

## REVIEW ON NUTRITIONAL CONTENT AND PHARMACOLOGICAL ACTIVITIES IN LEAVES OF BARRINGTONIA SPECIES (*Barringtonia acutangula* L. and *Barringtonia racemosa* L.)

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**Abstract:** *Barringtonia* species have enormous potential for complementary and medicinal uses, however, the uses of the species are underutilised and limited research. Each part of this species has their own functionality; however, this review only focused on the leaves as the leaves of the species can be consumed as *ulam*. It also contains high total phenolic content and exhibits antioxidant activity. It is aimed to provide a clearer explanation and information regarding these species. The review discussed two species which are *B. acutangula* and *B. racemosa* and made a comparison between the proximate analysis and the phytochemical content in the leaves of the plants. The approximate percent composition of moisture (70.52%), ash (0.96%), fibre (1.38%), protein (2.54%) and carbohydrate (25.71%) in *B. racemosa* while for *B. acutangula*, only carbohydrate (9.85%), protein (13.13%) and ash (7.7%) were analysed quantitatively. Phytochemicals present in these plants are collected from current studies and reported *B. racemosa* have higher content in total phenolic content (1585.20 mg/g) and total ascorbic acid (88.9 mg/g). Meanwhile, *B. acutangula* reported to have higher content in total flavonoid (109.52mg/g) and total tannin (105.52 mg/g). The review also comprised pharmacological activities in the *Barringtonia* species, particularly, antioxidant, antibacterial and antidiabetic activities, from current documented literatures to provide significant information on the nutritional benefits of *Barringtonia* species. This review proved the needs for future research and commercialisation on this species due to the abundance of sources and nutritional content especially in making it as future medicine for Malaysians.

**Keywords:** *Barringtonia racemosa*, *Barringtonia acutangula*, proximate analysis, phytochemicals, pharmacological activities

### 1. Introduction

In Malaysia, *ulam* is a popular traditional vegetable due to the unique aroma, flavors, a useful source of medical uses and has plenty of nutrition. *Barringtonia* is a genus of big tree that has flowers and comes from the Lecythidaceae family. There are three species of *Barringtonia* that are known for nutritional and ethno-biological uses, however, only *Barringtonia racemosa* and *Barringtonia acutangula* will be reviewed in this article. *B. racemosa* L. is known as *putat* in Malaysia and used as traditional medicine to cure snake bites and rat poisoning. Fruits, seeds and leaves of the *putat* plant can be consumed and have their own nutrition and benefits to the consumer's health. Triterpenoids, diterpenes, flavonoids, saponins and steroids have been found in *putat* plants (Nurul Mariam et al., 2008). According to current research, this species has been used



as natural antioxidants as it can scavenge free radicals and can inhibit tissue damage and degenerative diseases (Ali et al., 2007). *B. acutangula* can be consumed as *ulam* and traditionally used for many diseases such as diarrhea, inflammation, arthralgia, flatulence, and haemorrhoids as an anthelmintic. In India, *B. acutangula* is popular and usually used for medication especially in liver disorders, eye problems, splenic diseases and worm infestation. This plant has a lot of nutrients and benefits, and all the parts can be used including root, leaves, fruit, seed and bark. According to Sultana et al. (2019), compounds that have been isolated from the leaves of *B. acutangula* are acutangulic acid, saponins, acutagenol A, acutagenol B, barringtogenols B, C, and D, stigmasterol,  $\beta$ sitosterol, and  $\beta$ -amyirin. It was also reported to contain antioxidant, phenolic compounds and hepatoprotective activities in the leaves of the plant.

## 2. Discussion

### 2.1. Nutritional Content

Proximate analysis is needed to evaluate the nutritional content of the *B. racemosa* and *B. acutangula*. It includes moisture, ash, lipid, protein and carbohydrate contents. Proximate analysis of *B. racemosa* showed higher content in moisture, carbohydrate and ash and indicates best sources of energy and high mineral content while *B. acutangula* is higher in protein content. The approximate percent composition of moisture (70.52%), ash (0.96%), fibre (1.38%), protein (2.54%) and carbohydrate (25.71%) in *B. racemosa* while for *B. acutangula*, only carbohydrate (9.85%), protein (13.13%) and ash (7.7%) were analysed quantitatively (Nurul Syafizan & Rabeta, 2018; Vaidya & Shingadia, 2017; Kathirvel & Sujatha, 2012).

