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Research Article

Bioactive Ethnomedicinal Plant Extracts for the Management of Urinary Tract Infection in Pregnancy Women Challenges in Pandemic Period

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Abstract

Today urinary tract infection causing *Escherichia coli* is also serious problem among pregnant women especially during pandemic period. So the mid stream urine samples were collected from different clinics and Public Health Centre in from rural area of Salem city. Totally 25 *E. coli* was isolated from 25 mid stream urine samples and confirmed by biochemical test and growth parameters. In this study the optimum growth was recorded in *p*H 7 at 37°C. To date the patterns of resistance to the antimicrobial agents may be due to indiscriminate, wide spread and lengthy use of antibiotics in the treatment of UTI particularly in pandemic situation 2022. So, the present research targeted to extract the therapeutic drug from the high medicinal value of ethano medicinal plant extract because it having anti-UTI compound to diagnose the UTI infection. In this research the antibacterial activity of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* was studied by agar well diffusion method. Four different concentrations (25µl, 50µl, 75µl and 100µl) were used against *Escherichia coli*. The maximum zone of inhibition were observed in plant extracts *Terminalia chebula* 11mm, 13mm, 16mm and 20mm in strain no. EC05 followed by minimum zone of inhibition was observed in the plant extract *Hybamthus enneapermus* 10mm in strain no. EC05 at 100µl concentration of crude plant extracts. The research proved the ethano medicinal plant extract to cleave the pathogenic cell wall of *E. coli*.

Keywords: *E. coli*, Urinary tract infection, Pregnancy Women, Medicinal Plant Extracts

1. INTRODUCTION

During COVID periods the urinary frequency is a common symptom in urinary infection. In developing countries, especially in Tamilnadu, India have UTIs are serious health problem affecting women in their reproductive ages during Lock-Down period because of improper sanitation, unhygienic drinking water, sexual activity etc.,

The researcher prospectively, looked at patient histories for the presence of urinary frequency on admission during COVID period is specialized COVID-19 wards.[1] At that time the pregnant women are more susceptible to UTIs due to combination of hormonal and physiologic changes that predispose them to bacteriuria. Therefore, pregnant women should have a routine urine test in pregnancy.[2] UTI occurs approximately in 5-10% of all pregnancies, [3] and it can be seen in three different forms in pregnancy: asymptomatic bacteriuria, acute cystis and acute pyelonephritis.

The incidence of asymptomatic bacteriuria has been reported between 2-13% in pregnancy all over the world and if not treated, it will increase the frequency of premature delivery and neonates with low birth weight and is likely to cause acute pyelonephritis at a rate of 15-30%. Numerous studies during the past 30 years have reported association between UTI during pregnancy and adverse outcomes.[4] UTI is also important complication of pregnancy. When it is associated with any structural and neurological deficit of the urinary tract often leads to death.[5]

The rate of urinary tract infection usually increases during the hormonal changes in pregnancy leads to decreased bladder tone, diminished peristalsis and dilatation of renal pelvis and ureter. The organisms that cause UTI during pregnancy are the same as those found in non-pregnant women. *E. coli* is reported to be the major cause (85-95%) of urinary tract infection.[6] The other gram negative pathogens causing UTI are *Klebsiella* spp., *Proteus mirabilis* and *Pseudomonas aeruginosa*, however, Enterococci and coagulase negative *Staphylococci* are the most frequently encountered gram positive bacteria in UTI.

