

Effectiveness of traditional medicinal vegetables (ulam) against pathogenic microorganisms –A review

ABSTRACT

Ulam is a group of traditional Malaysian medicinal plants which are consumed raw in meal. Antimicrobial properties of ulam are one of the most significant current discussions among public and scientist. It is always a contradiction among public belief and scientific data about the pharmacological effect of ulam. Hence, various research was anticipated to scientifically prove the medicinal benefit of different ulam. In addition, the factors found to be influencing the antimicrobial activities have been explored in several studies. Hence, this review aims to collect scattered information on antimicrobial effects of ulam that might be beneficial for further isolation of the biologically active compound of this ulam in future.

Keywords: Ulam, antimicrobial, medicinal plant

INTRODUCTION

World Health Organization reported in 1993 that 80% of the world population still depends on herbal remedies for treatment even in this modern culture¹. Malaysia is rich in flora and fauna because of favourable climate that is suitable for plant growth. This climate enhances growth of many types of plants including ulam. Ulam refers to medicinal plant which is consumed raw during meal. During ancient time, ulam is famous raw food among Malay ethnic. However, recent trend shows that ulam is gaining attention from all ethnic in Malaysia due to its beneficial health effects.

There are various studies that have linked ulam and its pharmacological effect such as anti-hyperglycemic effect, blood pressure lowering activity, cardiac protective activity, anti-cancer activity, asthma relief, and anti-microbial activity.

Major cause of premature death worldwide is infectious disease due to microbial infection². The emergence of this infectious disease remains a serious issue, and cause economical loss to the government for the treatment. These infectious diseases are primarily by the infection of pathogenic microorganisms such as *Escherichia coli*, *Salmonella spp.*, *Staphylococcus aureus* and *Candida albicans*³. The antimicrobial effect of herbal plant against this microbial species is gaining attention in modern community today as they provide lesser side effect compared to conventional medicine in treatment of infectious disease⁴. Antibiotics were also linked to some adverse effect such as hypersensitivity, immunosuppressant and allergic reactions⁵. In addition, resistance developed by microorganism against antibiotic is an alarming issue, hence there is an urgent necessity for discovery of alternative treatment using herbal remedies to treat microbial infection.

Alternanthera (Kermak)

Alternanthera is a genus of Amaranthaceae that can be found in America ("Alternanthera in Flora of North America @ Efloras.Org"), Asia, Africa and Australia⁶. Detailed investigation on the antimicrobial activity of *Alternanthera* by Johnson et al showed good antibacterial activity against gram positive and gram negative organisms⁷. Aqueous extract of *Alternanthera* leaves, inter-nodes, leave and inter-nodal segments were proven to be active against *Proteus vulgaris*, *Streptococcus pyogenes*, *Bacillus subtilis* and *Salmonella typhi*⁷.

Anacardium occidentale (Pucukgajus)

Cashew tree botanically named as *Anacardium occidentale* is a common edible plant originated from North-east of Brazil and now rooted at various parts of the world. Cashew has medicinal, industrial and economic values to most of the countries which makes it so valuable in disease treatment. Researchers have reported that cashew leaves exhibit antibacterial activity against common oral pathogens, gram positive and gram negative bacteria at low MIC concentrations⁸. Ethanol extract of *A. occidentale* leaves was found to exhibit significant antimicrobial and antifungal activity due to the presence of tannin⁹. Chabi et al also pointed out that ethanol leave extract exhibited high bacteriostatic and bactericidal activity against *Staphylococcus sp*¹⁰. This finding is supported by Gisele & Julianawho reported stable antimicrobial activity against tested *Staphylococcus sp.* with ethanol leave extract¹¹. These data supports the consideration of the usage of *A. occidentale* leave extract for wide range of pharmaceutical applications.

Barringtonia racemosa (Pucukputat)

Barringtonia racemosa (*B. racemosa*) is a tropical higher plant of Lecythidaceae family, native of East Africa, South East Asia and Pacific Islands¹². Previous study had reported that the roots of *B. racemosa* exhibit antibacterial activity against several Gram positive and Gram negative bacteria and are a rich source of phytomedicine¹³. Besides, *B. racemosa* also have been proven for its antifungal properties in a research conducted by Hussin and team¹⁴. The antifungal activity of *B. racemosa* may be attributed by the various phytochemical constituents such as phenolic acid and flavonoids present in the crude extract. The study proven that

methanolic extract of *B.racemosa* leaf has the strongest inhibitory effect against *Fusarium sp.* (53.45%), *Ganoderma lucidum* (34.57%), *Aspergillus sp.* (32.27%) and *Tricoderma koningi* (20.99%). Hot water extract of *B.racemosa* leaf also showed remarkable inhibitory effect against *Fusarium sp.* (51.72%)¹⁴.

