



EFFECTIVENESS OF GARLIC INTAKE AMONG HYPERTENSIVE PATIENTS: A REVIEW ARTICLE

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ABSTRACT: Hypertension remains an important health challenge. Various factors might have contributed to this rising trend of hypertension. Moreover, the global burden of disease is already very high as people are spending lots of money on drugs. Therefore it seems to be a necessity to create awareness in people regarding complementary modalities. Complementary modalities play an important role in the management of hypertension. Factors leading to hypertension are age, alcohol, cigarette smoking, diabetes mellitus, elevated serum lipids, excess dietary sodium, gender, family history, obesity, ethnicity, sedentary lifestyle, socio-economic status and stress. Hypertension has become a major global epidemic that imposes a substantial health burden in the world. But over time, high blood pressure increases the risk of serious problems such as stroke, congestive heart failure, heart attack, and kidney failure. As per ICMR report in 2018 revealed that, raised blood pressure attributes to the leading risk factor for morbidity and mortality in India. Hypertension is attributable to 10.8% of all deaths in India. According to Global Burden of Diseases study, in the year 2017, it led to 1.54 million deaths in India and 10.4 million deaths globally. It also led to 38.1 million disability adjusted life years lost in India and 220.0 million globally. The global burden of hypertension has increased from 594 million patients in 1975 to 1.13 billion in 2015. In the past decades garlic was an herb. It is the best known as a flavouring food. But over the years garlic has been used as a medicine to prevent or treat a wide range of diseases and condition. Garlic has numerous health benefits; it has an antihypertensive, antidiabetic, antilipido, antimicrobial and antiplatelet effect on the body. Mechanism of antihypertensive action is it interferes with the function of angiotensin I, thereby relaxes the smooth muscles of blood vessels. Traditionally, it has been employed to treat high blood pressure, infections, high cholesterol, fungal skin infections wounds, rheumatism heart disease, diabetes, and many other disorders. Garlic is used for many other conditions related to the heart and blood system. In various studies, it was found that garlic can be added as an adjuvant in the diet so that it helps in maintaining normal blood pressure among hypertensive clients.

KEY WORDS: Effectiveness, Garlic, High Blood Pressure, Hypertensive Patients.

INTRODUCTION :

World Hypertension Day (WHD) is a day designated and initiated by the World Hypertension League (WHL), which is itself an umbrella to organizations of 85 national hypertension societies and leagues. The day was initiated to increase the awareness of hypertension. This was especially important because of the lack of appropriate knowledge among hypertensive patients. The WHL launched its first WHD on May 14, 2005. Since 2006, the WHL has been dedicating May 17 of every year as WHD. In 2005, as the inaugural effort, the theme was simply "Awareness of high blood pressure"^[1]

Blood pressure is the force of your blood pushing against the walls of your arteries. Each time your heart beats, it pumps blood into the arteries. Your blood pressure is highest when your heart beats, pumping the blood. This is called systolic pressure. When your heart is at rest, between beats, your blood pressure falls. This is called diastolic pressure.^[2]

Hypertension is the leading global risk factor for cardiovascular disease (CVD) and mortality. The definition of hypertension has changed over the years, from a systolic blood pressure (SBP)/diastolic blood pressure (DBP) of $\geq 160/90$ mmHg in 1984 to $\geq 140/90$ mmHg in 1993, and a further reduction to $\geq 130/80$ mmHg in 2017. The recent definition of $\geq 130/80$ mmHg has led to a substantial increase in the prevalence of hypertension and a small increase in recommended antihypertensive medications in the US adults compared with the long used definition of $\geq 140/90$ mmHg.^[3]

According to the ACC/AHA in 2017 hypertension guideline recommendations, categorized adults without hypertension when their BP level was $< 130/80$ mmHg, stage 1 hypertension when their BP level was 130-139/80-89 mmHg, and stage 2 hypertension when their BP level was $\geq 140/90$ mmHg.^[3]

The global estimation by WHO showed that in 2021, hypertension is a major cause of premature death worldwide. An estimated 1.28 billion adults aged 30-79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries. An estimated 46% of adults with hypertension are unaware that they have the condition. It is estimated that at least one in four adults in India has hypertension, but, only about 12% of them have their blood pressure under control.^[4]

As per ICMR report in 2018 revealed that, raised blood pressure attributes to the leading risk factor for morbidity and mortality in India. Hypertension is attributable to 10.8% of all deaths in India.^[5]

Hypertension (HTN) is a modern day's epidemic and it is becoming a public health emergency worldwide, especially in the developing countries. It is seen that majority of the hypertensive patients remain asymptomatic, that's why hypertension is known as silent killer.^[6]

