ANTIBACTERIAL ACTIVITY OF GINGER (ZINGIBEROFFICINALE)
AGAINST E.COLI FROM THE UTI AFFECTED URINE SAMPLES

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ABSTRACT

Natural products are became main source for the discovery of new drugs. Ginger has strong antibacterial activity and to some extent antifungal properties. In vitro studies have shown that active constituents of ginger inhibit multiplication of colon bacteria, these bacteria ferment undigested carbohydrates causing flatulence, this can be counteracted with ginger. Traditional medicine as an alternative form of health care and reduce the microbial resistance to the available antibiotics, cost of the antibiotics. Extracts of Ginger (Zingiber officinale) was tested for in vitro antibacterial activity against E.coli isolated from Various UTI samples by disc diffusion method. The present investigation of the study showed the methanolic extract of Zingiber officinale exhibited more considerable antibacterial activity against E.Coli from various UTI infected urine samples.

KEYWORDS: Antibacterial activity, Zingiber officinale, Methanolic extracts, UTI.

INTRODUCTION

Medicinal plants are finding use as pharmaceuticals, nutraceuticals, cosmetics and food supplements. Plant derived products have been used for medicinal purposes for centuries. In traditional Indian medicine or Ayurveda, Zingiber officinale and many other herbs have been used as medicine (Supreetha SL et al.,2011). Ginger (Zingiber) is a perennial herb belongs to Zingiberaceae family, the rhizome is part used its horizontal, branched, fleshy, aromatic,
white or yellowish to brown. Leaves are narrowly, up to 20 cm long and 1.5-2 cm wide, flowers are produced in a dense spike, yellow green with purple endings. (Sharma et al., 2010). Ginger has strong antibacterial activity and to some extent antifungal properties. (Nielsen and Rios. 2000) In vitro studies have shown that active constituents of ginger inhibit multiplication of colon bacteria, these bacteria ferment undigested carbohydrates causing flatulence, this can be counteracted with ginger. (Gupta and Ravishankar. 2005) It inhibits the growth of *Escherichia coli*, *Proteus sp*, *Staphylococci*, *Streptococci* and *Salmonella*. (Ernst and Pittler. 2000; White. 2007). The rhizome is rich in the secondary metabolites such as phenolic compounds (gingerol, paradol and shogaol), volatile sesquiterpenes (zingiberene and bisabolene) and monoterpenoids (curcumene and citral) (Ali et al., 2008). The spices have a unique aroma and flavour which are derived from compounds known as phytochemicals or secondary metabolites (Avato et al., 2002; Melvin et al., 2009). The phytochemicals are antimicrobial substances present in the spices which are capable of attracting benefits and repel harmful organisms; they also serve as photoprotectants and responds to environmental changes (Melvin et al., 2009). Numerous classes of phytochemicals including the isoflavones, anthocyanins and flavonoids are found associated with the spices (Chang, 1988; Melvin et al., 2009). Previous studies have demonstrated that plant extracts and isolated compounds from *Z. officinale* possess strong antioxidant (Stoilovaet al., 2007), antibacterial, antifungal, anticancer and anti-inflammatory effects (Habib et al., 2008). Important secondary metabolites present in the rhizome are curcumene, non-volatile hydroxyaryl compounds e.g. zingerone, gin-geroles and shogaoles (phenylalkanones), volatile ses- quiterpenes (e.g. zingiberene and bisabolene) and monoterpenoids (e.g. citral) (Bensky et al., 1993). Natural products are a major source of new natural drugs and their use as an alternative medicine for treatment of various diseases has been increased in the last few decades (Vuorelaa, et al., 2004; Ansari, et al., 2006), particularly those of plants origin which are easily available and have considerably less side effects. (Khulbe and Sati. 2009). Urinary tract infections that occur in a normal genitourinary tract with no prior instrumentation are considered as “uncomplicated”, whereas “complicated” infections are diagnosed in genitourinary tracts that have structural or functional abnormalities including instrumentation such as indwelling urethral catheters, and are frequently asymptomatic (Gonzalez and Schaeffer et al., 1999). (Stamm and Hooton et al., 1993). Many different microorganisms can cause UTIs though the most common pathogens causing the simple ones in the community are *Escherichia coli* and other Enterobacteriaceae, which accounts for approximately 75% of the isolates.
UTI is an infection of any part of the urinary system-kidneys, ureters, bladder and/or urethra. It is the second most common infection after respiratory tract. An increasing proportion UTIs are due to multidrug-resistant (MDR) pathogens for which there are limited treatment options (Hoban et al., 2011). The main goal of this study to determine the antimicrobial activity of Zingiber officinale against e.coli from various urinary tract infected samples.

MATERIALS AND METHODS

Collection of plant: The Rhizome of the Zingiber officinale was purchased in market of salem and they were thoroughly washed with sterile water. Air dried the plant parts then powdered with help of waring blender.

Preparation of extracts of Rhizome

25 grams of shade and dried powder of rhizome was filled in the thimble & extract successfully with methanol, Ethanol, Petroleum ether, &Water for 48 Hrs.

Isolation of E-coli from various UTI samples

Various uti samples were collected from different hospitals located in salem. Primarily samples were inoculated on nutrient agar and incubated for 24 hrs for the isolation of microorganisms from the urine samples. Finally E-coli was identified by the following tests,

- Gram Staining
- MacConkey Agar
- Eosin Methylene blue Agar
- Wet Mount
- Biochemical Tests
  a. Indole Production Test
  b. Methyl Red Test
  c. Vogeus Proskauer Test
  d. Citrate Utilization Test
  e. Triple Sugar Iron Test
  f. Urease
  g. Oxidase

Disc Preparation: Using sterile pouching machine cut the 2-3 mm sterile filer paper (using only Watt men No-1 filter paper ). Then dried herbal leaves are mix with methanol, water,
Petroleum ether, ethanol (1 gram of dried leaves using 1 ml of solvents). Then prepare disc in different concentration from 10µl to 160 µl.

