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## Studies On Antibacterial Potential Of *Aloe Vera* Fresh Gel, Latex And Commercially Available Powders

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### ABSTRACT

*Aloe vera* is a medicinal herb that has been benefiting mankind for thousands of years. The comparative antibacterial activities of *Aloe vera* fresh gel, latex and commercially available powder on pathogenic bacteria were studied. The antibacterial potential of *aloe* gel and latex were tested by agar gel well diffusion technique and found that *E.coli* was highly sensitive to aloe latex followed by *Pr.vulgaris*, *Sal. typhimurium*, *Staph. aureus*, *Ps.aeruginosa*, *Ps.aeruginosa*, *Sal.typhi*, *Ent. aerogenes* and least with *Staph. Epidermidis*. In case of aloe gel, the *Pr.vulgaris* was maximally sensitive followed by *Staph. aureus*, *Staph. Epidermidis*. The various solvent extracts of commercial *Aloe vera* powder were weak antibacterial. The study concluded that the fresh aloe gel and latex has the higher degree of antibacterial potential as compared to commercial available aloe powders. © 2007 Trade Science Inc. - INDIA

### KEYWORDS

*Aloe vera*,  
*Aloe* gel;  
*Aloe* latex;  
*Aloe* powder;  
antibacterial properties;  
Bacterial pathogens.

### INTRODUCTION

*Aloe vera* is a medicinal herb that has been benefiting mankind for thousands of years. Therapeutic uses of *Aloe vera* have been reported in medical literature for more than 50 years, although it has been reported in botanical and naturopathic literature for many more years. Scientific studies reported its gel, latex and juice as antibacterial and antifungal, in treatment of ulcers, burns frostbite, and skin abrasion. *Aloe vera* gel is the mucilaginous produced from the centre(parenchyma) and aloe latex is the acrid, resinous compound derived from the outer

membrane(pericarp) of the leaf. The *Aloe vera* species obtained in the Amravati District of Maharashtra State(India) is *Aloe barbadensis*.

*Aloe vera* gel was antibacterial against *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus agalactiae*, *Escherichia coli*, *Serratia marcescens*, *Klebsiella spp.*, *Enterobacter spp.*, *Citrobacter spp.*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Candida albicans*<sup>[6,4,10,2]</sup>. Aloemodin also inhibits the growth of *Helicobacter pylori* in a dose-dependent fashion<sup>[13]</sup>. Pauer et al.<sup>[9]</sup> showed inhibition of *Staphylococcus aureus* by leaf gel of *Aloe vera* and its acetone and methanol extracted antibacterial component was proved cidal at 1 and

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3mg/ml concentration. Coopoosamy and Magwa<sup>[1]</sup> isolated the two different organic fractions from the extracts of leaves of *Aloe excelsa* and showed them antibacterial. Atherton<sup>[1]</sup> had suggested that aloe works best when used fresh from the plant but it oxidizes rapidly when cut and exposed to air. The products of aloe, which is prepared by heat treatment, filtration, such as powdered, may change correct balance of ingredients and may not give expected antibacterial properties.

Although a lot of works have been carried out on the medical use of *Aloe vera*, there is still little information on comparative antibacterial activities of fresh gel, latex and commercially available powder on pathogenic bacteria. Hence, attempt was made to find out antibacterial potentials of gel, latex, and commercially available powder of leaves of *Aloe vera*.

## MATERIALS AND METHODS

### Collection of Samples

#### The gel

Freshly and fully expanded leaves of *Aloe vera* were selected from Botanical Garden, S.G.B. Amravati University, Amravati and gel was extracted by peeling off the hard layer of the leaves with the help of sharp knife. The homogenized slurry of the gel was prepared by grinding in the mixer.

#### The latex

Fully expanded leaves of *Aloe vera* were given a short cut from the bottom and the yellow colored latex was collected in the sterilized bottle.

