



Analysis of the antibacterial properties of jute leaf

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Abstract

In this experiment, tea liquor has been prepared by 10% dried tea leaves and boiling time was 5, 10 and 15 minutes. For the determination of antibacterial activity, *Salmonella typhi* were inoculated on nutrient agar media by spread plate method and tea liquor was poured in the middle of the bacterial inoculated plate. Antibacterial activity was observed where boiling time has affected antibacterial activity. Antibacterial activity of different extracts of jute leaves were evaluated by agar well diffusion method against different pathogenic bacteria viz., *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus cereus* etc. Antibacterial activity was found increasing with increased by longer time prepared tea liquor and the highest antibacterial activity of the aqueous extract of jute leaf was observed against *E. coli* (ZOI=17.0±1.0 mm) followed by *Salmonella typhi*. Therefore, these results clearly support the traditional use of jute leaf as a broad-spectrum antimicrobial agent against a wide range of microbes.

Keywords: Antibacterial; Jute; Leaf.

1. Introduction

Jute is found in tropical and subtropical regions of Bangladesh and is traditionally used for fiber but it has medicinal applications too. Jute leaf tea has been studied for antibacterial activity. Many research reveals about antibacterial property of jute leaves. Jute leaves (*pat shak*) are favorite vegetables in Bangladesh. Rural people in Bangladesh think *pat shak* cures fever. Antibacterial property of jute leaf may support belief of common rural people about anti-fever quality of jute leaf. In our country jute leaves are well known as folk medicine for remedy of fever, removal of hook worm, etc. [1, 2, 3]. Besides, Bangladesh some other country cultivates jute as herbal medicinal plant. Microbiology and Biochemistry Department of Bangladesh Jute Research Institute (BJRI) has been working on jute leaf tea. As tea jute leaves antibacterial property may study for commercialization of the product. Along with reveal the proof of some herbal medication as jute leaf. Based on the fact that there is no scientific research reporting on the antimicrobial activity of this jute leaf tea, Therefore this study has been undertaken to screen for its potential antibacterial activity. Jute leaf is the good source of vitamin, nutrient, minerals etc. Tea provides antioxidant and some other health benefit also. Vegetables constitute essential components of the meal by contributing protein, vitamins, iron, calcium, and other nutrients. That is usually in shortage of supply in the daily diets. It is important to provide vitamin C, vitamin A and other vitamins also in the diet [1, 2]. Rural people preserve jute leaves by drying and use it later for different medicinal purposes. During preservation, some portion of nutrients may loss. To make value added product from jute leaves, level of antimicrobial and antioxidant are required to know. Therefore antimicrobial properties of jute leaves and antioxidant level of processed jute leaves should be analyzed. Research revealed that tea and herbal tea both have antibacterial potentiality. Antibacterial activity of tea may provide some health benefit by controlling bacterial growth and activity. Because disease causes by that specific bacteria may be prevented or cured. Present experiment has been undertaken to investigate the antibacterial property of jute leaf tea. The present study was taken to investigate the antibacterial properties of jute leaf tea, improve the quality of jute leaf tea and to give the information about health potentiality of jute leaf tea. This study will help to obtain information about antibacterial activity status of jute leaf tea.

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2. Material and methods

Present study was conducted in the department of Microbiology and Biochemistry, Head Office, Bangladesh Jute Research Institute (BJRI), Dhaka using the equipments, chemicals and raw materials where all the chemicals and media were reagent grade (Sigma). The standard bacterial samples (Table 1) collected. Fresh jute leaves of some Deshi (*C. capsularis* CVL-1) and Tossa (*C. olerius* O-9897) were collected from premises of BJRI, Dhaka. Jute leaf tea was made of both *deshi* (CVL-1) and *tossa* (O-9897) jute leaves.

2.1. Extraction of samples from jute leaves

The leaf extracts were prepared by sequential cold maceration method using distilled water as a solvent [4]. Fifty grams of dried powder of leaf material was soaked in 250 ml distilled water for 24 h at room temperature under shaking condition at 120 rpm. This solution was filtered with the help of Whatman No. 1 filter paper and the filtrate was collected in sterile flask at room temperature which was further used for antimicrobial assay after dilution.

