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Antibacterial Activities of Aqueous and Ethanolic Extract of Allium cepa (Onion Bulb) Against Some Selected Pathogenic Microorganisms

Oyebode, J. A. and Fajilade, T. O

Department of Science Technology, Microbiology unit, Federal Polytechnic, P.M.B. 5351, Ado-Ekiti, Ekiti State, Nigeria

Abstract- Antibacterial activities of aqueous and ethanolic extracts of *Allium cepa* (onion bulb) were investigated against *Escherichia coli*, *Salmonella* spp., *Streptococcus pneumoniae*, *Shigella* spp., and *Staphylococcus aureus* with the minimum inhibitory concentration (MIC) of 0.2 g/ml by agar dilution technique. The antibacterial potency of the extract as evaluated by broth dilution technique, showed diameter of inhibition zone of 17.08 mm, 0.00 mm, 19.00, 19.00 and 15.0 mm for *E. coli*, *Salmonella* spp., *S. pneumoniae*, *Shigella* spp., and *Staph. aureus* respectively at a concentration of 0.2 mg/ml for aqueous extract and diameter of inhibition zone of 23.0 mm, 20.00 mm, 20.00 mm, 21.00 mm and 21.00 mm for *E. coli*, *Salmonella* spp., *S. pneumoniae*, *Shigella* spp., and *Staph. aureus* respectively at a concentration of 0.2 mg/ml for ethanolic extract. The result obtained using the ethanol and hot water extract of the plant showed that the local use of medical plant are based on the efficacy of their active principle which can be discovered scientifically; orthodox medical practices can therefore be complemented with traditional practices.

Index Terms- Allium cepa, Aqueous, Ethanolic, Microorganisms

I. INTRODUCTION

It is believed that the history of herbal medicine began with the earliest man (Sofowora, 1993). The first written herbal record was in 2800BC and herbal medicine is practiced today in countries around the world. Some of the advantages of herbs over the formulated drugs are that they typically have fewer side effects and may be less safe to use over time. They are inexpensive compared to formulated drugs and they are readily available (Grubben and Denton, 2004).

Allium cepa (Onion) which belongs to the family Alliaceae, is also known as garden onion or bulb onion; it is called Albasa and Alubosa in the indigenous language of Hausa and Yoruba respectively in Nigeria. It is one of the oldest cultivated vegetables in history. It is thought that bulbs from the onion family have been utilized as food source for millennia (Zohary and Hopf, 2000). Above ground, the onion shows only a single vertical shoot, the bulb grows underground and is used for energy storage, leading to the possibility of confusing it with tuber which it is not. The leaves are blush-green and hallow, the bulbs are large, fleshy and firm. The three main varieties of onion are available red, white and purple skinned (Thompson, 1995). *Allium cepa* are effective against common cold, heart disease, diabetes, osteoporosis, coughs and sore throat. They also act as bacteriostatic; certain chemical compounds believe to be anti-inflammatory, anti-cholesterol, anti-cancer and antioxidant properties such as suercertin are present in onion. They are high in flavonoids which is concentrated on the outer layer of the flesh onions are also high in polyphenols than other allium vegetables (Thompson, 1995).

In a research works also discovered that crude juices of onion and garlic bulbs exert inhibition on the growth of *E. coli*, *Pseudomonas pyocyaneus*, *Salmonella typhi*, *Bacillus subtilis*, *in vitro* (Abdou *et al*., 2001). Also, Nolan *et al*., (2007) confirmed the sensitivity of certain food-borne bacterial pathogens to Allicin, which is the major component of garlic extracts, including onion (Jeffrey and Herbert, 2003). Nolan *et al*., (2007) used chemically synthesized and purified Allicin and discovered the inhibitory property of Allicin on *Salmonella typhimurium*, *Shigella dysentariae*. All these food-borne pathogens were inhibited by Allicin in a dose-dependent manner. Thus, various medicinal properties have been ascribed to natural herbs. Therefore, since it had been confirmed that the extracts from onion have some inhibitory effects on some foodborne pathogens generally have antimicrobial properties (Purseglove, 2005), it is therefore necessary to confirm the scope of the inhibitory properties of aqueous and ethanolic extracts of onion some microorganisms implicated in various infections such as impetigo contagiosa often caused by *Streptococcus pneumoniae* (Bruce, 2001), diarrhea caused by *E. coli*, salmonellosis caused by *Salmonella* spp., shigellosis caused by *Shigella* spp., and furuncles and carbuncles caused by *Staph. aureus.*

II. MATERIALS AND METHODS

A. Collection of sample plant

Fifty bulbs of the plant sample (*A. cepa*) were purchased at Bisi market in Ado-Ekiti, Nigeria. The plant sample was identified at The Department of Science Technology, Federal Polytechnic Ado-Ekiti and a voucher specimen was kept in the laboratory No: Med Plant 2011/098. The method described by Osho *et al.* (2007) for extraction of plants active components was used. Samples were air-dried at room temperature of ($26^oC \pm 1^oC$) and milled using a Thomas Willey Milling Machine. 100grams of the milled samples was soaked with 200ml of distilled water, and another 100grams of the milled sample was soaked in another 200ml of ethanol. The aqueous and ethanolic extracts were filtered and evaporated to dryness at 20^oC using a rotary evaporator.

B. Extraction of bioactive components from the plant materials

Extraction method described by Ajibade and Famurewa (2011) was employed. Fifty grams (50 g) of the powdered plant materials (*A. cepa*) was poured into different beakers and 500 ml of distilled water and ethanol were poured into each beaker respectively and beaker with distilled water was boiled on electric cooker at 100^{o}C. The contents are stirred using a sterile glass rod and allowed to stand for 72 hours at room temperature (25^{o}C ± 1). The contents were filtered through a filter paper (Whatman No. 1) and the filtrate concentrated and evaporated using water-bath at the temperature of +95^{o}C. Extracts are then kept at 20^{o}C prior use.

