

(REVIEW ARTICLE)



## Hypertension management: A comparative analysis of garlic, hibiscus, hawthorn, and olive leaf and a survey

Jones, Martayevious <sup>1</sup>, Hailemeskel, Bisrat <sup>1,\*</sup> and Fullas, Fekadu <sup>2</sup>

<sup>1</sup> College of Pharmacy, Howard University, 2300 4<sup>th</sup> Street, N.W., Washington, D.C. 20059, USA.

<sup>2</sup> Independent Researcher, 1409 Jackson Rd, Silver Spring, MD, 20904, USA.

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### Abstract

Hypertension, a prevalent cardiovascular condition characterized by elevated blood pressure, poses a significant global health challenge. This paper reviews the potential of garlic, hibiscus, hawthorn, and olive leaf in reducing hypertension and improving one's health. A survey was conducted among first year pharmacy students. The survey included 5 knowledge-based and 5 opinion-based questions, focusing on the four herbal remedies. The knowledge-based questions showed a correct answer rate of 61.1%, with the statement that garlic is generally safe to include in one's diet, but excessive consumption can lead to adverse effects garnering a 91.1% correct response rate. 58.3% of the respondents failed to know the simple definition of hypertension. Opinion-based questions revealed a positive attitude towards herbal remedies with an average of 81% showing agreement on the potential benefits. Nearly 83% believed in consulting health professionals before integrating olive leaf extract, and about 89% agreed that garlic should be used as an approach to manage hypertension.

**Keywords:** Hypertension; Garlic; Hibiscus; Hawthorn; Olive Leaf; Survey

### 1 Introduction

Hypertension is a high blood pressure characterized by blood pressure reading of 140/90 mm Hg or higher. The risk of hypertension increases with old age, genetic factors, overweight or obesity, physical inactivity, high-salt diet, and excessive alcohol consumption. Lifestyle changes, such as healthy diet, quitting tobacco and engaging in physical exercise can help lower blood pressure. Modifiable risk factors include unhealthy diets, such as excessive salt consumption, diet high in saturated fat and trans fats, low intake of fruits and vegetables, physical inactivity, consumption of tobacco and alcohol, and being overweight or obese. Air pollution is also an environmental risk factor. Non-modifiable risk factors include a family history of hypertension, age over 65 years and other co-existing conditions such as diabetes or kidney disease [1].

**Prevalence and Impact:** An estimated 1.28 billion adults aged 30–79 years worldwide are believed to have hypertension, with about two-thirds living in low- and middle-income countries. An estimated 46% of adults with hypertension are unaware that they have the condition. Only less than half of adults (42%) with hypertension are diagnosed and treated. Approximately, 21% of patients with hypertension are well controlled. Hypertension is a major cause of premature death worldwide. According to the World Health Organization (WHO), one of the global targets is to reduce the prevalence of hypertension by 33% between 2010 and 2030. The prevalence of hypertension varies across regions, countries and income groups. The highest prevalence of hypertension (27%) is in Africa while the lowest (18%) is in the Americas [1].

\* Corresponding author: Bisrat Hailemeskel

The number of adults with raised blood pressure increased from 594 million in 1975 to 1.13 billion in 2015, with the predominant increase being in low-income and middle-income countries. The global increase in the number of adults with hypertension is attributed to population growth and aging [2].

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## 2 Review of Herbs

Garlic (*Allium sativum*) is a popular herb and spice with a long history of use in traditional medicine. It has been used for centuries in traditional medicine for its potential health benefits, including its use as an antimicrobial and for cardiovascular health. A study published in 2013 reported on the impact of garlic on blood pressure by analyzing 11 randomized controlled trials involving 865 participants. The analysis suggested that garlic supplementation, particularly with garlic powder or aged garlic extract, had a modest but significant blood pressure-lowering effect. The systolic blood pressure was reduced by an average of 5.1 mmHg, and the diastolic blood pressure by 2.5 mm Hg [3].

Hibiscus (*Hibiscus sabdariffa*), a plant native to India and Malaysia, also known as jamaica (in Spanish), red sorrel (in English), or karkadeh (in Arabic), is a tropical species extensively cultivated in tropical and subtropical regions worldwide, including Central and West Africa as well as South-East Asia. Its other names include karkade, bissap, sour tea, and red tea. The plant has demonstrated antihypertensive, anti-hyperlipidemic, anti-inflammatory, antimicrobial, diuretic, uricosuric, and anemia-treating effects. In traditional medicine, hibiscus has been used in both culinary practices in foods as food coloring, and in beverages and as a remedy for various health conditions [4].

