

## Chemical And Shelflife Analysis Of Dry Garlic Powder: A Golden Herb

M.Bi Bi Mariam and Dr, Usha Devi C.

*V.H.D. Central Institute of Home Science, Bangalore.*

*Correspondence to: M.Bi Bi Mariam 1/84, 8th Main road, 4th A cross BTM Layout  
1st stage, Bangalore-560029, India. Email: bibimariamdiet@yahoo.com*

### **Objectives:**

Garlic is commonly used as flavoring, culinary and herbal remedies. Garlic contains a higher concentration of sulfur compounds than any other *Allium* species. Garlic is known for anti-thrombosis, anti-microbial and cholesterol lowering activities. In the present research garlic as a raw material was explored to its chemical composition, heavy metal content, Antioxidant content as well as microbiological analysis.

### **Methods:**

The current study was conducted in the VHD Central institute of Home science Bangalore. Standard procedures were used for processing garlic cloves to obtain dry garlic powder which was subjected to chemical analysis. Indian standard method was used to obtain proximate principle, LC-28 for antioxidants, ICP-OES method for heavy metal analysis, APHA/FDA-BAM-2001 to estimate microbial flora, HPCL for sulfur compounds. Shelf life analysis was done for a short period to measure stability, chemical, physical, microbiological changes.

### **The results:**

The current study proved that it contains  $3.91 \pm 0.03\%$  moisture,  $19.75 \pm 0.12\text{g}$  protein,  $0.49 \pm 0.02\text{g}$  Fat,  $1.73 \pm 0.01\text{g}/100\text{g}$  crude fiber,  $0.49 \pm 0.01\%$  Volatile oil,  $66.36 \pm 0.11\text{g}$  of Carbohydrate,  $348.85 \pm 2.11$  K. Calais,  $3.39 \pm 0.02\text{g}$  total ash and  $0.09 \pm 0.00\text{g}$  acid insoluble ash, whilst, the antioxidant analysis revealed its high content of Vitamin C,  $41.79 \pm 0.21\text{mg}/100\text{g}$ , Selenium  $12.1 \pm 0.02$  mg/100g and zinc  $0.9 \pm 0.0$  mg/100g. however, Heavy metals like Lead, Mercury, Arsenic, Cadmium, Selenium, and Pesticide residue DDT were less than 0.1ppm,  $7.23 \pm 0.01$  mg/g of Alliin and  $2.21 \pm 0.01$  mg/g of  $\gamma$ -Glutamyl-(S)-allyl-L-cysteine estimated by HPCL method. Whereas Microbiological test showed, total bacterial count/g was 6900. *Staphylococcus*

aureas, Total coliform count and total yeast and mold count/g were less than 10 CFU. E. Coli, Salmonella and Shigella/g were absent.

**Conclusion:**

The current study showed that dry garlic powder contains good amount of vitamin C which is a powerful antioxidant, good amount of sulfur compound which has cholesterol lowering activities. No chemical, physical and microbiological changes were seen during the study period.

**Keywords:** Garlic, Chemical composition, Moisture, Protein.

**Introduction**

Garlic (*Allium sativum*) belongs to the family alliance is one of the 600 known species, including onion, shallots and leek (1). It is broadly classified into two varieties hard necks (*ophioscordon*) and soft neck (*sativum*) (2). It has also been used in medical science and culinary purposes since ancient times. The oldest-known cultivated plants as an integral component of human diet. Egyptian fed garlic to pyramid crews to boost their immunity thereby rendering safe from various maladies and improve their performance (3). Garlic (*Allium sativum* L.) Has been used for culinary and medicinal purposes by many cultures for centuries (4). Garlic is a particularly rich source of organosulfur compounds, which are thought to be responsible for its flavor and aroma, as well as its potential health benefits (5). Many favorable experimental and clinical effects of the consumption of garlic preparations, including garlic extract, garlic oil, dehydrated garlic powder have been reported. These biological responses include reduction of risk factors for cardiovascular diseases and cancer, a stimulation of immune function, enhanced foreign compound detoxification, radioprotection, restoration of physical strength, resistance to various stresses and potential anti aging effects. In the present research garlic as a raw material was explored to its chemical composition, heavy metal content, Antioxidant content as well as microbiological analysis.

