WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 6.805
Volume 5, Issue 9, 1797-1802. Research Article ISSN 2277– 7105

ANTIBACTERIAL ACTIVITY OF MANGOSTEEN (*GARCINIA MANGOSTANA*) PERICARP

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Article Received on
20 July 2016,

Revised on 11 Aug. 2016,
Accepted on 02 Sep. 2016

DOI: 10.20959/wjpr20169-7046

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ABSTRACT

Mangosteen (*Garcinia mangostana*) is a fruit that has had its origin from the South East Asian countries. Traditional healers have found its antibacterial potency in curing various ailments. After consumption of the fruit pulp, the pericarp is regarded as waste but this contains a lot of bioactive components which have unique antibacterial effects. In this study, the anti bacterial activity of mangosteen pericarp against specific respiratory tract and food borne pathogens like *Staphylococcus aureus*, *Salmonella typhi* and *Escherichia coli* was assessed. It was found that mangosteen pericarp exhibited moderate to excellent antibacterial effect against all the pathogens at smaller concentrations like 5 µl, 10 µl and 15µl. This proves its efficacy as a natural antibacterial agent in curing various diseases.

KEYWORDS: Bioactive, Agar well diffusion, Concentration, Pathogen, Zone of Inhibition, Subculture, Sterile.

INTRODUCTION

Recent scientific interest in fruits for health care has gained a lot of attention in the last decades. This shift from chemical drugs to fruit based therapy is primarily due to the more frequent unpleasant effects seen with the former. This has led to the identification of various naturally occurring compounds in fruits. Mangosteen pericarp is an important source of bioactive components possessing various biological and medicinal properties which makes it a potential natural therapeutic agent. The pericarp can be utilized in many ways and can be included in the diet to fight against infections.

Staphylococcus aureus causes a wide variety of infections, most of which are localized to the skin and are nonfatal. Staphylococcus aureus bloodstream infections are among the most prevalent and difficult to treat.[1] *Escherichia coli* are gram negative bacteria that can cause infections like diarrhoea, dysentery, pyelonephritis and the haemolytic-uremic syndrome.[2] *Salmonella typhi* is a gram negative rod that is spread through faecal-oral transmission that can cause a febrile illness known as typhoid. This is characterized by nausea, vomiting, non-bloody diarrhoea along with fevers and abdominal cramping.[3]

Mangosteen pericarp extract acts as a good antimicrobial agent against various bacterial pathogens.[4] It is found to be effective against respiratory and food borne pathogens like *Staphylococcus aureus*, *Salmonella typhi* and *Escherichia coli*. Mangosteen pericarp is proven to be effective against *Staphylococcus aureus*.[5] The antibacterial activity of ethanolic and aqueous rind extract of *Garcinia mangostana* was screened against a variety of organisms like *Salmonella typhi* (Gram negative bacilli-GNB), *Shigella dysentriae* (GNB), *Escherichia coli* (GNB), *Klebseilla pneumonia* (GNB), *Vibrio cholera* (GNB), *Pseudomonas aeruginosa* (GNB) and *Staphylococcus aureus* (Gram positive bacteria) using agar well diffusion technique. It was found that both the extracts of mangosteen at different concentrations exhibited antibacterial activity.[4] In this study, the anti-bacterial effect of an aqueous preparation of mangosteen pericarp powder was studied. Hygienically dried and powdered mangosteen pericarp was used in this study.

MATERIALS AND METHODS

A. Preparation of mangosteen pericarp powder aqueous solution

1. To 1.0 g of dried mangosteen pericarp powder in a test tube, 10 ml of the deionized water was pipetted out.
2. The contents were mixed well by gently tapping the sides of the test tube while holding the neck of the tube.

B Assessment of antibacterial activity of mangosteen pericarp: The agar well diffusion method is the most widely used technique for assaying extracts for their antimicrobial activity as described by Perez et al. (1990).[6] In this technique, a well or reservoir containing the test compound at a known concentration is brought into contact with an inoculated medium and the diameter of the clear zone around the reservoir (zone inhibition diameter) is measured at the end of the incubation period. Different types of reservoirs can be used, such as filter paper discs or holes punched in the medium. The principle behind agar well diffusion method is

that the antimicrobials present in the test sample will diffuse out into the medium and interact in a plate freshly seeded with the particular test organisms. The resulting zones of inhibition will be uniformly circular as there will be a confluent lawn of growth. The diameter of zone of inhibition can be measured in millimetres. Zone of inhibition from 15-20 mm indicates the maximum antibacterial activity; zone of inhibition from 10-15 mm indicates moderate antibacterial activity and zones less than 10 mm indicates minimal or no antibacterial activity.[7]

C. Preparation of the Mueller Hinton Agar (MHA agar)

1. 3.8 grams of MH agar was weighed and dissolved in 100 ml of deionized water in a 250 ml conical flask. The mouth of the flask was plugged with sterile cotton plug.

