

Formulation And Evaluation of Garlic Capsules for Anti-Hypertensive

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Abstract:

Although garlic is believed to have health-promoting benefits, many of the claimed benefits are not supported by good scientific studies. This research critically examined current scientific literature concerning claims of cardiovascular benefits from regular consumption of garlic or garlic preparations. The vast majority of recent randomized, placebo-controlled studies do not support a role for garlic in lowering blood lipids. There also is insufficient evidence to support a role in reducing blood pressure. While there have been indications of antiatherosclerotic effects associated with garlic consumption, there are insufficient data in humans. Investigation of antithrombotic effects of garlic consumption appears to hold promise, but too few data exist to draw firm conclusions.

Keywords: antioxidant, antithrombotic effects, blood lipids, blood pressure, cardiovascular, garlic, hypertension, platelets.

1. Introduction

Traditionally, garlic has a long history as a strength enhancer, fatigue reducer, and immune booster to prevent and treat infectious diseases and digestive function. In modern times, garlic is also associated with improved cardiovascular health, including blood pressure, cholesterol, and other cardiovascular markers.¹ We updated our previously published meta-analysis of the effects of garlic on blood pressure to include some of the more recent studies. Meta-analysis of the effect of garlic on cholesterol and summarizes the effect of garlic on the immune system.²

Therefore, this report aims to provide a comprehensive overview of clinical studies over the last 20 years evaluating the therapeutic effects of garlic on various common human diseases such as cancer, cardiovascular diseases, diabetes, metabolic disorders, osteoporosis and skin diseases with the main focus on antioxidant, anti-inflammatory and lipid-lowering effects. This review also describes the main molecular mechanisms of garlic related to its promising health benefits when ingested.³ Various bioactive compounds of spices, including alkaloids, tannins, vitamins and phenolic diterpenes, flavonoids and polyphenols, and sulphur-containing compounds are responsible for various types of healing properties due to their antioxidant, anticancer, anticancer, and anti-inflammatory properties. And hypoglycaemic and cholesterol-lowering properties.⁴ Garlic (*Allium sativum* L.), a member of the Amaryllidaceae family grown worldwide, has significant health benefits. In 1550 BC Antibiotics and medicines were not available, so garlic was used medicinally in various epidemics such as typhoid, dysentery, cholera and influenza. The therapeutic effect of garlic is mainly due to the impressive activity

of the bioactive compounds it contains, such as organic sulphides, saponins and phenolic compounds and polysaccharides.⁵

Garlic (*Allium sativum* L.; Liliaceae family) is one of the most important bulbous plants, cultivated and used as a spice and popular traditional Indian herbal medicine. The health benefits of garlic are mainly attributed to the sulfur-containing compounds such as allicin, S-allylcysteine, and the essential bioactive elements of garlic include organosulfur compounds, thiosulfates and allicin.⁶ The effect of garlic consumption on reducing total cholesterol (TC) and low-density lipoprotein (LDL) has been studied and is more pronounced at lower doses and longer duration, particularly in people with cardiovascular disease. Raw garlic and garlic extract in the form of oil or powder can be used as functional foods and medicines. There is significant evidence supporting garlic's preventive and therapeutic roles in immune-boosting, anti-cancer properties, and garlic's antioxidant activity against free radicals.⁷ A balanced diet rich in functional foods prepared with garlic has been shown to have beneficial effects on human health. Garlic can alter blood thinner levels and increase the activity of various organs in the body, primarily the respiratory and digestive systems. Garlic has been reported to reduce the amount of cryptosporidiosis that causes gastrointestinal disease in immune-compromised mice and reduce inflammation. Garlic alone can provide us with over 200 unique chemicals that can boost the immune system and help the body fight off a range of ailments. The bioactive components of garlic can be protected by encapsulation techniques.⁸

2. Garlic



Fig No1: Garlic

Allium sativum is a species of bulbous plant in the *Allium* genus. Their close relatives are onions, shallots, leeks, chives, spring onions and Chinese onions. Native to South Asia, Central Asia, and northeastern Iran, it has long been used as a spice around the world, with a history of thousands of years of human consumption and use. It was known to the ancient Egyptians and used both as a spice and as a traditional medicine. China produces 76% of the world garlic supply.⁹