**MATERIAL AND METHODS**

The current study was conducted in the VHD Central institute of Home science Bangalore. All chemical and biological tests were carried out in the Bangalore Test House, Bangalore.

**Sample preparation**

Garlic cloves were separated and peeled. Afterwards, garlic was dried at  $40 \pm 5^{\circ}\text{C}$  for 16 hrs till weight constant and ground to a fine powder using grinder, Alliin and enzyme alliinase are quite heat stable, but allicin is not, which is converted to several other sulfur compounds, such as diallyl sulfide, diallyl disulfide, etc. Alliin and alliinase are also stable when dry (6). Water-soluble vitamins are sensitive to heat,

alkali, and light (7). The resultant garlic powder was analyzed for their chemical and biological aspects.

### Chemical analysis

Garlic sample was evaluated for moisture, protein, fat, crude fiber, volatile oil content on dry basis, total ash, acid insoluble ash, and pH value according to their respective methods as mentioned in IS:1797-1985. Carbohydrate, by difference method and Energy according to NIN. All the tests were carried out in triplicates. Garlic sample was evaluated for antioxidants and heavy metal content by using LC-28 and ICP-OES method respectively. Microbiological test was carried out using the Indian standard method and APHA/FDA-BAM-2001. Alliin and  $\gamma$ -Glutamyl-(S)-allyl-L-cysteine was estimated by HPCL method.

### Shelf life analysis:

Garlic sample was stored at  $30 \pm 2^\circ \text{C}$ ,  $65 \pm 5\%$  relative humidity chamber in an air tight container for 2 weeks duration. The sample was evaluated periodically for chemical, physical and microbiological change. 7 points Hedonic scale was used for sensory evaluation by 12 panelists.

**Table no-1 Chemical composition of Garlic**

SL. NO.	PARAMETERS	RESULTS	TEST METHOD
1	Moisture, g/100g	$3.91 \pm 0.03$	IS: 1797-1985
2	Protein, g/100g	$19.75 \pm 0.12$	IS: 7219-1973
3	Fat, g/100g	$0.49 \pm 0.02$	IS: 1797-1985
4	Crude fibre, g/100g	$1.73 \pm 0.01$	IS: 1797-1985
5	Volatile oil content on dry basis,% By mass	$0.49 \pm 0.01$	IS: 1797-1985
6	Carbohydrate g/100g	$66.36 \pm 0.11$	Difference method
7	Energy, K Cals/100g	$348.85 \pm 2.12$	NIN
8	Total ash, g/100g	$3.39 \pm 0.02$	IS: 1797-1985
9	Acid insoluble ash, g/100g	$0.09 \pm 0.00$	IS: 1797-1985
10	pH value	$5.49 \pm 0.00$	IS: 1797-1985
	<b>Antioxidants</b>		
11	Vitamin C	$41.79 \pm 0.21 \text{ mg/100g}$	LC-28
12	Selenium	$12.1 \pm 0.02 \text{ mcg /100g}$	LC-28
13	Zinc	$0.9 \pm 0.00 \text{ mg /100g}$	LC-28
	<b>Sulfur compounds</b>		
14	Alliin mg/g	$7.23 \pm 0.01$	USP RS 621
15	$\gamma$ glutamyl-(S)-allyl-L-cysteine mg/g	$0.221 \pm 0.03$	USP RS 621

**Table no-2 Heavy metal analysis of garlic sample**

SL. NO.	PARAMETERS	RESULTS	TEST METHOD
	Heavy Metals:		
1	Lead as Pb	Less than $0.1 \pm 0.0$ ppm	ICP-OES
2	Mercury as Hg	Less than $0.1 \pm 0.0$ ppm	ICP-OES
3	Arsenic as As	Less than $0.1 \pm 0.0$ ppm	ICP-OES
4	Cadmium as Cd	Less than $0.1 \pm 0.0$ ppm	ICP-OES
5	Selenium as Se	Less than $0.1 \pm 0.0$ ppm	ICP-OES
6	Pesticide residue DDT	Less than $0.1 \pm 0.0$ ppm	ICP-OES

