

## Phytochemical Analysis and Growth Inhibitory Impact of *Swertia chirayita* Aqueous Leaf Extract Against Some Human Pathogens

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**Abstract:** In the present study the leaves of *Swertia chirayita* were subjected to phytochemical analysis and the impact of the leaf extract of *Swertia chirayita* was tested against *Staphylococcus aureus*, *Bacillus subtilis* and *Salmonella typhi*. The phytochemical analysis revealed the presence of various phytochemicals such as alkaloids, flavonoids, phenols, quinones, saponins, tannins and terpenoids. The antibacterial activity was done by Agar disc diffusion method and the result showed that the leaf extract of *Swertia chirayita* showed 100% inhibition of all the test bacteria. The Minimum Inhibitory Concentration (MIC) of *Swertia chirayita* leaf extract that showed 100% inhibition was 0.13 mg, 0.36 mg and 0.13 mg in case of *Staphylococcus aureus*, *Bacillus subtilis* and *Salmonella typhi* respectively.

**Key words:** *Swertia chirayita* • *Salmonella typhi* • *Staphylococcus aureus* • *Bacillus subtilis* • MIC

### INTRODUCTION

Plants are nature's richest source of chemicals on Earth. Recent researches have shown immense antimicrobial impact of phytochemicals against major human pathogens [1]. Millions of people in sundry traditional societies including India have turned to use medicinal plants for ailment treatment. This dependency on plant products has its merits, but care must be taken while use of inimical plants or high dose plant extracts, which could have deleterious effects on vital organs of the body [2]. Plants play a major role in the health care desiderata for treatment of diseases to improve the immunological response [3]. Different parts of plant such as leaf, bark, fruits, roots and seeds are used in treatment of various diseases [4]. Plants are rich in secondary metabolites such as tannins, alkaloids, flavonoids, phenols etc. which are responsible for therapeutic activities [5]. *Swertia chirayita* is also known as Chireta in hindi; haima in Sanskrit [6]. *Swertia chirayita* is an important herb which is commonly available in India, Nepal and China. The plant is found at an altitude of 1200 – 3000 m and available throughout the year. It is generally consumed by the older people and or people with type 2 diabetes and is useful for lowering blood glucose level [7]. Thus owing to the above apprehensions the present

study was undertaken to find the phytochemical constituents of leaf extract of *Swertia chirayita* and analyze the antibacterial effect of leaf extract on *Staphylococcus aureus*, *Bacillus subtilis*, *Salmonella typhi*.

### MATERIALS AND METHODS

**Plant materials:** The fresh tender leaves of *Swertia chirayita* were collected from Ranchi district (23.3500° N, 85.3300° E) of Jharkhand state of India and were washed with deionized water and disinfected with 0.1% HgCl<sub>2</sub> solution for 5 min and dried in shade for 15 days and ground to fine powder [8, 9].

**Preparation of Plant Extracts:** The fine powder of *Swertia chirayita* was made into thimble for loading in Soxhlet apparatus and extraction was done using H<sub>2</sub>O. The extraction was done continuously for 72 hours. The extracts thus obtained were concentrated under vacuum rotary evaporator and extracts were kept in desiccator until used [2, 5].

**Phytochemical Screening:** Preliminary phytochemical screening were conducted on *Swertia chirayita* leaf sample with previously published standards [10, 11].

**Antibacterial Analysis:** The organisms namely *Staphylococcus aureus*, *Bacillus subtilis* and *Salmonella typhi*

Were used during the present experiment and were procured from Hi-media. These organisms are potential causative agents for different diseases.

**Agar Disc Diffusion Method:** Initially, the stock cultures of bacteria were revived by inoculating in broth media and grown at 37 ° C for 48 hrs. The agar plates of the above media were prepared and wells were made in plate each plate was inoculated with 18h hold cultures (100µ, 104 CFU and spread evenly on the plate. After 20 min, the wells were filled with different concentrations of samples. The control wells were filled with Gentamycin along with solvent. All the plates were incubated at 37°C for 24 h and the diameter of Zone of Inhibition (ZOI) were noted [4].

MEDIA USED: peptone – 10g, NaCl – 10g and Yeast extract 5g, agar – 20g in 1000 ml of distilled water.

**RESULTS AND DISCUSSION**

**Phytochemicals:** The preliminary phytochemical screening is presented in Table 1. The results showed the presence of various phytochemicals such as alkaloids, flavonoids, phenols, quinones, saponins, tannins and terpenoids.

Medicinal properties of plants are due to the secondary metabolites (Alkaloids, phenols, tannin etc.) present in different plant parts [1]. The phenols possess redox properties and thus impart antioxidant properties to the plants in which they are present.

