Brief description of patient problem/setting (summarize the case very briefly)

A 35 years old male has been diagnosed with hypertension and has a family history of Cardiovascular disease and he saw in google that garlic consumption can reduce blood pressure. Therefore, before starting medication therapy, he is asking for your opinion.

**Modified PICO Question:**

In the adult population, does daily garlic consumption reduce blood pressure?

**PICO search terms:**

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| **P** | **I** | **C** | **O** |
| Hypertensive patient | Garlic cloves | Placebo | Reduces Blood pressure |
| Recently diagnosed Hypertensive adult | Garlic extract |  | Decreases Systolic Blood pressure |
| Hypertensive adult male | Essential garlic oil |  | Decreases Diastolic blood pressure |
| Hypertensive adult female | Garlic powder |  | Anti-hypertensive |

**Search tools and strategy used: Use at least 3 databases**

**PubMed:**

Garlic reducing blood pressure (Best Match) – 2146

* Filter (Best Match, 10 years, Systematic Reviews, Meta-Analysis, RCT, free full text)-4

Garlic for blood pressure (Best Match) – 248

* Filter (Best Match, 10 years, Systematic Reviews, Meta-Analysis, RCT, free full text)- 18

Garlic for hypertensive patient (Best Match)-85

* Filter (Best Match, 10 years, Systematic Reviews, Meta-Analysis, RCT, free full text)- 9

**Cochrane Library:**

Garlic reducing blood pressure– 34

* Filter (Cochrane review) – 2

Garlic for blood pressure – 89

* Filter (Cochrane review) - 3

Garlic for hypertensive patient- 31

* Filter (Cochrane review)- 1

**Google Scholar**

Garlic reducing blood pressure- 2930

**Trip Database**

Garlic reduces blood pressure- 141

**How I selected articles:**

First, I used google scholar to look for articles that analyzed the relationship between garlic and blood pressure. Next, I used PubMed, Cochrane and Trip to look for systematic review, meta-analysis, RCT, cohort studies indexed for Medline and that was published within the last 10 years because I wanted to access the highest level of evidence that would answer the PICO questions effectively.

**Results found:**

**Article # 1**

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| **Citation:**  Stabler SN, Tejani AM, Huynh F, Fowkes C. Garlic for the prevention of cardiovascular morbidity and mortality in hypertensive patients. *Cochrane Database Syst Rev*. 2012;2012(8):CD007653. Published 2012 Aug 15. doi:10.1002/14651858.CD007653.pub2 |
| **Type of article**: Systematic Review |
| Abstract  **Background:**Garlic is widely used by patients for its blood pressure lowering effects. A meta-analysis published in 2008 concluded that garlic consumption lowers blood pressure in hypertensive and normotensive patients. Therefore, it is important to review the currently available evidence to determine whether garlic may also have a beneficial role in the reduction of cardiovascular events and mortality rates in patients with hypertension.  **Objectives:**To determine whether the use of garlic as monotherapy, in hypertensive patients, lowers the risk of cardiovascular morbidity and mortality compared to placebo.  **Search methods:**A systematic search for trials was conducted in the Cochrane Hypertension Group Specialised Register, CENTRAL, MEDLINE, EMBASE, AGRICOLA, AMED, and CINAHL up to November 2011. A hand search of reference lists of identified reviews was conducted. Experts in the area were also contacted to identify trials not found in the electronic search. Clinicaltrials.gov was searched for ongoing trials.  **Selection criteria:**Randomized, placebo-controlled trials of any garlic preparation versus placebo for the treatment of hypertension were included.  **Data collection and analysis:**Two reviewers independently extracted data and assessed trial quality using the risk of bias tool. Data synthesis and analysis was performed using RevMan 5.  **Main results:**The search identified two randomized controlled trials for inclusion. One trial included 47 hypertensive patients and showed that garlic significantly reduces mean supine systolic blood pressure by 12 mmHg (95% CI 0.56 to 23.44 mmHg, p=0.04) and mean supine diastolic blood pressure by 9 mmHg (95% CI 2.49 to 15.51 mmHg, p=0.007) versus placebo. The authors state that garlic was "free from side effects" and that no serious side effects were reported. There were 3 cases "where a slight smell of garlic was noted."The second trial could not be meta-analysed as they did not report the number of people randomized to each treatment group. They did report that 200 mg of garlic powder given three times daily, in addition to hydrochlorothiazide-triamterene baseline therapy, produced a mean reduction of systolic blood pressure by 10-11 mmHg and of diastolic blood pressure by 6-8 mmHg versus placebo.Neither trial reported clinical outcomes and insufficient data was provided on adverse events.  **Authors' conclusions:**There is insufficient evidence to determine if garlic provides a therapeutic advantage versus placebo in terms of reducing the risk of mortality and cardiovascular morbidity in patients diagnosed with hypertension. There is also insufficient evidence to determine the difference in withdrawals due to adverse events between patients treated with garlic or placebo.Based on 2 trials in 87 hypertensive patients, it appears that garlic reduces mean supine systolic and diastolic blood pressure by approximately 10-12 mmHg and 6-9 mmHg, respectively, over and above the effect of placebo but the confidence intervals for these effect estimates are not precise and this difference in blood pressure reduction falls within the known variability in blood pressure measurements. This makes it difficult to determine the true impact of garlic on lowering blood pressure. |
| Article: |

