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Phytochemical profiles and antimicrobial activities of garlic bulb extracts: Traditional medicinal plant in Maiduguri, Borno State

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Abstract

The aim of present study was to assess phytochemical profile and antibacterial activities of some selected bacterial species. All the bacteria species tested showed higher inhibition zone varying from 20mm-27mm with 100mg/ml of ethyl acetate, methanol, Hexane and chloroform respectively. Moreover, the phytochemical profile revealed the presence of steroids, alkaloids, flavonoids and tannin in the extracts. Thus, result of this study showed that Garlic bulb extract could be a good candidate for production of synthetic antibacterial drug for the treatment of infections caused by the organisms used in this study.

Keywords: Garlic bulb; Profile; Phytochemical; Antimicrobial activities; Traditional; Medicinal plant; Extract; Maiduguri

1. Introduction

According to Borek [1] Garlic (*Allium sativum*) belongs to the Allium family Liliaceae. Recent literatures revealed that Garlic bulbs extract is a potential immune booster, reduces blood cholesterol level and inhibition of cholesterol synthesis (Piscitelli et al. [2]. Rakashit and Ramalingam, [3] reported that Garlic extracts has been used as a source of antibacterial and antiviral for the treatment of illness in developing countries like Nigeria since time immemorial. In recent years Garlic bioactive compounds are known for pharmacological activities against many microbial species. Garlic plant extracts has been rank as highest antimicrobial bioactive compound in Africa traditional medicinal plants against bacterial agents (Sofowora. [4], Awosika, [5]. The presence of secondary metabolites such as Tannins, terpenoids, alkaloids, flavonoids, saponins and steroids make it a good candidate as antioxidant, antiviral and antibacterial respectively (Cowan, [6], Chinedu, [7], Arify et al; [8]). In the present study, we evaluated phytochemical properties and antibacterial potential of garlic against some selected bacterial species in Maiduguri as a source of bioactive compound for future chemotherapeutics drugs development.

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2. Material and methods

2.1. Sampling of Garlic bulbs and Processing

The Garlic bulbs for the study were purchased at Gamboru Market in Maiduguri metropolitan council. The garlic bulbs were washed thoroughly and subsequently grounded into powdered using homogenizer. The sample obtained after homogenization were subjected to phytochemical analysis using Soxhlet extraction method.

2.2. Phytochemical Screening

The preliminary screening of secondary metabolites such as alkaloids, saponins, terpenoids, tannins and steroids were carried out as described by Harsha et al. [9].

2.3. Test for Saponin

The test for Saponin was conducted using Froth test method as below: About 5ml of Garlic bulb extracts was boiled in approximately 20 ml of distilled water in a water bath and filtered as described by Benisheikh et al. [10].

2.4. Detection of Alkaloids

Alkaline reagent test was adapted as described by Benisheikh et al, 2020 [11]. Few drops of Sodium hydroxide solution were added to the Garlic bulb extracts which consequently leads to the formation of intense yellow colour when dilute Hcl acid is added which indicates the presence of alkaloids.

2.5. Detection of Tannins

Tannins detection was conducted using lead acetate test: The garlic extracts were dissolved and mixed vigorously with distilled water and subsequently 10% lead acetate solution were added to detect the presence of Yellow precipitate testifying the presence of tannins (Lyengar MA. [12].

2.6. Detection of Terpenoids

2 ml of Garlic extracts was added to 2 ml of acetic anhydride and concentrate H_2SO_4, the formation of blue green rings indicated the presence of terpenoids as described by Shruti Singh, [13].

2.7. Antimicrobial Analysis

The antimicrobial activities test of the garlic bulb extracts was determined using Kirby-Baver agar method against selected bacterial species. The microorganisms were cultured on Muller Hinton agar plates and incubated at 37^{o}C for 24 hours and the zone of inhibition was measured and recorded.

3. Results and discussion

The phytochemical screening of the Garlic bulb extracts for different phytochemical components such as saponins, flavonoids, alkaloids, steroids and terpenoids were carried out and the results obtained correlate with the work of Arify et al; [14] and Chinedu [15]. The results of this study also revealed the presence of steroids, flavonoids, tannins and alkaloids as shown in Table 1 as demonstrated by other researchers with relevant literatures. Whereas the Garlic bulb extracts analysed indicated the present of Alkaloids in higher concentration in aqueous extracts, Flavonoids present in medium concentration. Likewise Tannins is present in low concentration and totally absent in Terpenoids and steroids respectively as shown in Table 2 and this study results is in line with the findings of Shruti Singh [16]. Garlic plants are known to produce certain bioactive molecules which inhibit bacterial infections as shown in Table 3. Furthermore, antibacterial activity of Ethyl acetate, methanol, hexane and chloroform garlic bulb extract in this study indicated that most of the bacteria tested at 100mg/ml are susceptible with high zone of inhibition. In Ethyl acetate (100mg/ml) tested for Pseudomonas aeruginosa indicated inhibition of 21 mm, 22 mm in methanol (100mg/ml), 21 mm in hexane (100mg/ml), and 20mm in chloroform (100mg/ml) respectively. Similarly, Escherichia coli (100mg/ml) showed 20mm in Ethyl acetate, 23mm in Methanol (100mg/ml), 20mm in hexane (100mg/ml). Likewise Staphylococcus aureus showed 20mm inhibition zone in Ethyl acetate, 23 mm in Methanol, 24 mm in hexane and 21 mm in chloroform. Besides, Streptococcus pneumonia which showed 23 mm inhibition zone in Ethyl acetate (100mg/ml), 21mm in methanol (100mg/ml) , 21 mm in hexane (100mg/ml) and 20mm in chloroform (100mg/ml) respectively. This study is in line with the findings of.

