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ANTIMICROBIAL ACTIVITY OF *ALOE VERA* GEL AND HONEY AGAINST BACTERIA ISOLATES FROM WOUND ASPIRATES

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ABSTRACT: Wounds may harbour diverse microorganisms, especially bacteria that are resistant to many conventional antibiotics. The aim of this study is therefore to evaluate the antibiotic activities of *Aloe vera* gel and honey against bacteria isolates from wounds. A cross sectional study of wound aspirates from a health care center was carried out to evaluate the antibacterial activities of *Aloe vera* and honey against bacteria isolates from wounds following standard microbiological procedures. The antimicrobial susceptibility of the isolates to standard antibiotic discs, *Aloe vera* and honey were done using the agar-diffusion method. The minimum inhibitory concentration of the *Aloe vera* gel and honey (alone and in combination) were also evaluated using the agar-diffusion method. The bacterial isolated were: *Escherichia coli, Staphylococcus aureus, Proteus vulgaris, Staphylococcus epidermidis, and Streptococcus pyogenes*. The study showed that honey had a higher antibacterial activity than *Aloe vera* gel with an inhibition zone diameter (IZD) measuring mm. It also showed that *Staphylococcus aureus* was the most predominant pathogen found in wounds while *Proteus vulgaris* and *Staphylococcus epidermidis* were the least predominant.

INTRODUCTION: Wounds are injuries to the body tissues caused by physical trauma or disease processes including surgery, diabetes, burns, punctures, gunshots, laceration, bites, bed sores and broken bone [1]. The primary function of normal intact skin is to control microbial populations that live on the surface and to prevent underlying tissues from becoming invaded by potential pathogens. Exposure of subcutaneous tissue, following a loss of skin integrity (*i.e.* a wound) provides a moist, warm and nutritious environment that is conducive for microbial colonization and proliferation [2].

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Wounds are divided into two which are acute and chronic wounds: acute wound are caused by external damage to intact skin and it includes surgical wounds, bites, burns, minor cuts and abrasions and more severe traumatic wounds such as laceration and those caused by crush or gunshot injuries [3]. Irrespective of the nature of the cutaneous injury, acute wound are expected to heal within a predictable time frame, although the treatment required to facilitate healing will vary according to the type, site and depth of a wound.

Chronic wounds are caused by endogeneous mechanisms associated with a predisposing condition that ultimately compromises the integrity of dermal and epidermal tissue [3]. Appropriate method for healing of the wound is essential for the restoration of the disturbed functional status of the skin [4]. A wound leads to the establishment of infections by bacterial pathogens in the internal

tissues [5]. Wound healing involves a complex series of interactions between different cell types, cytokine mediators and the extracellular matrix. The phases of normal wound healing include hemostasis, inflammation, proliferation and remodeling [6]. For some time now, bacteria resistance has been rampant as they have emerged with forms of virulence and new patterns of resistance to antimicrobial agents. Resistance rate to the most common prescribed drugs used vary considerably in different areas World-wide. This emergence of bacterial resistance has led to difficulties in treatment of infections caused by these bacteria.

This research is thus aimed at the antimicrobial activity of both *Aloe vera* gel and honey in order to evaluate their potentials to meet patient's needs, pharmaceutical industries and other institutions in the treatment of some wound infections.

MATERIALS AND METHODS:

Sample Collection: The samples were collected from15 patients with various types of injuries or wounds referred to the diagnostic laboratory in the General Hospital, Abraka. A sterile swab stick was used to collect the sample from the injury with aspirate (Pus). After collection, the swab sticks were taken to the pharmaceutical microbiology laboratory for analyses.

Isolation: A swab containing the sample was inoculated on the agar medium by streaking. This process was done repeated for all the 14 swabs and were incubated at 35 - 37 °C for 24 h. Pure isolates obtained were inoculated in nutrient broth medium and incubated at 35 - 37 °C for 24 h.

Characterization and Identification: This was carried out by methods reported by Monica [7].

Antimicrobial Screening:

Antibiotic sensitivity testing: This was carried out using disc diffusion method. In this test, an aliquot (0.2mL) of the test organism was transferred from nutrient broth medium into sterile petri dish. The antibiotic discs were placed aseptically on the surface of the inoculated plates using sterile forceps.

Determination of Antimicrobial Activity of *Aloe vera* Gel and Honey against the Isolates: These were carried out using 5 ml each of *Aloe vera* gel, honey and a combination of *Aloe vera* gel and honey respectively. Ten fold serial dilution up to 10-10 was made and dilutions used were 50%, 25%, 12.5% and 6.25%. Aseptically prepared disc were impregnated with the dilutions that were dried using hot air oven. The plates were then incubated at 37 °C for 24 h. The zones of inhibition diameter were measured and recorded.