According to a 2010 study, a randomized, controlled clinical trial showed the impact of hibiscus tea consumption on blood pressure in prehypertensive and mildly hypertensive adults. The study found that daily consumption of hibiscus tea for six weeks resulted in a significant reduction in systolic blood pressure. The study concluded that hibiscus tea can be an effective natural intervention for reducing blood pressure [5].

Hawthorn (*Crataegus monogyna* Jacq.) is a wild edible fruit tree of the genus *Crataegus*, in the Rosaceae family. The green (unripe) and red (ripe) leaves, flowers and berries of *C. monogyna* are rich in bioflavonoids. A combined blend of leaves, berries and flowers has been used traditionally as an astringent, antispasmodic, cardiogenic, diuretic, hypotensive and anti-atherosclerotic herbal medicine [6].

A 2006 study examined the effects of hawthorn supplementation on blood pressure by analyzing data from randomized controlled trials. The analysis indicated that hawthorn supplementation was associated with a significant reduction in both systolic and diastolic pressure. The research suggested that hawthorn could be considered an adjunct treatment for hypertension [7].

Olive Leaf (*Olea europaea*) is a natural remedy with a long history of traditional use, particularly in Mediterranean regions, for its potential health benefits [8]. Olive leaf extract contains a bioactive compound called oleuropein, which has been associated with vasodilatory effects. Oleuropein may help relax and dilate blood vessels, allowing for improved blood flow and reduced pressure on the arterial wall [9].

A 2017 study investigated the effects of olive leaf extract on blood pressure in human participants and hypertensive rats. The research found that olive leaf extract reduced blood pressure in both. The study suggested that the hypotensive effects of olive extract could be attributed to its vasodilatory and antioxidant properties [10].

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## 3 Health Care Professionals' Knowledge & Opinions

### 3.1 Literature Gap, Study Objective, and Impact

While there is some research supporting the blood pressure lowering effects of garlic, hibiscus hawthorn, and olive leaf, there may be a gap of evidence due to the absence of large, long-term studies that investigate the sustained impact of these herbs and dietary supplements on hypertension. As a response to filling the gap, the objective of this study was primarily to conduct a literature survey of these plants and to assess the sustained impact of these herbal supplementation on blood pressure in individuals with hypertension.

The secondary objective of the study was to expose first-year pharmacy students to doing literature survey, and through a small students' survey to identify their level of knowledge and opinions about the role of selected herbal products in treating hypertension.

## 4 METHODS

This study was carried out within the framework of the Drug Information course, a compulsory 2-credit-hour class designed for first-year professional pharmacy students. Within the course, students were instructed in research methodology and survey administration. Each student was assigned an individual topic and given the responsibility of creating an introduction and formulating two sets of survey questions. The initial set consisted of 5 knowledge-based questions, while the second set comprised 5 opinion-based questions. These questions were integrated into an online survey, and all students were invited to participate in responding to them. A descriptive statistical data analysis was performed. For the opinion-based responses, a Likert Scale was utilized (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). A score above 2.5 on the Likert Scale was considered agreement.

## 5 Results

### 5.1 Demographics

The data in Table 1 contains information on the gender, age distribution, and geographical background of the survey participants. There was a total of 40 respondents with a 100% response rate. Thirty (75%) were female and 10 (25%) were male. Most respondents were in the 18 to 24 years age range (52.5%), and 15 (37.5%) in the 24 to 30 range. A smaller percentage (7.5%) were in the range 30 to 40. One participant was over 40 years old.

**Table 1** Demographic data of the participants (n=40)

| Demographic characteristics  |                  | n (%)     |
|--|------------------|-----------|
| Gender   | Male             | 10 (25)   |
|  | Female           | 30 (75)   |
| Age (years)  | 18 -24           | 21 (52.5) |
|  | 24 - 30          | 15 (37.5) |
|  | 30 - 40          | 3 (7.5)   |
|  | Above 40         | 1 (2.5)   |
| States you have lived in before coming to Howard Pharmacy Program* | Washington, D.C. | 6 (15.4)  |
|  | Maryland         | 15 (38.5) |
|  | Virginia         | 1 (2.5)   |
|  | Other States     | 17 (43.6) |

\*One participant did not answer the state she lived in.