Hypertension stand true in today's scientifically advanced scenario where every man is too busy to take some time out, even for himself. Hypertension affects approximately 1 billion individuals worldwide. Risk factors like aging, over weight, family history, smoking, stress, alcohol intake, sedentary life style, diabetes mellitus.^[7] Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India.^[8]

Its diagnosis is difficult; It is possible only through routine health check-ups, active surveys, or screening programs. The National Institute of Health classifies Complementary and Alternative Medicine (CAM) into five major categories- Alternative medical systems, Mind-body interventions, Biologic-based therapies, Manipulative and body-based methods, and Energy therapies.^[9]

A systemic review and meta analysis was conducted in 2008 on effect of garlic on blood pressure which showed that, in meta-analysis of all studies the mean decrease of 4.6 +/- 2.8 mm Hg for SBP in the garlic group compared to placebo (n = 10; p = 0.001), while the mean decrease in the hypertensive subgroup was 8.4 +/- 2.8 mm Hg for SBP (n = 4; p < 0.001), and 7.3 +/- 1.5 mm Hg for DBP (n = 3; p < 0.001). Regression analysis revealed a significant association between blood pressure at the start of the intervention and the level of blood pressure reduction (SBP: R = 0.057; p = 0.03; DBP: R = -0.315; p = 0.02). The meta analysis suggests that garlic preparations are superior to placebo in reducing blood pressure in individuals with hypertension.^[10]

PREVALENCE :

According to the reports by WHO in 2018, about 40% of individuals aged 25 years old and higher had HTN. The prevalence of hypertension across the World Health Organization (WHO) region was highest in Africa at 46% and lowest in America at 35% for both sexes.^[11]

In India the prevalence of the disease varies from 9.3% to 47.9% in different sets of population of the country. The prevalence of elevated BP in urban dwellers varied between 11.5% - 31.5% and that in rural population from 10.6 % — 33.8%.^[11]

In eastern Mediterranean countries and Middle East, the prevalence of HTN in various assessments was reported to be between 17 and 39%, and rapid social and economic changes of these countries in recent decades resulted in a high prevalence of the HTN.^[12]

Based on an analysis of data from 135 population-based studies that included 968,419 adults from 90 countries, they estimated that in 2010 the global age-standardized prevalence of hypertension (defined as systolic BP ≥ 140 mm Hg, diastolic BP ≥ 90 mm Hg, and/or current use of antihypertensive medication) was 31.1% (95% CI 30.0–32.2%). The age-standardized prevalence of hypertension was slightly higher in men (31.9%) than in women (30.1%) and was lower in HICs (28.5%) than in LMICs (31.5%). The lowest prevalence of hypertension in men was found in South Asia (26.4%), whereas the highest prevalence was in Eastern Europe and Central Asia (39.0%). In women, the prevalence of hypertension was lowest in HICs (25.3%) and highest in Sub-Saharan Africa (36.3%).^[12]

According to Global Burden Diseases study, in the year 2017, it led to 1.54 million deaths in India and 10.4 million deaths globally. It also led to 38.1 million disability adjusted life years lost in India and 220.0 million globally. The global burden of hypertension has increased from 594 million patients in 1975 to 1.13 billion in 2015.^[13]

In 2017, a community based cross-sectional study was conducted among urban population of Varanasi. The results showed that the prevalence of hypertension was 32.9% (male: 40.9%, female: 26.0%). Mean systolic and diastolic BP were 124.25 ± 15.05 mmHg and 83.45 ± 9.49 mmHg, respectively. Higher odds of being hypertensive were found in male subjects, the eldest age group, married subjects, subjects of upper socioeconomic status, illiterate subjects, and retired subjects. Tobacco and alcohol consumption, overweight, obesity, and abdominal obesity were also associated with hypertension.^[14]

Ghosh S and Kumar M, in 2019 stated in their study that the age-adjusted prevalence of hypertension in India was 11.3% and the prevalence was four percentage points higher in men (13.8%) than in women (10.9%). Hypertension prevalence was 12.5% in urban, compared with 10.6% in rural location. The results indicate that the age-adjusted prevalence of hypertension varied greatly between states and UTs, with a prevalence of 8.2% in Kerala to a prevalence of 20.2% in Sikkim. Quite intriguingly, the prevalence of hypertension was highest in the north-eastern (NE) states, namely Sikkim (20.2%), Nagaland (17.6%), Assam (17.6%), Arunachal Pradesh (16.6%) and Tripura (15.4%). Further, hypertension prevalence was very high in few non-NE states, namely Jammu and Kashmir (15.8%), Punjab (14.8%), Himachal Pradesh (14.8%) and Telangana (14.2%). On the other hand, proportion of population suffering from hypertension was relatively low in states such as Kerala (8.2%), Bihar (8.8%), Delhi (8.6%), Rajasthan (9.1%), Uttar Pradesh (9.6%) and Jharkhand (9.6%).^[15]

