

# Study of Supplementation of Dietary Garlic (*Allium Sativum*) on Hypertensive Subjects

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**Abstract:** Hypertension is persistently high arterial blood pressure, the force exerted per unit area on the walls of arteries. The curative effect of garlic is based on its sulfur compounds. More than 20 sulfur components have been discovered in garlic. The beneficial effect of garlic on arterial hypertension lowers high blood pressure. The objectives were planned to study the effect of supplementation of dietary garlic on stage I hypertensive Subjects. The descriptive study will be conducted among hypertensive clients in Siddapur PHC at Bangalore. This was a 12-week study done on subjects diagnosed with stage I hypertension. A questionnaire was developed covering the intake of garlic, demographic parameters. Anthropometric measurements were done and blood pressure was measured at 8th week and at 12th week. Finally, both were compared to know the effect of garlic on stage I hypertension. Garlic treated group showed 148.64 mmHg and 97.84 mmHg of average diastolic blood pressure of average systolic blood pressure on 1st week and decreased further after 8th and 12<sup>th</sup> week. Garlic supplementation demonstrated significant hypertensive effects in comparison to regular medications.

**Keywords:** Hypertension, Garlic (*Allium Sativum*), Systolic, diastolic

## 1. Introduction

Hypertension is persistently high arterial blood pressure, the force exerted per unit area on the walls of arteries (Surendran et al, 2016). Physiologically, blood pressure is measured relative to one atmosphere of pressure, which is considered as zero, although atmospheric pressure is actually 76 mmHg (Magder, 2014). Therefore, a measured pressure of 120 mmHg means the pressure is 120 mmHg higher than atmospheric pressure. However, in practice, blood pressure is always expressed as the measured value alone. Every individual has a necessary blood pressure to move blood through the arteries and provide oxygen to the body's tissues (Mayet & Hughes, 2003). Hypertension occurs when this pressure is elevated beyond the normal range.

Based on national health and disorders studies conducted on two occasions, between 1976 - 1998 and 1998 - 1991, the percentage of Americans who know they have high blood pressure increased from 51% to 72% (Hajjar & Kotchen, 2000). The number of Subjects during the same period increased from 31% to 55%. Among people aged 65 - 74, 52.5% of women and 65.4% of men have hypertension. Subjects with hypertension have a higher risk for other cardiovascular diseases, cerebrovascular, and endovascular diseases (Rigas et al, 2010). People with arterial hypertension have three times greater risk of acute myocardial infarction and seven times greater risk of cerebrovascular disease. Depending on the cause, hypertension is labeled primary or secondary (Lewington et al, 2002). About 90% of hypertensive Subjects have primary or essential hypertension, for which there is no single, clear-cut cause.

Stage I hypertension (140 - 159 to 90 - 99 mmHg) is the most prevalent level seen in adults; this group is most likely

to have myocardial infarction (MI) or stroke (Olafiranye et al, 2011). The defining point for hypertension is arbitrary because any level of elevated blood pressure is associated with increased incidence of cardiovascular disease (CVD) and renal disease. Therefore, normalization of blood pressure is important for all stages of hypertension.

Secondary hypertension occurs in response to another event or disease process in the body (Charles et al, 2017). One such event is pregnancy, during which hypertension may occur. Medications, such as contraceptive pills that contain progesterone, can stimulate the production of renin, leading to an elevation in blood pressure. Secondary hypertension can also result from diseases of the kidneys, adrenal glands, or nervous system (Charles et al, 2017).