Carica papaya (Betik)

Carica papaya (Family Caricaceae), is a common tropical fruit with high nutritional and medicinal values. The papaya plant has been used traditionally for the treatment of common infectious and non-infectious conditions¹⁵. Tannins, saponins, glycosides and phenols are found to be the main bioactive constituents of the leaves, fruit and seeds of *Carica papaya*¹⁶. A considerable amount of study have proved that methanol extracts of carica leaves, mainly the yellow leaves shows good bactericidal activity against gram negative bacteria¹⁷. Dawkins et al conducted a study to compare the antimicrobial activity of the various stages of fruit maturity and the seeds¹⁸. It was reported that seed extract shows better inhibitory effect against gram-positive and gram-negative organisms. Seed extract from the fruit showed inhibition in the following order: *B. cereus* > *E. coli* > *S. faecalis* > *S. aureus* > *P. vulgaris* > *S. flexneri*. The observed activity was independent of the maturity stage of the fruits. This finding is supported by Yismaw and team that proven as papaya seed could be used as an effective antibacterial agent for the tested organisms from the clinical samples¹⁹.

Colocasia esculenta (Kemahang)

Colocasia esculenta (araceae) was originated from the tropical region between India and Indonesia for hundreds of years. *Colocasia esculenta* have been reported for its antimicrobial activity against Gram positive and Gram negative bacteria²⁰. Recent evidence suggests that Araceae has considerable anti-bacterial and antifungal activity. Chloroform and

Methanolic extract of the Araceae have been proven to have maximum inhibition against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris*, *Candida albicans* and *Aspergillus flavus*²⁰.

Pluchea indica Less (L.) (Beluntas)

Pluchea indica Less (L.) is a native plant of Asia and Australia. *Pluchea indica* L. leaves have been identified to contain chemical properties such as tannins, flavonoids, polyphenols, and essential oils that are known to have antibacterial effect²¹. Purnomo points out that *Pluchea indica* L. leaves exhibit antibacterial effects against *Staphylococcus sp*, *Propionibacterium sp*, and *Corynebacterium*²².

Psophocarpus tetragonolobus (Kacang kelisa)

Psophocarpus tetragonolobus and locally known as kacang kelisa is found throughout Malaysia²³. Study conducted on *P. tetragonolobus* pods showed that the crude ethanolic extract of *P. tetragonolobus* pods shows significant antimicrobial activities against eight tested yeast and bacteria species. The extract shows dose response antimicrobial effect on microorganism tested namely *Bacillus cereus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*, *Candida albicans* and *Rhodotorula rubra*. The antimicrobial effect was assessed using disc diffusion assay and compared with vancomycin (30 µg/disc), tetracycline (30 µg/disc) and nystatin (30 µg/disc). The inhibitory effect of *P. tetragonolobus* for all the strain increased with increase concentration from 10 to 20 µL²⁴.

Polygonum minus (Kesum)

This plant is commonly found in Asian country such as Malaysia, Thailand, Indonesia and Vietnam²⁵. However, it is unfortunate that the study performed by Musa et al. indicated that aqueous extract of *P. minus* do not have any antimicrobial against isolated pathogenic fish bacteria namely *Aeromonas hydrophila*, *Citrobacter freundii*, *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus agalactiae*, *Streptococcus agalactiae*, *Vibrio alginolyticus*, *Vibrio parahaemolyticus* and *Vibrio vulnificus*. Another study showed that water extract of *P. minus* did not show any activity on *Bacillus subtilis* and *Escherichia coli*. However, ethanolic and methanolic extracts showed activity against *B. subtilis* and no activity against *E. coli*. Conversely Hashim et al. reported that *P. minus* water extract showed activity on *E. coli* but did not show any activity on *B. subtilis* and *S. aureus* while ethanol and methanol extracts showed good activity on *B. subtilis*, *S. aureus* and *E. coli*. Overall study indicates that *P. minus* is a potent antimicrobial agent which can be used to treat mild microbial infection²⁵.

Artocarpus communis (Nangka)

Artocarpus communis known by local people as breadfruit tree since the edible fruits look as bread. The methanolic bark extract of *A. communis* showed that it could inhibit the growth of all tested microbial species namely *Providencia stuartii*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Salmonella typhi*, *Escherichia coli* and *Candida albicans*. The minimal inhibitory concentration of extracts against all the strains was performed using INT colorimetric assay. The results showed that the lowest MIC value (64 µg/ml) recorded for the crude extract against two microbial strains namely *S. aureus* and *E. coli* ATCC8739. This present data support the usage of *A. communis* to treat infections related with tested microorganisms²⁶.