RISK FACTORS :

Hypertension is one of the most common complex disorders. The etiology of hypertension differs widely amongst individuals within a large population. And by definition, essential hypertension has no identifiable cause. However, several risk factors have been identified.^[16]

Genetic variation: Having a personal family history of hypertension increases the likelihood that an individual develops it. Essential hypertension is four times more common in black than white people, accelerates more rapidly and is often more severe with higher mortality in black patients.^[16]

An article analysed that the family history of hypertension was found to be a risk factor. Participants with positive family history of hypertension showed a prevalence rate of 41.4% compared to 30.9% among individuals without a family history of hypertension ($P = 0.000$).^[17]

Unhealthy diet: An unhealthy diet is a recognized risk factor for hypertension. A balanced diet is recommended for both its prevention and control.^[16]

Unhealthy diet and physical inactivity contribute to around 30% of preventable morbidity and mortality from noncommunicable diseases, including morbidity and mortality due to hypertension. Hypertension is a condition associated with increased risk for stroke, cardiac failure, renal failure and peripheral vascular disease. Excessive intake of saturated fatty acids and trans fatty acids, along with higher consumption of salt and sugar, are risk factors for cardiovascular diseases including hypertension.^[18]

Aging:

One possible mechanism involves a reduction in vascular compliance due to the stiffening of the arteries. This can build up due to isolated systolic hypertension with a widened pulse pressure. A decrease in glomerular filtration rate is related to aging and this results in decreasing efficiency of sodium excretion.^[16]

Hypertension is a highly prevalent condition with numerous health risks, and the incidence of hypertension is greatest among older adults. Several key mechanisms – including inflammation, oxidative stress, and endothelial dysfunction – are common to biologic aging and hypertension development.^[19]

A cohort study was conducted by Hong K, et al. which showed that during the follow-up period, 48 919 participants experienced progression to hypertension, which corresponded to incidence densities of 45.82/1000 person-years among men and 53.57/1000 person-years among women. Among both men and women, progression to hypertension was predicted by family history of hypertension, history of diabetes mellitus, and older age.^[20]

Diabetes:

Hypertension can also be caused by Insulin resistance and/or hyperinsulinemia, which are components of syndrome X, or the metabolic syndrome. Recent studies claim that obesity is a risk factor for hypertension because of activation of the renin–angiotensin system (RAS) in adipose tissue, and also linked renin–angiotensin system with insulin resistance, and claims that any one can cause the other.^[16]

A study conducted by Mengesha AY, which found that 61.2% of the DM patients had hypertension. 64.4% of female and 53.1% of male DM patients had hypertension. Female sex was associated with increased risk of hypertension ($P=0.0001$). The percentage of hypertensives among the DM population increased to 70.9% in those who were older than 50 years. Older age was associated with hypertension ($P=0.00$). Hypertension was present in 41.2% of type 1 and 63.1% of type 2 DM patients. Type 2 DM had significant risk of hypertension (chi-square=6.9, df=2, $P=0.032$).^[21]

Smoking:

Smoking does not directly cause high blood pressure. However it is a known risk factor for other serious cardiovascular disease.^[16]

As per WHO report, alcohol consumption was the third largest risk factor in the developed countries and tobacco use was being the second major cause of death worldwide. According to the World Health Organization (WHO, 2021), approximately 17.7 million people die from cardiovascular related diseases (CVD) each year. This number represents an estimated 31% of all deaths worldwide due to smoking or hypertension in both sexes.^[22]

Several studies indicate that HTN prevalence is increasing among the adult population globally. HTN, as a major global public health problem, is one of the most important preventable causes of premature morbidity and mortality. The mortality and morbidity linked to HTN are ranked at 45% worldwide and HTN affects over 26% of the adult population in the world. Smoking is estimated to be the cause of 1.69 million CVD-related deaths.^[22]