The curative effect of garlic is based on its sulfur compounds. Diallyl sulfide, a very important component of garlic, was discovered in 1844 by Wertheim, and in 1895, Semmler identified its ingredients—diallyl disulfide, diallyl trisulfide, and other sulfur compounds (Rao et al, 2015). More than 20 sulfur components have been discovered in garlic. When garlic is chopped or crushed, the enzyme alliinase converts alliin to allicin, a chemical known as S - allyl - cysteine sulfoxide, which is the main medicinal substance in garlic and gives it its distinctive, often unpleasant smell. Natural allicin is unstable; it loses its potency within hours and disappears after cooking for 20 minutes (Borlinghaus et al, 2014). Opinions about the beneficial effect of garlic on arterial hypertension are divided, although most authors agree that garlic lowers high blood pressure (Ried & Fakler, 2014). In China, garlic has been used since ancient times to treat hypertension, and the Japanese government has recognized it as a medicine (Petrovska & Cekovska, 2010).

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Numerous clinical investigations have shown that garlic may produce beneficial effects on various cardiovascular risk factors. It can reduce serum cholesterol levels in humans, inhibit cholesterol biosynthesis, lower arterial blood pressure, and suppress low - density lipoprotein (LDL) oxidation, lower plasma fibrinogen, and increase fibrinolytic activity, thus possessing anti - atherosclerotic properties (Aslani et al, 2016; Banerjee & Maulik, 2002; Santhosha et al, 2013; Wang et al, 2014). Garlic also helps prevent colds and acts as an insect repellent. Additionally, garlic may help prevent cancer and has antimicrobial, antiseptic, and antifungal properties (Bayan et al, 2014; Upadhyay, 2016).

With these preliminary data, the objectives of was planned to study the effect of supplementation of dietary garlic on stage I hypertensive Subjects, to assess the dose response tolerability & acceptability of dose of Garlic on stage I hypertensive Subjects.

## 2. Methodology

### 2.1. Research design

A researchers' overall plan for obtaining answers to the research question or for testing hypothesis is referred to as the research design. The research design used in my study was non - experimental research approach.

### 2.2. Research approach

The selection of research approach is the basic procedure for the conduction of research enquiry. A research approach tells us so as what data to collect and how to analyze it. It also suggests possible conclusions to be drawn from the data. In view of the nature of the problem selected for the study and the objectives to be accomplished a quantitative survey approach was considered the best to assess the knowledge of men and women who are newly diagnosed with stage I hypertension and to assess the knowledge about garlic.

### 2.3. Sampling Technique

Convenience sampling technique Sample size: 50

### 2.4. Setting of the study

The study was selected in Siddapur PHC at Bangalore on the basis of

- Geographical proximity
- Feasibility of conducting the study
- Availability of the samples

The descriptive study will be conducted among hypertensive clients in Siddapur PHC at Bangalore. The PHC covers the area of 20 kilometres. It covers the population of 34, 598 with bed strength of 8. The services provided by the PHC are Emergency treatment, Medical care, Control of communicable diseases, Health education, Family planning, Immunisation, MCH services etc. The PHC has one Medical officer with other 6 staffs.

This was a 12 week study conducted in Primary Health Centre in Siddapur, Bangalore. Subjects with newly diagnosed stage I hypertension were enrolled for this study. A questionnaire was developed in order to estimate the dietary intake of garlic per person per month and to record blood pressure readings on each individuals. The various demographic parameters including age, sex, marital status, and education etc were recorded. Those subjects found to be Diabetes mellitus, Ischemic Heart disease, stage II hypertension Subjects are excluded from the study.

### 2.5. Sampling criteria:

#### Inclusion criteria:

- Subjects of either sex aged between 30 - 60 years, with newly diagnosed stage I hypertension (systolic blood pressure between 140 to 159 mmHg and diastolic blood pressure between 90 to 99 mmHg.)
- Hypertensive Subjects those who understand Kannada and English.
- Hypertensive clients those who are willing to participate in the study.

#### Exclusion criteria:

- Subjects above 60 years.
- Subjects having history of allergy or beeta - blockers.
- Subjects with stage 2 hypertension.
- Pregnant or lactating woman.
- Subjects with Ischemic heart disease.
- Established coronary artery disease.
- Subjects with the history of Heart failure, Bradycardia, liver and Kidney dysfunction,
- Subjects who are taking systemic steroids, or any other drug known to have interaction with antihypertensive agents.

