

*Original Research Article***Antibacterial Activity of Honey against Clinical Isolates of MRSA, From Various Clinical Samples at a Tertiary Care Centre, Kanpur.**Deepak S¹, R. Sujatha², Nashra A³**Abstract**

Background- The continuous use of antibiotics in clinical practice has been the direct cause of the development of multiple antibiotic resistances among bacteria causing human infection. Therefore, the need for novel alternative antimicrobial strategies has renewed interest in therapeutic use natural products of ancient remedies like turmeric, honey, ginger and others exhibiting antibacterial properties.

Aims- To find out the efficacy of antibacterial activity of locally available honey against Methicillin Resistant Staphylococcus aureus (MRSA) and Methicillin Sensitive Staphylococcus aureus (MSSA) isolates.

Material And Methods- A prospective study was carried out from June 2018 to December 2018 in the Department of Microbiology, RMCHRC, Mandhana Kanpur, the antibacterial activity of dabur pasteurised honey was evaluated against the bacterial strains of Methicillin Resistant Staphylococcus aureus and Methicillin Sensitive Staphylococcus aureus. Their antibacterial sensitivity pattern was tested using Kirby-Bauer disc diffusion susceptibility testing technique of CLSI along with other commonly used antimicrobials

Result:- Out of 140 clinical samples, 59 isolates were of Staphylococcus aureus. This includes 22 isolates of MRSA out of which 20(90.9%) isolates were sensitive to honey & 37 isolates of (MSSA) Methicillin sensitive S. aureus out of which 30(81.08%) isolates were sensitive to honey. Antibiotics susceptibility testing was also carried out by using other commonly used antibiotics which include Erythromycin, Ciprofloxacin, Tetracycline, Ampicillin Levofloxacin, Clindamycin, Penicillin G, Linezolid, Vancomycin. All MRSA were sensitive to linezolid where as MSSA were sensitive to all except penicillin.

Conclusion – The excellent antibacterial activity of honey against MRSA isolates indicates the usefulness of honey against bacterial infections.

Keywords- MRSA, MSSA, Antibacterial Activity, Honey

Introduction

Antimicrobial agents are essentially important in reducing the global burden of infectious diseases [1]. The selection and spread of multi-resistant organisms in developing countries, which can often be traced to complex socio-economic and behavioural factors, contribute to the escalating problem of antibiotic resistance worldwide. In developing countries, the irrational use of antibiotics by health professionals, unskilled practitioners, laypersons, poor drug quality, unhygienic conditions and inadequate surveillance account for the spread of resistant bacteria. Nevertheless, misuse of antibiotics is one of the reasons for the increasing rates of resistance, especially in rural areas [2]. There is an emergence of drug resistance for the drugs like vancomycin

and daptomycin leading to search for still newer drugs for combating the drug resistance in Staphylococci [3]. With the irrational and excessive use of antibiotics in underdeveloped and developing countries the developed resistance may spread in the community making the strains as super bugs causing difficulties in eradication [4].

As a result, the effectiveness of the antibiotics is diminished [5]. Therefore, the need for novel alternative antimicrobial strategies has renewed interest in natural products like turmeric, honey, ginger etc., exhibiting antibacterial properties. This situation has led to a re-evaluation of the therapeutic use of ancient remedies including honey [6-8]. Honey is well known as a magic drug for almost all kinds of diseases, not to mention the fact that many people do depend more on folk medicine and natural remedies which are cheap that have been known for their therapeutic effects over the past decades [6].

Honey has well established function as an effective antibacterial agent with a broad spectrum of activity against Gram-positive and Gram-negative bacteria [9-11]. The application of honey can promote the healing of infected wounds that do not

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respond to the conventional therapy, i.e., antibiotics and antiseptics [12] including wounds infected with methicillin-resistant *S. aureus* [13,14]. Laboratory studies have revealed that honey is effective against MRSA, β -haemolytic streptococci and Vancomycin Resistant Enterococci (VRE) [15,16]. The beneficial role of honey is attributed to its antibacterial property with regards to its high osmolarity, acidity (low pH) and content of hydrogen peroxide (H₂O₂) and non-peroxide components, i.e., the presence of phytochemical components like Methylglyoxal (MGO). The antimicrobial agents in honey are predominantly hydrogen peroxide, of which the concentration is determined by relative levels of glucose oxidase, synthesized by the bee and catalase originating from flower pollen [17].

Material and Methods

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Results

Out of 140 clinical samples, 59 isolates were of Staphylococcus aureus. This includes 22 isolates of MRSA out of which 20(90.9%) isolates were sensitive to honey & 37 isolates of (MSSA) Methicillin sensitive *S. aureus* out of which 30(81.08%) isolates were sensitive to honey. Antibiotics susceptibility testing was also carried out by using other commonly used antibiotics which include Erythromycin, Ciprofloxacin, Tetracycline, Ampicillin Levofloxacin, Clindamycin, Penicillin G, Linezolid, Vancomycin. All MRSA were sensitive to linezolid where as MSSA were sensitive to all except penicillin.