**Table no-3 Microbiological analysis of Garlic sample**

SL.NO.	PARAMETERS	RESULTS	TEST METHOD
	Microbiological Test:		
1	Total Coliform Count/g	Less than $10 \pm 0.0$ CFU	IS : 5401(Part 1) 2002
2	Total Yeast & Mould Count/g	Less than $10 \pm 0.0$ CFU	IS : 5403-1999
3	E.Coli /g	Absent	APHA/FDA-BAM-2001
4	Salmonella,/g	Absent	IS:5887(Part3)1999
5	Shigella /g	Absent	APHA/FDA-BAM-2001
6	Staphylococcus aureas/g	Less than $10 \pm 0.0$ CFU	APHA/FDA-BAM-2001
7	Total Bacterial Count/g	$6900 \pm 50$ CFU	IS:5402-2002

**Table-4 Sensory evaluation of Dry Garlic powder over different days**

Day	Mean Response				
	Colour	Odour	Taste	Appearance	Texture
1 <sup>st</sup>	6.00	6.00	5.00	6.00	6.00
3 <sup>rd</sup>	6.00	6.00	5.00	6.00	6.00
5 <sup>th</sup>	6.00	6.00	5.00	6.00	6.00
7 <sup>th</sup>	6.00	5.00	5.00	6.00	5.00
9 <sup>th</sup>	6.00	5.00	5.08	5.00	5.00
11 <sup>th</sup>	5.00	5.08	4.317	5.00	5.08
13 <sup>th</sup>	5.00	5.00	4.17	4.17	4.17
15 <sup>th</sup>	5.25	4.83	4.00	5.00	4.17
F-Test	5.27*	6.12*	5.85*	12.46*	14.80*
SEm±	0.209	0.214	0.195	0.199	0.200
CD at 5% level	0.579	0.593	0.541	0.552	0.554

\*Significant at 5% Level, Panel of judges=12

## RESULTS AND DISCUSSION

### Proximate and mineral analysis:

Chemical composition of garlic was analyzed along with other parameters and the findings are presented in Table 1. Results showed that garlic contained moisture

contents  $3.91 \pm 0.03$ , protein  $19.75 \pm 0.12$ , fat  $0.49 \pm 0.02$ , fiber  $1.73 \pm 0.01$ , Total ash  $3.39 \pm 0.02$ , Acid insoluble ash, g/100g  $0.09$  g/100g, Volatile oil content on dry basis, the % By mass  $0.49 \pm 0.01$ , Energy, K Cals/100g  $348.85 \pm 2.12$ , Carbohydrate g/100g  $66.36 \pm 0.11$ , pH value 5.49. Garlic has good amounts of antioxidants, Vitamin C  $41.79 \pm 0.21$  mg/100g which is a very powerful antioxidant, Selenium  $12.1 \pm 0.02$ mg /100g, and zinc  $0.9 \pm 0.00$ mg /100g. Major sulfur compounds present in garlic, Allen  $7.23 \pm 0.01$ mg/g and  $\gamma$  glutamyl-(S)-allyl-L-cysteine  $0.221 \pm 0.03$  mg/g

The results are comparable with the earlier findings of Otunola *et al.* (2010). They showed that moisture, crude protein, crude fat, total carbohydrates, fiber and ash contents in garlic sample were  $4.55 \pm 0.1$ ,  $15.33 \pm 0.0$ ,  $0.72 \pm 0.0$ ,  $73.22 \pm 0.0$ ,  $2.10 \pm 0.0$ ,  $4.08 \pm 0.10\%$  respectively on dry basis. Previous findings by Nwinuka *et al.* (2005) revealed that garlic contains moisture, crude protein, crude fat, total carbohydrates and ash contents *i.e.*  $4.88 \pm 0.13$ ,  $17.35 \pm 0.00$ ,  $0.68 \pm 0.0$ ,  $73.03 \pm 0.06$  and  $4.06 \pm 0.10\%$  correspondingly on dry weight basis. They also mentioned that 100 g of garlic sample provides about 367.64 Kcal. The results of proximate analysis of garlic powder are comparable to the research conducted Research 900 Laboratory mentioned in Encyclopedia of Chemical Technology (1980) they recorded moisture 5.4%, protein 17.5%, lipid 0.6% and total carbohydrate 73.3%. Another group of researchers Odeunmi *et al.* (2009) evaluated the chemical composition of garlic and concluded that it contains moisture  $66.57 \pm 1.58\%$ , protein  $7.87 \pm 0.76\%$ , fat  $0.52 \pm 0.09\%$ , crude fiber  $0.73 \pm 0.19\%$ , ash contents  $1.33 \pm 0.04\%$  and dry matter  $33.43 \pm 1.58\%$ .