A cross-sectional analytical study was conducted by Habimana JF, et al. in 2021 showed that the overall prevalence of hypertension was 43.3%. The mean age (SD) of respondents was 45.6 years. Among participants, 7.7% were current smokers of any type of tobacco products, while 28.2% had a history of smoking. In bivariate analysis, current smoking of any type of tobacco product and history of smoking were found significantly associated with the development of hypertension (p-value ≤ 0.05). In multiple logistic regression analysis, history of smoking remained independently associated with hypertension; and study participants with a history of smoking were 3.15 more likely to develop hypertension compared to those who had never smoked (AOR=3.15; 95% CI= [1.44-6.85]).^[23]

Too much salt (sodium) in your diet:

Too much sodium in your diet can cause your body to retain fluid, and also causes the arteries in your body to constrict. Both factors increase blood pressure.^[24]

Dietary sodium intake has been associated with important CVD and CKD progression risk factors such as hypertension. A study was conducted by Nerbass FB, et al. in 2015, showed that sixty percent of participants who had estimated sodium intake above recommendation (>100 mmol/day or 6 g salt/day) also had higher diastolic blood pressure, mean arterial pressure (MAP), urinary albumin-to-creatinine ratio, high-sensitive C-reactive protein and uric acid and used a greater number of anti-hypertensive drugs. In multivariable regression analysis, excessive sodium intake was an independent predictor of MAP (B=1.57, 95% confidence interval (CI) 0.41-2.72; P=0.008) and albuminuria (B=1.35, 95% CI 1.02-1.79; P=0.03).^[25]

Too little potassium in your diet:

Potassium helps balance the amount of sodium in your cells. Potassium causes the smooth muscle cells in your arteries to relax, which lowers blood pressure.^[24]

When it comes to fighting high blood pressure, the average American diet delivers too much sodium and too little potassium. Normal body levels of potassium are important for muscle function. Potassium relaxes the walls of the blood vessels, lowering blood pressure and protecting against muscle cramping.^[24]

A number of studies have shown an association between low potassium intake and increased blood pressure and higher risk of stroke. The level of potassium intake can affect blood pressure. The effect varies with the direction (low potassium intake raises the blood pressure, and high potassium intake lowers the blood pressure) and magnitude of change in potassium intake. Low dietary potassium intake (below 40 mEq/day [1.5 g/day]) has been associated with an elevation in blood pressure and an increased risk of stroke, as well as an increase in risk of chronic kidney disease.^[26]

Not being physically active:

Exercise increases blood flow through all arteries of the body, which leads to release of natural hormones and cytokines that relax blood vessels, which in turn lowers blood pressure. Lack of physical activity also increases the risk of being overweight.^[24]

Physical inactivity is a leading cause of morbidity and mortality and is a major public health problem. Insufficient activity is responsible for a large proportion of non-communicable diseases such as hypertension. Physical inactivity led to 9% of premature deaths (5.3 million deaths) in 2008.^[24]

Gamage A.U and Seneviratne R in 2021, carried out a cross-sectional study among 275 senior-officers(SOs) and 760 managerial-assistants(MAs) aged 30–60 years and attached to Public Administration institutions in Colombo District in Sri Lanka. Socioeconomic variations in PA levels were observed as 58.1%(n = 158) SOs and 30.6%(n = 226) MAs were involved in inadequate PA. Among the SOs diagnosed with hypertension, more half(59.1%; n = 52) were physically inactive, while among MAs, 65.9%(n = 143) with hypertension were physically inactive. After adjusting for potential confounding factors being physically inactive was associated with a higher risk of hypertension among SOs[OR 2.08 [95% CI 1.07, 4.6] and MAs[OR 2.8 [95% CI 1.8, 4.6].^[27]

Drinking too much alcohol:

Having more than two drinks per day can cause hypertension, probably by activating your adrenergic nervous system, causing constriction of blood vessels and simultaneous increase in blood flow and heart rate.^[24]

Stress:

High levels of stress can lead to a temporary, but dramatic, increase in blood pressure. If you try to relax by eating more, using tobacco or drinking alcohol, you may only exacerbate problems with high blood pressure. Relaxation and meditation techniques effectively lower blood pressure.^[24]

Hu B, et al. conducted a study in 2015 where the logistic regression analysis was used to determine the associations between psychological stress and hypertension, calculating population-attributable risks and 95% confidence intervals (CIs). General stress was significantly related to hypertension (odds ratio [OR] = 1.247, 95% CI [1.076, 1.446]). Additionally, after adjustment for all other risk factors, women showed a greater risk of hypertension if they had either stress at work or at home: OR = 1.285, 95% CI (1.027, 1.609) and OR = 1.231, 95% CI (1.001, 1.514), respectively. General stress contributed approximately 9.1% (95% CI [3.1, 15.0]) to the risk for hypertension. Thus, psychological stress was associated with an increased risk for hypertension.^[28]