Description

Allium sativum, known as garlic, by William Woodville, Medical Botany, 1793

Scientific classification

Kingdom- plantae

Clade- Tracheophytes

Clade- Angiosperms

Order- Asparagus

Family- Amaryllidaceae

Sub-family- Alliodeae

Genus- Allium

Species - A.Sativum.¹⁰⁻¹¹

Allium sativum is a flowering perennial plant that grows from a bulb. It has a tall, erect flower stalk that grows up to 1 m tall. The leaf blade is flat, linear, strong, and about 1.25 to 2 inches tall.5 cm (0.5 to 1.0 in) wide, with a sharp point. The plant can produce pink to purple flowers from July to September in the northern hemisphere. The onion is fragrant and has outer layers of thin bracts surrounding an inner sheath that surrounds the clove. Often an onion contains 10-20 wedges of asymmetrical shape, except for those closest to the center. When planted at the right time and depth, garlic can be grown as far away as Alaska. It produces hermaphroditic flowers. It is pollinated by bees, butterflies, moths and insects.¹²

The Nutritional Composition of Garlic ¹⁰

Table No1: The Nutritional Composition of Garlic

01	MAJOR CONSTITUENTS Water (58.6 g), Energy (623 kJ), Protein (6.36 g), Total fat (0.5 g), Ash (1.5 g), Carbohydrate (33.1 g), Total dietary fibre (2.1 g), Sugars (1 g).
02	MINERALS Calcium (181 mg), Iron (1.7 mg), Magnesium (25 mg), Phosphorous (153 mg), Potassium (401 mg), Sodium (17 mg), Zinc (1.16 mg), Copper (0.299 mg), Manganese (1.67 mg), Selenium (14.2 µg).
03	VITAMINS Vitamin C (31.2 mg), Thiamin (0.2 mg), Riboflavin (0.11 mg), Niacin (0.7 mg), Pantothenic acid (0.596 mg), Vitamin B6 (1.24 mg), Total Folate (3 µg). Total Choline (23.2 mg), Vitamin A (9 IU), Vitamin E (0.08 mg), Vitamin K(1.7 µg).
04	FATTY ACIDS Total saturated fatty acids (0.089 g), Total monounsaturated fatty acids (0.011 mg), Total polyunsaturated fatty acids (0.249 g).
05	AMINO ACIDS Tryptophan (0.066 g), Isoleucine (0.217 g), Leucine (0.308 g), Lysine (0.273 g), Methionine (0.076 g), Cystine (0.065 g), Phenylalanine (0.0183 g), Tyrosine (0.081 g), Valine (0.291 g), Arginine (0.634 g), Histidine (0.113 g), Alanine (0.132 g), Aspartic acid (0.489 g), Glutamic acid (0.805 g), glycine (0.2 g). Proline (0.1 g), Serine (0.19g)

Doses according to WHO ¹²

The World Health Organization (WHO) recommended daily dose of garlic for adults is given

Table No2: Daily Dose of Garlic for Adults

Garlic product	Dose/Day
Fresh raw garlic	2-5 g
Dried garlic powder	0.4-1.2 g
Garlic oil	2-5 mg
Garlic extract (solid)	300-1,000 mg
Aged garlic extract (liquid)	2,400 mg

Properties

Anti-hypertensive properties

The antihypertensive movement of garlic is in particular because of organosulfur compounds, which sell elements that loosen up endothelium and reducing blood strain. Garlic extracts had been proven to be powerful in aqueous shape in opposition to coronavirus-inflamed embryonic eggs, suggesting that they'll save you or lessen viral growth. Furthermore, garlic changed into determined to be powerful in stopping thrombosis and platelet adhesion or aggregation in human beings.¹²⁻¹³

Anti-hyperlipidemic pastime

Processing 1.5% black garlic decreased overall ldl cholesterol, adjust triglyceride and low-density lipoprotein ldl cholesterol in rats fed a food plan which having excessive in ldl cholesterol. Aged garlic extract (AGE) changed into determined to decrease the blood strain through 3. seventy five mm Hg systolic and 3.39 mm Hg diastolic, while garlic dietary supplements decreased blood strain through approximately 10 mm Hg systolic and eight mm Hg diastolic, just like that of traditional BP medication.¹²⁻¹⁴

