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Effect of Salt on Hypertension - A Review Article

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ABSTRACT

Hypertension in majority of cases is the result of poor lifestyle. The salt intake level has changed over the centuries. In populations characterized by a low level of daily salt consumption, hypertension was a rare and cardiovascular diseases were much less common. More and more food is sold in processed form, and thus containing large amounts of salt. The amount of salt delivered with food significantly exceeds the actual bodys needs. Limitation of salt intake should apply to both prevention of hypertension and cardiovascular diseases as well as treatment of people suffering from hypertension. High sodium intake to increased systolic and diastolic pressure, increases the risk of cardiovascular disease as well as other disease. There are many mechanisms triggered by excessive intake of salt that lead to an increase in blood pressure. National and international scientific societies have developed many documents in the form of guidelines on the optimal daily sodium intake. Compliance with the recommendations and limitation of salt intake may significantly reduce the incidence of hypertension in the general population.

INTRODUCTION

Hypertension is the leading cause of death and the second leading caue of disability worldwide, accounting for 7.6 million premature deaths and 92 million disability. Worldwide, approximately 1 billion individuals had hypertension (>140/90 mmhg) in 2000 and the number is predicted to increase to about 1.5 billion by 2025[1]

The damage caused by hypertension is mainly through its effects on cardiovascular disease (CVD) (stroke, heart attacks, heart failure and kidney diseases). Worldwide hypertension is responsible for 62% of stroke and 49% of coronary heart disease. There is evidence that dietary salt intake is the major cause of hypertension. The salt intake most countries is between 9 and 12g/day. This level of salt intake is about 40 times higher than the amount human ancestor during several million year of evalution. Such a large increase in salt intake is relatively recent in evolutionary terms. Excreting these large amounts of salt through the kidneys presents a major challenges to physiological systems. The consequence is a gradual rise in blood pressure and an increase in the risk of CVD and renal disease.[2]

HYPERTENSION

Hypertension is defined by a systolic blood pressure that is > 140 mm hg and a diastolic blood pressure that is >90 mm hg. The world health organization ranks coronary heart diseases and cerebrovascular diseases as the world leading cause of death. Globally according to the world health report 2002, about 62%of cerebrovascular diseases and 49% of ischemic heart diseases, and hypertension is estimated to cause 7.1 million deaths, about 13% of the total. For the last several decades, hypertension has been ranked as one of the top 10 leading causes of worldwide disability adjusted life years. According to the result of more than 25% of the world adult population (approx.. 1 billion) has hypertension, and it was estimated that in 2025, 29% (1.56 billion) of the adult population will be hypertensive (an increase of the total number of hypertension individuals by 60%)[3]

PREVALANCE OF HYPERTENSION

Hypertension is the most important risk factor for chronic disease burden in india. Studies from various parts of india have reported high prevalence of hypertension. The global prevalence of hypertension is on the increase. In 2000, 972 million people had hypertension with a prevalence rate of 26.4%. these are projected to increase to 1.54 billion affected individuals and a prevalent rate of 29.4% in 2025.[4]

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TYPES OF HYPERTENSION

Hypertension is broadly classified into two,

1) Primary hypertension
2) Secondary hypertension

Primary hypertension

(also known as essential hypertension) accounts for 90 to 95% of cases of hypertension. This type of hypertension has no identifiable etiology and traditionally has been viewed as a consequence of interaction between environmental factors such as sodium intake and genetic factor. Essential hypertension is also greatly influenced by diet and lifestyle. The link between salt and high blood pressure is especially compelling. By contrast, people who add no salt to their food show virtually no traces of essential hypertension. The majority of all people with high blood pressure is salt sensitive, meaning that anything more than the minimal bodily need for salt is too much for them and increases their blood pressure.[5]

Secondary hypertension

(also known as non-essential hypertension), is the type of hypertension that has an identifiable cause and affecting approximately 5-10%of hypertensive patients secondary cause includes kidney diseases ranks highest, hypertension can also be triggered by tumors or other abnormalities that cause the adrenal glands to secrete excess amounts of the hormones that elevate blood pressure, diabetes, cushing syndrome(overproduction of cortisol) as more than 80% of patients with this disease have hypertension. When a direct for high blood pressure can be identified, the condition is described as secondary hypertension.[3]

CAUSES OF HYPERTENSION

In the majority of cases over 90% no specific cause for the elevated blood pressure can be identified. The high blood pressure due to hormonal factors relating to the handling of salt by the kidney or to elaboration of certain substances that cause constriction of blood vessels. These are probably genetically determined, but certain environmental factors, such as a high salt, low potassium diet and chronic stress, may play some role. Generally the following are the causes of hypertension.

