolic blood pressure [29]. In a related dietary research, another randomized clinical trial studied the effect of different levels of sodium in conjunction with DASH diet among 412 subjects assigned to eat either a control diet or DASH diet. The assigned diets comprised foods with high (150 mmol/d), intermediate (100 mmol/d), and low (50 mmol/d) levels of sodium in random order. Study findings revealed that low sodium DASH diet was responsible for additional decrease of blood pressure, an effect that was also revealed stronger among African Americans patients than others [30]. Accordingly, when this result was compared with the combination of the control diet and a high level of sodium, the DASH diet and low level sodium lowered the systolic blood pressure by 11.5 mm Hg for subjects with hypertension (12.6 mm Hg for African Americans; 9.5 mm Hg for others) and by 7.1 mm Hg for non-hypertensive subjects (7.2 mm Hg for African Americans; 6.9 mm Hg for others) [30].

On the basis of the DASH diets results and other clinical trials, the National High Blood Pressure Education Program Coordinating Committee universally recommended the reduction in dietary sodium intake of not more than 100 mmol/ day (2.4 gm. sodium or 6.0 gm. salt). The committee also maintain that lower levels of dietary sodium intake (< 70 mmol/day) can result in a greater reduction in blood

pressure [31]. Accordingly, it has been revealed that daily sodium intake reduction of about 30% to 40% has also been associated with decreased BP levels in elderly persons [32]. Other studies have confirmed the effectiveness of restriction of dietary sodium as an adjunct to pharmacotherapy in patients with hypertension [33]. Restricting daily sodium intake may also help reduce hypertension-related mortality. In this regard, an aggressive 100-mmol daily restriction in sodium intake during the first 55 years of life has been known to result in a 16% lifetime reduction in mortality from coronary artery disease, a 23% reduction in mortality attributable to stroke, and a 13% reduction in death from all causes [31].

### Use of Potassium Supplements & other Micronutrients

In the past decades, clinical and epidemiologic studies have clearly shown that adequate intake of potassium has an important role in blood pressure reduction and that insufficient potassium intake may contribute to the development of hypertension [19, 33].

A meta-analysis of RCTs showed that potassium chloride supplementation of 60 to 100 mmol/day decreased systolic BP by 4.4 mm Hg and diastolic BP by 2.5 mm Hg [33]. High potassium intake has also been associated with a decreased incidence of stroke, independent of its effect on blood pressure [34]. Based on this information, it is recommended that adequate intake of potassium (> 90 mmol or 3500 mg daily) be taken and this should include fruits, fruit juices, and vegetables which are all good sources of potassium.

### Other Micronutrients and Macronutrients

Current research data suggest that neither micronutrients (for example, calcium, magnesium, and zinc) nor macronutrients (for example, fat, fatty acids, carbohydrate, fiber, and protein) are major, independent determinants of hypertension risk because: short-term changes in the consumption of these nutrients do not seem to affect blood pressure levels [35-37]. However, diets rich in fruits, vegetables, and low-fat dairy foods that is low in both saturated and total fats, has also been shown to decrease blood pressure [38, 39]. This effect seems to be due to high fiber and low fat content of vegetarian diet as compared to non-vegetarian diet. Increased calcium and fish oil and reduced caffeine consumption have also indicated small blood pressure lowering effects [40]. Observational studies have shown a strong

association between dietary protein and fiber intake and blood pressure, but clinical trials in this area have been scanty [41-43].

Finally, the JNC-7, NIH, USDHHS [44] recommends treating hypertension to BP < 140/90 mmHg or BP < 130/80 in patients with diabetes mellitus or chronic kidney disease; and to prescribe lifestyle modification for all patients with pre-hypertension and hypertension for the following expected outcomes:

and thus allow for a measurable decrease in arterial blood pressure to be articulated.

Researchers recommend a low-calorie well balanced diet coupled with moderate levels of physical activity to avoid crash diets as a miracle solution to obesity. The use of salt in food preparation should be cut to a minimum. Also, processed foods, as well as, canned foods should be used sparingly. Salt can also be reduced by refraining from adding extra salt to food during mealtime.

