Does bitter melon (*Momordica charantia*) have antibacterial property?

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Background

- Bitter Melon (*Mormodica charantia*)
  - Popular in Southern Asia
  - Used mainly for culinary purposes
  - Claimed to work against diabetes, cancer, and cardiovascular diseases
  - Substance responsible for regulating the body metabolism and transporting glucose from blood into the cells
  - Africa: Gastrointestinal parasitic disease treatment
  - Anecdotal antimalarial and antiviral properties
Background

- **Infection**: bacteria, viruses, or fungi invade body tissues and produce inflammation and tissue damage

- **Bacteria**
  - Gram positive: thick cell wall, 50-90% peptidoglycan
  - Gram negative: thin cell wall, 10% peptidoglycan

- **Antibiotics**
  - Bactericidal: kill the bacteria damaging cell wall/membrane or altering necessary bacterial enzymes.
  - Bacteriostatic: inhibit the active growth of the bacteria without killing them
Background

Bacteria:
- Gram +ve: Staphylococcus aureus has golden yellow hue - skin infections, pneumonia, sepsis
- Gram -ve: Escherichia coli - GI problems, sepsis

Antibiotics:
- Bactericidal against gram +ve: Penicillin
- Bacteriostatic against gram +ve: Erythromycin
- Bactericidal/bacteriostatic against gram -ve: Gentamicin
Background

- Bitter melon contains glycosides, terpenoids, and momordicin-1
  - Momordicin-1 inhibits production of ribosomal proteins, therefore may have bacteriostatic activity
- Has chemical that inhibits 30s ribosomal protein, similar to aminoglycosides like Gentamicin (effective against gram negative bacteria)
- Hypothesis: bitter melon extract will either kill or inhibit growth of bacteria (gram positive or negative)
Objectives

- To examine if bitter melon has any antibacterial property
- If it has antibacterial property, to see the effect on gram positive and/or gram negative bacteria
- To know whether the antibacterial effect is through bactericidal or bacteriostatic mechanism
Materials and Methods

- Bitter melon extracts prepared from interior core, middle, and exterior skin after homogenization and dissolving with sterile distilled water.
Materials and Methods

- Bacterial colonies of Staphylococcus aureus* and Escherichia coli* inoculated on nutrient agar gel media containing petri dishes

- Agar gel disk diffusion method used to assess antibiotic efficacy

*Obtained from Carolina Biological Supply Company
The following disks* (5 in each dish) placed on petri dishes (n=7) with Staphylococcus aureus:

- Positive control: commercially available Penicillin, Erythromycin disks
- Negative control: un-medicated dry and distilled water-soaked disks
- Test: bitter melon extract-soaked disks (interior core, middle skin and exterior skin).

*Obtained from Carolina Biological Supply Company
Materials and Methods

The following disks* (5 in each dish) placed on petri dishes (n=6) containing Escherichia coli:

- Positive control: commercially available Gentamicin disk
- Negative control: unmedicated dry and distilled water-soaked disks
- Test: bitter melon extract-soaked disks.

*Obtained from Carolina Biological Supply Company
Materials and Methods

- All petri dishes put inside an incubator at 37° C
- After 24 hours of incubation petri dishes were taken out and clear zones of inhibition around the disks were measured
- The whole experiment repeated on following day
Assessment of the mechanism of action of bitter melon against infection (bactericidal vs. bacteriostatic):

- Extracts mixed with the liquid microKwik culture vials* containing Staphylococcus aureus (yellow) and Escherichia coli (white)
- After 24 hour incubation at 37 °C, noted any color change of the media

*Obtained from Carolina Biological Supply Company
Results

No clear zones of inhibition around bitter melon extract-soaked disks

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Zone of Inhibition (mm)</th>
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<tbody>
<tr>
<td></td>
<td>Disk 1</td>
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<tr>
<td>Control 1</td>
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<tr>
<td>Erythromycin 2</td>
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Results

No clear zones of inhibition around bitter melon extract soaked disks

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<tr>
<td>Gentamicin 2</td>
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</tbody>
</table>
Results

- No color change in the bitter melon extract treated liquid microKwik culture vial containing Staphylococcus aureus (yellow) and Escherichia coli (white) after 24 hours of incubation at 37°C when compared to those vials without bitter melon extract
Bitter melon (*Momordica charantia*) does not have antibiotic properties when tested against *Staphylococcus aureus* and *Eschericia coli*

Removes the erroneous perception that eating bitter melon will prevent bacterial infections
Discussion

- Agar gel disk diffusion method (measuring clear zones of inhibition) used to determine presence of antibacterial property in bitter melon

- For reproducibility of the data, repeated a second set of experiments following same methodology

- Penicillin more potent Erythromycin against gram positive bacteria

- Both negative and positive control improved quality of the study
Assessing the mechanism of bitter melon’s action against infection:

- No color change observed in the bitter melon extract treated liquid microKwik culture vial containing Staphylococcus aureus and Escherichia coli after 24 hours of incubation
- Further proof that bitter melon does not have any bactericidal action against those bacteria
Limitations

- Cannot completely rule out the presence of antibacterial compound in bitter melon as it may be in too minute a quantity to be picked up from the crude extract

- Did not test other health benefits bitter melon may have in humans
Conclusions

- No antibacterial action of bitter melon as proven by the lack of any zone of inhibition around bitter melon extract impregnated disks in Staphylococcus aureus and Escherichia coli colonies.
- No effect in the liquid microKwik culture vials after mixing with the bitter melon extract, thus disproving any bactericidal action.
- Even though bitter melon may not have antibacterial activity, this study does not disprove other health benefits this vegetable may have.
Acknowledgements

- Mrs. Berneice Boyle, Hathaway Brown School
- Hathaway Brown School
- Dr. Debabrata Ghosh, Associate Professor, Neurology and Pediatrics, Nationwide Children’s Hospital and Ohio State Medical Center, Columbus, Ohio
- Dr. Sudeshna Mitra, Pediatric Neurologist, Cleveland Clinic, Cleveland, Ohio
Suggested Readings

Thank you!