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Assessment Of Antimicrobial Activity Of Solo Himalayan Garlic And Onion Crude Extracts

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Abstract: Indian Solo garlic, also known as Himalayan garlic, is a rare, single clove variety of *Allium ampeloprasum*. Allicin compound in this garlic has potent anti-inflammatory, antioxidant and antimicrobial properties. Onion also possesses antioxidant, anti-inflammatory and antimicrobial activity. This study was carried out to study antimicrobial activity of aqueous crude extract of Himalayan solo garlic and methanolic extract of onion (Bhima light red variety) against two gram-positive bacteria namely, *Bacillus subtilis* and *Staphylococcus aureus* and two gram-negative bacteria namely, *Escherichia coli* and *Salmonella typhi*.

Index Terms **- Allicin, *Allium cepa, Allium sativum*, antimicrobial, solo garlic.**

I. INTRODUCTION

Garlic also called "*lasuna*" which means destroyer of diseases. Garlic is used for alleviating physical strength, promoting intellect and as aphrodisiac to maintain healthy life. Garlic is also used to cure skin disorders, intra-abdominal tumor, chronic rhinitis, hemicrania, epilepsy and fainting.**[1]**. However, if used regularly in high doses, may cause prolonged bleeding time **[2]**. At the time, antibiotics were not discovered garlic bulb represented whole pharmaceutical industry and was commonly called "Russian penicillin", "vegetable Viagra", "plant talisman" and "snake grass" **[3]**. Garlic is rich in organosulfur (allicin and alliin) and flavonoid (quercetin) compounds that exhibit natural antibacterial and antiviral activity. Indian Himalayan solo garlic is a single clove garlic, which varies in size from approximately 25-50 mm in diameter. In appearance, it has white skin with purple stripes (Fig. 1). This Solo garlic has been grown in foothills of Himalayan mountains for about 7000 years**[4]**.This is not a single variety of garlic, but a product of specific planting practices and is cultivated throughout the year. Native garlic is seven times less potent than Solo garlic in terms of its beneficial health effects and useful compounds. Solo garlic is rich in manganese, copper, selenium and in vitamin B and C. This garlic contains enzyme alliinase that converts alliin to allicin and pyruvate **[5]**. Allicin is the compound responsible for pungent smell of garlic and offers numerous health benefits. It possesses anti-inflammatory **[6]**, anti-tumoral **[7]**, antioxidant **[8]** **[9]**, antifungal,**[10]** antibacterial **[11]**, antiviral **[12]** and anti-parasitic activity **[13]**. Garlic is also an immunomodulatory compound **[14]** and helps in cardiovascular defense mechanisms **[15]**. It improves cardiac health by regulating blood cholesterol levels, high blood pressure and blood sugar levels. **[16]** **[17]**. Garlic strengthens immune system thus cures cold cough and helps to fight chronic diseases like cancer **[18]**.

Onions are rich in nutrients, help human body to fight many diseases (including bacterial, viral and heart diseases) and prevents cancer **[19] [20]**. They help in maintaining healthy nutritional state and are rich in prebiotics, which increase number of healthy bacteria in gut **[17]** and strengthen immunity against pathogenic bacteria **[21]**, viruses **[22]** and fungi **[5]**. Preventive alternative strategy to combat COVID-19 pandemic includes improving nutritional status of the body **[23]**.Onion helps in treating digestive problems, loss of appetite, upset stomach, gall bladder disorders, treatment of heart and blood vessel disorders including chest pain angina. In addition, onion cures sore throat, whooping cough, bronchitis, asthma, dehydration and inactivates parasitic worms **[24]**. In addition, it exhibits strong antioxidant and anti-inflammatory activity and helps in bone health. Historically onion has been used to combat bacterial infections. It also possesses anti-diabetic, anti-asthmatic, antioxidant and anti-inflammatory properties **[24]**.

Onion and garlic have been used in traditional medicine for almost 3000 years **[25]**. In ancient Indian medicine, "Ayurveda" meaning "true knowledge of life" prescribes use of onion and garlic to cure several diseases. Garlic and onion have been popularly used since ages as flavoring agents in food preparation **[26]** and to combat infectious diseases. They are used as capsules, dry powder, aqueous extracts and dietary supplements. **[27]**. They have significantly increased shelf life of food (Gündoğdu *et* al.2009) by their antimicrobial action which kills spoilage and disease-causing microbes.

