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Antimicrobial Activities of Fresh White Onion and Ginger on Staphylococcus Aureus Organism

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Abstract

Antimicrobial activities of fresh white onion (Alliums cepa) and ginger (Zingiber offinale) extract on Staphylococcus aureus organism was investigated. The samples were obtained from Lafia modern market the Nasarawa State capital. While the test organism was collected from patients having boil at the school clinic. The freshly onion bulbs were blended into powder and that of the ginger. Also their juices were extracted and subjected for the anti-microbial activities against the test organism (Staphylococcus aureus) as well as other organisms as control namely: Pseudomonas auroginosa, Escherichia coli, Salmonella typhi which were isolated from salad. All the bacteria except Staphylococcus aureus were susceptible to the fresh white onion juices and ginger with the diameter of zones of inhibition ranging from 12mm-10mm and 15mm-15mm respectively of white onion and ginger on the test organism. The Minimum Inhibitory Concentration (MIC) and the Minimum Bacterial Concentration (MBC) value of the fresh white onion juices and ginger against the test bacteria were low, ranging from 3.125% v/v-25.0%v/v. This study indicates that the plant extracts of white onion and ginger exhibits antimicrobial properties against Staphylococcus species. It is therefore, necessary as recommended to ascertain the safety usage of white onion and ginger, hence toxicological assessment test on the plants extracts for safety usage and purposes, while pharmaceutical industries can adopt this usage as raw materials for the production of skin sprays and drugs for the public consumption.

Keywords: *Antimicrobial Activity, Ginger; White Onion; Staphylococcus aureus.*

Introduction

Onion may be among the first cultivated crop in the world due to it prolonged storage time and portability. At this point in time, allium family has over 5000 members, each differing in colour and taste, but close in biochemical, phytochemical and neutraceutical contents (Ying and Chang, 1998).

Onion aqueous extract are effective against many yeast species and several G(+) bacteria but ineffective against G(-) bacteria (Ekerenye and Elegalam, 2005). Chen *et al.,* (1985) reported that strong antimicrobial (antibacterial) effect of fresh onion homogenates was due to both methylcysteine sulfoxide and s-n-propyl cysteine sulfoxide from which the corresponding thio-sulfinates are form enzymatically.

Alliums were concurred to possess antimicrobial activities and they contain numerous phenolic compounds beside of sulphurous compounds which arouse great interest (Yin and Chang, 1998). The flavonoid exhibits various antimicrobial activities, earlier researches on the flavonoid content of onion *(Allium cepa)* have indicated that the main flavonoids are quercetin, quercetin-4-glucoside, quercetin-3, 4-diglucoside, quercetin-7, 4-diglucoside and isorhamnetin glucoside (Cruickshank *et al.*, 1975).

The researches show that Allium plant extracts as a natural preservative, could be an alternative to synthetic antimicrobial compounds in various industries. The use of plant parts and extractives helps in designing new drugs as therapeutic agents or controlling food-related microorganisms (Ody, 1997). Onion is commonly used as spice in Turkey especially in ground beef, donor kebab (it is a popular meat product consumed widely in Turkey and in many countries), meat balls and raw meat balls-lig knife (it is a traditional food which is consumed in Turkey, it is prepared by adding boiled and powdered wheat, onion, garlic, tomato sauce, parsley and different speices into ground meat); it may also be used to reduce pathogenic microorganism whether they could be contaminated during unhygienic productions. Ginger (Zingiberaceae officinale)

Roswe zingiberaceae is one of the most commonly consumed dietary condiments in the world (Surh *et al.*, 1999) the oleoresin (i.e. oily resin) from the rhizomes (i.e. roots) of ginger contains many bioactive compounds such as [6] gingerol(1-[4-hydroxy-3-melxypheny1]-5-hydroxy-3-decanone.

Ginger is a member of a plant family that includes cardamom and turmeric. Its spicy aroma is mainly due to presence of ketones, especially the gingerols, which appear to be the primary component of ginger studied in much of the health related scientific research. The rhizore which is the horizontal stem from which the roots grow, is the main portion of ginger that is consumed. Ginger's current name comes from the Middle English gingering, but this spice dates back over 300years to the Sanskrit word srngaveram.

The use of "natural" or alternative medicine has increased mainly over few years, more and more older adults (e.g. baby boomers) are using complementary and alternative medicine dietary supplements and herbal remedies without advice from a physician on the assumption that these substances will have a beneficial effect (Cohen and Pan, 2002). Regrettably, a great deal of the information regarding the effectiveness and safety of these remedies has been garnered from a needful or historical accounts, and much of the information offered is generally misleading and might even be detrimental (Ernest and Schmidt, 2020). This work in other words intended to draw up an efficacy of two the local consumed herbs spices for same purpose in a practical way.