2.2. Sample Preparation

Fresh leaves of jute were washed with distilled water followed by air drying and then homogenized to fine powder and stored in airtight bottles at 4 °C in aseptic condition [4].

2.3. Microorganisms used in the present investigation

The antibacterial activity of jute leaf samples were checked on nutrient agar media against different pathogenic and non-pathogenic microorganisms. Different pure culture (ATCC) microbes were procured from the Primeasia University, Dhaka, Bangladesh. Out of all bacteria used in present investigation, *Salmonella typhi*, *Klebsiella* sp., *Escherichia coli*, and *Pseudomonas* sp. were Gram negative bacteria and *Acinetobacter* sp. and *Bacillus cereus* was Gram positive bacterium. All the bacterial strains used in present investigation were maintained at 4 °C on nutrient agar medium.

2.4. Preparation of bacterial suspension

Colonies of different strains of bacteria were aseptically transferred to the individual flasks containing fresh nutrient broth and further incubated at 37° C for 24 h.

2.5. Treatments

- Comparative treatment- Jute leaf of 0.03 g and 0.05 g jute leaf antibacterial activity against different bacterial isolates.
- Time duration treatment-study of Jute leaf (O-9897 & CVL-1) antibacterial activity against different bacterial isolates boiling at different time interval (5, 10, 15 and 20 min).

3. Results and discussion

The tea liquors were prepared using all these three different treatments and in these liquors antimicrobial activities were tested (Fig. 1). Antibacterial activity of aqueous extracts of jute leaf was evaluated by agar well diffusion method against different pathogenic bacteria (Fig 2 & 3). In this study, highest antibacterial activity was observed against *E. coli* (ZOI=17.0±1.0 mm) by extract followed by inhibition of *Salmonella typhi* by aqueous extract (ZOI=14.5±0.5 mm). Overall, it is clear that extract having maximum antibacterial activity against all the test organisms, followed by aqueous extracts. Infectious diseases are the major cause of morbidity and mortality worldwide. The number of multi drug resistant microbial strains and the appearance of strains with reduced susceptibility to antibiotics are continuously increasing due to indiscriminate use of antibiotics and other antibacterial agents in treatment. The plant based traditional medicines were proven highly effective for their utilization as a source of antimicrobial compounds [5]. The beneficial medicinal effects of plant materials typically result from the secondary metabolites present in the plant, although; it is usually not attributed to a single compound but a combination of the metabolites. Plants are potentially useful for the development of chemotherapeutic agents. The plants have traditionally provided a source of hope for novel drug compounds, as plant herbal mixtures have made large contributions to human health and well being. The use of plant extracts with known antimicrobial properties can be of great significance for therapeutic treatment [6]. One of the study showed that the aqueous crude extract of *Emblica officinalis* possess strong inhibitory action against all the test human bacterial pathogens such as *Bacillus* sp., *Lactobacillus* sp., *Pseudomonas* sp., *Proteus* sp. and *Streptococcus* sp. by using agar well diffusion method [7]. Dharajiya et al. [8] screened the *in vitro* antibacterial activity of aqueous, ethanol and acetone extracts of fruits of *Emblica officinalis* against Gram-positive versus Gram-negative bacteria employing *Staphylococcus aureus* and *E. coli*, respectively.

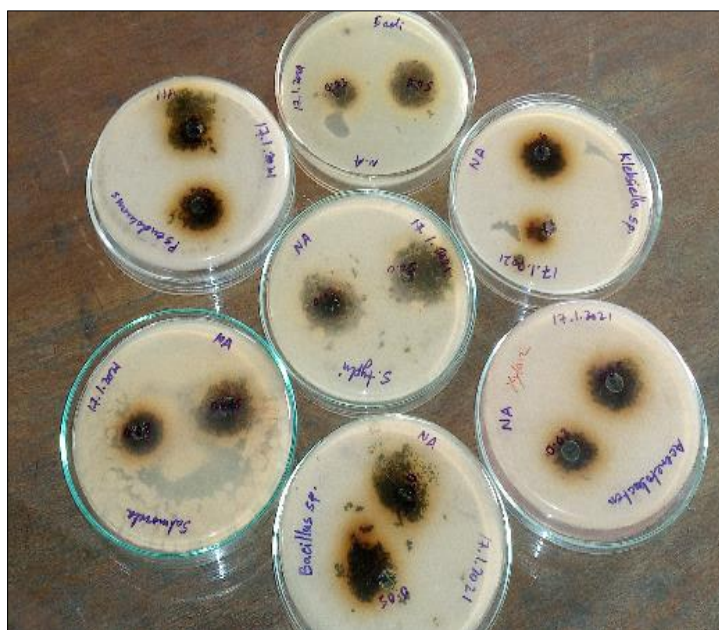


Figure 1 Jute leaf antibacterial activity against different bacterial isolates (0.03 g and 0.05 g jute leaf)