RESULTS: A Total of Five Bacteria were Isolated from the Wound Swab: *Escherichia coli, Proteus vulgaris, Staphylococcus aureus, Streptococcus pyogenes* and *Staphylococcus epidermidis.*

Aloe vera Gel and Honey Activity:

TABLE 1: INHIBITION ZONE DIAMETERS (mm) PRODUCED BY *ALOE VERA* GEL AGAINST THE ISOLATED ORGANISMS CONCENTRATION IN mg/ml (*ALOE VERA* GEL)

S. no.	Isolates	1st	2nd	3rd	4th
1	E	12	14	10	11
2	E	9	10	7	8
3	E	10	9	8	7
4	E	4	12	10	9
5	E	8	4	9	11
6	E	5	6	8	12
7	S.A	4	10	10	9
8	S.A	2	5	2	8
9	S.A	12	11	11	10
10	S.A	10	12	9	11
11	S.A	11	13	8	13
12	S.A	7	0	7	11
13	S.A	9	11	5	14
14	S.A	6	9	4	6
15	S.A	8	11	10	7
16	S.A	7	7	5	9
17	S.A	8	9	10	11
18	S.A	11	8	9	10
19	S.A	6	12	8	9
20	S.P	0	13	10	11
21	S.P	0	2	5	4
22	S.P	4	8	6	7
23	S.P	7	9	10	8
24	S.P	13	15	11	14
25	S.P	12	14	10	10
26	S.P	10	16	8	7
27	S.P	12	15	13	9
28	S.P	6	6	7	8
29	S.P	0	9	6	10
30	S.P	0	8	9	10
31	S.E	2	6	4	11
32	S.E	5	5	4	8
33	P	4	6	10	5
34	P	0	5	0	2

Keys: E= *Escherichia coli* S.A= *Staphylococcus aureus* S.E= *Staphylococcus epidermidis* S.P= *Streptococcus pyogenes*

TABLE 2: INHIBITION ZONE DIAMETERS (mm) PRODUCED BY HONEY AGAINST THE ISOLATED ORGANISMS CONCENTRATION IN mg/ml (HONEY)

S. no.	Isolates	1st	2nd	3rd	4th
1	E	14	11	12	10
2	E	10	8	9	7
3	E	9	7	10	8
4	E	12	9	4	10
5	E	4	11	8	9
6	E	6	12	5	8
7	S.A	10	9	4	10
8	S.A	5	8	2	2
9	S.A	11	10	12	11
10	S.A	12	11	10	9
11	S.A	13	13	11	8
12	S.A	10	10	7	7
13	S.A	11	14	9	5
14	S.A	9	6	6	4
15	S.A	11	7	8	10
16	S.A	7	9	7	5
17	S.A	9	11	8	10
18	S.A	8	10	11	9
19	S.A	12	9	6	8
20	S.P	13	11	0	10
21	S.P	12	4	0	3
22	S.P	8	7	4	6
23	S.P	9	8	7	10
24	S.P	15	14	13	11
25	S.P	14	10	12	10
26	S.P	16	7	10	8
27	S.P	15	9	12	13
28	S.P	6	8	6	7
29	S.P	9	10	1	6
30	S.P	8	10	1	9
31	S.E	6	11	2	4
32	S.E	5	8	5	4
33	P	6	5	4	10
34	P	5	2	1	12

Keys: E= *Escherichia coli* S.A= *Staphylococcus aureus* S.E= *Staphylococcus epidermidis* S.P= *Streptococcus pyogenes* P= *Proteus vulgaris*

TABLE 3: INHIBITION ZONE DIAMETERS (mm) PRODUCED BY MIXTURE OF BOTH *ALOE VERA* GEL AND HONEY AGAINST THE ISOLATED ORGANISMS CONCENTRATION IN mg/ml (HONEY + *ALOE VERA* GEL)

S. no.	Isolates	1st	2nd	3rd	4th
1	E	12	12	12	12
2	E	11	11	11	10
3	E	11	9	10	10
4	E	0	0	0	0
5	E	11	8	0	0
6	E	12	10	10	0
7	S.A	0	0	0	0
8	S.A	9	0	0	9
9	S.A	10	10	10	10
10	S.A	12	10	9	10
11	S.A	11	10	11	11
12	S.A	10	11	10	10
13	S.A	11	10	9	12
14	S.A	0	0	0	0
15	S.A	0	0	0	0
16	S.A	10	9	9	10
17	S.A	10	10	9	10
18	S.A	10	12	10	10
19	S.A	8	9	9	9
20	S.P	9	8	0	10
21	S.P	9	9	0	0
22	S.P	9	0	0	10
23	S.P	0	0	9	0
24	S.P	10	9	9	9
25	S.P	10	10	0	0

26	S.P	9	10	12	10
27	S.P	9	8	10	19
28	S.P	0	9	0	0
29	S.P	0	0	0	0
30	S.P	0	0	0	0
31	S.E	0	0	0	9
32	S.E	0	0	9	0
33	P	0	0	0	0
34	P	9	9	11	11

Keys: E= *Escherichia coli* S.A= *Staphylococcus aureus* S.E= *Staphylococcus epidermidis* S.P= *Streptococcus pyogenes* P= *Proteus vulgaris*

DISCUSSION AND CONCLUSION: Wounds are the physical injuries resulting in an opening and breaking of the skin. Appropriate method for healing of the wound is essential for the restoration of the disrupted anatomical continuity and disturbed functional status of the skin [4]. A wound leads to the establishment of infections by bacterial pathogens in the internal tissues [5]. The study revealed that *Staphylococcus aureus* was the most predominant organism present in wounds which agrees with the work of Okesola [8].

It was found that honey had more antibacterial activity than *Aloe vera* gel based on their inhibition zone diameters (IZD). Honey had higher IZD than *Aloe vera* gel against *Staphylococcus aureus, Streptococcus pyogenes,* and *Proteus vulgaris.* But honey and *Aloe vera* gel had the same IZD for *Escherichia coli* and *Staphylococcus epidermidis.* It also revealed that the mixture of both honey and *Aloe vera* gel had higher IZDs (*e.g.* using $10mm^3$ and above) than that for honey and *Aloe vera* gel against *Escherichia coli* and *Staphylococcus aureus* but the same with honey for *Proteus vulgaris* and lower against *Staphylococcus epidermidis* and *Streptococcus pyogenes.*

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