Anti-atherosclerotic pastime

Dyslipidemia and infection are foremost indicators of atherosclerosis, a persistent sickness, which develops relying on numerous elements. Atherosclerosis builds up through the years in human arteries as plaque and can pass disregarded for an extended period. Garlic coaching has direct anti-atherogenic movement and inhibits the improvement of ldl cholesterol-precipitated experimental atherosclerosis. Garlic extracts inhibited sialidase pastime in blood plasma, that is the foremost motive of the formation of atherogenic low-density lipoprotein.¹⁴

Heart sickness

Heart sickness is taken into consideration to be certainly considered one among the largest reasons of dying worldwide, which incorporates coronary heart-associated sicknesses like high blood pressure. Studies have proven that garlic can assist folks that are laid low with high blood pressure through reducing their blood strain. By in part growing Na⁺/K⁺-ATPase levels, garlic and its recognized metabolites can inhibit iso-precipitated hypertrophic improvement in rat coronary heart.¹⁵

Cardiovascular safety

Garlic can decrease blood lipids, lower CVD chance factors, and enhance HDL ranges similarly to improving cardiovascular parameters such microcirculation, epicardial and perivascular adipose tissue, submit occlusive reactive hyperemia, and carotid artery intima media thickness. Garlic has the ability for decreasing cardiovascular illnesses because it lowers each systolic and diastolic blood pressure. It is a well-hooked up reality that Garlic is having many cardiovascular safety homes as proven in figure.¹⁶

Effect of garlic on blood stress

High blood stress is an essential danger element for cardiovascular sickness and is attributed to an predicted 70% of coronary heart attacks, strokes, and continual coronary heart failure, main to 37% of cardiovascular deaths in Western nations and 13.5% globally three Epidemiologic research describe a non-stop affiliation among blood stress and cardiovascular sickness danger, suggesting a discount in excessive systolic blood stress (SBP; >one hundred forty mm Hg) via way of means of 20 mm Hg and a discount in excessive diastolic blood stress (DBP; >ninety mm Hg) via way of means of 10 mm Hg to be related to a 50% danger discount in growing cardiovascular sickness.¹⁷⁻¹⁸

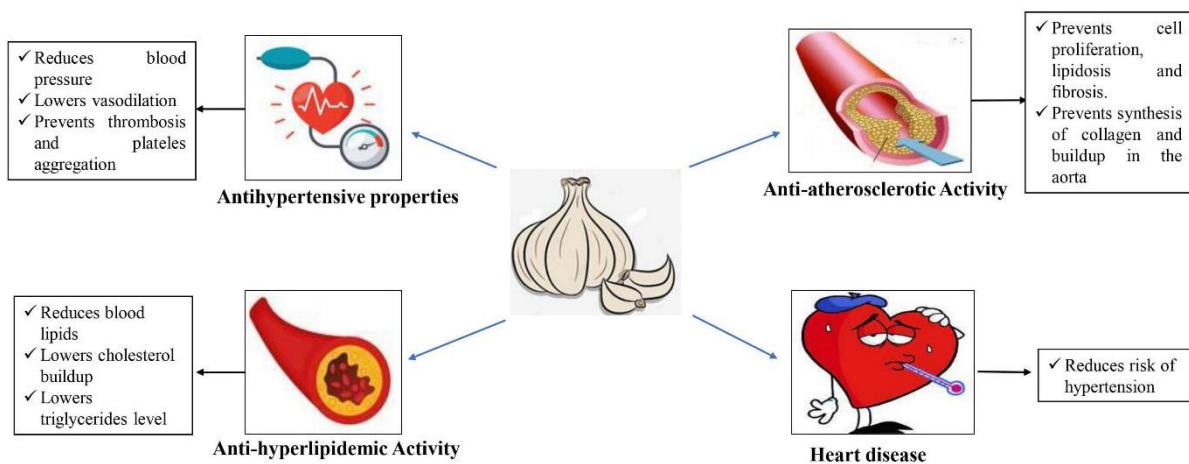
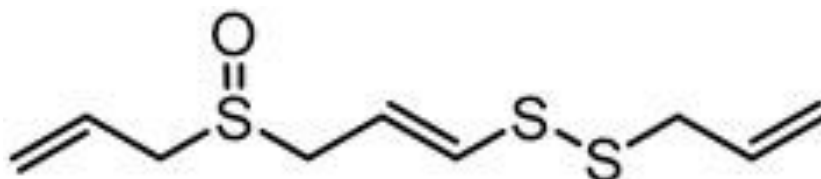


