Slovak honeydew honey – from basic science to clinical applications

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Honey – a natural remedy

- treatment of chronic wounds, burns and secondary skin infections
- treatment of eye infections
- treatment of stomach ulcers
- increases overall body’s immunity and suppresses inflammation
Medical-grade honeys

- Activon®, MediHoney® (manuka honey) - UK, USA, Australia
- L-Mesitran®, Revamil® - Netherlands
- VivaMel® (chestnut honey) – Slovenia

Do we need more medical-grade honeys?
What is medical-grade honey?

- sterile product (sterilization by $\gamma$-radiation)
- clinically tested product
- stable producing conditions (bees in greenhouses in Netherlands)
  or
- internally-standardized assays (biological activity or content of active compounds)
- all medical-grade honeys are monofloral honeys
- difficult to reproduce the conditions for producing polyfloral honeys at the same quality and composition of active molecules
- dark honeys are preferred to light ones (higher polyphenols content)
Slovakia has not its own medical-grade honey
Aim of the study

- to select the most potent natural honey that could fulfill all requirements on medical-grade honey
- to investigate antibacterial, anti-biofilm, anti-inflammatory properties in vitro of selected honey
- to determine clinical efficacy in wound management and ophthalmology
RESULTS
Selection of potential medical-grade honey – antibacterial activity

Slovak monofloral and polyfloral honeys

Antibacterial activity

Fir honeydew honey (Bardejov)

Cergov mountain (Bardejov)

Abies alba
(European silver fir)
Honeydew honey -I

- honeydew honey produced in Cergov mountains (\textit{Abies alba} Mill) has pronounced antibacterial activity
- it is more effective than manuka honey UMF 15+
- kills multidrug-resistant bacteria such as \textit{Stenotrophomonas maltophilia} and wound pathogens including MRSA.

Honeydew honey -II

- honeydew honey inhibits biofilm formation and disrupts established biofilm of wound pathogens
- contains a high level of polyphenols
- without or extremely few pollen proteins – less risk of allergy
Honey attenuates TNF-α-induced production of MMP-9 in keratinocytes

24 h pre-treatment with honeydew honey extract
24 h treatment with TNF-α (10 ng/ml)
Densitometric analysis of zymography gels

![Graph showing pro-MMP-9 activity (% of control) vs HAE (mg/ml) with TNF-α as a treatment.](image)
The effect of honey on TNF-α-induced MMP-9 mRNA expression
Densitometric analysis of agarose gels

![Graph showing MMP-9/β-actin ration (% of control) against HAE (mg/ml) for different concentrations of TNF-α.](image)
Phenolic compounds: anti-MMP-9 activities

Flavonoids: kaempferol, naringenin and quercetin

dark honeys vs. light honeys
Is honeydew honey effective in vivo?
Wound management
Treatment of venous leg ulcers with honeydew honey

15 patients with venous leg ulcer treated with honeydew honey

Honey was sterilized and applied to a depth of 3 mm (20 g of honey to a 10 x 10 cm area)
Treatment of surgical wounds with honeydew honey - I

Before

After
Treatment of surgical wounds with honeydew honey - II

Bacterial burden in post-operative wound was decreased
Honey reduces MMP-9 in wound: a case report

- detection in wound fluid
- using ELISA kit against MMP-9
- 3 intervals: 0, 7 and 21 days
Treatment of fistulas using honey: case report

A 55-years old man was referred to a Department of Surgery with septic shock and massive purulent secretion from gluteal, femoral and scrotal fistulas.

- infarct myocardium
- type 2 diabetes
- no Crohn’s disease history

Reccurent fistulas since 2001

No improvement

- medical treatment
- surgical treatment
Ophthalmology
Clinical eye study
antibacterial efficacy of honey -I

Ofloxacin (ATB)                  Honeydew honey

52 patients                      49 patients
scheduled for eye surgery

Elimination of eye bacterial pathogens
Equal efficacy

Clinical eye study
antibacterial efficacy of honey -II

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Ofloxacin group Before</th>
<th>Ofloxacin group After</th>
<th>Honey group Before</th>
<th>Honey group After</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Coagulase-negative <em>Staphylococcus</em></td>
<td>14</td>
<td>4</td>
<td>14</td>
<td>4</td>
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<tr>
<td><em>Corynebacterium</em> spp.</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
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<tr>
<td><em>Proteus</em> spp.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>Enterococcus</em> spp.</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><em>Klebsiella</em> spp.</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>
Honeydew honey and corneal ulcer: case report

Topical combination:

Levofloxacin and 25% (w/v) γ-irradiated honeydew honey solution

Duration:
4 weeks

Improvement of visual acuity
Conclusions

- Honeydew honey is clinically effective natural product with antibacterial, antibiofilm and anti-inflammatory properties.

- Honeydew honey from Cergov (Slovakia) has the potential to become one of the medical-grade honeys.
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