Louis Pasteur first described the antimicrobial effect of onion and garlic juice against both gram-positive and gram-negative bacterial cells **[28]**. Later many research publications clearly demonstrated that raw juice of garlic is effective against many common pathogenic bacteria **[29]** and against bacterial strains that have become resistant to antibiotics (Jezowa et al.,1966) **[30]**. Growth inhibition by garlic extract was also noted against *Staphylococcus aureus* isolated from skin diseases **[31]**.

Flavonoids produced by onion especially quercetin has been found to be effective antimicrobial substance against a wide array of microbial cells *in vitro* **[32]**. The antimicrobial activity of Himalayan solo garlic has not been previously tested. The purpose of this study was to determine *in vitro* antimicrobial activity of aqueous crude extract of Himalayan solo garlic and methanolic onion crude extract on *Salmonella typhi, Bacillus subtilis, Escherichia coli* and *Staphylococcus aureus*.

II. MATERIAL AND METHODS:

CULTURE MEDIA

Nutrient broth and nutrient agar media were used for cultivating two gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis* and two gram-negative bacteria (*Escherichia coli* and *Salmonella typhi*) used for this study.

PREPARATION OF CRUDE EXTRACT

100 gms of peeled, washed and cut pieces of Himalayan solo garlic were blended in 100 ml of sterile distilled water and the pulp was vacuum filtered and concentrated using rotary evaporator. (Fig. 2.) Similarly, prepared onion crude extract by weighing 100gms onion, washing, cutting, and subsequently blending using methanol as solvent. (Fig. 3.)

TEST OF ANTIMICROBIAL ACTIVITY

Spread plated 100 µl of log phase inoculum of bacterial strain to be tested on pre-prepared nutrient agar plates. Subsequently added 50 µl of aqueous crude extract (1mg/ml) of garlic in the centre of spread plated bacterial inoculum. Repeated the same procedure for all four bacterial strains. Similar procedure was used for testing methanolic crude extract of onion on all bacterial strains used in present investigation. Incubated all control and experimental plates overnight at 37ºC and recorded the results after 24 hours.

III. Results and Discussions

Aqueous solo garlic crude extract 1mg/ml exhibited antimicrobial activity against two gram- positive bacteria *Staphylococcus aureus* and *Bacillus subtilis* and two gram-negative bacteria *Escherichia coli* and *Salmonella typhi* (Fig. 4). Further zone of microbial growth inhibition was large and distinct for garlic aqueous crude extract against *Staphylococcus aureus* followed by *Escherichia coli* and *Salmonella typhi* . The bacterial growth inhibition zone was smallest for *Bacillus subtilis* (Table 1). Control plates in the above study did not exhibit any zone of microbial growth inhibition indicating solo garlic crude extract is responsible for antimicrobial action. Onion methanolic crude extract 1mg/ml showed antimicrobial activity similar to the control plates in experimental plates (crude extract of onion) tested with both gram-positive and gram-negative bacteria (Fig. 5). This clearly shows that microbial growth inhibition observed in both control and experimental plates is due to the solvent methanol rather than onion crude extract.

IV. Conclusion

The objective of this study is to investigate and compare the antimicrobial potential of aqueous crude extract from Himalayan Solo garlic (*Allium ampeloprasum*) and methanolic extract from Bhima light red variety onion (*Allium cepa*). Both garlic and onion are known for their bioactive compounds with beneficial properties such as anti-inflammatory, antioxidant, and antimicrobial effects. The focus of this research is to assess the efficacy of these extracts for antimicrobial activity against four different bacterial strains: *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella typhi*. By evaluating the antimicrobial activities of these extracts, we found that aqueous Solo garlic crude extract exhibits potent antimicrobial activity. This study aims to contribute valuable insights into the potential use of garlic and onion as natural agents against various bacterial pathogens, potentially paving the way for novel therapeutic applications in the field of medicine and health.

V. Source of Funding

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VII. Conflict of Interest:

The authors declare no conflicts of interest. The funders had no role in the design of the study, the collection of data, analyses, interpretation of data, the writing of the manuscript, or the decision to publish the results.

IV. RESULTS AND DISCUSSION

Table 1: Zone of bacterial growth inhibition formed by aqueous crude extract of Himalayan Solo Garlic

Name of Bacteria	Zone of bacterial growth inhibition observed
Staphylococcus aureus	+ + + + +
Escherichia coli	+ + +
Salmonella typhi	+ + +
Bacillus subtilis	+

+ indicates extent of anti-bacterial activity.

FIGURES: (1, 2, 3, 4, 5):

Fig. 1. Representative picture of Himalayan solo garlic.