Non-steroidal Anti-inflammatory Drugs (NSAIDs) and Cough and Cold Medications:

Ibuprofen (Advil, Motrin, Ibuprofen) can cause marked worsening of existing hypertension or development of new high blood pressure. It can also cause damage to the kidneys, worsening of heart failure, and even heart attack or stroke. Cough and cold medicines frequently contain decongestants such as pseudoephedrine and phenylephrine. These medications cause your blood pressure and heart rate to rise, by constricting all your arteries, not just those in your nose.^[24]

A diet low in vitamin D:

It's uncertain if having too little vitamin D in your diet can lead to high blood pressure. Researchers think that vitamin D may affect an enzyme produced by your kidneys that affects your blood pressure. More studies are necessary to determine vitamin D's exact role in high blood pressure. However, talk to your doctor about whether you may benefit from taking a vitamin D supplement.^[24]

Overweight and obesity:

The prevalence of obesity has increased rapidly worldwide over the past several decades. From 1975 to 2014, global age-standardized prevalence of obesity increased from 3.2% to 10.8% in men, and from 6.4% to 14.9% in women. During the same period, global age standardized mean body mass index (BMI) increased from 21.7 kg/m² to 24.2 kg/m² in men and from 22.1 kg/m² in 1975 to 24.4 kg/m² in women. BMI varied significantly by world region, from 21.4 kg/m² in central Africa and south Asia to 29.2 kg/m² in the Pacific Islands for men and from 21.8 kg/m² in south Asia to 32.2 kg/m² in the Pacific Islands for women in 2014.^[24]

Other potential risk factors:

Several other potential risk factors for hypertension have been proposed, including air pollution, psychological stress, sleep disorders and noise exposure.^[29]

MANAGEMENT (EFFECTIVENESS OF GARLIC INTAKE) :

Hypertension remains an important health challenge. Various factors might have contributed to this rising trend of hypertension. Moreover, the global burden of disease is already very high as the people are spending lots of money on drugs. Therefore it seems to be a necessity to create awareness in people regarding complementary modalities. Complementary modalities play an important role in the management of hypertension.^[30]

Garlic is a vegetable herb best known as a flavoring for food. Garlic has numerous health benefits; it has an antihypertensive, antidiabetic, antilipid, antimicrobial and antiplatelet effect on the body. Mechanism of antihypertensive action is it interferes with the function of angiotensin I, thereby relaxes the smooth muscles of blood vessels.^[30]

In 2022, a quasi experimental study was conducted on the effectiveness of garlic intake among hypertensive patients. The objectives of the study was to determine the effect of garlic intake in experimental group than in control group. The researcher adopted a quasi experimental research design with multiple time series design. Thirty samples were allotted to experimental group and thirty allotted to the control group. Garlic 30 grams was given experimental group to reduce for hypertension. Whereas control group was receiving regular anti hypertensive treatments. Post-test was conducted in experimental and control group using Vaughn's blood pressure chart. The study identified that the blood pressure was reduced in experimental group, after garlic administration. The 't' value shows there is the effectiveness of garlic intake to control and reduce high blood pressure. The study findings indicate that the garlic was effective non-pharmacologic measure to reduce blood pressure. Garlic was found to have no side effects when compared with other treatments.^[31]

In 2021, a quasi-experimental research was conducted on the effect of Red Ginger Warm Compress on Blood Pressure Reduction in Patients' Hypertension. The results showed that the average systolic blood pressure decreased by 9.14, therefore, there was a significant difference (p-value <0.05) before and after the application of the red ginger compress. Additionally, the average diastolic blood pressure decreased by 7.57, therefore, there was also a significant difference (p-value <0.05) before and after the intervention. Warm red ginger compresses have a significant effect on reducing the systole and diastolic blood pressure of patients with hypertension.^[32]

Another quasi experimental study was conducted in 2020, which showed that the mean value of the mean difference in systolic blood pressure 12.15 (SD=7.65) in the experimental group was more than the mean value of the mean difference in systolic blood pressure 5.23 (SD=4.67) of the control group. The obtained mean difference was 6.92 and 't' value $t = 3.45$ ($P = 0.001$) was significant. It was inferred that systolic blood pressure had significantly reduced after garlic administration in the experimental group.^[33]

Raju D, in 2019 conducted a quasi experimental community based study on Garlic therapy on blood pressure among hypertensive clients. The objectives of the study was to assess the effectiveness of garlic therapy on blood pressure among hypertensive clients in selected Community area. Results showed that use of Garlic therapy for 3 months have reduced the significant level of systolic and Diastolic Hypertension among the samples in experimental group. Post test Mean difference in Experimental group was 28.68mm of Hg in Systolic blood pressure and 9.76mm of Hg in Diastolic Blood pressure as compared to pre-test in control group.^[34]