**Article # 2**

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| **Citation**:  Wang, H., Yang, J., Qin, L., & Yang, X. (2015). Effect of Garlic on Blood Pressure: A Meta-Analysis. The Journal of Clinical Hypertension, 17(3), 223-231. doi:10.1111/jch.12473 |
| **Type of article:**  Meta- Analysis |
| Abstract  Garlic supplements are thought to reduce blood pressure (BP). The authors performed a meta‐analysis to investigate garlic's effect on BP. Ovid Medline, Cochrane Library, and PubMed (1946 to November 2013) were used to search for randomized controlled trials. Seventeen trials were included. Pooled analysis showed that garlic intake caused a 3.75‐mm Hg reduction (95% confidence interval [CI], −5.04 to −2.45, I2=30.7%; P<.001) in systolic BP and a 3.39‐mm Hg reduction (95% CI, −4.14 to −2.65, I2=67%; P<.001) 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, I2=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, I2=0.0%; P=.020) was shown in hypertensive patients. This meta‐analysis suggests that garlic supplements are superior to controls (placebo in most trails) in reducing BP, especially in hypertensive patients. |
| Article: |

**Article # 3**

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| **Citation:**  Andres Rohner, Karin Ried, Igor A. Sobenin, Heiner C. Bucher, Alain J. Nordmann, A Systematic Review and Meta Analysis on the Effects of Garlic Preparations on Blood Pressure in Individuals With Hypertension, *American Journal of Hypertension*, Volume 28, Issue 3, March 2015, Pages 414–423, <https://doi.org/10.1093/ajh/hpu165> |
| **Type of article:** Systematic Review and Meta-analysis |
| Abstract  **BACKGROUND**  Many patients prefer herbal medications to conventional drugs. Limited trial evidence suggests that garlic preparations reduce high blood pressure (BP).  **METHODS**  We searched electronic databases through March 2014 to identify all randomized controlled trials that compared a garlic preparation to placebo in hypertensive patients. Trials were required to report BP values at baseline and after a follow-up of at least 4 weeks.  **RESULTS**  Nine double-blind trials with 482 individuals fulfilled our inclusion criteria. Included trials were rather small, and the quality of the majority of included trials was moderate. Follow-up ranged from 8 to 26 weeks. All trials reported office BP measurements. Systolic BP and diastolic BP (SBP and DBP) were more effectively reduced in individuals treated with garlic preparations than in individuals treated with placebo. However, heterogeneity was high (weighted mean difference (WMD) for SBP was −9.1mm Hg; 95% confidence interval (CI), −12.7 to −5.4; *P* for heterogeneity = 0.0006; and *I*2 = 71%; WMD for BP was −3.8mm Hg; 95% CI, −6.7 to −1.0; *P* for heterogeneity = 0.00001; *I*2 = 80%). When analyses were restricted to higher-quality trials using intention-to-treat analysis or to trials with concealed treatment allocation and standardized and blinded BP measurement, effect sizes for SBP but not for DBP were lower and heterogeneity disappeared.  **CONCLUSIONS**  Although evidence from this review suggests that garlic preparations may lower BP in hypertensive individuals, the evidence is not strong. A well-conducted and powered trial of longer duration is needed to confirm these findings. |
| Article: |