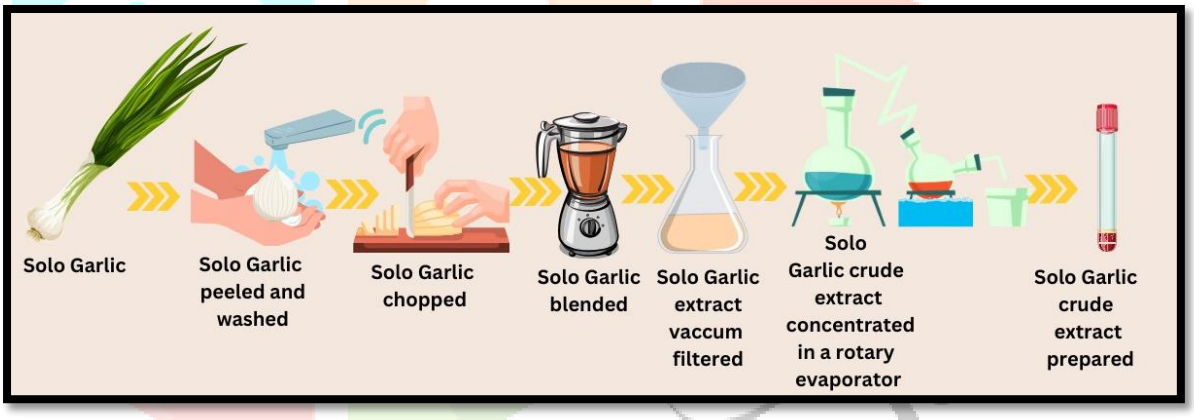

Fig. 2. Schematic illustration describing steps involved in preparation of aqueous crude extract of Himalayan Solo Garlic.

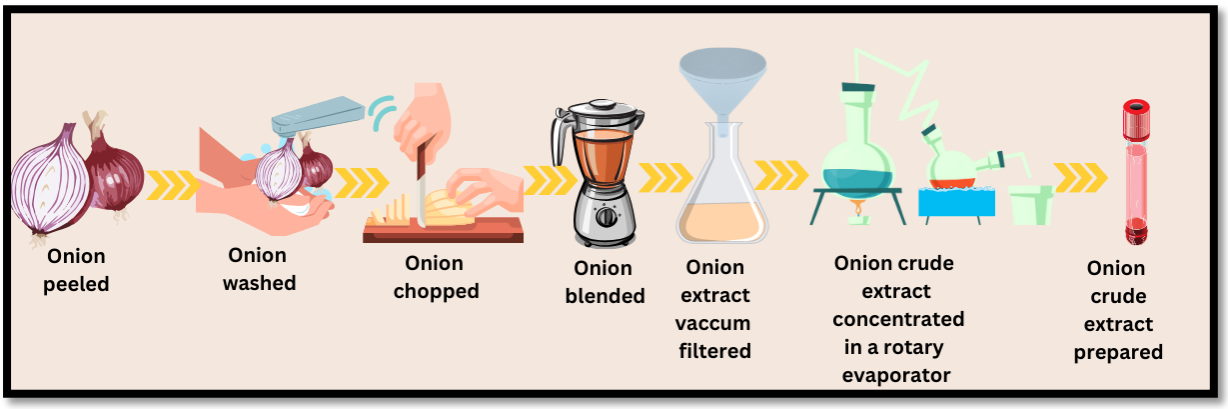

Fig. 3. Schematic illustration describing steps involved in preparation of aqueous crude extract of Onion (*Allium cepa*)