TOTAL NO OF <i>Staph.aureus</i> ISOLATES	MRSA	MSSA
59	22	37
Isolates sensitive to honey	20 (90.9%)	30 (81.08%)

Figure 1: Total Number of Isolates

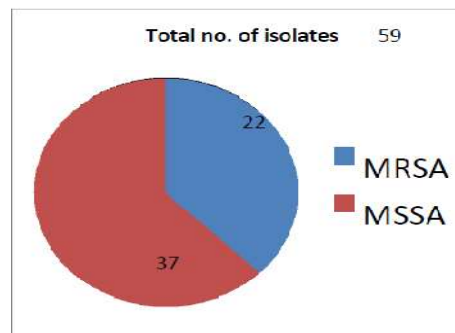


Figure 2: Total isolates of Staphylococcus aureus

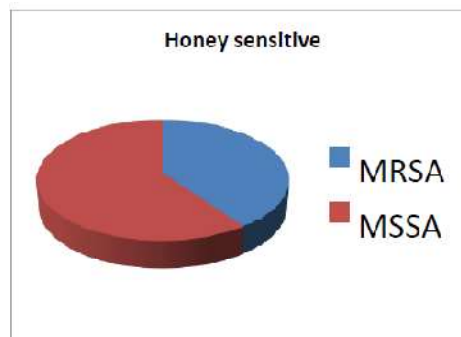


Figure 3: Staphylococcal isolates sensitive to honey



Figure 4: Antimicrobial activity of honey and Other common antibacterial agents on/against MRSA.

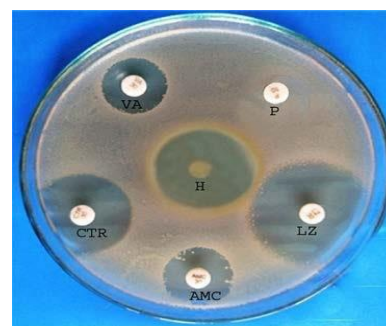


Figure 5: Antimicrobial activity of honey and other common antibacterial agents on/against MSSA

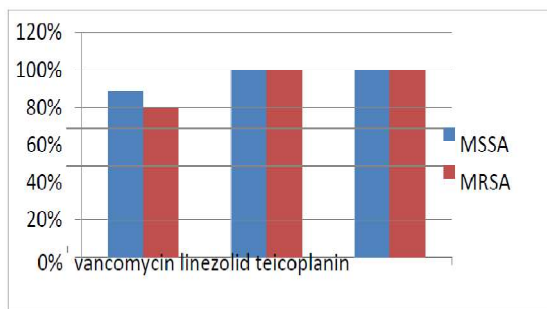


Figure 6: Antibiotic Sensitivity pattern of Staph. aureus

Discussion

Microbial resistance to honey has never been reported [18] which makes it a very promising topical antimicrobial agent against the infection of antibiotic-resistant bacteria (e.g., MDR *S. maltophilia*) and in the treatment of chronic wound infections that do not respond to antibiotic therapy. Hence honey has been used as a last-resort medication. Manuka honey has been widely researched and its antibacterial potential is renowned worldwide. The potency of honeys, such as Tualang honey, against microorganisms suggests its potential to be used as an alternative therapeutic agent in certain medical conditions, particularly wound infection.

It has been reported that honey showed both bacteriostatic and bactericidal effect against many Gram-positive as well as Gram-negative bacteria [19–23] Lusby et al [24] reported that honeys other than the commercially available antibacterial honeys (e.g., manuka honey) can have equivalent antibacterial activity against bacterial pathogens. This was similar to our study where honey possess antimicrobial property. Out of 140 clinical samples, 59 isolates were of *Staphylococcus aureus*. This includes 22 isolates of MRSA out of which 20(90.9%) isolates were sensitive to honey & 37 isolates of (MSSA) Methicillin sensitive *S. aureus* out of which 30(81.08%) isolates were sensitive to honey. Other study also states that Honey has been reported to be effective in eradicating antibiotic resistant bacteria including MRSA [25] which is a super bug now.

Antibiotics susceptibility testing was also carried out by using other commonly used antibiotics which include Erythromycin, Ciprofloxacin, Tetracycline, Ampicillin, Levofloxacin, Clindamycin, Penicillin G, Linezolid, Vancomycin. All MRSA were sensitive to linezolid where as MSSA were sensitive to all except penicillin.

It is also noted that Any zone diameter having less than 7 mm shows that the organism is resistant to the honey sample but if the zone diameter is greater

than 11 mm it suggests that the microorganism is sensitive to the honey with special reference to *Pseudomonas aeruginosa* [26]. Recent reviews on the successful usage of honey as a dressing on infected wounds show that many authors support the use of honey in infected wounds and some suggest the prophylactic use of honey on the wounds of patients susceptible to MRSA and other antibiotic-resistant bacteria [27]. Well documented clinical trials and researches are going on honey and nanotechnology which may provide promising results on therapeutic use of honey in the future.

Conclusion

Indeed, medicinal importance of honey has been documented in the world's oldest medical literatures, and since the ancient times, it has been known to possess antimicrobial property as well as wound-healing activity. The healing property of honey is due to the fact that it offers antibacterial activity, maintains a moist wound condition, and its high viscosity helps to provide a protective barrier to prevent infection. Its immunomodulatory property is relevant to wound repair too. The antimicrobial activity in most honeys is due to the enzymatic production of hydrogen peroxide.

It is definitely worthy to consider honey as a promising future antimicrobial to be tested and studied. Rediscovering honey as a natural remedy for wound pathogens proved its effectiveness on antimicrobial resistant strains of bacteria including MRSA. In the present study, we tried to focus more on whether honey can be used for treating Staphylococcal infections with special reference to MRSA. Honey, the nature blessed and environmental friendly product may be elaborately used in future with some more molecular studies on its method of action as an antimicrobial agent.

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