### 2.6. Data Collection Tool

- Section I: Socio demographic variables such as age, sex, education, occupation, marital status, type of family, dietary pattern, age of onset of hypertension, nature of treatment.
- Section II: Interview schedule on compliance of hypertensive Subjects in relation to diet, thought about garlic and blood pressure readings etc.

### 2.7. Data Collection Procedure

The descriptive study will be conducted in Siddapur PHC at Bangalore, with a sample of 30 hypertensive clients. An interview schedule will be used to collect the relevant information regarding hypertension and garlic. The duration of data collection will be for 12 weeks.

The data collection technique was through a interview schedule criteria, the questionnaire was prepared to assess the knowledge of clients regarding hypertension and garlic in the age group 30 - 60 years. The questionnaire was developed, based on the objectives, review of literature, suggestions by guide.

## 2.8. Preparation of the questionnaire

- Part I consists of personal data ie name, age, gender, education which includes No schooling - those who won't go to school, Primary - 1ststd to 7thstd. Secondary - up to 10thclass. Graduate -
- Occupation which consists of unemployed, private service, government service, and marital status includes married and unmarried. Lifestyle consists of sedentary, moderate and heavy. And food style consists of vegetarian and non vegetarian.
- Part II consists of anthropometric data like height, weight and BMI
- Part III consists of family history like any family history of hypertension and family history of CVD. And other information like when hypertension was diagnosed, whether hypertension was diagnosed during routine examination or it was measured due to symptoms. Age of onset of hypertension, and habits like alcohol, smoking, tobacco were entered. We also collect the information about the knowledge about garlic. Whether they are using the garlic regularly or not, if they were using how they were using either raw or in cooked form. And their thought about garlic was to be entered while collecting the data.

For the purpose of the study 50 Subjects are to be noted with stage I hypertension that are recently diagnosed. They are divided in to 2 groups group I and group II each group consists of 25 members each. In this group I is supplied with garlic 4mg/daily (about 4 cloves) along with normal meals. In group II we included primarily Subjects who were on an established plan of prescription antihypertensive medication for at least 1 to 2 months, including angiotension - converting enzyme inhibitors, angiotension II receptor blockers, calcium channel blockers diuretics and whose general practitioners was not planning to change the medication plan during the trial.

## 2.9. Blood pressure monitoring

Blood pressure was measured with mercury sphygmomanometer in laying down position, at the beginning of the treatment with garlic. And blood pressure is recorded for every week for 1 month, and again it is measured at 8th week and at 12th week. And finally both are compared to know the effect of garlic on stage I hypertension.

## 3. Results

### 3.1. Demographic Profile of Subjects

Among all participants consists of 40% male and 60% of female in Group I and 48% of male and 52% of female are there in non - garlic group. Out of 25 members in group I 20% are illiterate.36% of participants completed primary education (Table 1).28% of participants completed secondary education.16% of them are Graduates. In non - garlic group 16% are illiterate.32% have primary education.32% have secondary education. And about 20% are graduates. In group I there are 44% of participants are housewives, about 48% of participants are doing private

service. And about 8% are doing government service. And in group II about 40% of participants are housewives. About 40% of participants were working in private sector and about 20% of participants in government service. In group I about 96% of participants are married and about 4% of participants are unmarried. In the same way about 92% of participants are married and about 8% of participants are unmarried in group II. Out of 25 members about 11 participants ie 44% are vegetarians. And about 56% of participants are non - vegetarians in group I. About 56% participants are vegetarian and about 44% are non - vegetarians in group II.

### 3.2. Anthropometric Data of Subjects

In group I about 72% of participants are sedentary workers. About 20% are moderate workers and about 8% of participants come under heavy workers. In group II about 72% of participants are doing sedentary work, about 24% are under moderate workers and about 4% of participants are heavy workers (Figure 1).