**Article # 4**

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| **Citation**:  Ried K. (2020). Garlic lowers blood pressure in hypertensive subjects, improves arterial stiffness and gut microbiota: A review and meta-analysis. *Experimental and therapeutic medicine*, *19*(2), 1472–1478. https://doi.org/10.3892/etm.2019.8374 |
| **Type of article:**  Review and Meta- Analysis |
| **Abstract**  Garlic supplements have shown effectiveness in reducing blood pressure in hypertensive patients, similarly to first-line standard anti-hypertensive medications. Kyolic garlic has also shown promise in improving cardiovascular health by reducing arterial stiffness, elevated cholesterol levels and blood ‘stickiness’. In addition, the prebiotic properties in garlic increase gut microbial richness and diversity. This article systematically reviews previously published trials investigating the effects of garlic on blood pressure, and provides an updated meta-analysis of hypertensive participants. In addition, we summarise the findings of recent clinical trials investigating the effects of Kyolic aged garlic extract on arterial stiffness, and gut microbiota in hypertensive subjects. We searched online electronic databases, including PubMed and Google Scholar for randomised controlled trials (RCTs) published between 1955 and December, 2018 examining the effects of garlic on high blood pressure. The meta-analysis of 12 trials and 553 hypertensive participants confirmed that garlic supplements lower systolic blood pressure (SBP) by an average of 8.3±1.9 mmHg and diastolic blood pressure (DBP, n=8 trials, n=374 subjects) by 5.5±1.9 mmHg, similarly to standard anti-hypertensive medications. This reduction in blood pressure was associated with a 16–40% reduction in the risk of suffering from cardiovascular events. Additionally, this review summarises new evidence for the vitamin B12 status playing an important role in the responsiveness of blood pressure to garlic. Furthermore, Kyolic aged garlic extract significantly lowered central blood pressure, pulse pressure, pulse wave velocity and arterial stiffness, and improved the gut microbiota, evidenced by higher microbial richness and diversity, with a marked increase in the numbers of Lactobacillus and Clostridia species found following 3 months of supplementation. Thus, Kyolic aged garlic extract is considered to be highly tolerable with a high safety profile either as a stand-alone or adjunctive anti-hypertensive treatment, with multiple benefits for cardiovascular health. |
| Article: |