Table 1: Result of preliminary phytochemical screening of *Swertia chirayita* leaf extract

phytochemicals	<i>Swertia chirayita</i> (aqueous extract)
Alkaloids	+
Flavonoids	+
Phenols	+
Quinones	+
Saponins	+
Tannins	+
Terpenoids	+

Table 2: Table showing the Zone of Inhibition (ZOI) and Minimum inhibitory concentration (MIC) of *Sc* leaf extracts against test pathogens

Sample	0.13mg	0.36mg	0.612mg	MIC mg
<i>Staphylococcus aureus</i>	7.2	10.1	21	0.13 mg
<i>Bacillus subtilis</i>	6.2	11.3	14.6	0.36 mg
<i>Salmonella typhi</i>	8	12.3	15.8	0.13 mg

They act as reducing agents, hydrogen donors, singlet oxygen quenchers and metal chelators [12]. Flavonoids and tannins are major group of compounds that act as primary antioxidants or free radical scavengers. Tannins, alkaloids, saponins and flavonoids have been found to be active against pathogenic bacteria [13]. Thus taking into consideration the phytochemicals present, *Swertia chirayita* can be used as an effective potent antimicrobial agent.

**Antibacterial Activity:** The antibacterial activity of *Swertia chirayita* aqueous leaf extract against *Staphylococcus aureus*, *Bacillus subtilis* and *Salmonella typhi* was determined using the agar disc diffusion method. The results of antibacterial analysis is presented in Table 2 and the photos of the agar plates showing the ZOI is presented in Figure 1.

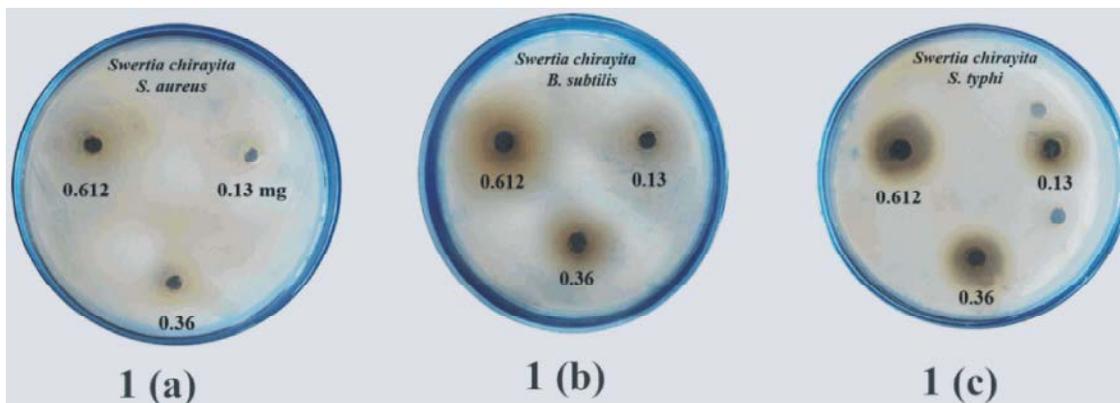


Fig. 1: Agar plates showing the zone of inhibition of *Sc* leaf extract against test pathogens (Numbers in the disk represent concentration of extract)

Several phytochemicals have been known to possess antibacterial properties. Tannins, alkaloids, saponins, flavonoids and sterols have been found to have growth inhibitory impact on *Salmonella typhi* [13]. Tannins form irreversible complexes with proline rich protein resulting in inhibition of cell synthesis of bacteria [11, 14]. Middleton and Kandaswami [15] showed that flavonoids inhibit several enzymes, chelate certain metal cation, affect protein phosphorylation. Smith [16] concluded that flavonoids interpose several membrane-linked processes. The leaf extract of *Swertia chirayita* was found effective against all the test bacteria. The MIC (Minimum inhibitory concentration – of the plant extract that shows 100% inhibition) of *Swertia chirayita* in case of *Sa*, *Bs* and *St* was found to be 0.13 mg, 0.26 mg and 0.13 mg respectively. *Staphylococcus aureus* is a gram +ve bacterium that is found frequently in human respiratory tract and on the skin. It is common cause of skin infections (eg. Boils), respiratory disease (eg. Sinusitis) and food poisoning. *Bacillus subtilis* is a gram +ve bacterium, found in gastrointestinal tract of ruminants and humans. *B. subtilis* is known to cause disease in severely immunocompromised patients. *Salmonella typhi* causes typhoid fever, paratyphoid fever.

The obtained results showed that the aqueous leaf extract of *Swertia chirayita* was effective as an antibacterial agent against tested bacteria (*Staphylococcus aureus*, *Bacillus subtilis* and *Salmonella typhi*) the demonstration of antibacterial activity of *Swertia chirayita* extract is indeed a promising development, which will help to discover new chemical classes (Medicines).

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