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Antibacterial Efficacy of Pineapple *(Ananas Comosus)* Peels Extracts on Some Selected Clinical Enterobacteriaceae

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ABSTRACT

The antibacterial efficacy of extracts from Pineapple (Ananas comosus) peels carried out on some selected clinical enterobacteriaceae (Salmonella typhi and Shigella dysenteriae) using agar "well" diffusion techniques. The extracts were obtained using two different solvents, ethanol, warm water and fresh juice extract through blending, to obtain the ethanol, aqueous and the fresh juice extracts respectively. The varying concentrations (50, 70, and 90mg/ml) of the crude extracts was used to determine the efficacy of the extracts on the test enterobacteriaceae. The extracts indicate the presence of appreciable compounds such as alkaloids, flavonoids, tannins and cardiac glycosides while glycosides and steroid were absent. The antibacterial susceptibility test on the crude extracts indicates high efficacy of 20.mm at the highest concentration of 90mg/ml for both ethanol and aqueous extracts while the juice extract did not show any efficacy on the test enterobacteriaceae. The chloramphenicol control used indicates activity of 22.0mm against the two test bacteria S typhi and S dysenteriae. The minimum inhibitory concentration and minimum bacteriocidal concentration indicates the plant extracts to be highly potent on the test enterobacteriaceae except the fresh juice extracts fails to show any potency on the test enterobacteriaceae. This research has given a clue for the possibility of using Pineapple peels for remedy on some enterobacteriaceae.

Keywords:
Aantibacterial,
Efficacy,
Pineapple,
Peels,
Clinical,
Enterobacteriaceae,
Phytochemical

INTRODUCTION

Plants are well-known natural sources for the treatment of various diseases since antiquity (Petrovska, 2012). More than 20,000 plant species used for medicinal purposes are reported and documented by World Health Organization (WHO) (Petrovska, 2012). In spite of the emphasis being put in research for synthetic drugs, the interest in medicinal plants has been reborn, due to the fact that a lot of synthetic drugs are potentially toxic and are not free of side effects on the host (Rates, 2001). This has prompt scientists in the world to search, formulate new antimicrobial agents and to evaluate the efficacy of natural plant products as a substitute for chemical antimicrobial agents (WHO, 2019). Plants have been found useful to man not only as food or as sources of raw materials for industrial purposes, but also as sources of medicine for treatment of different kinds of illness (Sofowora *et al*., 2013).

Plants continue to play essential roles in traditional medicine for the treatment or management of various human diseases, especially in rural Africa where diseases are endemic due to poverty and poor sanitations (Ekor, 2014). In Ghana, Mali, Nigeria and Zambia, herbal medicines are the first line of treatment for over 60% of the children with high fever at home (WHO, 2013). Despite the great technological advancement, man has continued to be embattled by emerging and reemerging infectious diseases (Mahomoodally, 2013). Responding effectively to these health challenges requires the mobilization of knowledge and energy; and a synergy between man and its environment (biotic and abiotic) (Newman and Cragg, 2020). Plant products play an important role in drug development activities in pharmaceutical industry (Balunas and Kinghorn, 2005).

Pineapple Fruit

Pineapples are fruits with a blend of sour and sweet taste. They are grown in most countries of the world with the climatic conditions of countries allowing slight variety in taste.

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Pineapples are eaten raw, cooked, dried and juiced to be preserved or used to improve taste in cuisines (Huang and Li, 2020). Pineapples are also used in pastries such as pineapple cakes, pineapple pies among others. Pineapple both the fruit and peels are free from cholesterol, low in sodium and make a good fruit for weight loss and digestion (DebMandal and Mandal, 2014).

Pineapple fruit, whole and in longitudinal section

(Bartholomew *et al.*, 2002)

Botanical classification

Kingdom: Plantae (Plant)

Division: Magnoliophyta

Class: Liliopsida

Order: Poales

Family: Bromeliaceae

Genus: Ananas

Species: *A. comosus*

(Bartholomew *et al.*, 2002)

Most fruits have their skin packed with nutrients and the pineapple peel or skin is no exception (Ramos-Goncalves, 2022). The peel of citrus fruits are dried and added to pastries, tea etc. Pineapple fruit and its peels are known to contain healing properties. In ancient times, the fruit was used in prevention and treatment of various infections (Li and Zhang, 2015). The peels from pineapple are mostly thrown away as waste and sometimes animals feed on the peels from the refuse dump sites; also local producers of beverages like "Sobo and Soya bean" drinks use the peels for the production of these beverages. The peels contains high amount of bromelain than the fruit itself; which helps the body part to reduce inflammation and also reduce injury and post surgery swellings (Maurya and Aggarwal, 2019). Pineapple peels can be a useful plant product, if the potentials are scout for therapeutic purpose. This is why this research determine the antibacterial efficacy of Pineapple *(Ananas comosus)* peels cextract on some selected clinical enterobacteriaceae (*Salmonella typhi* and *Shigella dysenteriae*)

MATERIALS AND METHODS

Sample Collection

The pineaple (*Ananas comosus)* peels *were* collected at pineapple selling points. The samples were then analyzed.