**Article # 5**

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| **Citation**:  Karin Ried, Garlic Lowers Blood Pressure in Hypertensive Individuals, Regulates Serum Cholesterol, and Stimulates Immunity: An Updated Meta-analysis and Review, *The Journal of Nutrition*, Volume 146, Issue 2, February 2016, Pages 389S–396S, <https://doi.org/10.3945/jn.114.202192> |
| **Type of article:**  Meta- Analysis and review |
| **Abstract**  Background: Garlic has been shown to have cardiovascular protective and immunomodulatory properties.  Objectives: We updated a previous meta-analysis on the effect of garlic on blood pressure and reviewed the effect of garlic on cholesterol and immunity.  Methods: We searched the Medline database for randomized controlled trials (RCTs) published between 1955 and December 2013 on the effect of garlic preparations on blood pressure. In addition, we reviewed the effect of garlic on cholesterol and immunity.  Results: Our updated meta-analysis on the effect of garlic on blood pressure, which included 20 trials with 970 participants, showed a mean ± SE decrease in systolic blood pressure (SBP) of 5.1 ± 2.2 mm Hg (P < 0.001) and a mean ± SE decrease in diastolic blood pressure (DBP) of 2.5 ± 1.6 mm Hg (P < 0.002) compared with placebo. Subgroup analysis of trials in hypertensive subjects (SBP/DBP ≥140/90 mm Hg) at baseline revealed a larger significant reduction in SBP of 8.7 ± 2.2 mm Hg (P < 0.001; n = 10) and in DBP of 6.1 ± 1.3 mm Hg (P < 0.001; n = 6). A previously published meta-analysis on the effect of garlic on blood lipids, which included 39 primary RCTs and 2300 adults treated for a minimum of 2 wk, suggested garlic to be effective in reducing total and LDL cholesterol by 10% if taken for >2 mo by individuals with slightly elevated concentrations [e.g., total cholesterol >200 mg/dL (>5.5 mmol/L)]. Garlic has immunomodulating effects by increasing macrophage activity, natural killer cells, and the production of T and B cells. Clinical trials have shown garlic to significantly reduce the number, duration, and severity of upper respiratory infections.  Conclusions: Our review suggests that garlic supplements have the potential to lower blood pressure in hypertensive individuals, to regulate slightly elevated cholesterol concentrations, and to stimulate the immune system. Garlic supplements are highly tolerated and may be considered as a complementary treatment option for hypertension, slightly elevated cholesterol, and stimulation of immunity. Future long-term trials are needed to elucidate the effect of garlic on cardiovascular morbidity and mortality. |
| Article: |

**Article # 6**

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| **Citation**:  Xiong, X. J., Wang, P. Q., Li, S. J., Li, X. K., Zhang, Y. Q., & Wang, J. (2015). *Garlic for hypertension: A systematic review and meta-analysis of randomized controlled trials. Phytomedicine, 22(3), 352–361.* doi:10.1016/j.phymed.2014.12.013 |
| **Type of article:**  A systematic review and meta-analysis of randomized controlled trials |
| **Abstract**  Garlic supplements have shown effectiveness in reducing blood pressure in hypertensive patients, similarly to first-line standard anti-hypertensive medications. Kyolic garlic has also shown promise in improving cardiovascular health by reducing arterial stiffness, elevated cholesterol levels and blood ‘stickiness’. In addition, the prebiotic properties in garlic increase gut microbial richness and diversity. This article systematically reviews previously published trials investigating the effects of garlic on blood pressure, and provides an updated meta-analysis of hypertensive participants. In addition, we summarise the findings of recent clinical trials investigating the effects of Kyolic aged garlic extract on arterial stiffness, and gut microbiota in hypertensive subjects. We searched online electronic databases, including PubMed and Google Scholar for randomised controlled trials (RCTs) published between 1955 and December, 2018 examining the effects of garlic on high blood pressure. The meta-analysis of 12 trials and 553 hypertensive participants confirmed that garlic supplements lower systolic blood pressure (SBP) by an average of 8.3±1.9 mmHg and diastolic blood pressure (DBP, n=8 trials, n=374 subjects) by 5.5±1.9 mmHg, similarly to standard anti-hypertensive medications. This reduction in blood pressure was associated with a 16–40% reduction in the risk of suffering from cardiovascular events. Additionally, this review summarises new evidence for the vitamin B12 status playing an important role in the responsiveness of blood pressure to garlic. Furthermore, Kyolic aged garlic extract significantly lowered central blood pressure, pulse pressure, pulse wave velocity and arterial stiffness, and improved the gut microbiota, evidenced by higher microbial richness and diversity, with a marked increase in the numbers of Lactobacillus and Clostridia species found following 3 months of supplementation. Thus, Kyolic aged garlic extract is considered to be highly tolerable with a high safety profile either as a stand-alone or adjunctive anti-hypertensive treatment, with multiple benefits for cardiovascular health. |
| Article: |