Furthermore, also the *Escherichia coli* present in the gastrointestinal tract as commensals provide the pool for initiation of UTI.[7] In UPEC strains, virulence factors include the ability to adhere to uroepithelial cells, some O and K antigens, and resistance to phagocytosis and to the bactericidal action of human serum.[8] Adherence to Uro-epithelial cells is mediated by fimbrial and non-fimbrial adhesions.[9] The *Escherichia coli*

caused UTI is a common infection encountered daily in medical practice and demanded correct diagnosis for proper management and appropriate antibiotic use has unquestionable benefit.[10]

Different studies have shown that *E. coli* accounted for approximately 70 to 95% of community acquired cases and about 30 to 50% of all nosocomial infections.[11] They also reported that these organisms were responsible for significant social and economic costs for both communities and public health resources. Despite of the fact that wide range of antibiotics is available against UTI, it remains one of the most common infections and is responsible for significant morbidity in females. It may mainly affected the women carrying with UTI and it gives serious penalty of develop renal damage. These necessitate better awareness for reproductive health needs of the women, and health education for hygienic and safe use of family planning methods.

Today resistance to different groups of antibiotics is however another severe problem. This is due to overuse as well as misuse of antibiotics that resistance of antibiotics is increasing day by day.[12] UTI are usually treated with antibiotics including Nalidixic acid, Nitrofurantoin, Ofloxacin, Perfloxacin, Ciprofloxacin, Gentamycin, etc. In the last couple of years, there has been a lot of focus in scientific literature on inappropriate use of antimicrobial agents resulting in the spread of bacterial resistance.[13]

The emergence of antimicrobial resistance in the management of urinary tract infections is an important public health issue. While many antibiotics including Penicillin, Macrolides and Tetracyclines were very useful in the treatment of urinary tract infections in the past, the rates of bacterial resistance to antimicrobial agents has significantly increased and are increasing in many countries in recent times. Despite the well published concerns about the problems of inappropriate use of antimicrobial agents, or use of broad spectrum antibiotics, increasing resistance of bacteria causing urinary tract infections to antimicrobial agents remains a serious problem.

Today WHO report showed overuse and misuse of available antibiotics and lack of detection of the new antibiotic drug by the pharmaceutical industry make the emergency more sever and life threaten situation UTI patients.[14] The increasing of resistance genes are raised in bacterial population through efflux, hyper-mutability and plasmid addiction. These factors recognized for compromised majority of the drugs belong to a given therapeutic.[15] As a result, UTI infection caused with resistant microorganisms have higher mortality and morbidity and this infection are costlier to treat, result in longer hospital stays and place a greater trouble on health systems than infection caused by vulnerable organisms. Many studies shown that in US, at least 2 million people acquire severe infections with microbes that are opposed to one or more of the group of antibiotics used for the management of disease.[16]

The whole financial cost of antibiotic conflict was predictable as high as $20 billion in direct health care and $35 billion in lost yield per year. If there were no flourishing efforts to cure them to combat them, the number of death per year would be ten million and the cost would raise up to $100 trillion by 2050.[17] So, searching for innovative antibiotics from natural products should be eventually a significant segment of contemporary medicine to overcome the different socioeconomic and health impacts caused by MDR pathogens.[18]

Searching of medicinal plants used as complementary treatment of emerging and re-emerging of MDR microbe is undergoing recovery because it exists, accessible, affordable and suitable to the local population.[19] According to WHO statement, therapeutic plants can potentially meet community's needs and get better access to safe, superiority and ethnically sensitive primary health care. Which in turn, they can make a major input to essential health services in the anticipation and administration of communicable diseases caused by drug resistance organism.[20]

Nowadays medicinal plants are major part and parcel of human society to combat diseases from the dawn of civilization. The *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* this are called the 'King of Medicine' in Tibet and is always listed at the top of the list of 'Ayurvedic Materia Medica' because of its extraordinary power of curing dreadful diseases. Nowadays, the bioactive compounds of above said plant remedies are a natural option for the long-term treatment of multi drug resistant UTI,[21] because it have a multi a synergistic antibiotic therapeutics to reduce different symptoms and helps to decrease antibiotic effects raised during UTI infection especially in COVID pandemic situation from 2019 to till year. The whole plant possesses high medicinal value and traditionally used for the treatment of various ailments for human beings. So hence the present study has made an attempt to point out the biomedical activity of gold standard antibacterial activity of plant extract against UTI infection causing *E. coli*. Moreover the proper research evaluation of the plant as medicinal agent against the human diseases it's also to bridge the gap in the existing literature and future scope which may will offer immense opportunity for researchers engaged in validation of the traditional claims and development of safe and effective meditional plant extract made therapeutic drug in future.