Wang HP, et al, in March 2015 stated in their study that garlic intake caused a 3.75-mm Hg reduction in systolic BP and a 3.39-mm Hg reduction in diastolic BP compared with controls. Meta-analysis of subgroups showed a significant reduction in systolic BP in hypertensive (4.4 mm Hg; 95% CI, 7.37 to 1.42, $I^2 = 0.0\%$; $P = .004$) but not normotensive patients. No significant reduction in diastolic BP was seen. After sensitivity analysis, heterogeneity disappeared and significant diastolic BP reduction (2.68 mm Hg, 95% CI, 4.93 to 0.42, $I^2 = 0.0\%$; $P = .020$) was shown in hypertensive patients. This meta-analysis suggests that garlic supplements are superior to controls in reducing BP, especially in hypertensive patients.^[35]

A quasi experimental research design was conducted in 2015 on the effectiveness of garlic intake on blood pressure among the hypertensive patients in selected community Marappadi at Kulasekharam. The objectives of the study was to determine the effect of garlic intake in experimental group than in control group. The researcher adopted with multiple time series design. The clients were selected in Marappadi village, based on inclusion criteria using purposive sampling techniques. Thirty samples were allotted to experimental group and thirty allotted to the control group. Garlic 30gms are given experimental group to reduce for hypertension. Whereas control group was receiving regular anti hypertensive treatments. Post-test was conducted in experimental and control group using Vaughn's blood pressure chart. The study identified that the blood pressure was reduced in experimental group, after garlic administration. The 't' value of difference of mean reduction of blood pressure tabulated was found to be $t = 34.8$, $df = 59$, $p < 0.05$. The study findings indicate that the garlic is effective non pharmacologic measure to reduce blood pressure. Garlic was found to have no side effects when compared with other treatments.^[36]

Garlic is one of the most utilized supplements, with its antibacterial and antioxidant abilities mainly produced by allicin in garlic.^[37] In recent years, garlic has been thought to be effective in the treatment of hypertension. It is reported that allicin has angiotension II–inhibiting and vasodilating effects.^[38]

Chithra D, in 2011 conducted a study on the effectiveness of garlic intake on blood pressure among patients with hypertension. The major study findings were the mean blood pressure level after administration of Garlic intake among the patient with hypertension was less than mean blood pressure level before administration of Garlic therapy. ('t' 15.2 and 7.6 df = 29). The mean blood pressure level after administration of Garlic intake ('t' 9.64 p > 0.05) among the patient with hypertension was lesser than the mean blood pressure level of the control group ('t' 3.27 p > 0.05). The study findings indicate that the garlic is effective non pharmacologic measure to reduce blood pressure.^[39]

CONCLUSION :

Hypertension is called the 'silent killer', because most patients with high blood pressure have no symptoms to alert them to elevated pressure. Complementary modalities play an important role in the management of hypertension, among them garlic is an important modality which helps to reduce blood Pressure. Hypertension to be controlled by medication. But there is always a risk of developing hypertension, when medications are stopped or even with the continuation of medications. The drugs which are used for hypertension also have many side effects. This emphasizes the need of a intervention which has no side effects. Garlic found to be an effective intervention in reducing hypertension among adult patients. Garlic not only helps to reduces the blood pressure but also helps to be used as a cost effective intervention in reducing the hypertension among the hypertensive clients. From various studies finding it was revealed that garlic was an effective intervention which helps to reduces the hypertension, prevent or delay the incidence of hypertension, enhance antihypertensive drug efficacy and decreases the cardiovascular risk.