Justification of the Study

The *Staphylococcus aureus* organism is notorious for causing boils, furuncles, styles, impetigo, and other superficial strains infections in human. It may also cause more serious infections, particularly in persons debilitated by chronic illness, traumatic injury, burns or immune suppression. These infection included pneumonia, deep abscesses, oestermyelitis, endocarditis, phlebitis martitis and meningitis are often associated with tropicalized patients rather than healthy individuals in the community. *S. aureus* and *S. epidemidis* are common cause of infection associated with in dwelling devices such as joint prostheses, cardiovascular devices and artificial heart values (Chessbrough, 2000).

This study is of high importance to everybody, more especially Africans, who are more underdeveloped countries and localities in the world, and are still living within the poverty line. Hence, need to still explore the use of some local

herbs spices/extracts for the treatment of some diseases such as this *Staphylococcus aureus* and others.

In most of the communities if not all in Nigeria, there is one or so antimicrobial herbs of the other present, hence the need to identify them for it is on this basis that the need to determine the antimicrobial activity of white onion and ginger extract on *Staphylococcus aureus* organism in our local settlement.

Materials and Methods

Materials

In this study, the materials that were used for the laboratory work include: autoclave, incubator, microscope, weighing glance, bunsen burner, pestle and mortar, knife, spatula, glass rod, petri dish, test tubes, forceps, muslin cloth, aluminum foil, cotton wool, and filter paper.

While the reagents and chemical used include: nutrient media, gram staining reagents, distilled water, ethanol and blood agar.

Collection of Sample Materials

The bulbs of white onion and ginger were obtained (purchased) from the Lafia Modern Market in Lafia Town, the Nasarawa State Capital. Also steriled swab sticks were aseptically used to collect microorganisms from patients having boil at the school clinic. All these samples collected were brought to the school laboratory for the analysis.

Extraction of the Plant Materials

Onion Extraction

The onions were washed with clean sterile distilled water and allowed to air dry for one hour. The outer covering of the onion were manually peeled off. The onion bulbs being separated were washed and extracted in the following ways:

i) Exactly 200g of fresh onion bulb were blended into fine powder and soaked in 100mls of distilled water for 24hours. The pulp obtained was left in a clean, sterile glass container and shaken vigorously to allow for proper extraction and it was filtered using a sterile muslin cloth after which the extract was obtained, air dried and store below ambient temperature until required, (Wikipedia, 2006).

ii) Exactly 200g of fresh onion bulbs were blended and soaked in 100mls of hot water for 24hours; the resultant juice was extracted, air dried and stored as in (1) above.

iii) Exactly 200g of fresh onion bulbs were blended and soaked in 100mls of 95% ethanol for 24hours and the extract was obtained, air dried and stored as in (1) above.

iv) Exactly 200g of fresh onion bulbs were blended and the raw juice was extracted after standing in a clean glass container for 24hours, it was extracted using a sterile muslin cloth and the extract was air dried and stored as in (1) above.

Ginger Extraction

The ginger rhizomes were washed with clean sterile distilled water and allowed to air dried for one hour. Then the outer covering of the ginger were manually peeled off and the ginger was washed again and extracted using the following procedures:

i. Exactly 200g of fresh ginger were blended into fine powder and soaked in 100mls of distilled water for 24hours. The pulp obtained was left in a clean, sterile glass container and shaken vigorously to allow for proper extraction and it was filtered using a sterile muslin cloth after which the extract was obtained, air dried and stored below ambient temperature until required.

ii. Exactly 200g of fresh ginger were blended and soaked in 100mls in hot water for 24hours. The resultant juice extracted, was air dried and stored as in (1) above.

iii. Exactly 200g of fresh ginger were blended and soaked in 100mls of 95% ethanol for 24hours and the extract was obtained, air dried and stored as in (1) above.

iv. Exactly 200g of fresh ginger were blended and the raw juice was extracted after standing in a glass (clean glass) container for 24hours, it was extracted using a sterile muslin cloth and the extract was air dried and stored as in (1) above.

Phytochemical Screening of Extracts

The methods described by Agboola (2015) were used to test for the presence of the active ingredients in the test sample.

Preparation of the Extract into Different Concentration
The dried extract of alcohol and aqueous solution of white onion and ginger were weighed 0.5g and 1.0g each dissolved in 10ml of distilled water.

Gram Staining Reaction
Growths of the colonies were observed after 24hours. Gram staining techniques was carried out and examined under the microscope using oil immersion objective so as to identify the micro-organisms associated with boils.