In Garlic treated group - I 4 out of 25 participants ie about 16% are having BMI from 18.5 - 25 are normal. About 19 participants, 76% of participants are having BMI about 25 - 30 are grade I obese.2 participants out of 25 ie 8% are having BMI > 30 are grade II obese. In non - garlic group 3, around 12% of participants are having BMI from 18.5 - 25, are considered as normal. About 20 members around 80% of participants having BMI in between 25 - 30 are grade I obese. About 2 participants around 8% having >30 are under grade II obese.

### 3.3. Family History of Subjects

In group I 64% of participants were not having any family history of hypertension. About 20% of participants are having the family history of hypertension with father. And 16% of participants having the family history of hypertension with mother. Among group II that is non - garlic group about 68% of participants are not have any type of family history of hypertension. About 20%of participants have the family history of hypertension with father. And about 12% of participants are having the family history of hypertension with mother.

Among the garlic treated group about 84% of participants did not have any history of Cardio vascular diseases. About 12% of participants are having the family history of cardio vascular disease with father. And about 4% of participants are having the family history of CVD with mother. In non - garlic group about 80% of participants did not have any history of cardiovascular disease. About 16% and 4% of participants have the family history of cardio vascular disease with their father and mother respectively (Figure 2).

### 3.4. Distribution of participants by Habits

In garlic supplement group about 12% of participants are having the habit of alcohol. About 20% of have the habit of smoking 12% of having habit of tobacco and about 56% of them did not have any habits. Among non - garlic group about 4% are having the habit of alcohol. About 16% of them

has the habit of smoking.4% of participants have the habit of tobacco.76% of them did not have any habits (Figure 3).

### 3.5. Distribution of participants by Use of garlic

In group I about 56% of participants were not using the garlic regularly. About 44% of participants are using the garlic regularly but in the cooked form. About 92% of people had the opinion that use of garlic is healthy. About 8% did not have any opinion about use of garlic (Figure 4).

### 3.6. Comparison of blood pressure of both groups. (Garlic and non - garlic group)

As mentioned earlier Group I is supplied with 4 gm of fresh garlic cloves daily for 12 weeks and another group was continued with antihypertensive medications. After the 12 weeks both values were compared. Garlic treated group shows 148.64 mmHg of average systolic blood pressure reading on 1st week, once garlic supplementation is started we noticed about 145.76 mmHg on 4th week, and about 143.2 mmHg and about 144.24 mmHg on 8th week and 12th week respectively. In non - garlic group we noticed the SBP readings of 149.12 mmHg on 1st week, 146.7 mmHg on 4th week, about 145.28 mmHg on 8th week and about 144.24 mmHg on 12th week. During the 12week treatment phase of the study systolic blood pressure in the non - garlic group was lowered by 4.84mmHg. In garlic treated group Systolic blood pressure was lowered by 2.94 mmHg after 4 weeks, 2.5 mmHg after 8 weeks and 2.4 mmHg after 12 weeks. Total group was lowered by 7.84mmHg (Figure 5).

Garlic treated group shows 97.84 mmHg of DBP on 1st week, about 95.68 mmHg of blood pressure on 4th week, and about 93.68mm Hg and about 90.08 mmHg on 8th and 12th week respectively. In non - garlic group DBP is about 98mmHg on 1st week. About 95.2mmHg on 4th week, 94.32 mmHg and 93.52mmHg during 8th and 12th week respectively. During 12th week of treatment phase of the study Diastolic blood pressure in the non - garlic group was lowered by 4.48 mmHg. In the non - garlic group DBP was lowered by 3mmHg after 4 weeks, by 0.9 mmHg after 8weeks and by 4.68mmHg after 12 weeks of treatment. In garlic treated group Diastolic was lowered by 2mmHg after 4week, 2mmHg by 8th week and about 3.6 mmHg after 12th week and total DBP lowered by about 7.76mmHg from 1st to 12th week (Figure 6).