134 *Kaempferiagalangal* (Cekur)

135 *Kaempferiagalanga*(*K.galanga*)is one of the valuable herbal plants in Zingiberaceae
136 family. The rhizome of *K.galanga*finds an important place in ayurvedic medicine²⁷.Ethanolic
137 extract of *K.galanga* showed significant antibacterial and antifungal properties²⁸.The
138 componentEthyl p-methoxycinnamate (EPMC) and ethyl p-hydroxycinnamate (EPHC) are found
139 to be the main chemical constituent that attribute to the microbial activity within the extract.
140 Another comparative study carried by Omar et al, have found that EPHC has better antimicrobial
141 and antifungal effect against common bacteria namely *S. aureus*, *B. cereus*, *P. aeruginosa*, *E.*
142 *coli* and fungus like *Trichophytonrubrum*, *Trichophytonmentagrophytes*and*Microsporum*
143 *gypseum*²⁹. These justify the indigenous usage of *K.galanga* extracts as antidermatophytic agent
144 as well³⁰.

145 *Morindacitrifolia*(Pucukmengkudu)

146 *Morindacitrifolia* (*M. citrofilia*) is a plant of the Rubiaceae family. It is found in
147 Southeast Asia and used widely in Polynesian traditional medicine. Over the past decade, most
148 research in the natural products has emphasized on the antimicrobial activities of *M. citrofilia*³¹.
149 Previous research has indicated that the juice of *M. citrofilia* is widely used in complementary
150 medicine due to its probable antioxidant, anti-inflammatory and antitumor effects³². It has been
151 demonstrated that ethanolic extract of *M. citrofilia* has antimicrobial activity by inhibiting the
152 growth of both Gram positive and Gram negative bacteria³³. These data corroborate others
153 authors report that the antimicrobial activity of the ethanolic extract of *M. citrofilia*. This showed
154 that its compounds may exhibit potent antibiotic activity against human pathogens such as *S.*
155 *aureus*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella* and *Shigella*³⁴.

Parkiaspeciosa (Petai)

Extensive research had indicated that antibacterial property of *P. speciosa* seed is contributed by their bioactive compounds which are hexathionine and trithiolane and two cyclic polysulfide compounds³⁵. Musa et al had reported that aqueous suspension of *P. speciosa* is capable in retarding growth of certain microbial species such as *Aeromonashydrophila*, *Staphylococcus aureus*, *Streptococcus agalactiae*, *Streptococcus anginosus*, and *Vibrio parahaemolyticus*³⁶. Previous study by Sakunpak et al demonstrated the promising antimicrobial activity of *P. speciosa* methanolic seed extract against *H. pylori* and *E. coli* (ethyl acetate extract)³⁷.

Musa troglodytarum (Pisangmuda)

Musa troglodytarum locally known as banana or pisangmuda is a familiar ulam among community. Different extract of *M. troglodytarum* (hexane, ethyl acetate and methanol) were subjected to agar well diffusion assay to determine the antimicrobial activity against different microorganisms such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Shigella flexneri*, *Citrobacter* sp., *M. troglodytarum* showed inhibitory effect in tested microorganism (Methycillin resistant *Staphylococcus aureus* and *Enterococcus faecalis*) with highest inhibitory activity against *E. coli* and *P. aeruginosa*. Agar well diffusion method was used to determine the minimum inhibitory concentration (MIC) of *M. troglodytarum*. The most sensitive bacterial pathogen against *M. troglodytarum* is *E. coli* with lowest MIC of 61.53 µg/ml and *P. aeruginosa* with MIC value of 31.25 µg/ml. The study also exhibits that ethyl acetate extract give most prominent result as compared to other extract. Karuppiah et al. concluded that *M. troglodytarum* possess potent antibacterial effect³⁸.

Solanum torvum (Terung pipit)

This plant is widely distributed in Malaysia, China, Philippines, Thailand and Tropical America. The antimicrobial activity assay of *Solanum torvum* fruit methanolic extract indicate that the this plant is potential antimicrobial agent against several microbial strain such as *A. pyogenes*, *B. subtilis*, *P. aeruginosa*, *S. aureus*, *S. pyogenes*, *A. niger* and *C. albicans*. The MIC value was determined using micro broth dilution assay. The extract showed potent MIC values against *M. tuberculosis*³⁹. Recent study clearly highlighted the medicinal benefit of *S. torvum* species in traditional medicine to treat various microbial infections.

CONCLUSION

It is interesting to note that ulam have been proven to help promoting health condition. The various studies make several noteworthy contributions to the antimicrobial activity of the medicinal plants. However, it is unfortunate that the current findings do not examined the antibacterial effect *in vivo*. It is suggested that the association of these factors is investigated on animals in future research for better understanding on the systemic effects. Further studies which take these variables into account will need to be undertaken for important implications of future practice.

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