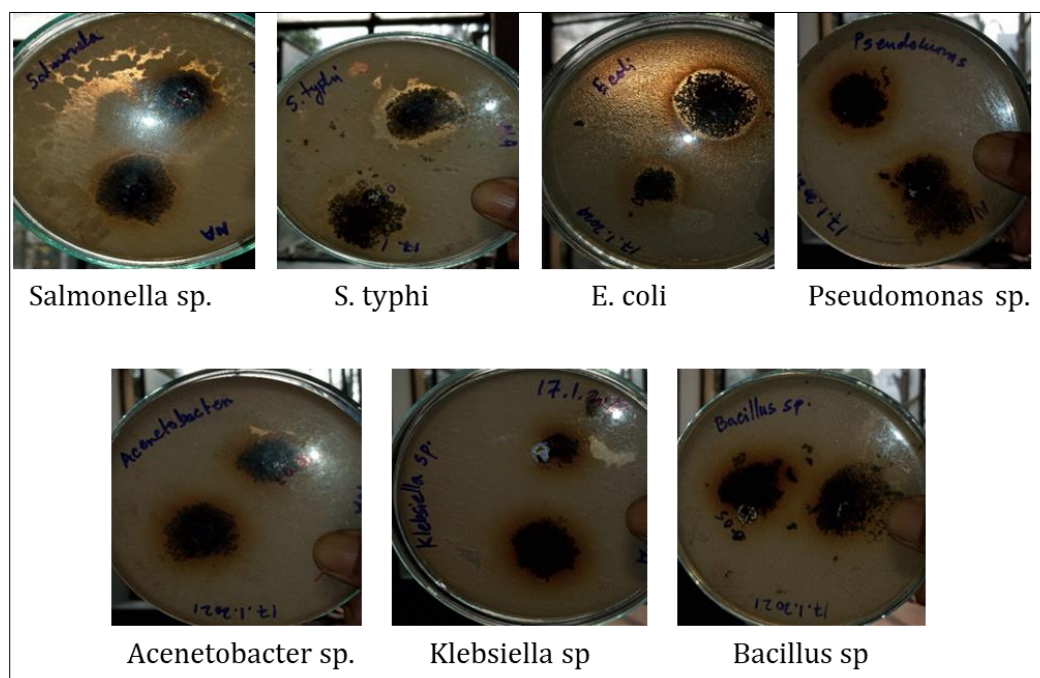


Figure 2 Jute leaf (0.03 g and 0.05 g jute leaf) antibacterial activity against individual bacterial isolates

Jute leaf has antimicrobial activity against different isolated bacterial sample. All the extracts exhibited significant antibacterial activity, more against *S. aureus* than *E. coli*. *Emblica officinalis* possess potent antibacterial activity against *Escherichia coli*, *K. ozaenae*, *K. pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *S. paratyphi A*, *S. paratyphi B* and *S. marcescens* [9]. Plant phytochemical constituents such as saponins, alkaloids, flavonoids, tannin and some other aromatic compounds are secondary metabolites those serve as defence mechanisms against many microorganisms, insects and other herbivores [10]. In the qualitative analysis of phytochemicals, the methanol and aqueous extract of *E. officinalis* fruits showed the presence of alkaloids, tannins, saponins, cardiac glycosides, steroids, phenols, glycoside and flavonoids. While, methanol extract of *V. negundo* leaves indicated presence of all the phytochemicals analysed in present study, except sterol. Hexane extracts of both the plant showed presence of less phytochemicals as compared to

other extracts which might be reason behind their reduced antimicrobial activity. It has been suggested that the antimicrobial activity of the plant is mainly due to the presence of essential oils, flavonoids, terpenoids, alkaloids, tanins, saponins and other natural polyphenolic compounds or free hydroxyl groups in plant extracts [11]. Presence of more bioactive phytochemicals in the extract may be the reason behind the higher inhibitory action of the particular extract [12].