### Commercial powders

Commercial powders of *Aloe vera* were purchased from the local market and the extracted with various solvents such as ethanol, methanol, acetone and distilled water. Ten gram of dried powder was dissolved in 100mL distilled water or organic solvents and soaked for 24h. This mixture was then refluxed in soxlet apparatus. The extracts were collected and filtered. Filtrate was evaporated in controlled tempera-

ture conditions. The extracts were tested against bacterial lawn culture using well/disc diffusion method. After incubation of 24h at 37°C the zone of inhibition in mm was measured.

### Phytochemical analysis

The presence of saponins, tannins, anthraquinones, alkaloids, triterpens, flavonoids, glycosides, reduced sugar and phlobatannins were detected by simple qualitative methods (Khandelwal, 2001).

### Bacterial cultures

The standard pathogenic bacterial cultures were procured from IMTECH, Chandigarh, India and used in the present study. (TABLE 1). The bacteria rejuvenated in Mueller-Hinton broth (Hi-media laboratories, Mumbai, India) at 37°C for 18 hours and then stocked at 4°C in Mueller-Hinton Agar. Subcultures were prepared from the stock for bioassay. A loopful of culture was inoculated in 10mL of sterile nutrient broth and incubated at 37°C for 3 hours. Turbidity of the culture was standardized to 10<sup>5</sup>CFU with the help of SPC and Nepheloturbidometer.

### Agar gel diffusion antibacterial activities

For antibacterial properties, 0.1ml bacterial suspension of 10<sup>5</sup> CFUml<sup>-1</sup> was uniformly spread on Mueller-Hinton Agar plate to form lawn cultures. The various organic extracts of acetone, ethanol, and methanol were prepared in dimethyl sulfoxide (DMSO) at the concentration of 20mg ml<sup>-1</sup>. For well diffusion method, the punch having diameter of 10mm was used to prepare the well in the agar plate. The wells were filled with 0.08mL of gel or latex or organic extracts of commercial powders. For disc diffusion method; the Whatman filter paper disc 10mm diameter were soaked in various extracts and paste were prepared and tested for their antibacterial activity against bacterial pathogens. After incubation of 24h at 37°C zone

**TABLE 1: Bacterial cultures used in study (IMTECH, Chandigarh, India)**

| Bacterial Pathogens               | MTCC |
|-----------------------------------|------|
| <i>Escherichia coli</i>           | 452  |
| <i>Staphylococcus aureus</i>      | 87   |
| <i>Enterobacter aerogenes</i>     | 111  |
| <i>Pseudomonas aeruginosa</i>     | 424  |
| <i>Salmonella typhi</i>           | 733  |
| <i>Staphylococcus epidermidis</i> | 435  |
| <i>Salmonella typhimurium</i>     | 98   |
| <i>Proteus vulgaris</i>           | 426  |

#### *Aloe vera* commercial powders

| Powder              | Manufacturers                             |
|---------------------|---|
| 1. Aloes            | Dr. Jain's Forest Herbals Pvt. Ltd, Vasai |
| 2. <i>Aloe vera</i> | Raj Gruh Udyog, Nagpur                    |
| 3. <i>Aloe vera</i> | Barsanya Kirana Stores, Amravati          |

RESULTS

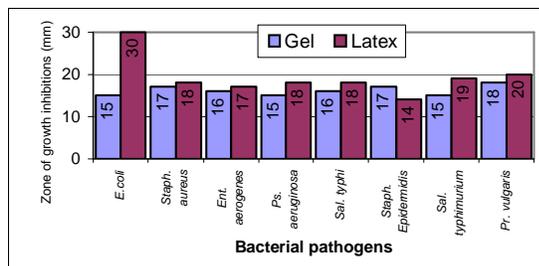


Figure 1: Antibacterial activity of *Aloe vera* gel and latex zone of inhibition in mm(average of 5 readings)