REFERENCES

1. World Hypertension Day. Wikipedia. 2021 Aug 23. Available from : https://en.wikipedia.org/wiki/World_Hypertension_Day
2. High blood pressure. Medline Plus [Internet]. 2020 Nov 20. Available from : <https://medlineplus.gov/highbloodpressure.html>
- 3.. Shuling W, et all. Hypertension Defined by 2017 ACC/AHA Guideline, Ideal Cardiovascular Health Metrics, and Risk of Cardiovascular Disease: A Nationwide Prospective Cohort Study. The Lancet Regional Health. 2022 Jan 08 ; 20 (1). Available from : DOI: <https://doi.org/10.1016/j.lanwpc.2021.100350>
4. Hypertension. World Health Organization [Internet]. 2021 Aug 25. Available from : <https://www.who.int/news-room/fact-sheets/detail/hypertension>
5. Indian Council of Medical Research. Hypertension: The Silent Killer. Available from : https://main.icmr.nic.in/sites/default/files/press_release_files/Hypertension.pdf
6. Mohmmedirfan M, Desai V and Kavishwar A. A Study On Effect Of Life Style Risk Factors On Prevalence Of Hypertension Among White Collar Job People Of Surat. The Internet Journal of Occupational Health. 2011;1(2). Available from: <http://www.ispub.com/journal/the-internet-journal-of-occupational-health.html>.
7. Kyrou I, Chrousos GP, and Tsigos C. Stress, visceral obesity and metabolic complications. Annals of the New York Academy of Sciences. 2006 November; 1083: 77–110.
- 8.. Gupta R. Trends in hypertension epidemiology in India. J Hum Hypertens. 2004 Feb;18(2):73-8. Available from : doi: 10.1038/sj.jhh.1001633. PMID: 14730320
- 9.. National Centre for Complementary and Alternative Medicine. What is CAM? 2009. Available from : [nccam.nih.gov/health/what is cam/D347.pdf](http://nccam.nih.gov/health/what_is_cam/D347.pdf).

10.. Ried K, et al. Effect of garlic on blood pressure: a systematic review and meta-analysis. *BMC Cardiovasc Disord.* 2008 Jun 16;8:13. Available from : doi: 10.1186/1471-2261-8-13. PMID: 18554422; PMCID: PMC2442048.

11. Luepker RV, et al. In blood pressure and hypertension detection, treatment, and control 1980 to 2009: the Minnesota Heart Survey. *Circulation.* 2012;126:1852–1857. Available from : DOI: 10.1161/CIRCULATIONAHA.112.098517

12. Mills KT, et al. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation.* 2016;134(6):441–450. Available from : <https://doi.org/10.1161/CIRCULATIONAHA.115.018912>

13. Gupta R, Gaur K. Hypertension Epidemiology in India in the Global Context. *RUHS Journal of Health Sciences.* 2021 Mar; 6(1): 6-13. Available from : DOI:10.37821/ruhsjhs.6.1.2021.376

14. Singh S, Shankar R, and Singh G. Prevalence and Associated Risk Factors of Hypertension: A Cross-Sectional Study in Urban Varanasi. *International Journal of Hypertension.* 2017 Dec 03;1-10. Available from : <https://doi.org/10.1155/2017/5491838>

15. Ghosh S, Kumar M. Prevalence and associated risk factors of hypertension among persons aged 15–49 in India: a cross-sectional study. *BMJ Open Access Journal.* 2019 Dec 16 ; 2(4) : 1-9. Available from : doi:10.1136/bmjopen-2019-029714

16. Essential Hypertension. Wikipedia [Internet]. Available from : https://en.wikipedia.org/wiki/Essential_hypertension

17. Bushara, et al. Prevalence of and risk factors for hypertension among urban communities of North Sudan: Detecting a silent killer. *Journal of Family Medicine and Primary Care;* 2016 Jul-Sep 5(3):p 605-610. | DOI: 10.4103/2249-4863.197317

18. World Health Organization. Diet, nutrition and hypertension. 2013 April. Available from : <http://www.emro.who.int/world-health-days/2013/nutrition-hypertension-factsheet-whd-2013.html>

19. Buford TW. Hypertension and aging. *Ageing Res Rev.* 2016 Mar;26:96-111. doi: 10.1016/j.arr.2016.01.007. Epub 2016 Feb 1. PMID: 26835847; PMCID: PMC4768730.

20. Hong K, et all. Incidence and risk factors for progression from prehypertension to hypertension: a 12-year Korean Cohort Study. *Journal of Hypertension* 38(9):p 1755-1762, September 2020. | DOI: 10.1097/HJH.0000000000002494

21. Mengesha AY. Hypertension and related risk factors in type 2 diabetes mellitus (DM) patients in Gaborone City Council (GCC) clinics, Gaborone, Botswana. *Afr Health Sci.* 2007 Dec;7(4):244-5. PMID: 21499491; PMCID: PMC3074377.