C. Reactivation of organism

The bacteria were re-suspended in 20 test tubes containing Nutrient broth and these test tubes were incubated at 37^{o}C for 18 – 20 hours.

D. Determination of Minimum Inhibitory Concentration (MIC)

This was carried out using the agar dilution method previously described by Odelola and Okorosobo (1996). A colony from each stock were sub-cultured into 5 ml of nutrient broth and incubated at 37^{o}C for 18 hours. 0.1ml of the overnight broth of each organism were pipette into 9.9 ml of the broth to yield a 10^{1} dilution. The procedure was continued to obtain a final dilution of 10^{3} (Smith *et al*., 2000). A 2cm streak of bacterial strains were made on an oven-dried nutrient agar plates containing increasing concentrations (0.2 – 0.8 mg/ml) of the extracts. The lowest concentration that gave no visible growth after overnight incubation at 37^{o}C was taken as the Minimum Inhibitory Concentration (MIC) of each extract.

E. Determination of the Degree of Antibacterial Potency

The disk diffusion method described by Brady and Katz (1990) was employed. Various concentrations of the extracts were prepared in test tubes (0.8 mg/ml – 0.2 mg/ml). Disks obtained from Whatman No. 1 filter paper was sterilized in an oven at 160^{o}C for 30 minutes and soaked in the extracts for 24 hours. A loopful of the final dilution (10^{3}) of the test bacterial suspension was spread on an oven-dried nutrient agar. The disk of different concentrations of the extracts were placed at equidistance on the agar and incubated at 37^{o}C for 24 hours. Zones of inhibition were measured in millimeters (mm) with a meter rule. Whatman No. 1 filter paper disks were placed at the center of each agar plates as a control.

III. RESULTS

The tables below show the antibacterial activities of the plants extract against the test organisms. The clear zone observed around the punched plate containing plant extract indicated that the extract prevent the growth or survival of the test organism been used.

The susceptibility of different concentrations of the aqueous and ethanolic extracts on test microorganism is shown in Tables 1 and 2 respectively.

Table 1: Antibacterial activity of aqueous extracts of *A. cepa* on selected microorganisms

Test organisms	Diameter of Zones of Inhibition (mm)			
	Concentrations (mg/ml)			
	0.20	**0.40**	**0.60**	**0.80**
E. coli	17.00	21.00	25.00	28.00
Salmonella spp.	0.00	17.00	17.00	17.00
Streptococcus pneumoniae	19.00	21.00	24.00	29.00
Shigella spp.	19.00	26.00	28.00	31.00
Staphylococcus aureus	15.00	22.00	22.00	25.00

Table 2: Antibacterial activity of ethanolic extracts of *A. cepa* on selected microorganisms

Test organisms	Diameter of Zones of Inhibition (mm)			
	Concentrations (mg/ml)			
	0.20	**0.40**	**0.60**	**0.80**
E. coli	23.00	24.00	25.00	25.00
Salmonella spp.	20.00	20.00	20.00	22.00
Streptococcus pneumoniae	20.00	20.00	24.00	25.00
Shigella spp.	21.00	21.00	22.00	22.00
Staphylococcus aureus	21.00	22.00	22.00	25.00

IV. DISCUSSION

From the result of this experiment, it was well illustrated that the extract from the plant were active against the test organism. This showed that punched plate method reviewed the antibacterial activities of the plant extracted. The active principles were exclusively extracted with ethanol and distilled water by using the soaking method.

The plant *Alium cepa* showed active potency against highly pathogenic test organism like *Staph. aureus* the causative agents of boil. The micro-organism was inhibited by the plant with the punched plate bioassay techniques used also it showed active potency against *E. coli* which is known to be causative agent of diarrhea, therefore drug develop from the plant would be effective in curing diseases associated with *E. coli*: *Allium cepa* also showed its potency against *Salmonella* spp. which is known to be causative agent of typhoid fever. It could then be said from the result obtained to be effectives in inhibiting the growth of other microorganism used in this experiment.

Streptococcus pneumoniae was another pathogenic organism that was used as test organism in this study when the organism spread from nasopharynx to distal loci such as lung, paranasal and ear it causes pneumonia. It is usually found in the blood and sputum and causes disease like arthritis, bronchitis etc. with symptom like cough producing greenish or yellow sputum, high fever, chest pain etc. *Allium cepa* is noted to inhibit this organism.

This plant could then be suggested to be good sources of wide spectrum antibiotic which could therefore be used in the control of these micro-organism from the body where they cause diseases. Antibacterial drugs, which might be made from this part of the plants, would be very effective against the organisms.

V. CONCLUSION

The observation reviewed that the extract of the tested part of the plant using punched plate method was active *in vitro* against some pathogens that affect humans which are *Staph. aureus*, *E. coli*, *Shegella* and *Salmonella* spp.

It could therefore be concluded from the result obtained using the ethanol and hot water extract of the plant that the local use of medical plant are based on the efficacy of their active principle which can be discovered scientifically; orthodox medical practices can therefore be complemented with traditional practices.

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AUTHORS

First Author – Oyebode, J. A, HND, PDG, The Federal Polytechnic, Ado-Ekiti, Nigeria, oyebodemirace@yahoo.com
Second Author – Fajilade, T. O, HND, PDG, MSc., The Federal Polytechnic, Ado-Ekiti, Nigeria, ollytame@yahoo.com

Correspondence Author – Oyebode, J. A, oyebodemirace@yahoo.com, +2348064407510