**Summary of the Evidence:**

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| **Author (Date)** | **Level of Evidence** | **Sample/Setting (# of subjects/ studies, cohort definition etc.)** | **Outcome(s) studied** | **Key Findings** | **Limitations and Biases** |
| Stabler SN, Tejani AM, Huynh F, Fowkes C.  Article #1 | Systematic Review | Two trials met the inclusion criteria and was included in this systematic review and a total of 87 hypetensive patient was included in this study.  One of the Randomized, placebo‐controlled, double‐blind trials included 47 hypertensive patients and 200mg of garlic powder three times daily vs placebo significantly lower the supine systolic and diastolic blood pressure by 12 mmHg and 9 mmHg, respectively. No cardiovascular event data or harm data were reported.(Auer 1990)  The second Randomized, placebo‐controlled, double‐blind trials could not be meta-analysed but this study reveals 200 mg of garlic powder given three times daily, in addition to hydrochlorothiazide‐triamterene baseline therapy, produced a 10‐11 mmHg mean reduction in systolic blood pressure and a 6‐8 mmHg mean reduction in diastolic blood pressure versus placebo | The aim of the study is to determine the effect of garlic as a monotherapy in hypertensive patients, in lowers the risk of cardiovascular morbidity and mortality compared to placebo group.  The primary outcomes the authors were analyzing including: death due to any cause, serious adverse events (an event that is life‐threatening, causes death, leads to hospitalization, prolongs hospitalization, leads to persistent or significant disability/incapacity, or leads to a congenital anomaly/birth defect), and cardiovascular events including myocardial infarction and stroke.  The secondary outcomes were blood pressure reduction, as well as breath and body odour, mouth and gastrointestinal burning or irritation, or any other adverse events severe enough to cause withdrawal from treatment. | Overall both trials showed garlic reduces mean supine systolic and diastolic blood pressure by approximately 10‐12 mmHg and 6‐9 mmHg, respectively in hypertensive patients.  Even though both trials reports decrease in BP but the confidence intervals for these effect estimates are not precise so it is difficult to make a true impact of garlic on reducing blood pressure. | The author acknowledges that there is insufficient evidence to determine the effect of garlic in reducing the risk of mortality and cardiovascular morbidity in patients diagnosed with hypertension. Therefore, the author suggests future studies need to be conducted with a large randomized hypertensive patient with several doses of garlic vs placebo to determine the differences in mortality, serious adverse events and cardiovascular morbidity. |
| Wang, H., Yang, J., Qin, L., & Yang, X | Meta- Analysis | These following databases were used to identify randomized control trials for this meta analysis: Medline, Cochrane Library, and PubMed (1946 to November 2013)  17 randomized controlled trials studies were included in this study | This meta-analysis aims to explore the association between garlic intake and BP reduction. Also, the authors want to examine association of Garlic according to dosage and duration. | Results showed a significant difference in favor of the garlic group, with garlic having a greater effect on reducing SBP by 3.75 mm Hg (95% CI, −5.04 to −2.45) compared with control (P<.001)  SBP was more obvious, with a reduction of 3.85 mm Hg (95% CI, −5.71 to −2.01, I2=0.0%; P<.001) ; the reduction in DBP was 1.59 mm Hg (95% CI, −2.91 to −0.26, I2=8.4%; P=.019)  Meta‐analysis of subgroups showed that garlic supplementation led to a significant fall in SBP in the hypertensive group but no significant decrease in the normotensive group.  There were no significant change regarding DBP in either the hypertensive or normotensive groups  Regarding the dosage, the author concluded, BP decreased with the increased intake of garlic, and the maximum effect was produced by 1500 mg of garlic at week 24. | Heterogeneity was not reported after elimination of a low-quality study  The garlic supplements were not the same among the 17 trials  One study was included twice, which may have increased its weight in the meta-analysis |