## 4. Discussion

Garlic produced a statistically significant hypotensive effect on both Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) in person with mild arterial hypertension. These data are similar to the results from earlier studies that showed the hypotensive effects of garlic products. Garlic ability to lower blood pressure has been linked to its hydrogen sulphide production and allicin content which is reported to have angiotensin II inhibiting and vasodilating effects (McMohan et al., 1993). Garlic was reported to lower BP by modulating the activity of several mechanisms including the prostaglandin system, renin angiotensin system, and renal tubular transport mechanisms (Ashraf et al, 2013).

The present study monitored the antihypertensive effects of garlic with respect to its ability to incite a decrease in systolic blood pressure and diastolic blood pressure and to discover the time taken for this reduction in comparison with garlic supplement with antihypertensive agents in the patients with stage I hypertension. Andrianova et al., (2002) and Sobenin et al., (2009) compared the antihypertensive effect of Kwai with long acting garlic preparation in patients with mild to moderate hypertension and reported reduction in both systolic and diastolic blood pressure. Auer et al., (1990) reported reduction of diastolic blood pressure from 102 mmHg to 91 mmHg after eight weeks and to 89 mmHg after 12 weeks of garlic supplementation. The antihypertensive effects observed by Reid et al., (2008) and Reinhart et al., (2008) after advocating garlic supplementation.

It has been reported that decrease in systolic blood pressure of 10 - 12 mmHg and diastolic blood pressure 5 - 6 mmHg significantly decrease cardiovascular risk by 8 - 20% (McInnes, 2005). This confirms our hypothesis that garlic can be a good alternative or addition in antihypertensive regimen for reducing cardiovascular related morbidity.

## 5. Conclusions

Garlic produced a statistically significant hypotensive effect on both Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) in person with mild arterial hypertension. These data are similar to the results from earlier studies that showed the hypotensive effects of garlic products. Garlic ability to lower blood pressure has been linked to its hydrogen sulphide production and allicin content which is reported to have angiotensin II inhibiting and vasodilating effects. The present study has demonstrated significant hypertensive effects of garlic as compared to the regular medications. Garlic could be a good addition in combination therapy for hypertension. Comprehensive clinical trials of longer duration, using standardized garlic preparations are desirable to confirm the findings of present study.

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**Table 1:** Descriptive statistics including other parameters

Gender	Garlic	Non - Garlic
Male	40%	48%
Female	60%	52%
No schooling	20%	16%
Primary	36%	32%
Secondary	28%	32%
Graduate	16%	20%
House - wife	44%	40%
Private service	48%	40%
Government service	8%	20%
Married	96%	92%
Unmarried	4%	8%
Sedentary worker	72%	72%
Moderate worker	20%	24%
Heavy worker	8%	4%
Vegetarians	44%	56%
Non - vegetarians	56%	44%