2. MATERIALS AND METHODS

2.1 Sample Collection

Urine samples were collected from pregnant women carrying COVID infection with Urinary tract infection during course of study samples were collected from different hospitals. Early morning clean catch mid stream urine is then collected in plastic sterile, wide-mouthed with a 350ml container should be covered with a tightly fitted lid. 25 samples were collected from different hospitals /clinics in Namakkal site of Tamilnadu, South India.

2.2 Isolation and identification of *Escherichia coli* from UTI samples

In this study isolation of *Escherichia coli* was done by selective EMB agar. After, isolation the identification of *Escherichia coli* was confirmed by routine laboratory techniques.

2.3 Effect of *p*H and Temperature on the Growth of UTI Causing Pathogen

In this research the effect of *p*H ranges from 2 to 8 followed by temperature 30°C to 45°C were adjusted in growth medium and the absorbance of the growth was checked by 600 nm in spectrophotometer.

2.4 Invitro isolation of ethnomedicinal plant extracts

2.4.1 Sample Collection

The antimicrobial activity of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* samples [Fig.1] were collected from natural environment in and around Namakkal District. Then samples were thoroughly with distilled water to remove the unsolicited dirt particles.

2.4.2 Identification of plant source

In this study plant parts were completely identified on the source of the sequence provided in the ethanobotanical assessment of India and local medicine of Namakkal region (TN), India.

2.5 Preparation of Bio-medically active Plant Extract

Take 10g of fresh plant material it weighed and then thoroughly washed with tap water followed by the sample was sun dried. Then it should take in 20 days. After, the samples totally dried the powder was extracted with the help of mortar and pestle. Then to prepare 100 ml of ethanol mixed with dried plant extract powder. Afterward depart to filter the sample with the help of muslin cloth. The filtered sample contain purified anti biomedical compound. After collecting the pure sample extract is used to check the antibacterial activity beside *Escherichia coli*. Finally, Invitro antibacterial activity of ethanolic compound extracts of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* samples was examined against UTI pathogen.

2.6 Antibacterial activity of ethno therapeutic values of plant extracts against UTI pathogen

Antimicrobial activity of plant extracts was carried out by using well diffusion method. In this study *E. coli* isolates was inoculated in nutrient broth and incubated for 24 hrs at 37°C. After growth of the UTI bacterial culture prepare MHA plates for antibacterial assay. Then 20 ml of MHA agar was poured on 6 different petriplates. After solidification of the plates the UTI bacteria spreaded on the surface of the MHA plate. Then make well using sterile cork borer for pouring the plant extract to treat the UTI bacteria. In this study different plant extract concentration like 25µl, 50µl, 75µl and 100µl were impregnated in to the well. Finally, end of the incubation the plates were analyzed examined to measure the zone of inhibition around the well.

RESULTS AND DISCUSSION

Generally for diagnostic purpose, totally 25 clean catch mid stream urine samples were collected from different clinics from rural area of Salem city. 25 isolates of *E. coli* (Plate: 1) were isolated from the samples.