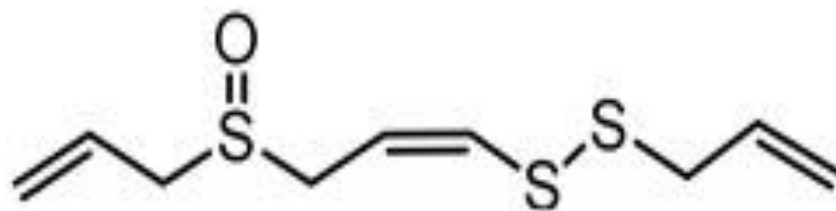
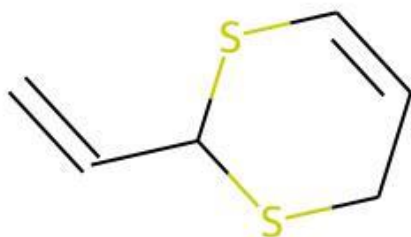
Fig No2: Cardiovascular Safety

Chemical Constituents of Garlic

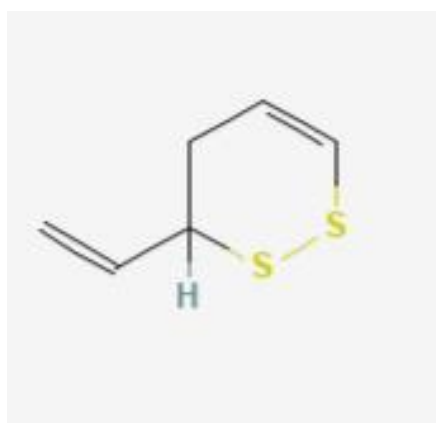
Garlic chemistry *A. sativum* contains hundreds of phytochemicals including sulfur compounds such as ajoene (E-ajoene, Z-ajoene), Thiosulfinate (allicin), Vinylthiine. Alliin, the main cysteine sulfoxide, is converted to allicin by the enzyme allinase after the garlic has been cut and the pulp broken down. .omogenize garlic. Depending on the water content and temperature, PCSO can produce more than fifty metabolites as well as the enzyme alliinase, which can interact with a mixture of MCSO, PCSO and alliin to produce other molecules such as allyl thiosulfinates, methyl methanethiosulphonate and other relevant thiosulfinates (R-S-S-R') R and R' are allyl, propyl and methyl groups.¹⁹

E-ajoene



Z-ajoene

Vinyldithiine


(2-vinyl-(4H)-1,3-dithiine)



3-Vinyl-(4H)-1,2-dithiin

3. Hypertension

Blood pressure is defined as the force of blood pushing against the artery walls as the heart pumps blood. High blood pressure - also known as hypertension - is a condition in which blood flows through blood vessels (arteries) at a higher pressure than normal. Blood pressure is measured in two numbers. The first number, or top number, is the pressure in your blood vessels when your heart beats, called the systolic blood pressure. Systolic blood pressure is higher in the two numbers. The second number, or lower number, measures the force of blood in your arteries while your heart relaxes between beats. The lower number is the lower of the two numbers and is called the diastolic pressure.²⁰

Nearly three-quarters of people with hypertension (639 million people) live in developing countries where health care resources are limited and people have low awareness of hypertension and poor blood pressure control. percent of people with hypertension whose hypertension is under control (Control). In some countries, such as rural Ecuador, the tax rate is as high as 0.3%. 5 In South Africa, the risk of dying from high blood pressure increased by 25% in less than ten years. In India, the incidence of hypertension in the urban population increased 30-fold in 25 years and 10-fold in the rural population in 36 years. Serial studies in Tanzania using the same methods in 1 and 1998 showed an increase in the prevalence of hypertension from 25.4% to 41.1% in males and from 27.2% to 38.7% in females in rural and urban populations.²¹

