ANTIMICROBIAL ACTIVITY OF ALOE VERA EXTRACTS AND PRODUCTS

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ABSTRACT

Crude extracts of Aloe Vera in ethanol and chloroform as well as its local products were tested for antimicrobial activity against eleven microbial clinical isolates. The isolates consisted of six bacteria and five fungi. The crude extracts were obtained by decoction. Agar cup diffusion method was the main susceptibility test while agar- dilution technique was employed in respect of the local liquid product. *Staph. aureus*, *Staph. albus* and *Sal. paratyphi* showed varying levels of growth inhibition by the ethanolic extract while the chloroform extract showed activity on *Sal. typhi* and *Sal. paratyphi* .Of the two local products of Aloe Vera, the B and B soap was active on *Staph. albus* and *Staph. aureus* while the liquid product showed varying levels of activity on all the bacterial isolates as evident in the countable colonies relative to carpeted growth where there was no activity.

Key words: Aloe vera Extracts, Antimicrobial

INTRODUCTION

Plants synthesize a variety of chemical substances, which have important effects on animal systems and some possess therapeutic properties. Aloe vera belongs to the family *Liliacea*. It is indigenous to East and South Africa, but has been introduced to the West Indies where it is cultivated extensively (Grieve, 1995).

Aloe vera belongs to the group of Xeroid plants which close the stomas of their leaves after any cut or wound on them, thus avoiding moisture loss. Two main products, Bitter aloe and Aloe gel were obtained from Dugbe market Ibadan. Bitter aloes contain 40-80% resin and 20% aloin an anthraquinoic glycoside which is an active component (George and Pamplona-Roger,1998).Bitter aloes can be used as a laxative while the Aloe gel contains acemanan and it has healing properties on the skin (George and Pamplona-Roger,1998).

Aloe Vera has been used in the treatment of various diseases related to skin such as eczema and diaper rash. Studies had been conducted on the antibacterial, antiviral, anti-inflammatory, immunostimulant, adaptogenic and duretic effects of aloe vera (Captone, 2000). The curative values of Aloe Vera lie in the fact that the plant is composed of antioxidants and phytochemical agents (Captone, 2000). Aloe vera is prepared into various products like Aloe vera soap, cream and drugs. Information on the antimicrobial activity of Aloe vera products is scanty, hence, the design of this study to identify antimicrobial potential of Aloe vera and its products.

MATERIALS AND METHODS

Plant Materials:

Samples of Aloe vera barbedensis (Aloe vera) were collected from Abeokuta environs. Both fresh and dried leaf samples were used. The leaves were dried at 60°C for 48hr to get the dry sample.

Preparation of Dried Plant Extract:

Finely powdered materials of the leaves weighing 5g were crudely extracted with 20ml each of 100% ethanol and chloroform in succession for 48hr. The different extracts were collected into sterile universal bottles and stored in the refrigerator for further use.

Preparation of Fresh Extract:

Fresh leaves of Aloe Vera were cut into pieces and soaked in 20ml each of ethanol and chloroform in succession for 48hr. The extract was collected into sterile universal bottles for further use.

Aloe Vera Local Products:

Liquid extract of Aloe Vera being peddled as herbal preparation was obtained from a hawker at Dugbe market in Ibadan. The extract was said to contain garlic and ginger. It was used as purchased. The B and B soap was also obtained from a hawker in the same market. It was indicated to contain Aloe Vera in 42% concentration (product manual)

Organisms

The microorganisms used in this study were collected from the Department of Microbiology and Parasitology, University College Hospital (UCH), Ibadan and they consisted of six bacteria and five strains of fungi. The bacteria were *Staphylococcus aureus, Staphylococcus albus, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi* and *Salmonella paratyphi* while the fungi were *Aspergillus flavus, Aspergillus niger, Microsporium spp, Epidermophyton, spp* and *Candida albicans*

Standard Antimicrobial Agent:

The Chemotherapeutic agent employed as standard was Ampicillin (as sodium salt) at a concentration of 0.5ug/ml. It was obtained from Doyin Pharmaceutical Nigeria Limited, Lagos.

Media:

Nutrient broth (pH 7.4), Nutrient agar (pH 7.4) and Saboraud dextrose agar (pH 5.4). All were products of Oxoid laboratories, England.

Susceptibility Test By Agar-cup:

This method was used in respect of the crude extracts of Aloe Vera and B&B soap. Fractional dilutions of 1:2, 1:3 and 1:4 of the crude extract and the B&B soap were each prepared in Sterile distilled water. Nutrient agar plates were then seeded with 0.1ml of 1:100 dilution of an overnight culture of each bacterial isolate, while the Sabouraud dextrose agar plates were each similarly seeded with each fungal strain. The seeded plates were allowed to dry in the incubator at 37°C for 20min. A standard corkborer of 7mm diameter was used to cut uniform wells on the surface of the solid medium into which was added 0.1ml solution of each fractional dilution. A standard chemotherapentic agent ampicillin was prepared in 0.5 ug/ml and similarly filled into a separate well to serve as control.

Susceptibility Test By Agar-dilution:

Factional dilutions 1:5 and 1:10 of the liquid Aloe Vera product were prepared in sterile distilled water. From the 10^{-2} dilution of the overnight broth culture of each bacterium, 0.1ml was added to 20ml of molten nutrient agar followed by 1ml of the stock and each dilution of the product. The mixture was shaken and poured aseptically into sterile culture plate. With respect to filamentous fungal strains, the cultures were 72hr-old in Saboraud dextrose broth before seeded plates were prepared with Saboraud dextrose agar. The bacterial plates were incubated at 37°c for 24hr and fungal plates for 72hours at 25°C Control plates were prepared for both bacteria and fungi by excluding the liquid product from seeded plates.

