Perspection of Royal Jelly and Bee Honey as new antibacterial therapy agents of hospital infections.

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Abstract

In short review were summarized a recent data for *in vitro* antibacterial activity and perspectives for immunological studies in aspects of investigations for specific antibacterial activity substances in mixes between royal jelly [RJ] and some kinds of bee honey. This could be important for future development of effective therapeutic agents for therapy of intestinal and skin hospital infections with case agents resistant for antibacterial substances *Escherichia (E.) coli*, *Aeromonas (A.) hydrophila* and *Staphylococcus (S.) aureus*.

Keywords: Royal jelly, Bee honey, Antibacterial activity.

Accepted on January 23, 2017

Introduction

In present, all over the world it was found problems with therapy of hospital infections from Gram-negative and Gram-positive microorganisms [1].

The antimicrobial activity of honey is attributed largely to the honey acids, low pH, osmolarity and hydrogen peroxide production [2]. *In vivo*, such activity may occur due to a synergistic relationship between any of these components [3].

As the potential role for honey as a topical agent to manage surgical site or infections is increasingly acknowledged and other types of honeys need to be assessed and evaluated [4].

It was found, that exert the main antibacterial factors Manuka honeys from New Zealand, which originates from the manuka tree [*Leptospermum scoparium*], is sold as a therapeutic antibacterial agent worldwide. The presence of methylglyoxal [MGO] in this type of honey has been termed as unique manuka factor [UMF®] [5,6].

Usually in spectrophotometrical studies for detection of antibacterial effect of honey connect turbidity of solutions, contaminated with microorganisms with high count of bacteria. As minimum inhibitory concentration [MIC], described the concentration before the tubes with turbid solutions and all concentrations greater than MIC are described as bactericidal concentrations [7,8].

Up till now, more than 11 types of Bulgarian's bee honey have been harvested and investigated. Based on the data from available literature in 2014 was summarized the scientific information related to the main types of bee honey in Bulgaria from 2000 to the present. In the study from 2014 were present quality parameters from organically produced and commercially processed bee honeys: pollen analysis, proline content, invertase activity, specifi c optical rotation, electrical conductivity, antioxidant and antibacterial activities [9].

The hypopharyngeal glands of the honeybee (*Apis mellifera L.*) produce RJ that is essential to feed and raise broods and queens [10]. RJ may cause allergic reactions in humans, asthma, to even fatal anaphylaxis, thus this product remains unaffordable in most countries [11-13].

From the other hand, it was found more positive effect of RJ: immunostimulating, activating vegetative and central neural systems etc. The main RJ acid, 10-hydroxy-2-decenoic acid (10-HAD), is known to have high antibiotic effect [14,15].

It was found specific antibacterial peptide Royalisin in RJ, displayed certain antibacterial activities against Gram-positive bacteria [16]. In the literature, could be found a few studies about antibacterial effect of RJ to Gram-negative microorganisms [17].

To avoid acid taste and allergic reactions after consumption of RJ many producers recommend mixing of this product with honey, mainly in proportion 1:100.

In next short review were presented last *in vitro* studies from mixes between RJ and some Bulgarian's kinds of bee honey for case agents for hospital intestinal and skin infections.

E. coli

The family *Enterobacteriaceae* comprises about 20 genera including *E. coli*, as well as some other foodborne microorganisms [18], proven to be case agents for hospital intestinal infections.

It was found that several honeys can inhibit *E. coli* and may have potential as therapeutic honeys [19].

In the study from 2014 was used a pathogen strain of *E. coli*, caused septicemia for ducks, resistant for different antibacterial agents: Amoxicillin, Lincospectin, Chloramphenicol, Doxycyclin, Enrofloxacin, Sulfonamides and Trimetoprim. Bacterial suspension of *E. coli* contaminated each from test solutions of RJ, mixes of RJ and rape honey and independent used rape honey [10% to 45% v/v]. Have in mind exactly counts of colonies before and after incubation from each of test substances was calculated the percent of reduction up to 30 min, and after incubation [24 h and 48 h]. In almost all concentrations of RJ [10-45 v/v], were found total inhibition effect to *E. coli*. Mixes from RJ and rape honey [1:100] possessed a higher antibacterial effect, compared with independent use of rape honey. Up to 45% [v/v], rape honey not causes total antibacterial reduction. It was concluded that the RJ and mixes from RJ and

rape honey have potential as alternative therapeutics agents against resistant for antibiotics pathogen strains of *E. coli*. [20]

Aeromonas hydrophila

Some typical fish bacterial pathogens as *A. hydrophila* are also associated to foodborne diseases in humans, making the aquaculture products a potential risk to the customers [21].

It is well known also that *A. hydrophila* strains associated with human gastroenteritis are capable of growing in foods at refrigeration temperatures currently considered adequate for preventing the growth of foodborne pathogens [22].

Different solutions of RJ, RJ and rape honey mix, and rape honey [2%, 5%, 10%, 20% and 30%] were contaminated with bacterial suspension of *A. hydrophila* [ATCC 7965]. Colony counts for each test substances were determined after incubation for 24 h and 48 h and those concentrations which completely inhibited the growth of the test strain were assigned as real bactericidal concentration [RBC] or 100% inhibition. Royal jelly and rape honey mixes possessed a lower antibacterial activity than rape honey. The concentrations of royal jelly [10, 20, and 30%] had a total inhibitory effect against *A. hydrophila* [ATCC 7965]. Royal jelly, royal jelly and rape honey mix, and rape honey have a potential as alternative therapeutic agents against *A. hydrophila* [23].

Staphylococcus [S.] aureus

In the study were presented data for comparison of antibacterial activities between long time stored acacia [*Robinia pseudoacacia* L.], multifloral and oak [*Quercus* spp.] honeydew honeys towards *S. aureus* [ATCC 9144]. The results showed that the antibacterial activity of oak honeydew and multifloral honeys was much higher in comparison with acacia honeys with the lowest antibacterial activity. In the oak honeydew honey samples there was remaining long time stored antibacterial activity towards *S. aureus* [ATCC 9144], [24].

The aim of the recent study was to investigate the *in vitro* means of a microbiological method antibacterial effect of royal jelly, rape honey, and their mixtures [1:100 w/w] against Methicillin-Resistant *S. aureus* [MRSA] strains. At least 3 decimal reductions of MRSA count were observed in Tryptone Soy broth [TSB] with concentrations of 40% v/v rape honey, 30% v/v mixtures royal jelly: rape honey [1:100 w/w], 20% and 30% v/v royal jelly. In general, honey and RJ, individually or in combination, appeared to have a potential as alternative therapeutic agents against MRSA infections, but clinical studies are needed for confirmation [25].

Conclusion

In conclusion, it could be point out that in the moment needs also studies for immunological aspects of specific antibacterial activity substances in mixes between RJ and some kinds of bee honey. Regarding the problem of microbial resistance, there is an urgent need to establish the discovery of new drugs including RJ and bee honey for alternative therapies to control hospital intestinal bacterial gastroenteritis associated with *A. hydrophila* and *E. coli* or *staphylococcal* skin infections.

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