Determination of Minimum Inhibitory Concentration (MIC) of Extract
Different concentration of the extracts were introduced into various test tubes, each concentration was used on the different inoculated plates. The plant extract concentration that did not permit any visible growth of the inoculated test organism in the plate was taken as the Minimum Inhibitory Concentration (MIC) in each hole and disc (Serrentino, 1991).
The control test experiment was set up with the commercial sensitivity disc and no plant extracts on nutrient agar plate.

Results and Discussion
The phytochemical screening of extract of the two samples showed that there are constituents content in these extract namely; the flavonoids, saponins, fructans and organosulfur compounds for white onions while the ginger constituents include the gingerols, shogaols, tannins and paradols which are of detrimental effect to the stubborn *Staphylococcus aureus* organism which is found predominantly in wounds, boils, decaying & rotten teeth and so on. Also the results for the identification of the isolates are presented as the organisms were identified through gram staining reaction. Gram positive bacteria, spherical in shape arranged in chains of various lengths which sticks together were seen. These structures were characteristics of *Streptococcus species*. While others were in clumps, joint together in bunch of grapes form which were characteristics of *Staphylococcus aureus*.

Presentation of Data Analysis
Table 1: Showing the various results obtained at the end of the experiment

S/No	Sample Number	Culture Characteristics	Gram staining Results
1	01	Scanty growth Staph aureus	Gram positive
2	02	Scanty growth Strept species	Gram positive
3	03	Scanty growth Staph aureus	Gram positive
4	04	Scanty growth Staph aureus	Gram positive

5	05	Scanty growth Staph aureus	Gram positive
6	06	Scanty growth Strept species	Gram positive

The table above shows the cultural characteristics and gram staining reaction of the test organisms.

Table 2: Shows the zone of Minimum Inhibitory Concentration (MIC) for Hole Diffusion Method (HDM).

S/No	Concentration (g/10ml)	Alcohol 0.5 1.0	Aqueous (Water)
1	White onion extract (Liquid)	12 12	6.0 10
2	White onion extract (Powder)	12 12	10 4
3	Ginger extract (Liquid)	15 15	11 4
4	Ginger extract (Powder)	14 15	15 15

The table above shows results for susceptible test of liquid and powdery extracts of white onion and ginger.

Table 3: Showing the control test with commercial sensitivity disc

S/No	Drugs	Zone
1.	CEP-Ceporex	-
2.	CPX-Ceproflox	20mm
3.	PN-Ampicillin	-
4.	S-Streplomacin	21mm

Discussion

From the tables above, it shows that *Staphylococcus* is dominant in boil swab. The result of this work indicates that the water-soluble and powdery extracts of white onion and ginger has antimicrobial properties. When the extracts were tested on *Staphylococcus species*, the widest zones of inhibition were obtained with *Staphylococcus aureus*. These differences in the zones of inhibition maybe

directly related to the susceptibility of each test organism to the onions and ginger extracts. The factors responsible for this high susceptibility of *Staphylococcus aureus* to the extracts are not exactly known but maybe attributed to the presence of secondary plant metabolites as mentioned above of the phytochemical screening of the extract..

However, comparing the results of the above tables, it is clearly seen that both plants extracts possesses antimicrobial activities. These results were inconformity with earlier works of Ekwenye and Elegalam, (2005) on phytochemical composition and antibacterial activities of red onion and ginger. Going by the conformity of these studies, the result showed that these plants may serve as a source of industrial drug in the treatment of boil and some skin infections, after a toxicological safety test might have been done. These plants will also serve as necessary ingredients (spices) for cooking.

In conclusion therefore, the plant extract of white onion and ginger exhibits antimicrobial property against *Staphylococcus aureus*. The antimicrobial substances contained in the extracts include alkaloids, tannins, saponins and glycosides (Cruickshank *et al.*, 1975).

It is important to note that the plant extracts used in this study shows activity against disease causing organism such as *Staphylococcus species*. It is therefore, suggested that constituents of these plants extract may serve as source of industrial drug in the treatment of some microbial infections because they have a direct influence on causing serious health problems on the skin.

Recommendations

Following the discoveries and findings highlighted in the discourse, the study recommended as follows, that:

i. It is necessary to ascertain the safety usage of white onion and ginger, hence toxicological assessment test on the plants extracts is hereby suggested;
ii. Where such toxicological assessment shows no hazardous implications of the usage, pharmaceutical industries can adopt this usage as raw materials for the production of skin sprays and drugs;
iii. World Health Organization (WHO), government, organizations, private and corporate bodies should sponsor researches on these plants (white onion and ginger) and to educate the general public on the importance of medical plants against diseases;

iv. The Agricultural sectors should be encouraged to develop skills in improving the genetic constituents of these plants towards the control of diseases and improve good fruiting yields;

v. Finally, farming of these plants should be encouraged as they also contain some important phytochemicals.

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