RESULTS

Results of antimicrobial activity of dried extracts of Aloe Vera are shown in Table 1. No activity was recorded for the crude extract while for the dried extract it was recorded for undiluted ethanol and Chloroform extracts

TABLE 1: ANTIMICROBIAL ACTIVITY OF DRIED EXTRACTS OF ALOE VERA

Test Micro Organisms	Diameters of Zone of Inhibition (mm)										
	Ethanol Concentrations					Chloroform Concentrations					
	Crude Extract	Undiluted	1: 2	1: 3	1: 4	Crude Extract	Undiluted	1: 2	1: 3	1: 4	AMP
Ps. Aeruginosa	-	-	-	-	-	-	-	-	-	-	-
Staph. albus	-	1.5	-	-	-	-	-	-	-	-	5.0
Staph. Aureus	-	3.5	-	-	-	-	-	-	-	-	8.0
Salm. typhi	-	1.0	-	-	-	-	0.5	-	-	-	-
Salm .paratyphi	-	1.2	-	-	-	-	5.5	-	-	-	-
E. coli	-	-	-	-	-	-	-	-	-	-	-
Aspergillus niger	-	-	-	-	-	-	-	-	-	-	-
Aspergillus flavus	-	-	-	-	-	-	-	-	-	-	-
Epidermophyton ;pecie	-	-	-	-	-	-	-	-	-	-	-
Microsporium ;pecie	-	-	-	-	-	-	-	-	-	-	-
Candida albican	-	-	-	-	-	-	-	-	-	-	-

* - = No zone of inhibition ;Amp = Ampicillin

The ethanol extract showed activity on *Staph. albus, Staph aureus* and *Salm. paratyphi* while the chloroform extract showed activity on *Salm. typhi* and *Salm. paratyphi.* The two products of Aloe vera employed in this study, B and B soap and local extract were found to have only antibacterial activity (Table 2). The stock and dilutions of B and B Aloe vera soap showed activity on both *Staph. albus* and *Staph. aureus* but more pronounced on *Staph. aureus*. The liquid product affected all the bacteria including, remarkably, *Pseudomonas aeruginosa* as manifested in the countable number of colonies compared with the normal carpeted growth obtained on the control plate.

DISCUSSION

The Result of crude extract of Aloe Vera obtained in this investigation showed no antimicrobial activity. The activity recorded for the undiluted dried ethanol and chloroform extracts may be attributed to the ability of the solvents (chloroform and ethanol) used to extract some of the active components in the plant which may have been in direct contact with these organisms as reported by Sanusi,1998). The activity on *Staph aureus* and *Staph albus* of the ethanol extract could be traced to the plant possessing acemanan, which has been scientifically proved to be able to stimulate the defenses of the body against staphylococcal infections (George and Pamplona-Roger, 1998).

The ineffectiveness of these extracts on some of the bacteria and all the fungi tested may likely be due to the fact that the solvents could not extract the active component of the plant. It could also be that the main active components of the Aloe Vera plant are only antibacterial. This observation supported the antimicrobial activities recorded by the two local products B&B soap and the retail Aloe Vera extract. The retail Aloe Vera extract was claimed to include in its composition garlic and ginger concentration (Product manual).

The B&B soap produced activity against *Staph aureus* and *Staph albus*. This result compared favourably with that of the standard used, ampicillin, at 0.5ug/ml. Similarly, the retail Aloe Vera extract gave promising result considering the activity exhibited in varying degrees against all the bacterial isolates tested including *Pseudomonas aeruginosa,* this agreed with work done by Paul *et al.*, 1997); Odetola and Okorosobo, 1998).

Table 2: Antimicrobial activity of aloe vera products b & b aloe vera soap and local product of aloe vera

Test Micro-Organisms	Diameters of zone of inhibition (mm)				Aloe Vera Local Products		
Undiluted	1:2	1:3	1:4	B & B Aloe Vera Soap	Undiluted	1:5	1:10
Ps. aeruginosa	-	-	-	-	22	32	68.5
Stap. Albus	1.2	0.5	-	-	48	+++	+++
Stap. Aureus	8.2	5.2	5.2	-	16	60	*85*
Salm. Typhi	13	-	-	-	15	22	*27.2*
Salm. Paratyphi	15	-	-	-	44	38.2	*46.8*
E. coli	-	-	-	-	30	55	+++
Aspergillus niger	-	-	-	-	+++	+++	+++
Aspergillus flavus	-	-	-	-	+++	+++	+++
Epidermophyton Specie	-	-	-	-	+++	+++	+++
Microsporium species	-	-	-	-	+++	+++	+++
Candida albican	-	-	-	-	+++	+++	+++

+++ = Carpet growth

The fact that discrete colonies rather than the normal carpeted growth were obtained in the agar dilution method signifies inhibitory activity for the undiluted local extract. For all the bacterial isolates, fractional dilutions also exhibited inhibitory activity against all the bacterial isolates. The antibacterial activities of these local products of Aloe Vera lend credence to the claim of the manufacturers. The B&B Aloe Vera soap has indications against skin infections while the local extract was credited with activity against typhoid fever among others. The antibacterial activity of retail Aloe Vera extract may have been enhanced by the presence of garlic and ginger in its composition. In conclusion, it is interesting to note that in every sensitivity test against Aloe vera in this report, *Staph.albus* showed greater resistance than *Staph.aureus* which has been a focus of resistance studied by many workers (Olukoya *et al.*, 1995; Adeleke and Odetola, 1995; Adeleke and Odetola, 2000).

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