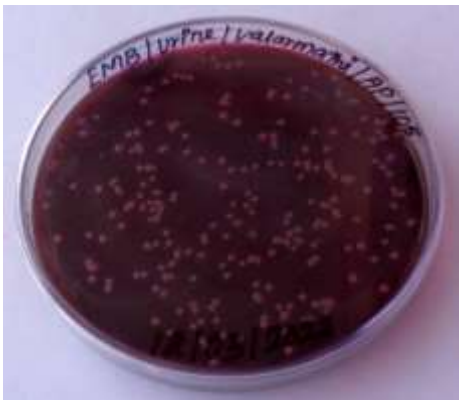


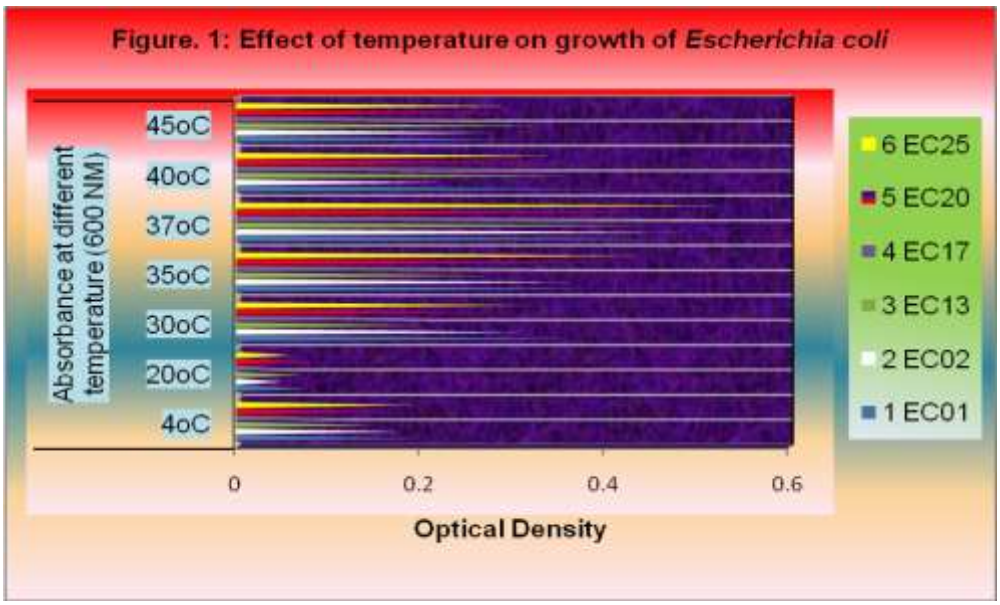
Plate 1: Isolated colonies of *Escherichia coli* on EMB agar

The UTI causing predominant pathogen *E. coli* strains were confirmed by comparing the results with biochemical characterization which includes the standard biochemical test of *E. coli* as result of gram staining the organism belongs to Grams Negative followed by the IMViC test (Plate: 2) the results produced in Indole test - Positive, MR-VP - Positive, Voges Proskauer - Negative, Citrate - Negative, Oxidase - Negative, Urease - Positive, Starch hydrolysis - Negative, Positive results were observed in case of Catalase, Nitrate reduction, Motility, Triple sugar iron agar followed by Sugar fermentation test which includes maltose, sucrose, glucose, fructose, raffinose, arabinose and lactose. Selective media like Eosin Methylene Blue agar media and MacConkey agar were used to isolate the *E. coli*. It showed metallic sheen color colony and pink color colony respectively. These colonies were isolated and stored for further experiment.

