Mango (*Mangifera indica*) Bark Aqueous Extract as Antimicrobial Spray

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Abstract: Emerging microbial agents have been increasing in number. Microbial agents are necessary in combating microbes such as bacteria that cause viruses and diseases. Hence, some bacteria are being resistant to antioxidant and antibacterial drugs that is why it resulted to find antimicrobial agents coming from organic molecules. This reason resulted in the researchers finding an organic antimicrobial agent using Mango Bark Aqueous Extract (MBAE). In the previous studies, it was proven that Mangifera indica (Mango) has phytochemicals that help inhibit the growth of bacteria. Thus, the researchers screened the antimicrobial activity of MBAE by applying the MBAE with a concentration of 50 mg/ml to the cultured microbes. The researchers selected chicken meat samples within the vicinity of Taytay, Rizal marketplace in March 2021. The sample was used to culture the microbes to be treated. The microbes were cultured on Nutrient agar over 24 hours under room temperature then the MBAE was applied by dropping an adequate amount of the extract on the plate and spreading it until the surface is fully covered. After twenty-four hours, the extract almost inhibited the growth of microbes on the plate. This justifies the claims regarding the potential usage of the Mango Bark Aqueous Extract as an antimicrobial agent.

Key Words: mango aqueous extract; antimicrobial screening; microbial agents; microbes; bark.

1. INTRODUCTION

The mango belongs to genus *Mangifera*, which consists of numerous species of tropical fruits in the family of *Anacardiaceae*. *Mangifera indica* L. is native to India and Southeast Asia where it has been cultivated for over 4000 years for the good qualities of the fruits. Currently, mango is also grown in Central America, Africa, Australia, and for a few years in Europe (Lauricella et al., 2017).

According to the study of Scartezzini et al. (2000, as cited by Ghuniyal, 2015), aqueous extract is traditionally used for the treatment of, syphilis, anemia, scabies, cutaneous infections, menorrhagia, and diarrhea. In line with it, as the aqueous extract shows that it combats different bacteria onto these diseases, the bark infusion has been used to treat mouth sores. In the study of Sanusi et al. (2011), the antimicrobial activity of the aqueous and methanolic extract of *Mangifera indica* stem bark both inhibits the growth of *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli* at a concentration of 50 mg/ml of the reconstituted extract. Similarly, Abubakar (2009), as cited by Osei-Djarbeng et al. (2020), has studied and found that the bark extract of the plant has exhibited antimicrobial activity against *Staphylococcus aureus* and *Escherichia coli*, *Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae and Streptococcus pneumoniae*. Moreover, in the study Prado et al. (2015), they stated that some studies have been performed in Cuba from one standardized aqueous stem bark of mango extract they isolated and purified mangiferin. Mango bark contains mangiferin (Nwoke et al., 2016; Govindan, 2019; Sani et al., 2015) and other phytochemical constituents. According to Stoilova et al. (2005) as cited by Tyagi et al. (2019), in an in vitro agar diffusion technique, mangiferin showed activity against 7 bacterial species, *Bacillus pumilus, B. cereus, Staphylococcus aureus, S. citreus, Escherichia coli, Salmonella agona, Klebsiella pneumoniae*, 1 yeast (*Saccharomyces cerevisiae*) and 4 fungi (*Thermoascus aurantiacus, Trichoderma reesei, Aspergillus flavus and A. fumigatus*).

Given this data, the researchers are encouraged to conduct experiments in testing the antimicrobial efficacy of the MBAE. The researchers will synthesize Mango (*Mangifera indica*) bark as antimicrobial spray for possible product development. This study aims to justify the potential of the MBAE as an organic antimicrobial agent.

1.1 Theoretical Framework

Resistance to antimicrobial drugs has become an increasingly important and pressing global

problem (Savant et al., 2017). Resistance of microorganisms to antibiotics and orthodox drugs has resulted in finding antibacterial agents that came from organic molecules from plants that have antibacterial properties (Sanusi et al., 2011). According to the study of Savant et al. (2017), there has been a ruthless increase in antimicrobial resistance in most of the pathogenic microorganisms all over the world due to irrational use of antimicrobial agents. Therefore, the use of antibacterial properties of Mango (*Mangifera indica*) bark extract is significant to the foregoing research.

Nworie et al. (2016), stated that the chance to find antibacterial property on both leaves and bark extract of the Mango were apparent, therefore, they suggested that the plant could be a new source of antibiotics. Accordingly, the study of Mazlan et al. (2019), mangiferin and its derivative compounds is a safe natural product, which can potentiate antibacterial effects of some antibiotics suggesting good potential for combination therapy against S. aureus. Likewise, the study of Savant et al. (2017), also showed the extract's potential antibacterial activity against different Gram positive and Gram-negative bacteria by performing MIC and zone of inhibition. Interestingly, these results encourage the researchers to carry out further study for its clinical use.

1.2 Research Question

Does the MBAE inhibits microbes?

1.3 Scope and Delimitation

This study focused mainly on the effect of antimicrobial properties of Mango on microbes collected on chicken meat samples.

This study is limited since the microbes collected on the chicken meat sample were not identified and verified. In addition, the researchers did not use positive and negative control in the experiment.

2. METHODOLOGY

2.1 Research Design

The researchers used Pretest and Posttest Control Group Design. They selected the test organisms on raw chicken samples at Taytay, Rizal public market in March 2021. The test organism was pre-tested, without the application of the MBAE, observed and post-tested after 24 hours of the application of the MBAE. After 24 hours of observation the treated plate was analyzed and drawn to a conclusion.