Sample processing

The peels were washed with clean water to remove sand and other particles like pieces of wood which may act as contaminants and was air dried for 14days until they are properly dried. The dried samples were then pounded using mortar and pestle to obtain fine powder. The grounded sample with characteristic dark green colour was then stored in airtight plastic bottles for further use (Kashari, 2021).

Extraction of samples

Exactly 100g of the pounded peels sample was weighed using a weighing balance. 400ml ethanol measured using a measuring cylinder and poured into the conical flask and was then shaken and allowed to stay for 3 days. The mixture was then sieved using whattamn No.1 fitter paper. The supernatant were then collected in a baker and was concentrated using water bath at 40^{o}C for a period of 4 days for ethanol to evaporate. The ethanol extract was then collected after four (4) days and stored for the analysis. The same procedure was repeated for the aqueous extract (Kashari, 2021; Kashari *et al*., 2025).

Preparation of Media

All the media (Nutrient Agar, Nutrient Broth, Salmonella-Shigella Agar and Mueller Hinton Agar) as contain in lebel of the containers, were prepared according to the manufacturer's instruction (Cheesbrough, 2000 and Yamaguchi *et al.*, 2008).

Confirmation of Bacteria

The test enterobacteriaceae (*Salmonella typhi* and *Shigella dysenteriae*) use were pathogens. The pathogens were confirmed by sub-culturing, Gram staining and were then subjected to specific biochemical confirmatory test and were maintained on nutrient agar medium. They were kept as stock cultures in the refrigerator until when need (Cheesborough, 2000).

Preliminary Phytochemical Screening

Tests for tannins

Exactly 20 mg of extracts was stirred with distilled water and filtered. Ferric chloride was added to the filtrate. A blue-black, green or blue-green precipitate indicates tannins (Sheikh *et al.*, 2013 and Goptep *et al*., 2010).

Test for flavonoids

Small amount of magnesium powder and few drops of concentrated hydrochloric acid were added to 3 ml of the

extract. A red or intense red colouration indicates flavonones (Uraku *et al.,* 2015 and Goptep *et al*., 2010).

Test for glycosides

The extract was hydrolyzed with HCl solution and neutralized with NaOH solution. Tow drops of Fehlings solution A and B was added. Red precipitate indicates glycosides (Uraku *et al.,* 2015).

Test for Cardiac glycoside (Keller-Killani test)

Exactly 20 mg of the extract was dissolved in 2 ml of glacial acetic acid containing one drop of ferric chloride solution followed by the addition of 1 ml of concentrated sulphuric acid. A brown ring at the interface confirmed the presence of cardiac glycoside (Uraku *et al.,* 2015).

Tests for alkaloids

Exactly 20 mg of extract was shaken with 1 % HCl for two minutes. The mixture was filtered and a drop of Dragendorff's reagent was added. Formation of a precipitate indicates alkaloids (Uraku *et al.,* 2015 and Goptep *et al*., 2010).

ANTIBACTERIAL TESTING

Formulation of various Concentrations of the extract

Exactly 5g of the ethanol extract was weighed and placed in 10ml of distilled water to obtain 50 mg/ml and the same was done to obtain varying concentrations 70 mg/ml, and 90 mg/ml. This same procedure was repeated to obtain concentrations of the aqueous and juice extracts (Kashari, 2021).

Preparation of Inoculum

Agar "well" diffusion techniques was used to determine the antimicrobial efficacy of the crude extracts of the Pineapple peels against the test enterobacteriaceae (*Salmonella typhi* and *Shigella dysenteriae)*. "Wells" were made on the prepared Mueller Hington agar. The organisms from prepared broth culture were then stricken separately on the plates containing the Mueller Hington agar and the varying concentrations of 50mg/ml, 70mg/ml, and 90mg of the crude extracts were place on the plate containing the organisms, this was done in duplicate and the plates were incubated at 37^0C for 24 hours. Chloramphenicol impregnated antibiotic disc was used as control (Cheesbrough, 2000; Kashari *et al*., 2025).

MIC and MBC of the Extracts

The Minimum Inhibitory Concentration (MIC) and Minimum Bacteriocidal Concentration (MBC) of the crude extracts of the Pineapple peels against the test enterobacteriaceae (*Salmonella typhi* and *Shigella dysenteriae)* and was determined using tube dilution method (Guarav *et al*., 2015).