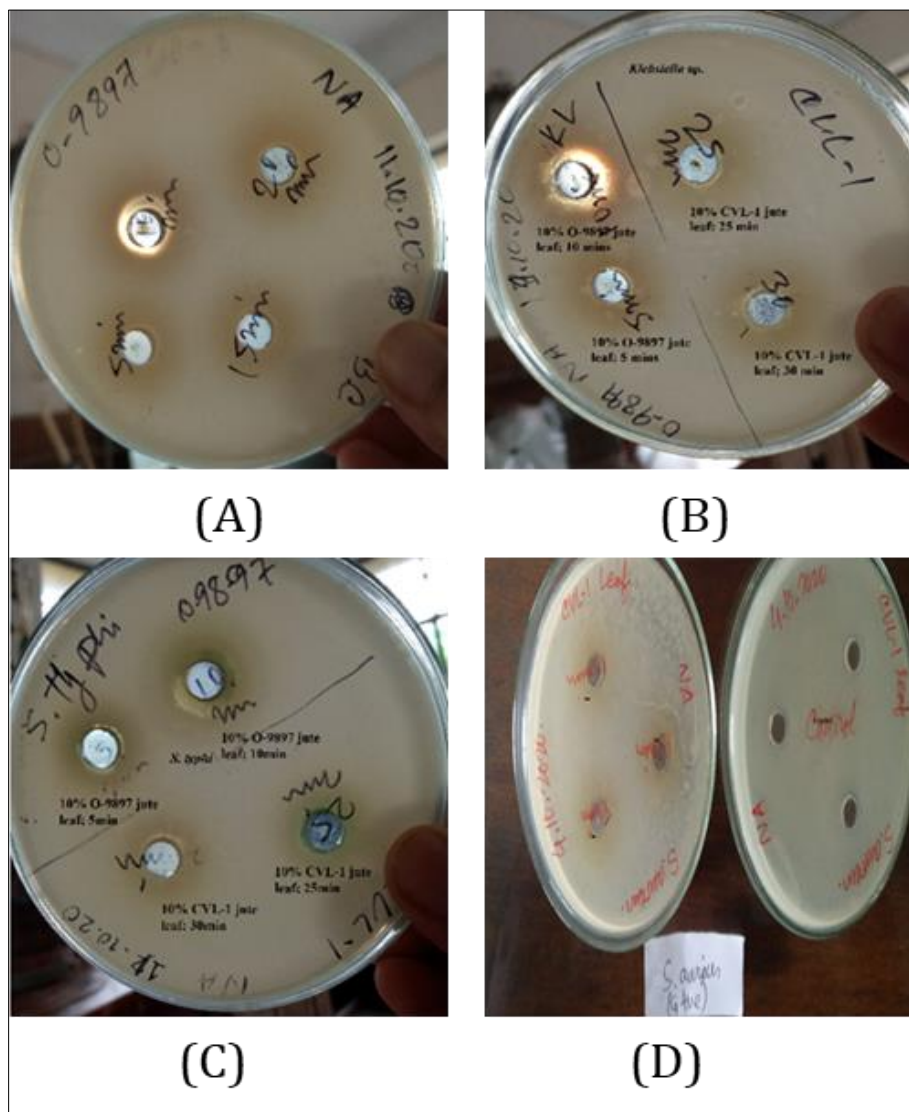


Figure 3 Comparative study of antibacterial activity of jute leaf extract of O-9897 & CVL-1 at different time interval (5, 10, 15 and 20 min) with boiling against (A) *B. cereus*, (B) *Klebsiella* sp. (C) *S. typhi* and (D) *S. aureus*

