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Honey Antibacterial Activity

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Abstract

An alternative to the increasing multiple antimicrobial resistances is honey whose activities can be effective against a broad spectrum of bacterial species especially those of medical interest. Remarkable antimicrobial properties of honey are mainly attributed to hydrogen peroxide and gluconic acid. There is a large variation in the antimicrobial activity of some natural honeys, which is due to spatial and temporal variation in sources of nectar. Thus, for honey to be used as an antimicrobial alternative it has to be first tested in laboratory to determine its antimicrobial spectrum.

Indeed, identification and characterization of new active principle(s) may provide valuable information on the quality and possible therapeutic potential of honeys.

This article focuses on the antibacterial effect of honey and examines variations in its activity against bacteria.

Keywords: Honey; Antimicrobial properties; *Staphyloccus a*ureus; *Escherichia coli; Pseudomonas spp*

Introduction

Antibiotics brought a solution to bacterial infections; regrettably, their efficiency has decreased overtime due to their excessive and abusive use. The production of new antibiotic substances is challenging, and requires besides the enormous budgetary costs in touch with the test duration, a careful attention to the potential side effects that may result from their use.

In recent years, medical authorities reported increased infections and emergence of strains resistant to certain antibacterial compounds mainly due to the misuse of these substances.

Among the possible alternatives, the use of natural substances has been reconsidered. Among these, the hive products such as honey which is historically known as a non-toxic very efficient antimicrobial with a broad spectrum of action.

While the medical use of honey has been recognized, at least since 2000 BC, it is recently, that the use of honey in wound management has become widely available [1]. This renewed interest is mainly due to the growing clinical problem of antibiotic-resistant bacteria and the combined difficulties for the practitioner in managing chronic wound types that may become infected, for example, with methicillin-resistant *Staphylococcus aureus* or *Pseudomonas spp*.

Honey Indications

Honey is produced from many different floral sources, and its antibacterial activity varies greatly with origin and processing [2]. It inhibits diverse bacteria such as *Staphyloccus a*ureus, *Escherichia coli* and *Pseudomonas spp* [3].

Honey was always used for its natural antiseptics properties. With a concentration varying from 30 to 50%, it event showed higher antibacterial activities than certain conventional antibiotics used to treat the urinary infections .

Various people through ages used it in local application to facilitate the healing of wounds.

Manuka honey, for instance is known to have relatively more antibacterial activity and strong curative properties. It is already available as a wound dressing.

Honey's Antibacterial Actors

Honey antibacterial potency has been reported in several studies. The two main actors responsible of this action are hydrogen peroxide and gluconic acid which originate from the dissolution of sugar by honey's glucose oxidase [2-4].

Action of honey is also linked with osmolarity, in fact, its high sugar contents, creates a high osmotic pressure unfavorable to bacterial growth and proliferation. The acidic pH of honey comprised between 4.31 and 6.02 plays also a role in microbial control. Additional honey components, such as aromatic acids or phenolic compounds, may also contribute to the overall antimicrobial activity [5].

Although the antimicrobial effects of various types' honeys are well established, the implicated mechanisms remain incompletely understood.

The antibacterial potential of the New Zealand honey (Manuka) is very high although it contains neither hydrogen peroxide nor glucooxydase. Recent study showed that the compound responsible of this high antibacterial activity is methylglyoxal and is highly effective against *S. aureus* and *E. coli* [6]. The norm UMF (Unique Manuka Factor) used to characterize the great properties peroxide non-hydrogen attributed to the Manuka honey was then abandoned for the benefit of the norm MGO (Methylglyoxal). In classical honeys, its concentration reaches 1-10 mg/kg. In the honey of New Zealand, the concentrations reach 800 mg/kg which explains its high antibacterial effect. This activity peroxide non-hydrogenates remains stable under the heat or the light [7].

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Type of honey	MIC range (%)	Microorganism	Reference
*Apismellifera*Manuka (*Leptospermum scoparium*)	3.4 - 20	*Streptococcus pyogenes, Staphylococci, Escherchiacoli, Pseudomonasaeruginosa, Salomonellatyphi*	[15]
Apis mellifera (differentflora)	2.5 - 50	*Escherchia coli, Pseudomonasaeruginosa, Staphylococcus aureus, Enterococcusfaecalis, Candidaalbicans*	[16]
Gelamhoney	5 - 15	*Staphylococcus aureus, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa.*	[17]
Apismellipodae	6.25 – 12.50	*Escherchia coli, Salmonella typhi, Listeria monocytogenes, Staphylococcus aureus, Shigellaflexneri*	[18]
Apismellifera	6.25 – 12.25	*Staphylococcus aureus, Escherichia coli,Klebsiellapneumoniae*	[19]

Table 1: Minimum inhibitory concentration of different types of honey against medically important microorganisms.

Assessment of Antibacterial Activity

In vitro trials

In this case agar diffusion test are used to assess the antimicrobial potential of honey. A known concentration of bacteria is cultivated in agar plate. Thin wafers are impregnated with different concentrations of honey and put on the surface of agar. The diffusion of honey compounds in agar will induce a clear surface surrounding the wafers. The diameter of the clear surface increases depending of the sensitivity of the bacterial strain. The antibacterial activity is estimated by measuring the zone inhibition diameter [8,9]. Several works using increasing dilutions of honey added to other substances have been realized; antibacterial power of the honey was enhanced in certain cases [10].

In vivo trials

The most renowned are the applications on wounds, in particular those showing resistance to usual antibiotics [11-13].

- In other cases, certain honey components have been tested [14].

Variations in Honey's Antibacterial Activity

Honey has been reported to have an inhibitory effect on around 60 species of bacteria, some species of fungi and viruses. The qualitative method used for the evaluation of antimicrobial activity is that of disk diffusion; however, the macro dilution method is also frequently used, as it is possible to calculate the minimum inhibitory concentration (MIC) which reflects the quantity necessary for microbial growth inhibition.

Table 1 summarizes MIC values obtained when using honey *in vitro*.

Precautions

Despite its beneficial actions, the honey is not the panacea and some precautions are to be considered. At first, it is necessary to guarantee its quality (absence of contaminants and spores); secondly it is necessary to consider the lesion type and the patient state (risk of allergy, diabetes, etc.).

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