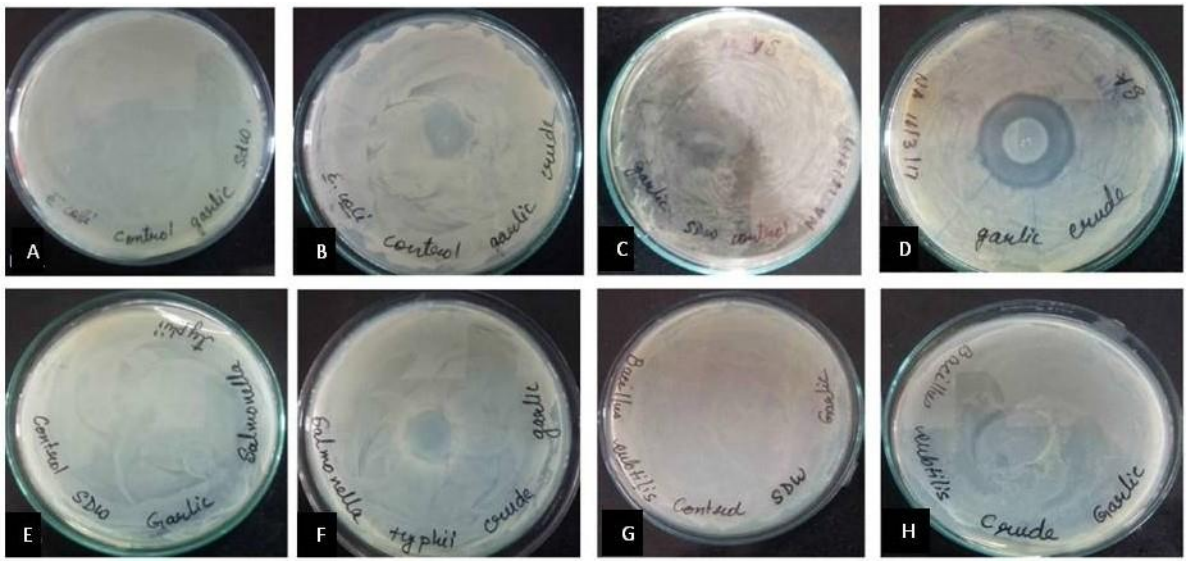

Fig. 4. Zone of bacterial growth inhibition formed by aqueous crude extract of garlic against different strains of bacteria. **A.** Control plate with only *Escherichia coli* **B.** Aqueous crude extract of garlic on *Escherichia coli* **C.** Control plate with only *Staphylococcus aureus* **D.** Aqueous crude extract of garlic against *Staphylococcus aureus* **E.** Control plate with only *Salmonella typhi* **F.** Aqueous crude extract of garlic against *Salmonella typhi* **G.** Control plate with only *Bacillus subtilis* **H.** Aqueous crude extract of garlic against *Bacillus subtilis*.

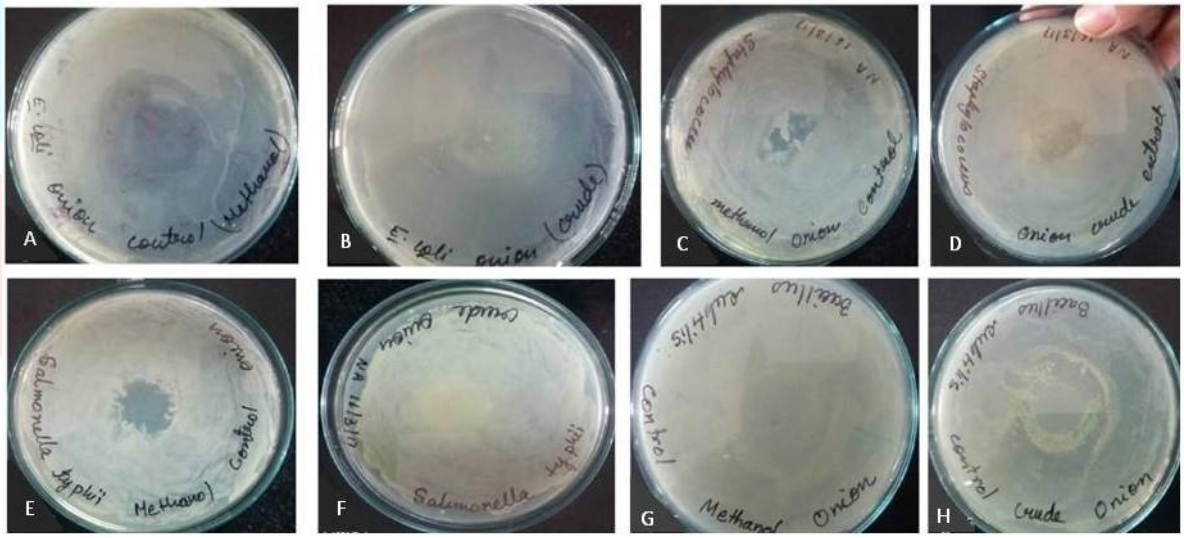

Fig. 5. Zone of bacterial growth inhibition formed by methanolic crude extract of onion against different strains of bacteria. **A.** Control plate with only *Escherichia. coli* **B.** Methanolic crude extract of onion against *Escherichia. coli*, **C.** Control plate with only *Staphylococcus aureus* **D.** Methanolic crude extract of onion against *Staphylococcus aureus* **E.** Control plate with only *Salmonella typhi* **F.** Methanolic crude extract of onion against *Salmonella typhi* **G.** Control plate with only *Bacillus subtilis* **H.** Methanolic crude extract of onion against *Bacillus subtilis*.

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