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## Antimicrobial Activity of *Musa acuminata* Peel Extract against Gram-Positive Bacteria

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### ABSTRACT

Particular communities are discarding banana (*Musa acuminata*) peels as household and industrial food waste. It is high in nutritive value and a healthy source of food to consume. This study aims to evaluate the antimicrobial activity of *M. acuminata* peels against four types of Gram-positive bacteria, namely, *Bacillus cereus*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus pyogenes*. The extract of *M. acuminata* peel was prepared using a Soxhlet apparatus for ethanolic extract and rotary evaporator to concentrate the ethanolic extract. Antimicrobial activity was carried out on the extract using agar disc diffusion technique; the inhibitory zones were recorded in millimetres. Results showed that the disc diffusion method of ethanolic extract of *M. acuminata* peel was not effective against all the Gram-positive bacteria strains. This result indicated that *M. acuminata* peel did not pose any potential antimicrobial effect against Gram-positive bacteria. However, further study should be carried out using different extraction method and concentration in order to evaluate antimicrobial activity.

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## Introduction

Banana (*Musa* spp) is the second most fruit crop plantation in Malaysia, and *Musa acuminata* plantation coverage is about 50% of the total banana plantation area [1]. Most of the time banana peel is discarded as waste by household and some industries. The bioactive compounds in banana peels such as flavonoids, glycosides, alkaloids and tannins have

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various pharmacological and biological effects [2]. Mohapatra et al., (2010) stated that banana peels are one of the good sources of pectin and nutrients such as dietary fibres, sugars and minerals [3]. Other varieties of banana peels such as *Musa sapientum* and *Musa paradisiaca* peels show effective antimicrobial activities against certain types of bacteria [4,5]. A wide range of pharmaceutical agents such as antibacterial, antiparasitic, antifungal and antiviral drugs was encompassed by antimicrobial activity [6]. Antimicrobial agents can be in the form of antibiotics, which helps to stop the growth or kill the microorganisms [7]. Encyclopedia Britannica stated that there were a number of natural origin antibiotics such as gentamicin and tetracycline used commonly in antibacterial activity. Nowadays, plant-derived antibiotics are mostly preferred for antimicrobial activities by pharmaceutical and food industries [8]. In antimicrobial testing disc diffusion method is a suitable technique to identify the zone of inhibition shown by the plant extract and nutrient broth agar method is used to determine the minimum inhibitory concentration (MIC) according to Clinical and Laboratory Standard Institute (CLSI) [9].

Gram-positive bacteria are multi-resistant bacteria that cause infections and lead to a significant health problem for the public. They affect the mortality and mobility of a person and cause an increase in the implementation of infection control measure and expenditure on patient management [10]. Even though, there are certain antibiotics used in order to treat the infections caused gram-positive bacteria; but they were still causing side effects [11]. Therefore, plant-derived antimicrobials are now preferable, and many researchers intend to conduct research based on plant extract. Although, *M. acuminata* peels consist of certain medical properties that can be used to treat diseases [12], the scientific evidence that has been provided in the management of Gram-positive bacteria is not that much susceptible in antimicrobial activity. Hence, this research was conducted to evaluate the potential antimicrobial activity of *M. acuminata* ethanolic peel extract against Gram-positive bacteria.

## Materials and Methods

### Sample extraction preparation

*Musa acuminata* fruit used in this research was collected from Kampung Parit Serong, 45500 Tanjong Karang, Selangor, Malaysia at the coordinate of longitude: 3.427186; latitude: 101.220844. Identification of *M. acuminata* peel was carried out at the Department of Crop Science, Faculty of Agriculture, University Putra Malaysia (UPM) and the peels were taken for an experiment at the herbarium. The peels of *M. acuminata* were rinsed with distilled water; chopped into 0.5 cm – 1.0 cm and dried in an oven at 50°C for 12 hours. The dried *M. acuminata* peel was grounded into a fine powder and soaked into hexane for defatting method. Then, the peel once again dried using the oven at 10°C for 10 minutes [13]. A total of 500g of powdered *M. acuminata* peels was soaked in 5 L of 85% ethanol and placed in a water bath at 60°C for 8 hours. The supernatant was filtered using filter paper and evaporated to dry by using a rotary evaporator at 40-50°C. The dried extract was dissolved in acetone and stored at 0-4°C in an airtight container for further use [14].

### Antibacterial activity of *Musa acuminata* peel

The disk diffusion method was used to evaluate the antimicrobial activity. Bacterial suspensions (100 µl) were spread using glass spreader (90° bend). An amount of 10 µl plant extract concentration of 10 mg/ml was loaded on sterile filter paper discs and placed on the top of Mueller-Hilton agar plates. Ampicillin (10 µg), Gentamicin (10 µg) and Tetracycline (10 µg) discs were also loaded on the same Mueller-Hilton agar plate as control. The plates were kept in an incubator at 37°C for 24 hours. Using a Vernier caliper, the zone of inhibition was measured [15].