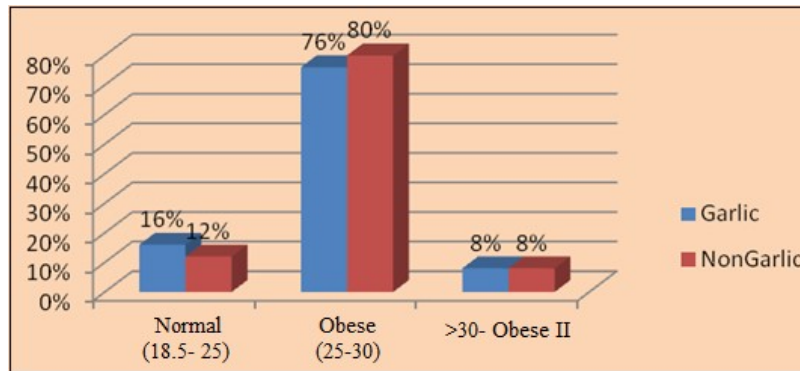


Figure 1: BMI chart of participants

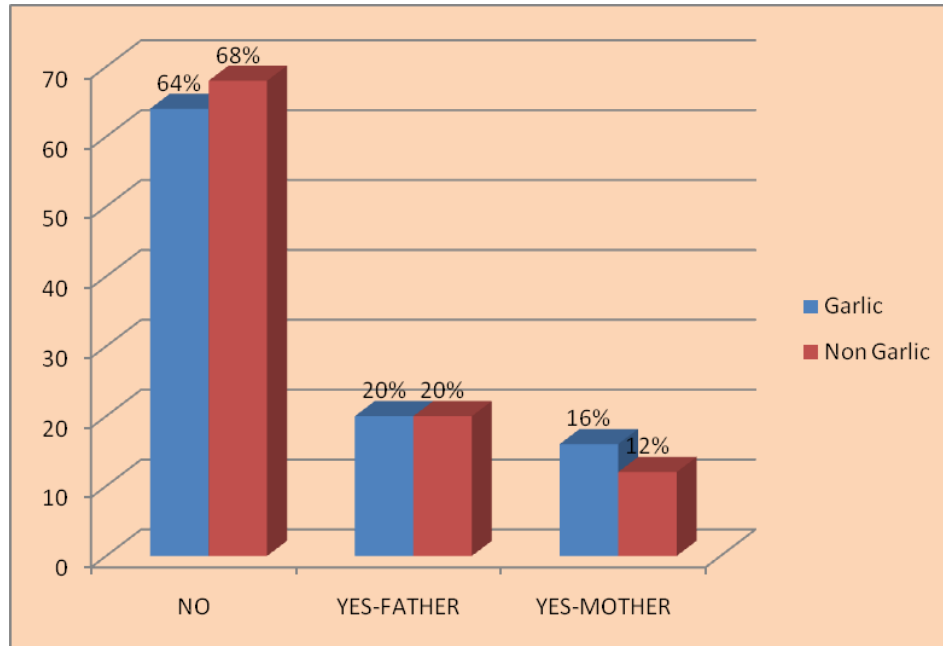


Figure 2: Family History of Hypertension

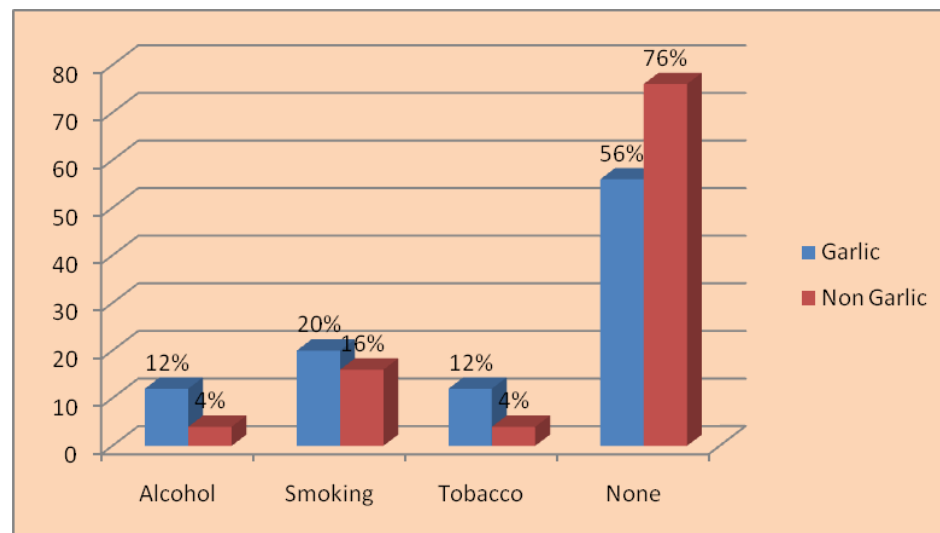


Figure 3: Lifestyle Habits of Subjects

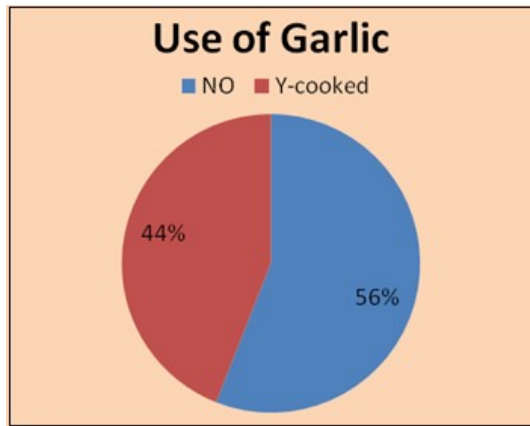


Figure 4: Distribution of participants according to the use of garlic.