2. The flask was microwaved for 3 minutes and then autoclaved for at 15 lbs pressure for 15 minutes at 121 degree Celsius.

4. The autoclaved agar was poured into the sterile petriplates within a laminar flow chamber.

5. The agar in the petri plates were allowed to cool and solidify within the chamber.

6. The agar was streaked with the prepared bacteria culture using sterile swab.

D. Preparation of the bacteria subculture

"Sub culturing is the aseptic transfer of microorganisms from a culture to fresh medium." Microorganisms are generally cultured in liquid medium i.e., broth or on solid medium i.e., agar plates or slants. The growth of bacteria is shown as a cloudiness or turbidity in the broth.

1. The sterile loop is used to remove the organisms (the inoculum) from a culture and inoculate the sterile growth medium. The sterile growth medium would contain the inoculum with the required quantity of nutrient broth.

2. The loop must be flamed to red heat when the sub culturing procedure is finished.

3. To remove any contamination, the neck of the bottle should be passed through hot Bunsen flame before and after the inoculation.

4. The prepared sterile growth medium was closed tightly with a sterile cotton plug and left in the shaker for 24 hours at a speed of 120 revolutions per minute (rpm)

5. Three subcultures of *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* were prepared this way and were labelled separately.

E. Antibacterial test

1. After 24 hours, the three sterile petriplates with the solidified agar were streaked with subcultures of *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* using sterile swabs within the laminar flow chamber.

2. Three wells were made in each petridish using the cork borer and a concentration of 5 µl, 10 µl and 15µl of mangosteen pericarp powder in aqueous solution were loaded in each of the wells using a micropipette. Petridish with agar served as control.

3. The setup was incubated at room temperature for 24 hours.

4. The zone of inhibition was observed for all the petri plates including the control. Zone of Inhibition is the clear region around the wells where the sample was loaded. This clear region is an indication of the absence of bacterial growth and it reveals the potency of the sample as an antibacterial agent.

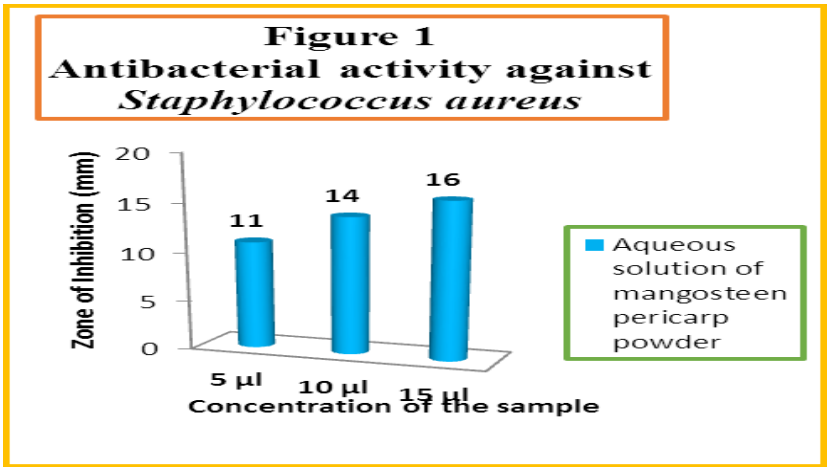
6. The diameter of the zone of inhibition was measured using a measuring scale. The result is expressed in millimetres.