TABLE 2 : Antibacterial activity of extracts of various powders of *Aloe vera* (Diameter of zone of inhibition in mm.)

| Pathogens                | <i>Aloe vera</i> 1 |          |         | <i>Aloe vera</i> 2 |          |         | <i>Aloe vera</i> 3 |          |         | Negative Control | Positive control |    |    |    |    |    |    |
|--------------------------|--------------------|----------|---------|--------------------|----------|---------|--------------------|----------|---------|------------------|------------------|----|----|----|----|----|----|
|                          | Ethanol            | Methanol | Acetone | Ethanol            | Methanol | Acetone | Ethanol            | Methanol | Acetone |                  |                  |    |    |    |    |    |    |
| <i>E.coli</i>            | -                  | -        | -       | 14                 | -        | -       | -                  | -        | -       | 12               | 15               | -  | -  | 11 | 11 | -  | -  |
| <i>Staph.Aureus</i>      | 12                 | 14       | 20      | -                  | 12       | -       | 12                 | 13       | 14      | -                | -                | -  | -  | 12 | 12 | -  | -  |
| <i>Ent.aerogenes</i>     | 12                 | -        | -       | -                  | -        | -       | -                  | -        | -       | -                | -                | -  | 11 | 14 | 11 | -  | -  |
| <i>Ps.aeruginosa</i>     | 15                 | 15       | -       | -                  | 15       | -       | -                  | -        | -       | -                | -                | -  | 14 | -  | 12 | -  | 10 |
| <i>Sal.typhi</i>         | -                  | 13       | -       | 13                 | -        | -       | -                  | 15       | 13      | 16               | -                | -  | -  | 13 | 13 | -  | 18 |
| <i>Staph.epidermidis</i> | 24                 | 13       | 20      | -                  | -        | -       | -                  | 18       | -       | -                | -                | -  | -  | 15 | -  | -  | 18 |
| <i>Sal.typhimurium</i>   | -                  | -        | -       | 12                 | -        | 11      | 11                 | -        | -       | -                | 12               | 11 | 12 | 11 | 11 | -  | -  |
| <i>Pr.vulgaris</i>       | -                  | 14       | -       | -                  | 13       | -       | 11                 | -        | 13      | -                | 13               | -  | -  | 12 | 11 | 11 | -  |

TABLE 3: Phytochemical present in various *Aloe vera*

| Phytochemical                 | Powder extract |         |         |          | <i>Aloe vera</i> gel/latex |
|-------------------------------|----------------|---------|---------|----------|----------------------------|
|                               | Aqueous        | Acetone | Ethanol | Methanol |                            |
| Alkaloids                     | +              | +       | +       | +        | +                          |
| Flavonoids                    | +              | +       | +       | +        | +                          |
| Carbohydrate                  | +              | +       | +       | +        | +                          |
| Cardiac Glycosides            | -              | -       | -       | -        | -                          |
| Anthraquinone Glycosides      | +              | +       | +       | +        | +                          |
| Saponins                      | +              | +       | +       | +        | +                          |
| Proteins                      | +              | +       | +       | +        | +                          |
| Tannin and Phenolic Compounds | +              | +       | +       | +        | +                          |
| Volatile oils                 | -              | -       | -       | -        | -                          |
| Steroids                      | +              | +       | +       | +        | +                          |

of growth of inhibition was measured mm. Ampicillin 10mcg(Hi-Media disc) was used as positive control while disc soaked in various organic solvents were placed on lawns as negative control.

In the present study *Aloe vera* gel, latex, and commercial powders were tested for their antibacterial potential against the various enteric and the skin pathogens. There is only one species *Aloe barbadensis* was found in the Amravati region. The samples were collected randomly from the various plants and used for the testing.