It has been reported that many volatile components are effective against Gram positive and Gram negative bacteria. The leaves of plant are used commonly by the people in food as a vegetable. The human body is able to directly absorb the different compounds and due to the low concentration of these compounds, it has transpired that the plant particularly provides effective protection against infection. This protective property, either through the plant itself or by the compounds contained within, also has the effect of prolonging the shelf life of food in which it is used or prevents it being spoiled by microorganisms. Its current use as a plant additive to other food and consumed by the public may be due to its health-giving properties and its taste. There is a definite need for more research to determine the metabolite synthesis, other antimicrobial properties that occur in this jute leaf, as well as the construction of new molecules. The results obtained from this study revealed that the jute plants leaf has antimicrobial properties. Therefore, jute leaf has possibility of presence of bioactive and phytochemicals compounds that might be dependent on many factors like, solvent used, method of extraction, plant material used and methodology, etc. It is proven that aqueous extract effectively inhibited the growth of the test bacteria. There are significant result but more study need to be taken to certain its antimicrobial properties with compare to over commercial antimicrobial agents. Also research should be

follow up to determine the Minimum Inhibitory Concentration (MIC) and Minimum Bacteriocidal Concentration (MBC) of jute leaf of different varieties. Moreover, Activity Index (AI) and Relative Percentage Inhibition (RPI) should be estimate of effectiveness of the inhibitory action of the extract as compared to standard drug and extracts should be quantitatively analyzed for all the phytochemicals which might lead to final estimate of phytochemicals responsible for the antibacterial activity. Thus, extracts having higher AI and RPI, can be used to develop alternative drug from the plant as it is more effective on the pathogenic bacteria. Finally, the result has positive indication and has potential future which needs further investigation.

4. Conclusion

The present experiment has been undertaken to investigate the antibacterial properties of jute leaves tea which will help to obtain information about antibacterial activity status and also help to improve the quality of jute leaves tea that has impact on health potentiality of jute leaf tea.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

All authors declare that they have no competing interests.

References

- [1] Nasreen A, Ahmed Z, Ali M, Rahman T, Tahmina. Effect of processing and preservation on L-ascorbic acid content in commercially cultivated jute leaves. *GSC Advan Res Rev.* 2021a; 9(3): 63–69.
- [2] Nasreen A, Ahmed Z, Ali M, Shimu T. Jute leaves: A potential sources of lycopene. *Inter.J.Veg. Sci.* 2021b; 1-9.
- [3] Nasreen MA, Ahmed Z, Ali MM, Tahmina. Determination of β -carotene in jute leaves by spectrophotometry and thin layer chromatography. *World J Biol Pharm Health Sci.* 2022; 9(2): 11–20.
- [4] Dharajiya D, Moitra N, Patel B, Patel RK. Preliminary phytochemical analysis of the Indian medicinal plants for antibacterial activity against bovine mastitis pathogens. *Wayamba J Animal Sci.* 2012; ISSN: 2012-578X, Number 1342590628.
- [5] Iwu MW, Duncan AR, Okunji CO. New antimicrobials of plant origin, in: J. Janick (Ed.), *Perspectives on new crops and new uses.* ASHS Press, Alexandria. 1999; 457-462.
- [6] Selvamohan T, Ramadas V, Kishore S. Antimicrobial activity of selected medicinal plants against some selected human pathogenic bacteria. *Adv Appl Sci Res.* 2012; 3(5): 3374-3381.
- [7] Kanthimathi M, Soranam R. Antibacterial effects of *Emblica officinalis* and *Phyllan thusniruri* crude extracts against bacterial pathogens. *Int J Pharm Clin Sci.* 2013; 3(3): 20- 23.
- [8] Dharajiya D, Patel P, Moitra N. Antibacterial activity of *Emblica officinalis* (Gaertn.) Fruits and *Vitex negundo* (L.) Leaves. *Curr Tren Biotech Pharm.* 2015; 9(4): 357-368.
- [9] Saeed S, Tariq P. Antibacterial activities of *Emblica officinalis* and *Coriandrum sativum* against Gram negative urinary pathogens. *Pak J Pharm Sci.* 2007; 20(1): 32-35.
- [10] Marjorie MC. Plant products as antimicrobial agents. *Clin Microbiol Rev.* 1999; 12(4): 564-582.
- [11] Ramkumar KM, Rajaguru P, Ananthan R. Antimicrobial properties and phytochemical constituents of an antidiabetic plant *Gymnema montanum*. *Adv Biol Res.* 2007; 1(1-2): 67-71.
- [12] Dharajiya D, Khatrani T, Patel P, Moitra N. Evaluation of antifungal activity of *Emblica officinalis*, *Aloe vera* and *Vitex negundo* extracts. *J Chem Bio Phy Sci.* 2015; 5(4): 3990-3996.