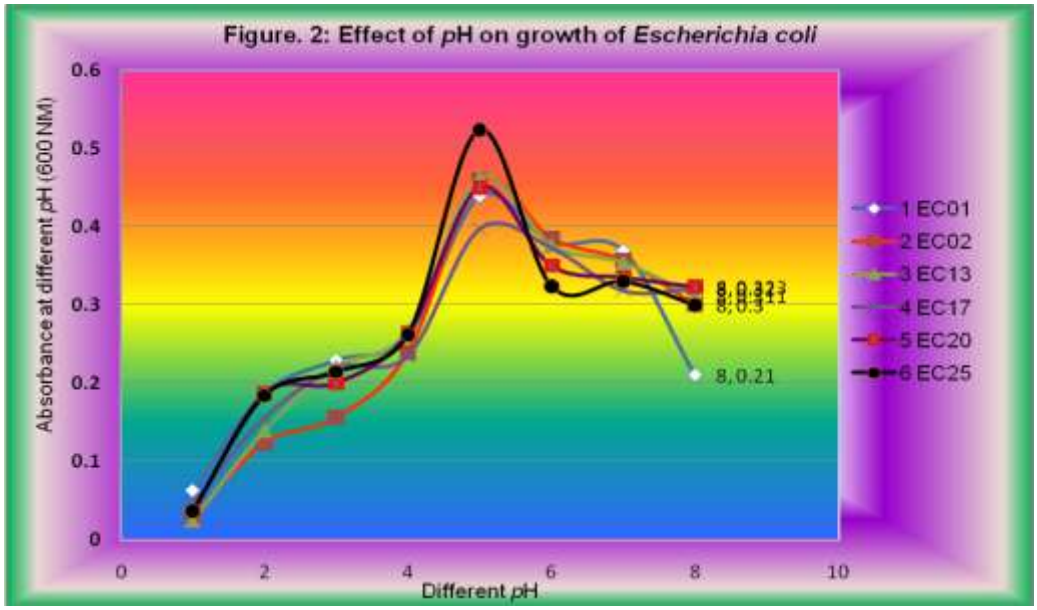
Plate 2: Biochemical characterization of *Escherichia coli* isolated from UTI sample

Further to identify and confirm the *E. coli* at phenotypic level, the characterization of growth parameter like effect of *p*H and temperature was checked.

The growth medium of *E. coli* was adjusted at different temperature: 4°C, 20°C, 30°C, 35°C, 37°C, 40°C and 45°C. The results indicated that the rapid growth was temperature obtained from to 30°C, 35°C, 37°C and 40°C, and declined in 45°C. Maximum growth was recorded in 37°C it indicates the optimum temperature for the growth of *E. coli* was recorded at 37°C (Fig.1).