### 5.2 Participant's work and educational background

The work and educational background of the survey participants is recorded in Table 2. 52.6% of participants had employment in pharmacy-related jobs, while 23.7% were employed in health-related but non-pharmacy positions, and the same number of participants held non-health related jobs. The majority (65%, n=26) had a Bachelor of Science (BSc) or Bachelor of Arts (BA) prior to joining the pharmacy program. Seven (17.5%) held a Master of Science (MSc) degree. 12.5% (n=2) had completed some pre-pharmacy or college coursework, while two (5%) had an associate degree. This data present a snapshot of the job and academic backgrounds of the surveyed individuals, offering valuable context for their decision to pursue a pharmacy education.

**Table 2** Work and educational background of the participants

| Question  | Response     | n (%)   |
|---|--------------|---------|
| How many years have you had a paying job before joining the Pharmacy program at Howard? | Never Worked | 2 (5)   |
|   | 1-2          | 12 (30) |

|  |  |           |
|--|--|-----------|
|  | 3-4  | 10 (25)   |
|  | 5 or more                                      | 16 (40)   |
| What kind of work have had?  | Pharmacy Related                               | 20 (52.6) |
|  | Non-pharmacy-related, but other health related | 9 (23.7)  |
|  | Non-health related                             | 9 (23.7)  |
| What is the highest educational level you have achieved before joining the pharmacy program at Howard? | Pre-Pharmacy or some college work              | 5 (12.5)  |
|  | Associate degree                               | 2 (5)     |
|  | BSc or BA degree                               | 26 (65)   |
|  | MSc/MA or higher                               | 7 (17.5)  |

### 5.3 Knowledge-Based Questions

As shown in Table 3, an average of 61.1% of respondents answered the knowledge-based questions accurately, while 38.9% failed to respond correctly. The question relating to the safety of garlic garnered the highest accuracy at 91.1% providing the correct answer. Only 41.7% recognized the correct definition of hypertension. Less than 50% knew the false statement that hibiscus tea is considered a guaranteed remedy for hypertension. However, when questioned about the avoidance of hawthorn by pregnant or breastfeeding individuals, 80% correctly concurred with the statement.

**Table 3** The results of the knowledge-based questions

| Questions   | Correct Answer | True (n) | False (n) | Participants with correct answers; n (%) | Mean correct answer rate out of 1 ( $\pm$ SD) | Variance |
|---|----------------|----------|-----------|--|---|----------|
| Hypertension is also known as low blood pressure  | False          | 31       | 3         | 15 (41.7)                                | 0.4167 $\pm$ 0.5                              | 0.25     |
| Garlic is generally safe to include in one's diet, but excessive consumption can lead to adverse effects. | True           | 31       | 3         | 31 (91.1)                                | 0.9118 $\pm$ 0.2879                           | 0.0829   |
| Hibiscus tea is a guaranteed remedy for hypertension and can replace prescribed medication.               | False          | 18       | 17        | 17 (48.6)                                | 0.4857 $\pm$ 0.5071                           | 0.2571   |
| Pregnant or breastfeeding individuals should avoid hawthorn if they have hypertension                     | True           | 28       | 7         | 28 (80)                                  | 0.8 $\pm$ 0.4058                              | 0.1647   |
| Olive leaf extract is entirely safe to use with no risk of side effects                                   | False          | 19       | 15        | 15 (44.1)                                | 0.4412 $\pm$ 0.5040                           | 0.2540   |
| Average correct answer  |                |          |           | 61.1%                                    | 0.6110 $\pm$ 0.4410                           | 0.2017   |

### 5.4 Opinion Based questions

Table 4 shows the summary of the data for the opinion-based questions. Most respondents in this survey (81%) expressed positive agreement with the potential of herbal remedies to reduce hypertension. Over 61% strongly agreed or agreed that individuals with hypertension should consider natural remedies like garlic as first line treatment before prescription medications, but about 90% agreed that garlic should be used as a comprehensive approach to managing hypertension, including diet and lifestyle changes.

Over 83% believed that hibiscus has the potential to effectively lower hypertension, and 88.9% agreed that hawthorn is effective in helping individuals with hypertension manage their blood pressure. About 83 % agreed that it is crucial for individuals with hypertension to consult with a healthcare professional before integrating olive leaf extract into their treatment plan.