**Table 1: JNC – 7 USDHHS Recommendations for High Blood Pressure Control**

MODIFICATION	RECOMMENDATION	AVG. SBP REDUCTION RANGE
Weight reduction	Maintain normal body weight (body mass index 18.5-24.9 kg/m <sup>2</sup> ).	5-20mmHg/10kg
Dash eating plan	Adopt a diet rich in fruits, vegetables, and low fat dairy products with reduced content of saturated and total fat.	8-14mmHg
Dietary sodium reduction	Reduce dietary sodium intake to /less than 100mmol per /day (2.4 sodium or 6g sodium chloride).	2-8mmHg
Aerobic physical activity	Regular aerobic physical activity (e.g., brisk walking) at least 30minutes per day, most days of the week.	4 -9mmHg
Moderation of alcohol consumption	Men: limit to/less than 2 drinks per day. Women and lighter weight persons: Limit to /less than 1 drink per day.	2 - 4mmHg

Source: National Institutes of Health. JNC-Seventh Report of the Joint Commission on Prevention, Detection, Evaluation and treatment of High Blood Pressure 2005; US Department of Health & Human Services, Washington D.C.

## DISCUSSION

The authors believe that the major process in high blood pressure control lies in the concept of primary and secondary prevention intervention involving sustained efforts in behavior and lifestyle changes, and therapeutic compliance by individuals and the community. These should include weight reduction in overweight and obese persons, increased physical activity and lifestyle changes, consumption of foods rich in fruits and vegetables. Others include low intake of dairy fat and sodium, and avoidance of excessive intake of alcoholic beverages.

With heredity being another known risk factor for the development of high blood pressure [45], positive steps must but be taken prior to the development of high blood pressure, which would include a healthful life-style from an early age, such as: avoiding the use of tobacco products, consumption of salty fatty foods, and living a sedentary lifestyle. Only by making these improved lifestyle choices can morbidity be improved

A healthful effect to the diet can come from potassium. Potassium intake should be increased because it may have an “antihypertensive effect” [46]. A healthful diet should include “foods that are low in sodium and rich in potassium,” such as beans, dark green vegetables, bananas, melons, carrots, beets, tomatoes, and oranges. Also, it is imperative to keep alcoholic beverages to a minimum.

Hypertension can be prevented with regular physical exercise, which decreases blood pressure [47]. Moderate aerobic exercise, such as walking, cycling, and swimming, for approximately 30 minutes, three times a week is beneficial. Other factors such as quitting smoking, minimizing cholesterols and triglycerides have been associated with a more healthful life-style and stress reduction. Adopting a healthful life-style early in life will be beneficial, not only for the hypertensive person but also for members of the family, especially African American families where the staple diet might be high in cholesterols and sodium.



## CONCLUSION

With approximately 30% of American adults living with high blood pressure, whereas the rate for African Americans is more than 40%, the highest in the world, it is imperative that primary and secondary prevention strategies be employed to bridge and possibly eliminate the disparity in this regard [48]. Use of the Health Belief Model, a model that is directed at changing individual behavior, must be encouraged as it helps to educate individuals on both their intra- and interpersonal risk factors that are adversely impacting their personal health and wellness. This includes promoting awareness and screening in communities where individuals might be unaware that they are already hypertensive.

Hypertension is often referred to as the 'silent killer' because it is a disease without symptoms until something serious occurs. As a result of this, all too often physicians are faced with diagnosing patients late in the natural progression of this disease [48]. Therefore, strategies such as implementing a near vegetarian diet and a regular exercise regimen to decrease the incidence of overeating and obesity are absolutely necessary and important.

Communities of low socioeconomic status and inadequate education tend to suffer high level of stress, another risk factor for hypertension, at disproportionate levels. US minority communities, such as African Americans, Latinos, and American-Indian communities often fit this description. However, with proper encouragement in respect to cultural views and sensitivity, even these populations with highest rates of hypertension, can modify their behavior to prevent or control hypertension and all associated co-morbid factors [49]. In sum, these and other recommendations addressing the reduction of hypertension over the past several decades will undoubtedly go a long way to prevent and control the incidence and prevalence of hypertension in all communities, as well as, decrease the comorbid conditions (cardiovascular, cerebrovascular & renal diseases, etc.) linked to high blood pressure disease in the United States.

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