2.2 Selections and Trials

All the conclusions were drawn only after the testing of organisms on collected chicken sample. The purpose of taking samples was to randomly select test organisms on the raw chicken sample to get the data and information, which conclusions are drawn.

2.3 Proposed Product

Figure 1

MBAE as antimicrobial spray

2.4 Procedures

2.4.1 Collection of Plant Materials

Samples of Mango (*Mangifera indica*) tree bark were obtained from Taytay Rizal.

2.4.2 Preparation of Plant Materials

Freshly collected stem barks of *M. indica* were thoroughly cleaned and washed with water and were dried under sunlight with a span of three days. After drying the stem bark, it was pounded with mortar and pestle to obtain smaller pieces and then powdered using an electric blender. 150 grams of the powdered stem bark of the *M. indica* was stored in a container until required.

2.4.3 Preparation of Aqueous Extract

The researchers used five grams of the dried powdered sample soaked in 100 ml of distilled water contained in a container. The container was covered and then stored for 24 hours. After 24 hours, the suspension was shaken vigorously and filtered using filter paper. The extract was stored 24 hours under room temperature. After 24 hours, the 50 mg/ml extract was used in the antimicrobial screening.

2.4.4 Preparation of Microbial Media

As suggested by the manufacturer's specification, 8.4g of Nutrient agar was dissolved in 300ml of distilled water. After the agar was dissolved the solution was then autoclaved. After autoclaving,

the nutrient agar was poured on petri dishes and allowed to harden under room temperature. The plates were then inoculated with the test organisms and then treated by 50 mg/ml concentration of MBAE.

2.4.5 Collection of Test Organisms

Test organisms were obtained upon culturing microbes from the raw chicken food sample. The test organisms were cultured on Nutrient Agar. The researchers swabbed the surface of the food sample using sterile swabs and transferred it into the nutrient agar plate in a side-by-side motion. The plates were incubated at a room temperature for 24 hours.

3. RESULTS AND DISCUSSION

1. Does the MBAE inhibits microbes?

This study's finding intends to show antimicrobial activity of the MBAE on the test organism within the time interval; 5:50 PM, 6:00 PM, 9:00 PM, 10:00 PM, 7:00 AM, 12:00 PM, 3:00 PM, 5:50 PM.

Figure 2

The antimicrobial activity of the MBAE on the test organism within 24 hours.

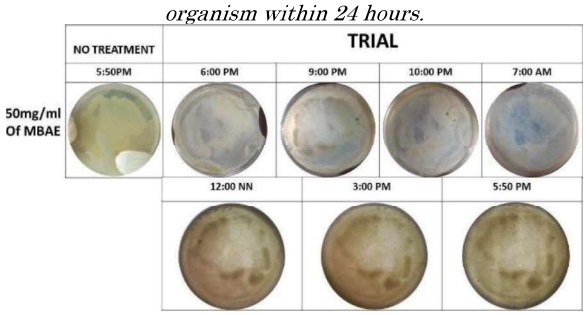
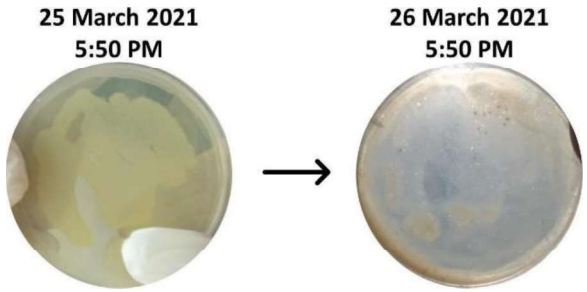


Figure 3

Effect of the MBAE to the test organism after incubation for 24 hours.



Through 24 hours of observation, the results were gathered and analyzed. The results showed that at the concentration of 50 mg/ml, the growth of microbes has been inhibited. As shown on Figure 2 the first ten minutes of the application of the extract the results were visible that MBAE acted fast. Continuously, the 24 hours of observation showed that every time interval after the application of the MBAE it showed significant effect that it inhibits the growth of microbes.

As the study of Sanusi et al. (2011), stated that in their phytochemical screening, aqueous extract of Mango bark has the presence of tannins, saponins, sterols, cardiac glycosides, flavonoids, and alkaloids. Mango bark also contains mangiferin (Nwoke et al., 2016; Govindan, 2019; Sani et al., 2015), which is, according to Stoilova et al. (2005, as cited by Tyagi et al., 2019), showed activity against 7 bacterial species, *Bacillus pumilus*, *B. cereus*, *Staphylococcus aureus*, *S. citreus*, *Escherichia coli*, *Salmonella agona*, *Klebsiella pneumoniae*, 1 yeast (*Saccharomyces cerevisiae*) and 4 fungi (*Thermoascus aurantiacus*, *Trichoderma reesei*, *Aspergillus flavus* and *A. fumigatus*).

4. RECOMMENDATION

This study only focused on the 50 mg/ml concentration of the extract. There are still concentrations suggested by Sanusi et al. (2011), to be explored. The concentration showed inhibition to the growth of microbes in the sample. To further know the efficacy of the extract on foodborne bacteria, it is suggested to find different food samples like meat, vegetable, and fruit regarding also from where these food samples come from. It is also suggested to use identified and verified test organisms, use verified methods in finding the inhibitory effect, and conduct a positive and negative control to the experiment.

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