Between 1990 and 2020, mortality from coronary heart disease is expected to increase by 120% in women and 137% in men in developing countries.¹⁰ Two-thirds of all strokes and half of all coronary artery disease can be attributed to suboptimal blood pressure.²¹

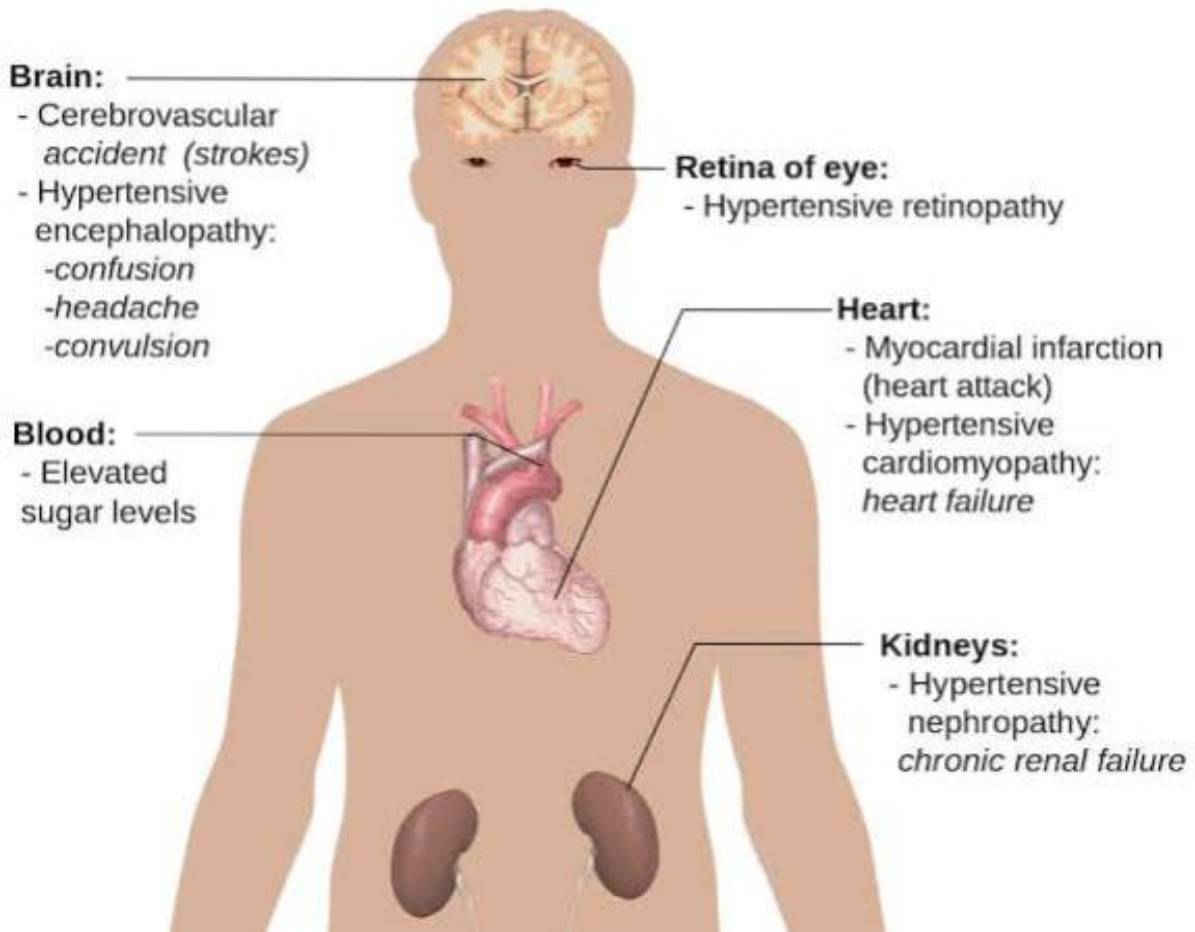


Fig No3: Hypertension

Normal blood pressure. Blood pressure is 120/80 mmHg or less.

Rise in blood pressure. The top number is between 120 and 129 mmHg and the bottom number is under, not over 80 mmHg.