Heavy metal analysis of garlic sample shows the presence of Lead (Pb), Mercury (Hg), Arsenic (As), Cadmium (Cd), Selenium (Se), Pesticide residue (DDT) Less than  $0.1 \pm 0.0$ ppm presented in table-3 and microbiological analysis of garlic sample indicates in table-4, Total Coliform Count/g, Total Yeast & Mould Count/g, Staphylococcus aureus/g were Less than  $10 \pm 0.0$ CFU , Total Bacterial Count/g  $6900 \pm 50$ CFU and E.Coli /g, Salmonella./g , Shigella/g were absent.

The results of the present study are compatible with Indian standards for dehydrated garlic specified by the Bureau of Indian Standards (12) and specification for dry garlic powder given by USP (U. S. Pharmacopeia) (13).

### Summery and conclusion:

The current study showed that dry garlic powder contains good amount of vitamin C which is a powerful antioxidant, good amount of sulfur compound which has cholesterol lowering activities. No chemical, physical and microbiological changes were seen during the study period.

### References:

1. Rehman, K. 2003. Garlic and aging: new insight into an old remedy. Age. Res. Rev. 2:39-56.
2. Borek, C. 2001. Antioxidant health effects of aged garlic extract. J. Nutr. 131(3):1010-1015.

3. Rivlin, R. 2001. Historical perspective on the use of garlic. J. Nutr. 131:951-9954
4. Lawson LD. Garlic: a review of its medicinal effects and indicated active compounds. In: Lawson LD, Bauer R, eds. Phytomedicines of Europe: Chemistry and Biological Activity. Washington, D. C.: American Chemical Society; 1998:177-209
5. Block E. The chemistry of garlic and onions. Sci Am. 1985;252(3):114-119. (PubMed)
6. Cantwell M., Perishables Handling Quarterly Issue No.102 (2000), p.5-6.
7. Mayers R.A., Encyclopedia of Analytical Chemistry, Vitamins: Fat-and Water-Soluble: Analysis, by: Bates C.J., John Wiley & Sons Ltd, Chichester.
8. Otunola, G.A., O.B. Oloyede, T. Adenike, T. Oladiji and A.J. Afolayan. 2010. Comparative analysis of the chemical composition of three spices *Allium sativum*, *Zingiber officinale* Rosc. And *Capsicum frutescens* L. commonly consumed in Nigeria. Afr. J. Biotechnol. 9(41):6927-6931.
9. Nwinuka, N.M., G.O. Ibeh and G.I. Ekeke. 2005. Proximate composition and levels of some toxicants in four commonly consumed spices. J. Appl. Sci. Environ. 9(1):150-155.
10. Odebunmi, E.O., O.O. Oluwaniyi and M.O. Bashiru. 2009. Comparative proximate analysis of some food condiments. J. App. Sci. Res. 2(1):1-3.
11. Otunola, G.A., O.B. Oloyede, T. Adenike, T. Oladiji and A.J. Afolayan. 2010. Comparative analysis of the chemical composition of three spices *Allium sativum*, *Zingiber officinale* Rosc. And *Capsicum frutescens* L. commonly consumed in Nigeria. Afr. J. Biotechnol. 9(41):6927-6931.
12. Indian standards for dehydrated garlic powder-BIS <https://law.resource.org/pub/in/bis/S06/is.5452.2008.html>
13. USP for dry garlic powder. [http://www.pharmacopeia.cn/v29240/usp29nf24s0\\_m34687.html](http://www.pharmacopeia.cn/v29240/usp29nf24s0_m34687.html)