Phytochemicals are commonly known as secondary metabolites and have low molecular weight. It is produced by plants in a small amount by several chemical pathways. Recent studies reported that phytochemicals can give a lot of benefits to consumers, especially in human cells. The flavonoid content in *B. racemosa* leaves using methanol extraction is from 83.7 mg/g until 239.35 mg/g. Meanwhile, 13.21 mg/g to 109.52 mg/g of flavonoid contents were reported in *B. acutangula*. The phenolic compounds can be found in most of the plants and play as antioxidant agent as it has redox properties and a good electron donor (Johari & Khong, 2019). Based on the data collected, phenolic content in *B. racemosa* leaves is in range (146 mg/g-1585.20 mg/g) (Nurul Syafizan & Rabeta, 2018; Kong et al., 2012). Kathirvel and Sujatha (2012) used several types of solvent extraction to estimate the phenolic content, and methanol extraction produced the highest yield of the content which is 79.71 mg/g in *B. acutangula*. Several studies reported presence of ascorbic acid in leaves of *B. acutangula* in the range of 16.35 mg/g-79.69 mg/g while *B. racemosa* reported to have ascorbic acid in the range of 42.7 mg/g-88.9 mg/g. Tannins are the substances that have astringent properties that are commonly found in plants such as at leaves, woods and bark. Based on study, leaves of *B. acutangula* and *B. racemosa* contained tannin compounds. Kathirvel and Sujatha (2012) reported that tannin content in leaves *B. acutangula* from various solvents are 15.39 mg/g-105.52 mg/g. 105.52mg/g tannin in *B. acutangula* in methanol extraction is the highest value while *B. racemosa* contained 33.11 mg/g of tannin by Nurul Syafizan and Rabeta (2018). Tannin content in *B. racemosa* using aqueous solution is reported to have lower value compared to methanol which is 13.38 mg/g.



## 2.2. Pharmacological activities

Consumption of antioxidant foods is important because oxidants that are present in our body can give harmful effects to human bodies because the oxidant could attack lipid, DNA and protein that lead to critical diseases like cancer, diabetes etc. Leaves of *B. acutangula* are reported to have high antioxidant activity. Based on several studies, the antioxidant activity analysis by DPPH can be summarized in range of 3.83-38.16  $\mu\text{g/mL}$  (Mohan & Anand, 2019; Faruk et al., 2016; Woraratphoka et al., 2012). While the *B. racemosa* leaves reported to have antioxidant and this have been proved by several studies that DPPH inhibition of *B. racemosa* in range of 78.42% - 85.34% (Nurul Syafizan & Rabeta, 2018; Sumazian et al., 2010).

Antidiabetic is an agent that can treat diabetes patients by controlling glucose in blood. Diabetes mellitus is a carbohydrate metabolism complication that is evaluated by the ability of producing insulin to control blood in glucose. The data showed that *B. racemosa* extract can reduce the blood glucose from 398.6 mg/kg to 45.5 mg/kg. This reaction agrees with the statement that *B. racemosa* has the ability to inhibit carbohydrate absorption due to diterpenoids, triterpenoids, pentacyclic and bartogenic acid (Umaru et al., 2018). *B. racemosa* is reported to have antidiabetic properties due to the presence of phenolic compounds. For *B. acutangula*, the antidiabetic activities of the leaves in aqueous extract shown at 500 mg/kg is the most effective as it can reduce the value of blood glucose to 96.24 mg/kg which is below than control sample value.

Both *Barringtonia* species are a good antimicrobial agent. Gonelimali et al. (2018) stated that phytochemicals in medicinal plants such as flavonoids, alkaloids, tannins, and terpenoids, can act as antimicrobial and antioxidant properties. *B. acutangula* could inhibit several types of microorganism and could be summarised as a good antimicrobial agent. Chandra Mo and Anand (2019) mentioned that phytochemicals extracted from the plants can produce effective drugs and less lethal in controlling microbial activities. A study conducted on *B. racemosa* leaves extracts, to evaluate microbial activity against *Mycobacterium smegmatis*. The microorganism can cause tuberculosis disease and affect human's health. Minimum inhibitory concentration was evaluated by analysing the lowest concentration of extracts which means no growth in the sample in *B. racemosa* extract (Mmushi et al., 2019).

## 3. Conclusion

In conclusion, this review revealed that there is abundance of nutritional content (moisture, protein, carbohydrate, ash, fibre, flavonoid, phenolic, ascorbic acid and tannin) and pharmacological activities (antioxidant, antidiabetic and antimicrobial) of *Barringtonia* species. *B. racemosa* has higher nutritional content in carbohydrate, ash, phenolic, flavonoid and ascorbic acid content while *B. acutangula* only higher in protein and tannin. In terms of pharmacological activities, *B. acutangula* showed higher potential in antioxidant and microbial agents while *B. racemosa* has higher potential in antidiabetic activity.

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