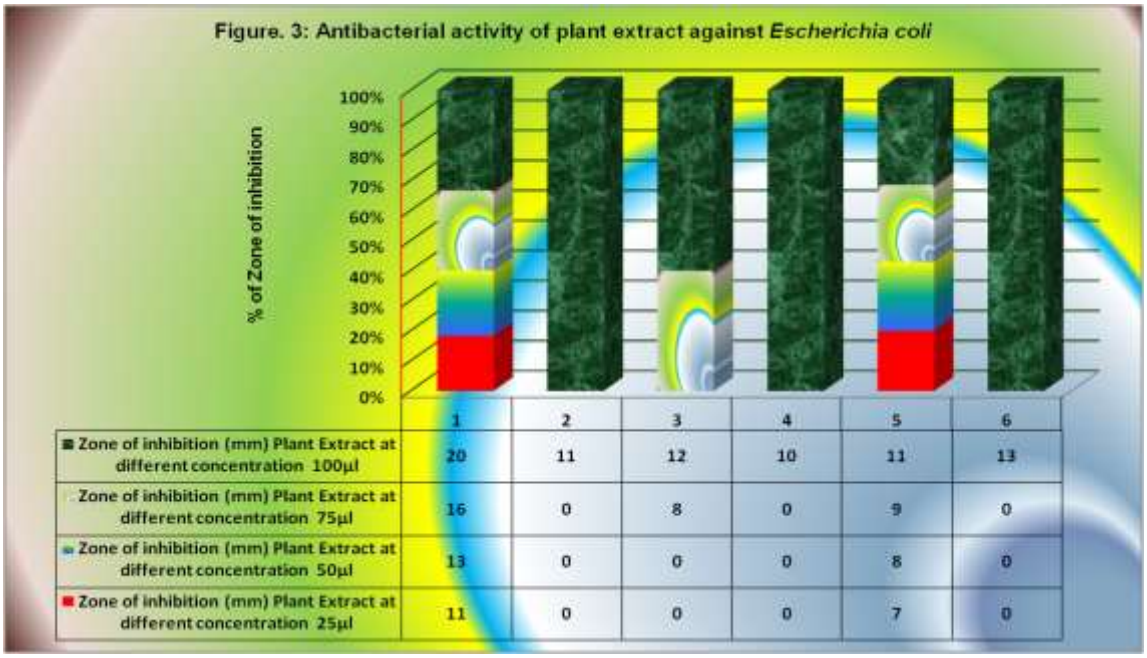


The growth medium of *E. coli* was adjusted at different *p*H values: *p*H 2.0, *p*H 3.0, *p*H 4.0, *p*H 5.0, *p*H 6.0, *p*H 7.0, *p*H 7.5, *p*H 8.0 and *p*H 10. The results indicated that the rapid growth was obtained from *p*H 5 to *p*H 8, and declined in *p*H 2.0. Maximum growth was recorded in *p*H 7.0 it indicates the optimum *p*H for the growth of *E. coli* was recorded at *p*H 7.0 (Fig. 2).



The antimicrobial activity of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* samples were collected from natural environment in and around Salem District. After collection the plant parts thoroughly washed with tap water for extraction of ethanolic crude extracts for the treatment of UTI.

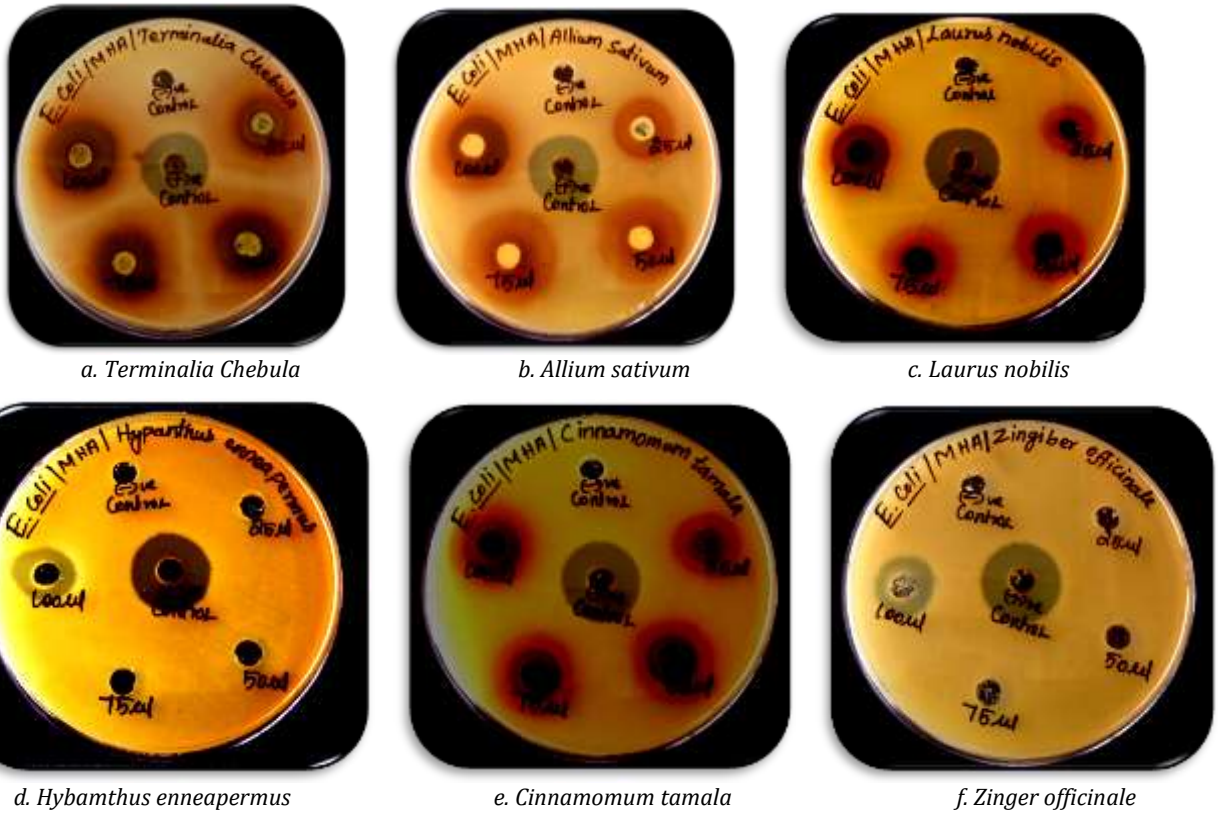
Ethnomedicinal plant extracts which includes *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* were tested against *E. coli* at different concentration of extracts 25µl, 50µl, 75µl and 100µl were used to treat the UTI pathogen. Among the four different concentrations of Ethanolic combo of medicinal extracts, the maximum zone of inhibition found in *Terminalia chebula* 11mm, 13mm, 16mm and 20mm was observed against the isolate EC01 followed by *Zingiber officinale* produce the maximum zone of inhibition 13mm in 100µl concentration in the strain No. EC25 followed by *Laurus nobilis* 8mm and 12mm observed in strain No. EC13 at 50 and 100µl concentration of extracts followed by *Cinnamomum tamala* produce the maximum zone was 7mm, 8mm, 9mm and 11mm in the strain no. EC20 followed by Allium sativum gave the maximum zone of inhibition observed in the strain no. EC02 got 11mm in 100µl followed by minimum level of zone of inhibition was observed in the strain No, EC17 gave 10mm in 100µl concentration of *Hybamthus enneapermus* (Fig. 3).