| Andres Rohner, Karin Ried, Igor A. Sobenin, Heiner C. Bucher, Alain J. Nordmann | Systematic Review and Meta-analysis | The author used following databases: PubMed, Embase, Cochrane Library, and Web of Science to search for articles using the search terms “garlic” and “blood pressure” or “hypertension”  Nine trials were included in this study which consist of 577 patients who met the inclusion criteria | The aim of the study is to evaluate the effect of garlic on blood pressure in a hypertensive individuals and systematically assess risk of bias. | SBP was more effectively reduced in individuals treated with garlic preparations than in individuals treated with placebo (WMD, −9.1mm Hg; 95% CI, −12.7 to −5.4; P for heterogeneity = 0.0006; I2 = 71%)  DBP was more effectively reduced in individuals treated with garlic preparations than in individuals treated with placebo (WMD, −3.8mm Hg; 95% CI, −6.7 to −1; P for heterogeneity = 0.00001; I2 = 80%)however, heterogeneity was high.  The overall estimates for both SBP and DBP were highly heterogeneous with relatively large effect sizes and large CIs. All included trials were of small sample size. Empirical evidence suggests that effect sizes from small trials tend to be larger than those of highly powered trials.  Based on short-term evidence, the BP-lowering effect of garlic preparations seems comparable to the effect of the 5 main classes of BP-lowering drugs (diuretics, beta blockers, calcium channel blockers, angiotensin-converting enzyme inhibitors, and angiotensin II receptor blockers). | The overall estimates for both SBP and DBP were highly heterogeneous with relatively large effect sizes and large CIs  All the trials included in this study were of small sample size  The overall quality of the majority of included trials was moderate |
| Ried K. | Review and Meta- Analysis | Randomised double-blind placebo-controlled trials on garlic for blood pressure with a minimum of 2 months duration  A total of 12 trials involving 553 participants with hypertension were included in this meta-nalysis | This mesta-analysis aims to study the effect of garlic and blood pressure (systolic and diastolic) in hypertensive subjects | According to this meta-analysis, garlic supplements significantly lower SBP by an average of 8.3±1.9 mmHg and DBP (n=374) by 5.5±1.9 mmHg  In addition to the beneficial effects of garlic supplements on blood pressure, we, as well as others have found that Kyolic aged garlic extract is effective in rejuvenating the arteries, as evidenced by a reduction in pulse wave velocity | Most of therandomized clinical trials in this meta-analysis is conducted in Germany (5 articles) and only 4 articles are conducted in the USA  This study does not analyze long term effects of kyolic age garlic extract so further studies need to be conducted.  Also future studies need to analyze the effect of garlic on the gut microbiota |
| Karin Ried | Meta- Analysis and review | 20 trials with 970 participants were included in this study  Inclusion criteria: Studies with placebo control groups, that used garlic-only supplements, and that reported mean SBP and/or DBP and SDs w | the effect of garlic preparations on blood pressure. In addition, we reviewed the effect of garlic on cholesterol and immunity.  Changes in mean SBP or DBP in garlic and control groups before and after intervention were entered into the meta-analysis  Effect of garlic on cholesterol | garlic supplements have the potential to lower blood pressure in hypertensive individuals, to regulate slightly elevated cholesterol concentrations, and to stimulate the immune system  decrease in systolic blood pressure (SBP) of 5.1 6 2.2 mm Hg (P < 0.001) and a mean 6 SE decrease in diastolic blood pressure (DBP) of 2.5 6 1.6 mm Hg (P < 0.002) compared with placebo. | Future long-term trials are needed to elucidate the effect of garlic on cardiovascular morbidity and mortality |
| Xiong, X. J., Wang, P. Q., Li, S. J., Li, X. K., Zhang, Y. Q., & Wang, J  (Article #6) | A systematic review and meta-analysis of randomized controlled trials | 213 articles were found that analyzed efficacy of garlic using these three databases PubMed, the Cochrane Library and EMBASE  A total of seven randomized, placebo-controlled trials mets the inclusion criteria  Inclusion criteria: BP-lowering effect of garlic preparations. | The primary outcome measures were mortality and cardiovascular events including CHD, myocardial infarction, heart failure, and stroke.  The secondary outcome measures were SBP and DBP at the end of the treatment.  This article aimed to provide the latest systematic review and meta-analysis to summarize the existing evidence of garlic as an antihypertensive agent. | Garlic has a statistically significant and clinically meaningful effect on SBP (decreased by 6.71 mmHg) and DBP (decreased by 4.79 mmHg) compared to the placebo.  use of garlic seemed safe and well-tolerated by hypertensive patients  no conclusion could be made about garlic effect on mortality or cardiovascular event | The article was not analyzes for publication bias because the study only included  less than 10 trails.  some important primary endpoints have not been reported, such as morbidity and mortality with long-term follow-up  the main limitation of our review is the heterogeneity of the clinical assessment due to variations in participants as well as the vastly different garlic preparations |