Stage 1 hypertension. The top number is between 130 and 139 mmHg and the bottom number is between 80 and 89 mmHg.

Stage 2 hypertension the top number is 140 mmHg or more and the bottom number is 90 mmHg.²²

Causes Of Hypertension

Age. The threat of excessive blood stress will increase with age. Up to across the age of 64, excessive blood stress takes place extra often in men. Women are much more likely to broaden excessive blood stress after the age of 65

Races. Hypertension is in particular not unusualplace in black humans. It develops at a more youthful age in blacks than in whites.

Own circle of relative's history. You're much more likely to broaden excessive blood stress when you have a discern or sibling with the condition. No movement.

Lack of workout can result in weight benefit. Weight benefit will increase the threat of excessive blood stress. Inactive humans additionally have better coronary heart rates.²³

Smoking or vaping. Smoking, chewing tobacco or vaping will increase blood stress straight away for a brief time. Smoking damages the partitions of the blood vessels and quickens the hardening method of the arteries. If you smoke, ask your caregiver approximately techniques that will help you quit.

Too a great deal salt. A huge quantity of salt - additionally referred to as sodium - withinside the frame can result in fluid retention withinside the frame. This will increase blood stress..

Low potassium content. Potassium enables stability the quantity of salt withinside the frame's cells. Balanced potassium stability is vital for true coronary heart fitness. Low potassium degrees may be because of a loss of potassium for your eating regimen or via way of means of positive fitness conditions, such as dehydration.

Drinking an excessive amount of alcohol. Alcohol intake has been related to excessive blood stress, in particular in men.

Strain. Severe strain can motive a transient boom in blood stress. Stress-associated habits, consisting of overeating, smoking, or consuming alcohol, can motive blood stress to upward thrust further.

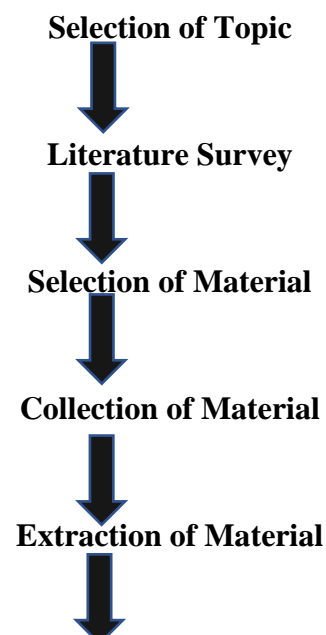
Certain persistent sicknesses. Kidney disease, diabetes and sleep apnea are only some of the sicknesses which could result in excessive blood stress.

Being pregnant. Sometimes being pregnant reasons excessive blood stress. Hypertension risk factors ²⁴⁻²⁵

Symptoms

- intense headaches
- chest ache
- dizziness
- Issue breathing
- Nausea
- vomiting
- blurred imaginative and prescient or different imaginative and prescient changes
- Anxiety
- Confusion
- humming with inside the ears
- Nosebleeds
- Unusual coronary heart rhythm ²⁶

Plan of work:



Preparation of Allium sativum powder



Evaluation test of garli capsul



Result



Conclusion and Reference

Literature search

A comprehensive search was conducted using electronic databases such as Medline, Scopus, Google Scholar and the Web of Science, world health organisation research paper.

4. Materials and methods

Raw materials: The freshly picked garlic was used under this experiment. garlic was obtained from Pratibhatai Pawar College of Pharmacy, Wadala Mahadev, Shirampur- 413739. Immature bulbs, diseased and damaged bulbs were identified and dropped then fresh garlic products were chosen for the experiment. For different treatments of fresh garlic bulbs, a sample of 100 g. Each was weighed. Dry garlic cloves were grinded in a domestic grinder to make the powder. All the chemicals and reagents used in this study were of analytical grade.

