

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



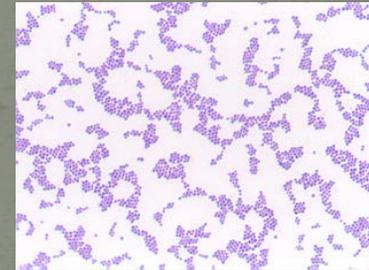
Background

- 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

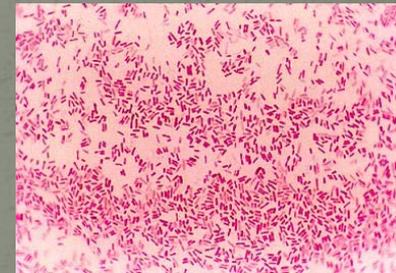
Background

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

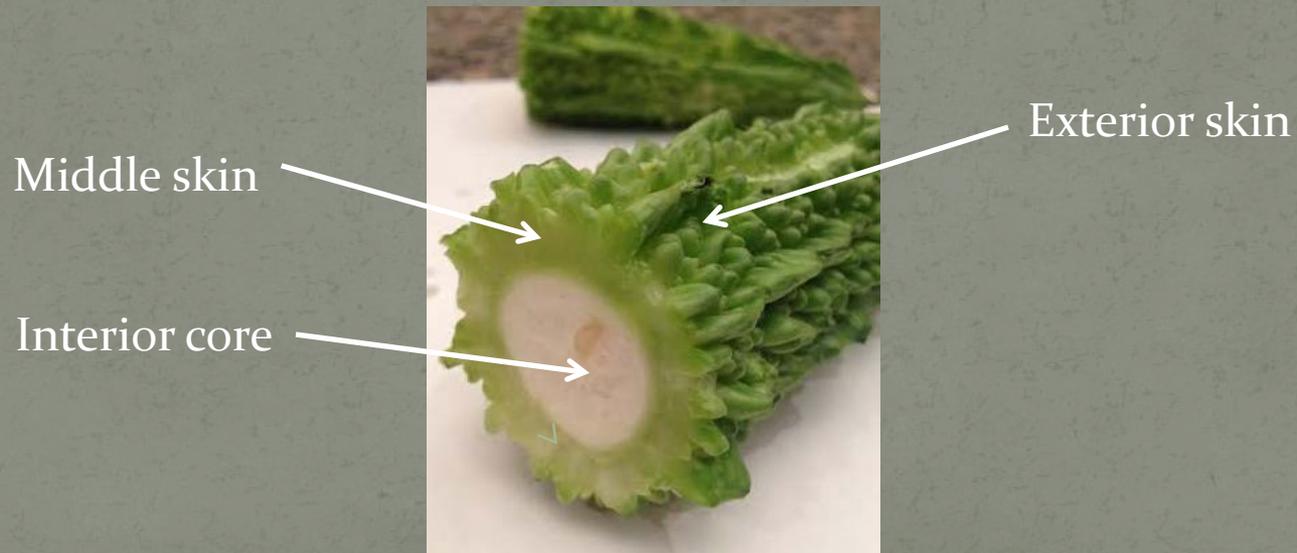
- Bitter melon contains glycosides, terpenoids, and momordicin-1
 - Momordicin-1 inhibits production of ribosomal proteins, therefore may have bacteriostatic activity
- Has chemical that inhibits 30s ribosomal protein, similar to aminoglycosides like Gentamicin (effective against gram negative bacteria)
- 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

Materials and Methods

- 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

Materials and Methods

- 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

Independent Variables	Zone of Inhibition (mm)					
	Disk 1	Disk 2	Disk 3	Disk 4	Disk 5	Avg.
Control 1	0	0	0	0	0	0
Control 2	0	0	0	0	0	0
Distilled Water 1	0	0	0	0	0	0
Distilled Water 2	0	0	0	0	0	0
Interior Skin 1	0	0	0	0	0	0
Interior Skin 2	0	0	0	0	0	0
Middle Skin 1	0	0	0	0	0	0
Middle Skin 2	0	0	0	0	0	0
Exterior Skin 1	0	0	0	0	0	0
Exterior Skin 2	0	0	0	0	0	0
Penicillin 1	13	12	12	12	13	12.4
Penicillin 2	12	15	15	12	13	13.4
Erythromycin 1	11	10	10	10	11	10.4
Erythromycin 2	7	9	8	8	6	7.6

Interior core



Penicillin



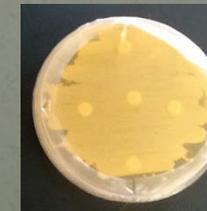
Middle skin



Erythromycin



Exterior skin



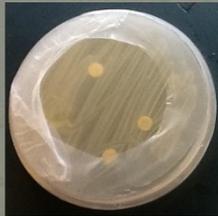
Results

No clear zones of inhibition around bitter melon extract soaked disks

Middle skin



Inner skin



Gentamicin



Exterior skin



Independent Variables	Zone of Inhibition (mm)					
	Disk 1	Disk 2	Disk 3	Disk 4	Disk 5	Avg.
Control 1	0	0	0	0	0	0
Control 2	0	0	0	0	0	0
Distilled Water 1	0	0	0	0	0	0
Distilled Water 2	0	0	0	0	0	0
Interior Skin 1	0	0	0	0	0	0
Interior Skin 2	0	0	0	0	0	0
Middle Skin 1	0	0	0	0	0	0
Middle Skin 2	0	0	0	0	0	0
Exterior Skin 1	0	0	0	0	0	0
Exterior Skin 2	0	0	0	0	0	0
Gentamicin 1	8	7	9	6	13	8.6
Gentamicin 2	12	15	15	12	13	13.4

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

Discussion

- Bitter melon (*Momordica charantia*) does not have antibiotic properties when tested against *Staphylococcus aureus* and *Escherichia 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

Discussion

- 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

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Suggested Readings

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Thank you!