**Conclusion(s):**

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| **Article** | **Conclusions** |
| **Article # 1** | Based on this Systematic Review, **garlic reduces mean supine systolic and diastolic blood pressure by approximately 10-12 mmHg and 6-9 mmHg.** The confidence intervals for this result is not precise so it is difficult to identify a true impact of garlic on reducing blood pressure. Therefore, the author acknowledges, large randomized studies need to be conducted to determine the effect of garlic on BP and cardiovascular morbidity. |
| **Article # 2** | The authorof this meta-analysis concludes, **garlic supplementation is superior to placebo in reducing BP in hypertensive patients, especially in those with high SBP.** However, more studies need to be conducted to explore the association between dosage and duration of garlic in impacting blood pressure. |
| **Article # 3** | According to the Systematic review and meta-analysis, **there is statistically significant finding that suggests garlic preparation decreases SBP and DBP in hypertensive individuals**. Future studies need to be conducted to establish the garlic preparation effect on BP for long term. |
| **Article # 4** | This meta-analysis concludes that **garlic is effective in reducing blood pressure and in a hypertensive adult garlic can reduce SBP by 8-10 mmHg systolic and DBP by 5-6 mmHg**. Also, this effect of garlic on reducing blood is associated with 16-40% decrease risk of cardiovascular events (heart attack and stroke). Also, this meta-analysis established that garlic extract improves central blood pressure and pulse pressure, and pulse wave velocity, a measure for arterial stiffness which is directly related to cardiovascular disease. However, the author acknowledges that further studies need to be conducted to see the long term effect of garlic on blood pressure and gut microbiota. |
| **Article # 5** | The author of the meta-analyses concluded that all 20 trials revealed  **garlic supplements significantly lower SBP (P < 0.001; n = 19) and DBP (P < 0.001; n = 20).** The author suggested, garlic supplementation looks promising and has the potential to lower blood pressure in hypertensive adults. Also, garlic supplements can regulate cholesterol concentration and stimulate the immune system. Garlic may be considered as an alternative to conventional therapy in the future once future trials determine the effect of garlic on cardiovascular morbidity and mortality. |
| **Article # 6** | According to this meta-analysis, **garlic has a significant effect on decreasing both systolic and diastolic blood pressure**. The author concludes, **garlic is an effective and safe approach for hypertension management** and maybe can be considered as alternative anti-hypertensive therapy. However, before using garlic as first line anti-hypertensive, more randomized, double-blinded, placebo-controlled trials need to be conducted to analyze the long term effect of garlic on hypertensive patients. |

**Overarching Conclusion:**

Garlic supplementation appears to be promising and has the potential to reduce blood pressure in hypertensive individuals. However, before considering garlic as an alternative treatment to standard therapy further studies need to be conducted to evaluate the effect of garlic after long term usage, effective dosage and the efficacy of specific garlic supplementation.

**Clinical “bottom line”**

Hypertension is a common medical problem, 1 in 3 adults in the world are affected by it. Antihypertensive medications are widely used, but the side effects and financial cost lead to low adherence. Garlic is a simple commodity used in everyday life and has antibacterial and antioxidant ability along with a reputation to reduce hypertension. Based on this pico finding, all the authors agree that **garlic consumption looks promising in reducing blood pressure, but there is insufficient evidence to suggest garlic preparations as the alternative mode of treatment** to conventional antihypertensive medications. **I would recommend this patient to initiate antihypertensive drugs** because many more studies need to be conducted in order to identify the true impact of garlic in reducing blood pressure. Also, there are still plenty of questions that need to be answered such as: specific dose of garlic, specific garlic preparations and long term effect.