22. World Health Organization. Geneva, Switzerland: World Health Organization; 2005. WHO STEPS surveillance manual: the WHO STEP wise approach to chronic disease risk factor surveillance. [[Google Scholar](#)]

23. Habimana JF, et all. Cigarette smoking and hypertension among adult outpatients: An explanatory evidence model from a rural District Hospital, Rwanda. *Global Scientific Journals.* 2021 September; 9(9) : 62-82. Available from : https://www.globalscientificjournal.com/researchpaper/Cigarette_smoking_and_hypertension_among_adult_outpatients_An_explanatory_evidence_model_from_a_rural_District_Hospital_Rwanda.pdf

24. Risk Factors for High Blood Pressure (Hypertension). University of California San Francisco. Available from : <https://www.ucsfhealth.org/education/risk-factors-for-high-blood-pressure-hypertension>

25. Nerbass FB, Pecoits-Filho R, McIntyre NJ, McIntyre CW, Taal MW. High sodium intake is associated with important risk factors in a large cohort of chronic kidney disease patients. *Eur J Clin Nutr.* 2015 Jul;69(7):786-90. doi: 10.1038/ejcn.2014.215. Epub 2014 Oct 8. PMID: 25293433.

26. Mount DB. Potassium and hypertension. Upto Date. 2023; Available from : <https://www.uptodate.com/contents/potassium-and-hypertension#:~:text=The%20level%20of%20potassium%20intake,of%20change%20in%20potassium%20intake.>
27. Gamage A.U and Seneviratne R. Physical inactivity, and its association with hypertension among employees in the district of Colombo. *BMC Public Health* **21**, 2186 (2021). <https://doi.org/10.1186/s12889-021-12013-y>
28. Hu B, et al. Effects of Psychological Stress on Hypertension in Middle-Aged Chinese: A Cross-Sectional Study. *PLoS ONE* 10(6): e0129163. Available from : <https://doi.org/10.1371/journal.pone.0129163>
29. Mills KT, et al. The global epidemiology of hypertension. *Nat Rev Nephrol.* 2020 April ; 16(4): 223–237. Available from : doi:10.1038/s41581-019-0244-2.
30. Kaur M. A Quasi Experimental Study on Effectiveness of Structured Teaching Programme on Knowledge Regarding Complementary Modalities of Hypertension among Hypertensive Patients in Selected Rural areas of District Jalandhar, Punjab 2012. *Int. J. Adv. Nur. Management.* 2016; 4(2): 141-147. Available from : doi: 10.5958/2454-2652.2016.00032.9
31. Das S, Deb P. Effectiveness of garlic intake among hypertensive patients: a quasi experimental study. *Universe International Journal of Interdisciplinary Research.* 2022 April ; 2 (11) : 83-88. Available from : DOI: <https://www.doi-ds.org/doilink/05.2022-98866687/UIJIR>
32. Sridani NW, et al. Effect of Red Ginger Warm Compress on Blood Pressure Reduction in Patients' Hypertension. *Mal J Med Health Sci.* 2021 December; 6-11. Available from : https://medic.upm.edu.my/upload/dokumen/2021122908074602_MJMHS_0767.pdf
33. N. Chinna Chadyan, N. Balasubramanian. Effectiveness of garlic on reduction of blood pressure among hypertensive clients in a selected hospital at Cuttack, Odisha: A pilot study report. *International Journal of Nursing Studies.* 2020 Mar; 7(1). Available from : DOI: 10.6084/m9.figshare.14769198.v1
34. Raju D. Garlic therapy on blood pressure among hypertensive clients; a community based study. *Journal of Emerging Technologies and innovative Research.* 2019;6 (5): 33-37. Available from : <https://www.jetir.org/papers/JETIRCY06004.pdf>
35. Wang HP, et al. Effect of garlic on blood pressure. *The Journal of Clinical Hypertension.* 2015 Mar; 17 (3): 223-231. Available from : DOI: 10.1111/jch.12473
36. Mol CM. Effectiveness of garlic intake on blood pressure among the hypertensive patients in selected community Marappadi at Kulasekharam. *TNMGRMU REPOSITORY.* 2015 October. Available from : <http://repository-tnmgrmu.ac.in/1950/>
37. Benavides, et al. Hydrogen sulfide mediates the vaso activity of garlic. *Proc Natl Acad Sci USA.* 2007;104:17977–17982. Available from : Hydrogen sulfide mediates the vasoactivity of garlic - PubMed (nih.gov)
38. Sharifi AM, Darabi R, Akbarloo N. Investigation of antihypertensive mechanism of garlic in 2K1C hypertensive rat. *J Ethnopharmacol.* 2003;3:219–224. Available from : Investigation of antihypertensive mechanism of garlic in 2K1C hypertensive rat - PubMed (nih.gov)
39. Chithra D. Effectiveness of garlic intake on blood pressure among patients with hypertension. *TNMGRMU REPOSITORY .* 2011 April. Available from : <http://repository-tnmgrmu.ac.in/2182/1/300105511chithra.pdf>