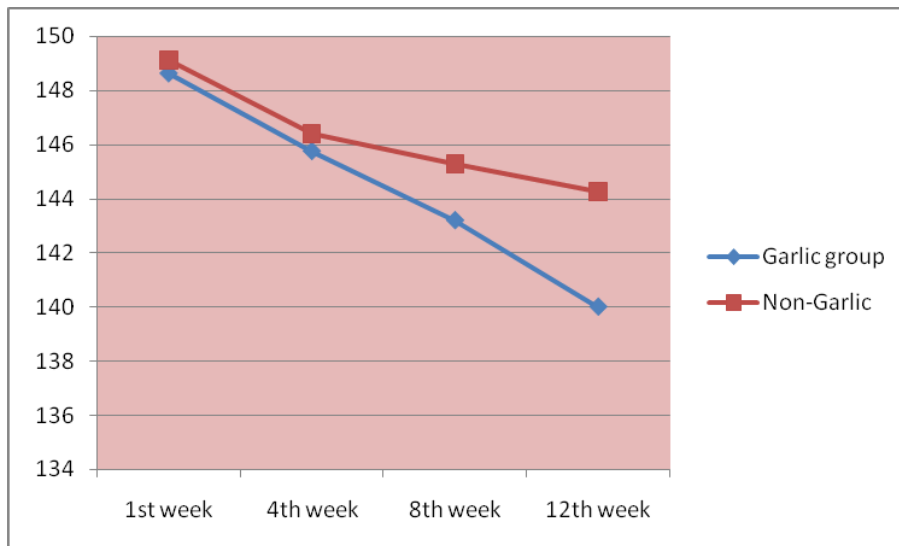


Figure 5: Graph showing fall in systolic pressure after supplementation

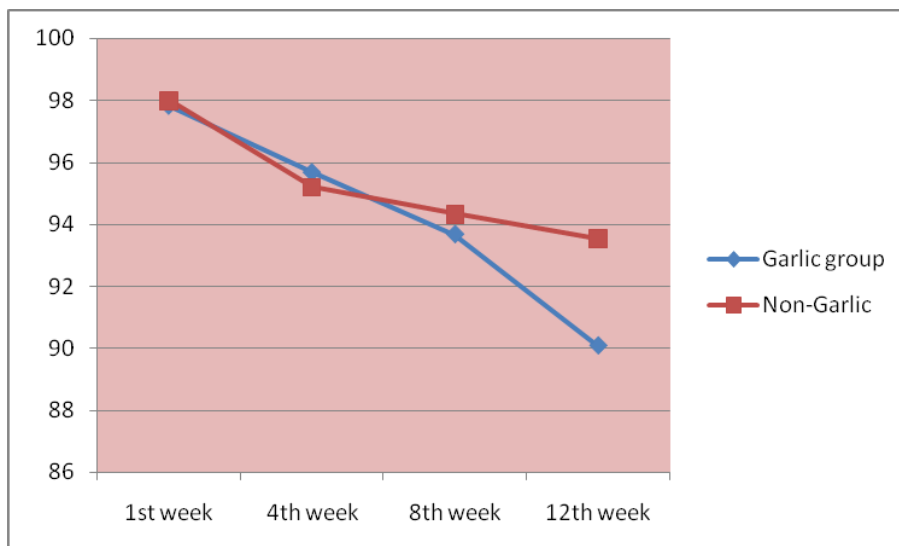


Figure 6: Graph showing fall in diastolic pressure after supplementation