**Weight of the Evidence:**

**Ried K. (2020) [Article #4]**- I weighed this article as the highest because it was published in 2020 one of the most recent studies that analyzed the effect of garlic on blood pressure. Also, it is medline indexed meta-analysis which is the highest level of evidence. Additionally, this article answers my PICO question as it analyzed the efficacy of garlic as an antihypertensive agent. Furthermore, this study included 12 randomized placebo control clinical trains with 553 subjects, which makes the data more reliable. The author of the meta‐analysis concludes garlic extract is safe and effective as a stand-alone or adjunctive anti-hypertensive treatment.

**Stabler SN, Tejani AM, Huynh F, Fowkes C. (2012) [Article #1]** I weighed this article as second highest because it is a systematic review that was published within the last 10 years. This systematic review aims to answer my PICO question regarding the effect of garlic in reducing HTN in a hypertensive patient. Additionally, both studies included in the study are randomized, placebo‐controlled trials.

**Karin Ried (2016) [Article # 5]** I weighed this article as third highest because it is a meta-analysis that was published in 2016. This article is indexed for Medline and it includes 20 trials with 970 participants. Also, this article answers the PICO question efficiently, as the author concludes, garlic supplements have the potential to lower blood pressure in hypertensive individuals

**Wang, H., Yang, J., Qin, L., & Yang, X. (2015) [Article #2]** I weighed this article as the fourth highest because it is meta-analysis that answers my PICO question regarding the effect of garlic on blood pressure. The article includes 17 randomized controlled trials, but the garlic supplements were not the same among the 17 trials.

**Xiong, X. J., Wang, P. Q., Li, S. J., Li, X. K., Zhang, Y. Q., & Wang, J (2015**) [Article #6] I weighed this article as the fifth highest because it was published within the past 10 years and includes seven randomized, placebo-control analyses that analyze the effects of garlic on blood pressure. Also, the article is medline indexed and systematic review and meta-analysis which is the highest level of evidence. However, there was heterogeneity of the clinical assessment due to variations in participants.

**Andres R, Karin R, Igor A. S, Heiner C. Bucher, J. Nordmann, A (2015) [Article #3]** I weighed this article as sixth highest because it is a systematic and meta-analysis that was Medline indexed and published within the last 10 years. This is a high level of evidence that answers my pico question effectively and suggests garlic preparations can significantly reduce SBP and DBP in hypertensive individuals. However, the data is highly heterogeneous with relatively large effect sizes and large CIs

**Magnitude of any effects**

Based on all the findings, there is statistically significant data to support that Garlic supplement reduces blood pressure in hypertensive individuals. In order to conclude the efficacy of garlic on Blood pressure the level of each study was high and the magnitude was consistent throughout.

**Clinical significance (not just statistical significance)**

For many years, garlic has been used as a remedy and many patients prefer natural herbs over medication due to cost and side effects. High blood pressure is a common medical problem faced by many people and it is a common risk factor for cardiovascular disease such as stroke, heart attacks and chronic heart failure. In the western countries, high blood pressure contributes to 37% of cardiovascular death and if a simple remedy like garlic can effectively reduce blood pressure that the burden of cardiovascular death might be lessened. Clinically, the low side effect of garlic is short term use can also promote adherence to treatment which is a common problem faced with anti-hypertensive medication.

**Any other considerations important in weighing this evidence to guide practice**

According to current findings, Garlic appears to have a blood pressure lowering effect but more large sample size and randomized- control trial studies need to be conducted to explore the association between dosage and duration of garlic in regard to reducing Blood Pressure. Additionally, the safety of long‐term garlic use should be investigated before garlic can be considered as conventional therapy for hypertension