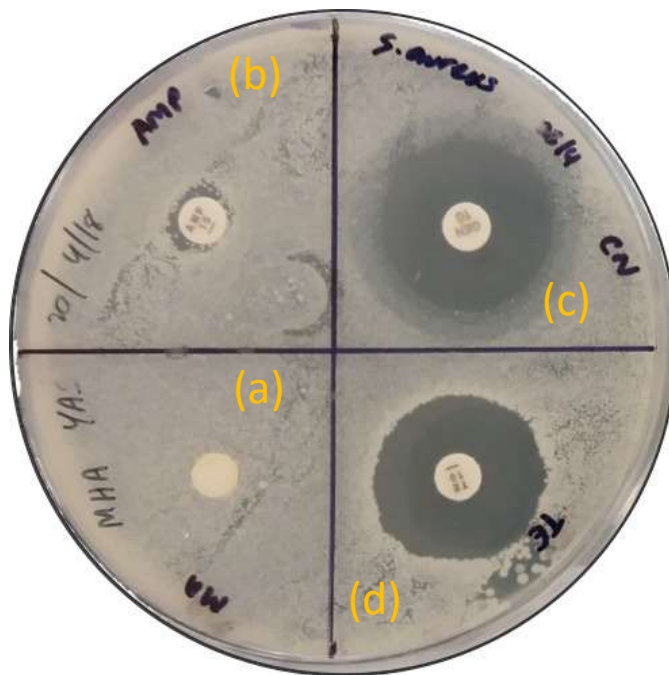
## Result and Discussion

The *Musa acuminata* ethanolic peel extract does not show zone of inhibition (0.00mm) on four types of tested organisms, as presented in Table 1. The results revealed that ethanolic extract of *Musa acuminata* peel was resistant to all the Gram-positive bacteria tested. The previous study reported that Gram-positive bacteria had shown the lowest inhibition zone in other variety of banana *Musa* spp. [4,5]. However, Rattanavichi & Cheng (2014) reported that there was the antimicrobial activity of the hot-water extracts of *M. acuminata* peel

against pathogens from aquatic animals [16]. Different extraction methods can be used to test the effectiveness against Gram-positive bacteria. The disk diffusion method was used in this study to evaluate the antimicrobial activity of the *M. acuminata* and antibiotics such as Ampicillin, Gentamicin and Tetracycline against the Gram-positive bacteria such as *Bacillus cereus*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus pyogenes*. Figure 1 shows the inhibition zone of *Musa acuminata* ethanolic peel extract and antibiotics against *Staphylococcus aureus*. This method has been used widely in the previous study [13,14]. However, in this study, the value of MIC was not determined; thus, the result obtained did not justify the concentration of extract used. A study by Mokbel and Hashinaga (2005) showed that with a MIC value of between 140 - 750 ppm, it was unable to inhibit all the Gram-positive bacteria [17].

**Table 1** Inhibition zone (mm in diameter) of *Musa acuminata* ethanolic peel extract and antibiotics (positive control) against four different organisms

	<i>B. cereus</i>	<i>S. aureus</i>	<i>S. pneumoniae</i>	<i>S. pyogenes</i>
<i>Musa acuminata</i> <i>peel extract</i>	0.0 mm ± (Resistant)	0.0 mm ± (Resistant)	0.0 mm ± (Resistant)	0.0 mm ± (Resistant)
<i>Ampicillin</i>	10.0 mm ± (Resistant)	7.0 mm ± (Resistant)	7.0 mm ± (Resistant)	9.0 mm ± (Resistant)
<i>Gentamicin</i>	24.0 mm ± (Susceptible)	24.0 mm ± (Susceptible)	21.0 mm ± (Susceptible)	20.0 mm ± (Susceptible)
<i>Tetracycline</i>	8.0 mm ± (Resistant)	23.0 mm ± (Susceptible)	7.0 mm ± (Resistant)	20.0 mm ± (Susceptible)



**Fig 1** Inhibition zone (mm) of (a) *Musa acuminata* ethanolic peel extract, (b) Ampicillin, (c) Gentamicin, and (d) Tetracycline against *Staphylococcus aureus*

## Conclusion

It was concluded that the *M. acuminata* ethanolic peel extract did not pose any antimicrobial effect against Gram-positive bacteria *Bacillus cereus*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus pyogenes*. Future study can be conducted by measuring the Minimum Inhibitory Concentration (MIC) of the extract and using different extraction method.

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