Table 1 Phytochemical screening of Garlic bulb extracts and relevant literatures

S/N	Phytochemical compounds used	Analysis Undertaken	References
01	Saponins	Frost Test	
02	Alkaloids	Mayer's Test	
03	Steroids	Salkowski Test	
04	Tannins	Fecl3 Test	Benisheikh et al, 2020
05	Terpenoids	Salkowski Test	Shruti Singh, 2018

Table 2 Phytochemical analysis of aqueous extract of Garlic bulb (*Allium sativum*)

S/N	Phytochemical constituents	Aqueous Extracts
01	Alkaloids	+++
02	Flavonoids	++
03	Tannins	+
04	Terpenoids	-
05	Steroids	-

-: Absent, +: present in low concentration, ++: present in medium concentration, +++: present in high concentration

Table 3 Data obtained by measuring Inhibition zone diameter (IZD) (mm) of Garlic bulbs extracts against test organisms

S/N	Bacterial species tested	Inhibition Zone Diameter (IZD)(mm)			
		Ethyl acetate (100mg/ml)	Methanol (100mg/ml)	Hexane (100mg/ml)	Chloroform (100mg/ml)
01	Escherichia coli	16	16	18	19
02	Pseudomonas aeruginosa	15	17	16	18
03	Staphylococcus aureus	16	14	14	18
04	Streptococcus pneumoniae	18	18	18	20

Key: 20mm-27mm (Higher zone of inhibition), 14mm-17mm (Moderate zone of inhibition), 10mm-12mm (Weak zone of inhibition)

4. Conclusion

The presence of phytochemicals components such as flavonoids, alkaloids, steroids, terpenoids and tannins making them potential candidates for the treatment of bacterial infections. Besides, Garlic bulb could be recommended to be added in the diet as spice that served as a source of primary medicinal plant for bacterial infections treatment.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have no conflict of interest.

References

[1] Borex C. Antioxidant health effects of aged garlic extracts. Journal of Nutritional science. 2001; 131: 1010-1015.

[2] Piscitelli SC, Burstein AH, Welden N, Gallicane KD, Fallon J. The effect of Garlic supplements on the pharmacokinetics of sequinavirs. Clinical infectious Diseases. 2002; 35(3): 343.

[3] Rakshit M, Ramalingam C. Health benefits of spices with special reference to antimicrobial activity and bioactive components. Journal of experimental Science. 2010; 1 (7): 12-18.

[4] Sofowora A. Medicinal plants and medicine in Africa. Spectrum Books, Ibadan, Nigeria. 1993; 120-123.

[5] Awosika F. Traditional medicine as the solution to Nigeria Health problems, clinical pharmacology and Herbal Medicine. 1993; 9(3): 26-31.

[6] Cowan M. Plant products as antimicrobial agents. clinical microbiology reviews. 2000; 12(4): 564-582.

[7] Chinedu felix Akubuenyi. Comparative assessment of the antibacterial profile of onion (Allium cepa) and Garlic (*Allium sativum*) against Pseudomonas aeruginosa, Staphalococcus aureus and Candida albicans. International journal of Biotechnology and food science. December 2019; 7(5): 65-71.

[8] Arify T, Ezhilvalavan S, Varun A, Sundaresan A, Manimaran K. Qualitative phytochemical analysis of garlic (*Allium sativum*) and Nilavembu (Andrographis paniculata). Int. J. Chem. Stud. 2018; 6(3): 1635-161638.

[9] N Harsha, V Sridevi, MVV Chandana Lakshmi, K Rani, N Divyasatya Vani. Phytochemical analysis of some selected spices, IJIRSET. 2013; 2.

[10] Gana Benisheikh ali, Tom Isyaka Mohammad, Jibrin mallam Wali, Mshelia Madu Adamu, Kime mahammad Mahmud, Adam Fatima Barma, Bizi Amina Gargado. Phytochemical characterization and antimicrobial studies on four folklore medicinal plant in semi-arid region of Borno state, Nigeria. World journal of Advanced research and reviews. 2020; 07(01): 001-006.

[11] Gana Benisheikh ali, Tom Isyaka Mohammad, Jibrin mallam Wali, Mshelia Madu Adamu, Kime mahammad Mahmud, Adam Fatima Barma and Bizi Amina Gargado. Phytochemical characterization and antimicrobial studies on four folklore medicinal plant in semi-arid region of Borno state, Nigeria. World journal of Advanced research and reviews, 2020, vol. 07(01). 001-006

[12] Lyengar MA. Study of crude Drugs. 8 thed, Mnipal power press, manipal, india. 1995; 2.

[13] Shruti Singh, Studies on antimicrobial and phytochemical properties of *Allium sativum* Extracts. Int. Jour. Of innovative research in science, engineering and technology. 2018; 7(5).

[14] Arify T, Ezhilvalavan S, Varun A, Sundaresan A, Manimaran K. Qualitative phytochemical analysis of garlic (*Allium sativum*) and Nilavembu (Andrographis paniculata). Int. J. Chem. Stud. 2018; 6(3): 1635-161638.

[15] Chinedu felix Akubuenyi. Comparative assessment of the antibacterial profile of onion (Allium cepa) and Garlic (*Allium sativum*) against Pseudomonas aeruginosa, Staphalococcus aureus and Candida albicans. International journal of Biotechnology and food science. 2019; 7(5): 65-71.

[16] Shruti Singh. Studies on antimicrobial and phytochemical properties of *Allium sativum* Extracts. Int. Jour. Of innovative research in science, engineering and technology. 2018; 7(5).