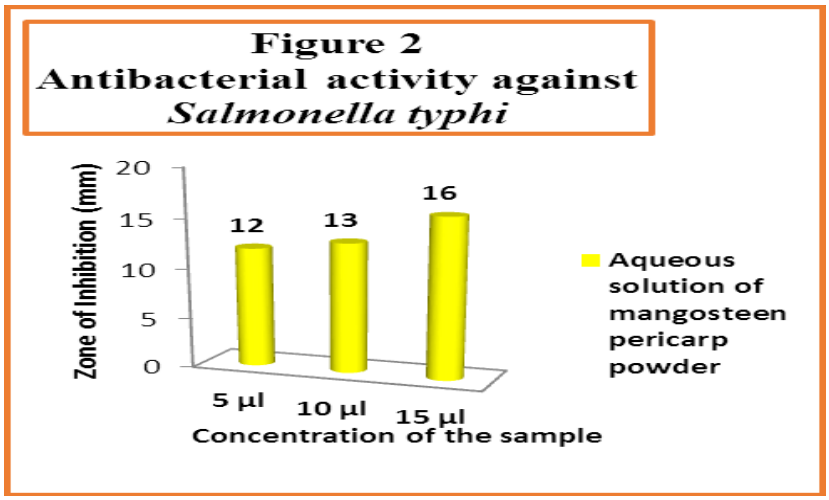
RESULTS AND DISCUSSION

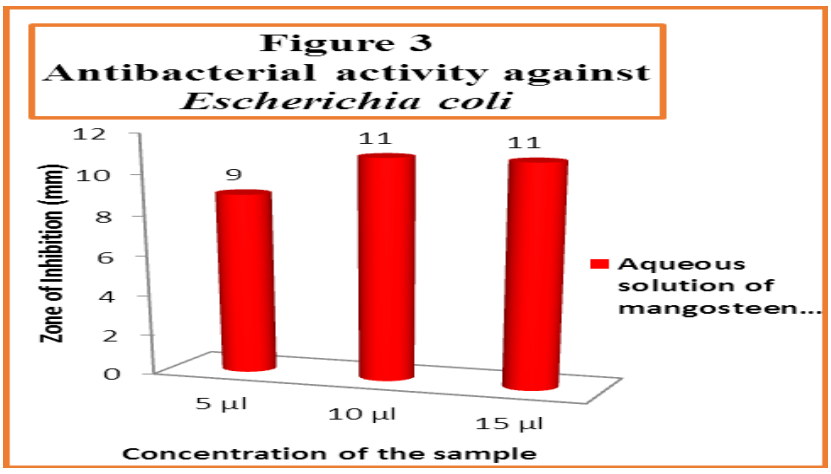
The sample was made by mixing one gram of mangosteen pericarp powder in 10ml of de-ionized water. Samples of 5µl, 10 µl, and 15 µl were loaded on to the sterile discs using a micropipette. The sample in different concentrations was tested for its antibacterial activity against *Staphylococcus aureus, Salmonella typhi* and *Escherichia coli* for their antibacterial activity. After a 24 hour incubation period, the plates were observed and the zone of inhibition was measured (Refer table 1 and figures 1, 2 and 3).

Table 1: Zone of Inhibition of mangosteen pericarp powder against *Staphylococcus aureus, Salmonella typhi* and *Escherichia coli*

Bacteria	Concentration of mangosteen pericarp in aqueous solution		
	5 µl	**10 µl**	**15 µl**
Staphylococcus aureus	11mm	14mm	16 mm
Salmonella typhi	12mm	13mm	16 mm
Escherichia coli	9mm	11mm	11mm







From table 1, it is evident that mangosteen pericarp powder had significant anti-bacterial activity against *Staphylococcus aureus, Salmonella typhi* and *Escherichia coli.* The results indicated that the inhibitory activity of mangosteen was dose-dependent. When the concentration of the sample increased, a concomitant increase in the diameter of zone of inhibition was observed.

In this study, mangosteen pericarp displayed excellent antibacterial activity against *Staphylococcus aureus* and *Salmonella typhi* even in small concentrations of 5, 10 and 15µl. It also showed moderate antibacterial activity against *Escherichia coli* and it was noted that as the concentration of the sample increased, the antibacterial activity or the zone of inhibition increased in diameter.

SUMMARY AND CONCLUSION

The dried and powdered mangosteen pericarp in aqueous solution was found to exhibit moderate to excellent growth inhibition against *Staphylococcus aureus*, *Salmonella typhi* and *Escherichia coli* at smaller concentrations like 5, 10 and 15 µl. With due understanding of the potential benefits in the pericarp of mangosteen, we can look forward to developing natural therapeutic products which can benefit society.

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