Smoking, being over weight or obese, lack of physical activity, too much salt in the diet, too much alcohol consumption (more than 1 to 2 drinks per day), older age, genetics, adrenal and thyroid disorder, chronic kidney disease, people with diabetes.[6]

KIDNEY DISORDERS

About 4% of all cases of high blood pressure can be traced to some type of kidney disorders. The kidneys work in several ways to help regulate blood pressure. For example, they are instrumental in regulating the bodys fluid volume and its balance of sodium(salt) and water. If the kidneys conserve too much sodium, the bodys fluid volume increases. In turn, this increased fluid volume puts an increased burden on the heart to maintain an adequate flow of blood to tissue and causes blood pressure to rise. The kidney also produce renin, an enzyme that plays a role in regulating blood pressure. The kidneys increase their secretion of renin an enzyme that, through a series of biochemical changes in kidney and lungs, gives rise to a substance called angiotensin 2 this is a vasoconstrictor, this constriction results in increased blood pressure. This substance also increases the secretion of a hormone, aldosterone, which leads to a retention of salt and water further increasing blood pressure. Renovascular hypertension is rare, but it is relatively more common in elderly person who may have widespread hardening of the arteries. It tends to occur more frequently in smokers. Its sometimes occurs in children, as a result of infection or an inflammatory condition.

In fact renovascular hypertension is one of the more common cause of high blood pressure in young children, and should be suspected in any youngster under the age of 10 to 12 with elevated blood pressure. Less commonly, renovascular hypertension may be due to an inflammatory disorders that affects the muscles that encircle the arteries and control their diameter. This type of renovascular hypertension occurs more frequently in young women, although it is occasionally seen in men. It also develop more frequently in smokers than in non smokers population.[7]

SALT

Salt (sodium chloride), a white crystalline substance with characteristics found in sea water. Salt is sodium chloride (NaCl). By weight, salt is 40% sodium and 60% chloride. Sodium is an essential nutrient, a mineral that the body cannot manufacture itself but is required for life and good health salt has several functions in the body. Firstly, sodium together with potassium is an essential mineral for regulating body fluid balance.

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Secondly, it is essential for the transmission of nerve and muscle impulses salt in its natural form as a crystalline mineral is known as a rock salt or halite.[8] The molar mass of salt is 58.443g/mol, its melting point is 801 c and its boiling point is 1,465 c. it has a density of 2.17g per cubic centimeter and it is readily soluble in water. When dissolved in water, it separates into Na and Cl ions and the solubility is 359grams per liter. One of the biological necessities for human is salt, which is added to a majority of foods, not only for improving the taste, but also as a preservative.[9]

Sodium is responsible for regulating extracellular volume, maintaining acid base balance, neural transmission, renal function, cardiac output. While there is variability in individual sodium requirements, the world health organization recommends that an adult adequate sodium intake is >5g/day (world health organization, 2012).[10] Chloride is primarily responsible for maintenance of proper hydration, osmotic pressure and normal cation-anion balance in the vascular and intestinal fluid compartment. Excess sodium consumption has been linked to numerous adverse health condition and is a major public health concern in worldwide. Decreases in diastolic blood pressure (-2 mmHg) as a result of sodium reduction can reduce the prevalence of hypertension by 17%. While decreasing sodium in reducing hypertension (world health organization 2012)[11], existing evidence suggest that low sodium intake is necessary for protection against high blood pressure and development of cardiovascular diseases.