	1	2	3	4	5	6
Zone of inhibition (mm) Plant Extract at different concentration 100µl	20	11	12	10	11	13
Zone of inhibition (mm) Plant Extract at different concentration 75µl	16	0	8	0	9	0
Zone of inhibition (mm) Plant Extract at different concentration 50µl	13	0	0	0	8	0
Zone of inhibition (mm) Plant Extract at different concentration 25µl	11	0	0	0	7	0

In this present master project shows that the isolation of UTI pathogen *E. coli from* COVID carrying pregnancy women in and around Government and Private Clinics of Namakkal City, Tamilnadu India. This research is correlated with the research of Adriana Mirela Tache [22] also isolated the *Escherichia coli* from patients with UTI in and around Saint George Hospital located in Beirut.

This study the identification of *E. coli* was done by biochemical characterization which includes IMViC, Motility, Staining techniques, Microscopic observation, Sugar Fermentation Test, Catalase Test, Oxidase Test, Nitrate Reduction Test, Starch Hydrolysis Test, Triple sugar Iron Test and Urease test. In this examine the results of the final identification of *E. coli* was also confirmed and agreed with the results of the author [23] investigate the identification of *E. coli* strains in UTI sample also identified by using biochemical characterization which includes IMViC, triple sugar iron, Catalase test, urease test gas production test, morphology, staining techniques and microscopic analysis of the isolates. The antibacterial activity of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* (Plate: 3) was tested against UTI pathogen *E. coli.*



a. Terminalia Chebula *b. Allium sativum* *c. Laurus nobilis*

d. Hybamthus enneapermus *e. Cinnamomum tamala* *f. Zinger officinale*

Plate 3: Antibacterial activity of plant extracts against *Escherichia coli*

In this antimicrobial activity compare than other plant ethanolic plant extracts the maximum zone of antibacterial activity is recorded in this research its exhibit 11mm, 13mm, 16mm and 20mm were observed in ethnomedicinal value of *Terminalia chebula* in strain No. EC01 followed by Zingiber officinale produce the maximum zone of inhibition 13mm in 100µl concentration of ethanolic extract observed in the strain No. EC25. This result agreed with the results of [24] investigate the antibacterial activity of *Tamarindus indica* beside UTI pathogens with extracts of Acetonic, methanolic and chloroform leaf extracts were used to evaluate their antibacterial activity against UTI bacteria and zones of inhibitions were measured. But the solvents combo it varies in our research. The researcher recorded compare than other solvents the maximum level of activity from acetone extract of *Tamarindus indica* leaves showed uppermost antibacterial activity against *E. coli* got 22.5 mm.