On the other hand, the percentage range of those who showed aggregate strong disagreement or disagreement with the five statements was notably lower, ranging from 11% to 38.8%, indicating a prevailing inclination toward positive agreement regarding the benefits of these herbal remedies for hypertension.

**Table 4** Opinions of survey respondents ( $n=36$ )

| Question   | SA<br>(n, %) | A<br>(n, %)  | DA<br>(n, %) | SA<br>(n, %) | Mean LK $\pm$ SD    | Variance |
|--|--------------|--------------|--------------|--------------|---------------------|----------|
| I believe individuals with hypertension should consider natural remedies like garlic as a first line treatment before prescription medications.                      | 8<br>(22.2)  | 14<br>(38.9) | 10<br>(27.8) | 4<br>(11.1)  | 2.7222 $\pm$ 0.9313 | 0.8673   |
| I believe that hibiscus has the potential to effectively lower hypertension  | 8<br>(22.2)  | 22<br>(61.1) | 6<br>(16.7)  | 0 (0.0)      | 3.0556 $\pm$ 0.6211 | 0.3858   |
| I agree that hawthorn is effective in helping individuals with hypertension manage their blood pressure  | 9 (25)       | 23<br>(63.9) | 3 (8.3)      | 1 (2.8)      | 3.1111 $\pm$ 0.6573 | 0.4320   |
| I believe it is crucial for individuals with hypertension to consult with a healthcare professional before integrating olive leaf extract into their treatment plan. | 11<br>(30.6) | 19<br>(52.8) | 5<br>(13.9)  | 1 (2.8)      | 3.1111 $\pm$ 0.7370 | 0.5432   |
| Garlic should be used as part of a comprehensive approach to managing hypertension, including diet and lifestyle changes   | 10<br>(27.8) | 22<br>(61.1) | 4<br>(11.1)  | 0 (0)        | 3.1667 $\pm$ 0.6009 | 0.3611   |
| Average  | 25.4%        | 55.6%        | 15.6%        | 3.3%         | 3.0332 $\pm$ 0.7095 | 0.5179   |

\*SA= Strongly agree; A=agree, DA=Disagree; SD=Strongly disagree; LK=Likert Score; SD=Standard deviation

## 6 Discussion

The response rate for knowledge-based questions, relative to that of the demographic rate, was 87%, while the response rate for the opinion-based statements was 90%. In the knowledge-question panel it was noteworthy that less than 50% knew that hypertension is a high blood pressure. Most respondents recognized that garlic is generally safe to include in one's diet, and that excessive consumption can lead to adverse effects.

Hibiscus tea is known to reduce blood pressure, the answer if false because it may interact with other medications such as antihypertensive drugs. Pregnant or breastfeeding individuals should avoid hawthorn if they have hypertension. Only 15 participants (44.1%) recognized that the statement olive leaf extract is entirely safe to use with no risk of side effects is false.

The survey data on opinion-based questions revealed a prevalent positive attitude towards the potential benefits of herbal remedies in hypertension. An average of 81% of respondents strongly agreed or agreed with their potential benefits. Nearly 83% concurred that individuals should consult doctors before incorporating olive oil, and about 89% agreed that garlic should be used in managing hypertension. The percentage of those disagreeing was notably lower, indicating a prevailing inclination towards positive agreement regarding the benefits of these remedies for hypertension. The positive attitude was shown in the average Likert score of 3.0332. The score of responses across all the five opinion statements, ranging from 2.7222 to 3.1667, proved a predominant agreement trend.

## 7 Conclusion

In this survey involving 40 participants, knowledge-based questions revealed that over 61% answered correctly. The respondents demonstrated a notably positive attitude toward herbal remedies for hypertension, with over 80% strongly agreeing or agreeing with their potential benefits. Nearly 89% concurred that individuals should consult a

doctor before incorporating olive oil and that garlic should be used in managing hypertension. Disagreement was minimal, ranging from 11% to 38.5%, indicating a widespread inclination toward positive agreement regarding the hypertension-lowering benefits of these remedies.

This study has several limitations. The sample size of 40 participants is relatively small and lacks diversity, thereby limiting the generalizability of findings. Factors beyond knowledge and attitudes, such as cultural influences and marketing strategies, could possibly influence the results of similar surveys.

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## Compliance with ethical standards

### *Acknowledgement*

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### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

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