Ingredients	Activities
Garlic powder	Herbal Drug
lactose	Binder, Diluent
Starch powder	Disintegrate
Talc	Glidants
Magnesium stearate	Lubricant

Table No3: Ingredient activity

Ingredients activity:

Ingredients	Quality/mg capsule	Quality/(30) mg capsule
Garlic powder	395 mg	11.85 gm
lactose	17.5 mg	0.52 gm
Starch powder	75 mg	2.25 gm
Talc	10 mg	0.3 gm
Magnesium stearate	2.5 mg	0.075 gm

Ingredients used in capsule:

Table No4: Ingredients used in capsule

5. Formulation Garlic Capsules

Granulated Garlic prepared by wet granulation. The garlic powder was mixed with the lactose to obtain a cohesive mass. No binder is added from the outside as the garlic that is present acts as a binder. All ingredients were mixed. Then the required amount of starch powder was prepared and a 15% starch solution was slowly added, after which the powder mixture was passed through the sieve #12 to form the granules. The pellets were gently spread and dried below 60°C. The dry pellets were weighed and their mass recorded. Additional dry pellets were regranulated by passing through sieve # 16 . The prepared pellets were packed into hard gelatin capsules (size 0) with a manually operated capsule filling machine, each capsule containing 500 mg of capsule.

6. Evaluation test for garlic capsule:

Uniformity of weight

Each capsule was weighed on an analytical balance, the contents carefully emptied, the shells reweighed and the weight of the contents determined. The total weight of the content, the average weight of the content per capsule, and the deviation (%) of the individual weights of the content from the average were calculated.

Dissolution Test:

The dissolution test is conducted using an official dissolution device that is both USP and IP. The capsule is placed in the basket, which is immersed in the dissolution medium and rotated at a specific speed. The dissolution medium is stored in a covered 1000 mL glass container and maintained at 37°C ± 0°C.5°C with a suitable water bath at constant temperature. The speed of mixing and the nature of the dissolution medium are indicated in the individual monographs.

Disintegration time

The disintegration times of the capsules were determined using a disintegrator. Six capsules were placed in six plate test tubes and the apparatus was run with water as the mold release agent maintained at 37 ± 2°C. The capsules were observed and the times required for all capsules to completely disintegrate were determined

Weight variation:

Weigh 20 capsules at a time and determine the average weight. The individual weight should be within limit of 90 and 110% of their average weight. If all capsules are out of range, weigh the capsules and re-weigh 20 capsules at a time. Remove the net contents of each capsule with a brush. Weigh the empty shell individually. Net weight of contents individually = weight of shell - gross weight. Determine the average net content from the sum of the individual net weights. Then determine the differences between each individual net content and the average net content

Content Uniformity:

10 capsules were removed and tested. 9 out of 10 capsules should be in the 15% (85-115%) range. The 10th capsule is outside the range of ± 15%, 20 capsules are tested. All capsules ± 25% (75 - 125%).

Tap density

The measuring cylinder was then tapped 50 times wooden table from a height of about 2 cm on a wooden table and the tapped volume was recorded. The tapped density Td was calculated as follows:

$$\begin{aligned} Td &= WP / TV \\ &= 0.45 / 7 \end{aligned}$$

= 0.064 g/ml

where

TV = tapped volume occupied by the garlic powder

S. No.	Parameters	Average value ± SD
1.	Bulb weight of sample	24 g ±3.41
2.	Number of bulbs/kg	53± 5.21
3.	Number of cloves per bulb	17±4.33
4.	Weight of cloves before peeling	1.68 g ± 2.01
5.	Weight of cloves after peeling	1.28 g ±2.13
6.	Moisture content, wb	67.60%±1.9
7.	Ascorbic acid	11.51 mg/100 g ±2.11
8.	Acidity	2.57% ± 0.99
9.	cutting strength	7.25 N ± 3.61
10.	Total number of fungal (cfu/g)	Nil

7. Results

For an preparation of garlic capsule for the hypertension we performed several tests like uniformity of weight , dissolution test, disintegration test, weight variation etc to check whether the product is performed in well manner and with total safety for human beings. All the tests are performed sucessfully

Physical and Quality parameters of fresh garlic

Markets product:





8. CONCLUSION

From the study, it was concluded that a stable, sustained release, Garlic capsule formulation was successfully prepared. This formulation can overcome problems of taste and odour masking, gastric irritation and loss of active constituents present in garlic. A twice-a-day dosing of the garlic capsule can be a viable substitute to the standard triple therapy for the treatment of hypertension. In general, garlic

supplements have some value as a supplemental agent in reducing certain risk factors associated with cardiovascular disease.

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