RESULTS AND DISCUSSION

Table 1: Phytochemicals present in the extracts from Pineapple peels

Phytochemical	**Level of Presence**		
Compounds	**Ethanol extract**	**Aqueous extract**	**Fresh juice extract**
Tannins	++	++	+
Glycosides	-	-	-
Flavonoids	+ +	+ +	++
Alkaloids	+	+ +	+
Cardiae glycoside	+ +	+ +	++
Steroids	-	-	-
Phenols	++	++	+

Key: ++ = **Slightly** Present**,** + = Moderately Present**,** - = Absent

Table 2: Main zone of inhibition of extracts from Pineapple peels obtained on the enterobacteriaceae

Extract /	Concentration in (mg/ml)/ Zone of inhibition in (mm)			
Test Bacteria	**50**	**70**	**90**	**Chloram. Control**
Ethanol Extract				
S typhi	17.0	19.0	20.0	22.0
S dysenteriae	18.0	20.0	20.0	22.0
Aqueous Extract				
S typhi	15.0	17.0	20.0	22.0
S dysenteriae	17.0	19.0	20.0	22.0
Fresh juice Extract				
S typhi	00.0	00.0	00.0	22.0
S dysenteriae	00.0	00.0	00.0	22.0
Key: mg/ml = Milligram/ml, Mm = Millimeter, 6.0 = No activity, Chloram. =Chloramphenicol				

Table 3: MIC and MBC of the extracts from Pineapple peels obtained on the enterobacteriaceae

Extracts /	MIC	MBC
Test Bacteria	**Values**	**Values**
Ethanol Extract		
S typhi	2.8125	5.625
S dysenteriae	5.625	11.25
Aqueous Extract		
S typhi	5.625	11.25
S dyscenteriae	5.625	11.25
Fresh juice Extract		
S typhi	-	-
S dyscenteriae	-	-

Key: mg/ml = Milligram/ml, mm = Millimeter

The antibacterial activity of crude extracts from Pineapple (*Ananas comosus)* peels was carried out against some selected clinical enterobacteriaceae using agar "well" diffusion method against the selected enterobacteriaceae (*Salmonella typhi* and *Shigella dysenteriae).* The extracts were obtained using two different solvents, ethanol, warm water and fresh juice

extract through blending, to obtain the ethanol, aqueous extract and the fresh juice extract respectively. The varying concentrations (50, 70, and 90mg/ml) of the crude extracts was used to determine the efficacy of the extracts against the test enterobacteriaceae.

The Pineapple peels crude extracts contains appreciable Phytochemical compounds such as alkaloids, glycosides, flavonoids, tannins and cardiac glycosides while steroid and glycosides were absent in both the ethanol, aqueous and fresh juice extracts. This confirms the findings of Goptep *et al*., (2010) who reported the presence of same phytochemicals in *Acalypha wilkesiana* ethanolic leaves extracts use by locals for treatment of conditions associated with both Gram positive and Gram negative organisms studied; Li and Zhang, (2015). also reported that the presence of Phytochemical compounds in plants are responsible for a range of antibacterial efficacy.

Table 2, indicate the main zone of inhibition of the crude extracts from Pineapple peels on the enterobacteriaceae (*S typhi* and *S dysenteriae*), the ethanol extract of the peels is indicated by high activities of 17.0, 19.0, and 20.0mm, 18.0, 20.0, and 20.0mm on *S typhi* and *S dysenteriae* at the concentrations of 50, 70 and 90mg/ml used. The aqueous crude extracts of the peels indicates activity of 15.0, 17.0 and 20.0mm for *S typhi*, and 17.0, 19.0 and 20.0mm for *S dysenteriae* at all the concentrations used. The juice extract did not show any activity on both the enterobacteriaceae and this could be due to lack of certain phytochemicals in the juice extract that could be responsible for antibacterial efficacy observed in the ethanol and aqueous extracts. The chloramphenicol control used indicates activity of 22.0mm against the two test bacteria *S typhi* and *S dysenteriae*. These findings are in-line with the work of Abubakar, (2016) and Nwankwo and Uzoeto, (2018) reported that plants has been used as therapeutic alternative because of their antimicrobial properties.

Table 3, Shows minimum inhibitory concentration and minimum bacteriocidal concentration study of the extracts from Pineapple peels on the test eutarobacteriaceae *(S typhi and S dysenteriae)*. The study revealed that the plant crude extracts are highly potent against the test enterobacteriaceae *(S typhi and S dysenteriae)* and this indicates that the plant have both inhibitory and bacteriocidal potentials except the fresh juice extracts that fails to show activity against the test bacteria at all the concentrations used. This is in-line with the findings of CLSI, 2016, who demonstrated that tube dilution test for MIC and agar in-corporation method gives quality assessment of the result.

CONCLUSION

The Phytochemicals present in the Pineapple peels extracts could have been responsible for the antibacterial activity observed. The antibacterial activity of the extracts from pineapple peels on the enterobacteriaceae indicate high efficacy except for the fresh juice extract that fails to show activity on the test bacteria at all the concentrations used. MIC and MBC study shows that the plant extracts has both inhibitory and bacteriocidal abilities except for the fresh juice extract. This study has given a clue to the possibility of using Pineapple peels for remedy on some enterobacteriaceae.

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