**Antimicrobial Sensitivity Test**
The Kirby-Bauer method was used to test the bacterial isolates susceptibility to the plant extract of Zingiber officinale. These antibiotic sensitivity studies of the isolates were conducted by disc diffusion method. Young and active culture (24 hours) were used for the test. A sterile cotton wool swab was dipped in the culture broth and used evenly inoculated the surface of the Muller hinton agar plates. After the agar surface has dried for about 5 minutes the appropriate antibiotic discs were placed on the plate with sterile forceps. The plates were incubated at 37°C for 24 hours.

**RESULTS AND DISCUSSION**

**Isolation**

*Escherichia coli, Proteus sp, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus sp* strains selected in the present study were isolated from urine samples from various hospitals in Salem.*Escherichia coli* was dominated others isolated from many samples.

**Table Showing The Organism Isolates From Urine**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Organism</th>
<th>No. Of Infected Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>E.coli</em></td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td><em>Pseudomonas</em></td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td><em>Staphylococcus</em></td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td><em>Proteus</em></td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td><em>Streptococcus</em></td>
<td>2</td>
</tr>
</tbody>
</table>

**Identification of*Escherichia coli***

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Biochemical activity</th>
<th><em>E -coli</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gram staining</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Motility</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Indole</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>MR</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>VP</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Mannitol</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Citrate</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Urease</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td><em>H₂S</em></td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Catalase</td>
<td>+</td>
</tr>
<tr>
<td>11</td>
<td>Oxidase</td>
<td>-</td>
</tr>
</tbody>
</table>
Antibiotic sensitivity test
Isolated E. Coli was resistant to water, petroleum, ether and ethanol, But highly sensitive to Zingiber officinale in methanol. At the same time the E. Coli was resistant to some herbal in ethanol, petroleum, ether, water and also in methanol.

In this study checked the zone of inhibition for the E. Coli strain, when few herbal used it showed no zone of inhibition in antibiotic sensitivity test. But Zingiber officinale was used for the current study. The Zingiber officinale with methanol was produce (40 µl) 11mm, (80µl)19mm, (160µl) 25 mm. The isolated strain is highly resistant to the solvent there are water, petroleum, ether, Ethanol (No Zone formation). Present study showed the antibacterial activity of Zingiber officinale against E. Coli isolated from various UTI infected urine samples.

<table>
<thead>
<tr>
<th>Zingiber officinale with methanol (µl)</th>
<th>Zone of inhibition</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 µl</td>
<td>11mm</td>
<td>sensitive</td>
</tr>
<tr>
<td>80µl</td>
<td>19mm</td>
<td>sensitive</td>
</tr>
<tr>
<td>160µl</td>
<td>25 mm</td>
<td>sensitive</td>
</tr>
</tbody>
</table>

(Suhad et al., 2012) evaluated the antibacterial activity in the ginger against different pathogenic bacteria include Streptococcus pyogenes and Staphylococcus aureus, founded that, latest concentration (0.4mg/ml) of the extract gave highest activity against tested bacteria.

The antibacterial activity of aqueous, ethanolic, methanolic, hexane and ethyl acetate extracts of Z. officinale was studied by Kaushik and Goyal (2011), and they determined low sensitivity of E. coli. Auta et al. (2011) investigated ethanolic, cold water and raw extract of Z. officinale and demonstrated that the P. aeruginosa was more susceptible than E. coli.

Purshotam Kaushik and Pankaj Goyal (2011) indicated that methanol extract was found most significant inhibitor than other extracts and this extract inhibited the Staphylococcus aureus comparatively at very lower concentration of 512 µg/ml. Bacillus subtilis was inhibited by this extract at 4096 µg/ml; however, comparatively higher inhibitory concentrations were required for inhibition of both Bacillus cereus and Escherichia coli.

The antimicrobial activity of ginger may be attributed to the fact that it contains antimicrobial substances such as zingiberol, zingiberine and bisabolene. (Michael. 1999; Melvin et al., 2009).
Nwaopara et al. (2009) reported that: ginger had strong antibacterial and to some extent antifungal properties. *In vitro* studies had shown that active constituents of ginger inhibited multiplication of colon bacteria. Ginger inhibited the growth of *Escherichia coli*, *Proteus sp.*, *Staphylococci*, *Streptococci* and *Salmonella*. Hence, ginger should have impact on the growth of *Bacillus cereus*, which mainly caused diarrhoea and nausea.

Nada Khazalet al. (2014) indicated that the various soluble extracts of ginger have antibacterial properties. When the extracts were tested on both gram negative and gram positive bacteria, the widest zones of inhibition was obtained with *Proteus mirabilis*, *Klebsiella pneumonia*, *Salmonella typhi* followed by *Acinetobacter* Escherichia coli *Moraxallia catarralis Serratia spp*. Then *Pseudomonas aerogina* using Apple vinegar extract of fresh Ginger.

**CONCLUSION**

This work conveyed that the methanolic extract of *Zingiber officinale* exhibited more considerable antibacterial activity against *E. Coli* from various UTI infected urine samples. The natural herbal can be useful in the discovery of new drugs against the resistant pathogens and treat infectious diseases.

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