USES OF SALT

Industrial salts have found several uses or applications: the salt can be used to fix and standardize dye batches in the textile industry,used in the processing and secondary aluminum making,rubber manufacturers use tha salt to separate rubber from latex. Sodium and chloride help to regulate blood pressure, control fluid balance and maintain the right condition for muscle and nerve functioning.[12]

SALT AND HUMAN LIVING

Salt is an essential electrolyte to life in human beings and is used universally in cooking, seasoning, and preserving manufactured food stuffs around the world. For several million years, human diet that contained less than 1 g of salt per day. Salt was the most taxed and traded commodity in the world, with intake reaching a peak around the 19th century. Salt intake had been declining, but with the recently large increases in the consumption of highly salted processed food, salt intake is increasing towards levels similar to those of the 19th century, and is approximately 9-12 g/day in most countries around the world. Most table salt sold for consumption contain additives. The amounts of additives vary widely from country to country. Iodine is an important micronutrient for human and iodized table salt has significantly reduced disorders of iodine deficiency. Salt is present in most foods we eat. However, in naturally occurring foods such as meats, vegetables, and fruits, salt are present in small quantities. There is more salt in animal tissues such as meat, blood and milk, than there is in plant tissues. Recently many processed foods use large amount of salt and over 75% of daily sodium intake comes from salt found in processed foods.[13]

Mechanism Of Developing Hypertension

The renin angiotensin system is a hormone system that regulates blood pressure and water balance. When blood volume is low, juxtaglomerular cells in the kidneys activate their pro-renin and secrete renin directly into circulation. Plasma renin then carries out the conversion of angiotensinogen released by the liver to angiotensin I. angiotensin I is subsequently converted to angiotensin II by the enzyme angiotensin – converting enzyme found in the lungs. Angiotensin II is a potent vaso- active peptide that causes blood vessels to constrict, resulting in increased blood pressure. Angiotensin II also stimulate the secretion of the hormone aldosterone from the adrenal cortex, aldosterone causes the tubules of the kidneys to increase the re-absorption of sodium and water into the blood. This increase the volume of fluid in the body, which also increases blood pressure.[14]

MANAGEMENT OF HYPERTENSION

Reduce sodium intake

High salt intake is associated with significantly increased risk of stroke and total cardiovascular disease. Evidence from published systematic review and meta analyses showed that restricting sodium intake in people with elevated blood pressure in the short term leads to reductions in blood pressure of up to 10.5 mmHg systolic and 2 mmHg diastolic. An intake of <100 mmol of sodium or 5g of sodium chloride a day is recommended.[15]

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Regular physical exercise

Aerobic exercise is more effective than resistance training (e.g. weight lifting). Exercise like walking-jogging can result in a reduction of 13/18 mmHg in SBP/DBP. More recent evidence showed that resistant exercise is effective in lowering blood pressure among normotensives and pre-hypertensive but not among hypertensives. Howevers isometric resistant execise can reduce hypertension by 10.4/6.7 mmHg as shown by a recent meta analysis.[16]

Weight reduction

Weight reduction diets in overweight hypertensive persons can result in modest weight loss in the range of 3-9% of body weight 40 and are associated with blood pressure reduction of about 3-6 mmHg.

Avoidance of alcohol intake

Alcohol consumption elevates BP acutely. For those who consume alcohol, intake should be restricted to no more than 21 units for men and 14 units for women per week (1 unit is equivalent to one half-pint of beer). Meta analyses have shown that, interventions to reduce alcohol consumption caused a small but significant reduction (3.3/2 mmHg) in both systolic and diastolic blood pressure respectively.

Healthy diet

A diet rich in fruits, vegetables and low fat dairy products with reduced saturated and total fat can substantially lower BP (11/6 mmHg in hypertensive patients and 4/2 mmHg in patients with high normal BP). More recently, diet high in L-Arginine has been shown to be able to reduce BP by 5.4/2.3 mmHg

Halting of smoking

Smoking can raise BP acutely. However the effect of chronic smoking on BP is less clear. Halting of smoking is important in reducing overall cardiovascular diseases.

Relaxation therapy

Relaxation interventions were shown to be associated with statistically significant reduction in systolic and diastolic blood pressure of about 3 mmHg.[17]

CONCLUSION

Sodium chloride is a very regular and necessary constituent of food and the main cause for the rise in arterial pressure. A high salt diet disrupts the natural sodium balance in the body. To avoid high dietary salt intake for the prevention and treatment of hypertension. A consistent body of evidence suggest that the chloride component of salt is an important contributor to NaCl induced elevations of blood pressure.

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