In this investigate the antibacterial activity of Ethano-medicinal extract of *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* was done by agar well diffusion method and also proved the plant extracts of *Cinnamomum tamala* is a very good URO therapeutic nature to eliminate the *E. coli*. The similar method and results was used and delivered by the author[25] have proved the same ethnomedicinal antibacterial values of *Cinnamomum tamala* used against UTI pathogen was done by also agar well diffusion method. Finally they measured the zone of inhibition by the measuring scale.

Recently, a big notice has been paid to non-antibiotic approach as a choice to predictable antibiotics. Among many strategies, phyto-therapeutic value has gained a special interest worldwide. Herbal remedies have been used in conventional drug since ancient times and they are well notorious for their efficiency in treating many physical conditions including urinary tract infections. Especially the researcher Razan Salman[26] states that use of many medicinal plants against UPEC strain to facilitate their mechanisms of action, and to determine their energetic constituents. Their research the novelist reviewed and revealed the many phytochemicals have wide range of bioprocesses to cleave the pathogen UTI bacteria and also proved very promising therapeutic products to treat and prevent UTIs caused by *Escherichia coli*. So this motive the present research is also agreed and intended to isolate medicinal value of different plant extract *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* were extracted along with ethanol solvent to treat against the urinary tract infection causing *E. coli* and also this invention is one of the current therapeutic gold standard approach using low cost technology to extract the drug to treat the UTI pathogen in present pandemic 2022. Moreover the work of the research it will be helpful to evaluate the present status of Ethano-medicinal values of plant extract to understand and elaborate the research in the mode of extracts it will target to eliminate the UTI infection in any type of pandemic situation.

CONCLUSION

In this research concluded that UTI causing *Escherichia coli* is important public health problem in many under developed and developing countries particularly in Tamilnadu, India during LOCK DOWN period. The pathogens may highly spread through some factors predominantly in COVID period which includes increased age, high parity, and poor perineal hygiene, history of recurrent UTI, diabetes mellitus, neurogenic bladder, retention, anatomic or functional urinary tract abnormality, and increased frequency of sexual activity. Predisposing determinants of high prevalence of UTI in pregnancy include hormone induced ureteral dilatation, urinary dilatation, urinary stasis, reduced immune function, and presence of vesicoureteric reflux. The patterns of resistance to the antimicrobial agents may be due to indiscriminate, wide spread and lengthy use of antibiotics in the treatment of UTI. While many antibiotics including Penicillin, Macrolides and Tetracycline were very useful in the treatment of urinary tract infections in the past, the rates of bacterial resistance to antimicrobial agents has significantly increased and are increasing in many countries in recent times. Pathogens are not inhibited the antibiotics, at presently Ethnomedicinal plant extracts is an emerging field that is potentially changing the way we treat and diagnose the UTI infection in present pandemic situation. Especially, in this research the Ethnomedicinal plant extracts like *Terminalia chebula, Allium sativum, Laurus nobilis, Hybamthus enneapermus, Cinnamomum tamala* and *Zingiber officinale* are used and it shows the most promising tools applied as antimicrobial agents for diagnosis of diseases, drug delivery systems, sun screens and ceramics in biochemical and pharmaceutical arena in future.

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AUTHORS CONTRIBUTIONS

Each author has given considerable and equal contributions to this research

CONFLICTS OF INTEREST

The authors have no conflict of interest

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