The *Aloe* gel and latex were tested by gel well diffusion technique and found that *E.coli* was highly sensitive to *aloe* latex followed by *Pr.vulgaris*, *Sal.typhimurium*, *Staph.aureus*, *Ps.aeruginosa*, *Ps.aeruginosa*, *Sal.typhi*, *Ent.aerogenes* and least with *Staph. Epidermidis*. In case of *aloe* gel, the *Pr.vulgaris* was maximally sensitive followed by *Staph. aureus*, *Staph. Epidermidis* and least with rest of the organisms (Figure 1). The *aloe* latex showed the higher degree of antibacterial potential as compared to *aloe* gel.

The various solvent extracts of commercial *Aloe vera* powder were tested for their antibacterial activities and most extracted component showed negligible or mild or no antibacterial activities (TABLE 2). It indicated that the commercially prepared *aloe vera* powder lost their antibacterial properties. The antibacterial properties of latex were highest as compare to gel and least/negligible with commercially available powders.

It was found that the fresh gel of the *Aloe vera* and the extracts which are prepared from the commercially available powders such as acetone, methanol, ethanol and aqueous extracts contain alkaloids, flavonoids, carbohydrate, anthraquinone glycosides, saponins, proteins, tannins, phenolic compounds and steroids whereas cardiac glycosides and volatile oils were absent (TABLE 3).

DISCUSSION

In the present study *Aloe vera* was used to test the antibacterial activity against the various enteric and the skin pathogens. Latex is more potent antimicrobial agent than the fresh gel, but the moisturizing property along with antimicrobial activity can be observed only in the presence of gel. Phytochemical screening study of the fresh gel, latex, commercial powder suggested that though they contained all different phytochemicals but their antimicrobial activi-

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ties were decreased. Fresh gel/latex without any processing was more effective as antimicrobial agent as compared to dried commercial powders. This suggests that drying procedure of gel might have lost the antimicrobial activity.

Highest antibacterial activities of fresh latex and a moderate activity were recorded in present study; similar finding was reported by Tambekar and Deb,<sup>[12]</sup> Tambekar and Khante<sup>[11]</sup> against skin pathogens such as *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Streptococcus pyogenes*. Lorenzetti et al,<sup>[8]</sup> reported that the juice(latex) significantly inhibited *Staphylococcus aureus*, *Streptococcus pyogenes*, *Corynebacteria xerose* and *Salmonella paratyphi*. Similar results were also recorded in the present study against *Escherichia coli*, *Proteus vulgaris*, *Salmonella typhimurium*, *Staphylococcus aureus* and *Salmonella typhi*. Hegggers et al.<sup>[6]</sup> tested microbial pathogens such as *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus agalactiae*, *Escherichia coli*, *Serratia marcescens*, *Klebsiella* spp., *Enterobacter* spp., *Citrobacter* spp., *Bacillus subtilis* and *Candida albicans* and found 90% gel concentration was inhibitory to all organisms. In the present study all tested pathogens were inhibited by fresh *Aloe vera* gel, which confirms the previous findings.

Heck et al.<sup>[4]</sup> used a preserved aloe gel extract cream(commercial) against burn infection; Robson et al<sup>[10]</sup> studied various extracts of dried powder and showed more effective bactericidal as compared to fresh unpreserved aloe extract but present study showed more antibacterial potential of fresh *Aloe vera* gel than the various commercially powders available in the market. On the basis of present study, we can conclude that, the commercially available powders that are mainly used by various cosmetologists for various beauty treatments could only be used as moisturizer after their reconstitution, as they are less effective antibacterial.

## CONCLUSIONS

The present study showed that *Aloe vera* fresh gel/ latex are good antibacterial agent hence infections caused by enteric pathogens could be cured by regular intake of fresh gel/ latex. It can also cure dermal infections caused by *Staph.aureus*, *Ps. aeruginosa*, and *Staph.epidermidis*. The fresh *Aloe vera* gel/latex which is collected directly from the plant

is much more effective antimicrobial agent than the commercial dried powders available in the market.

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