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## Proximate analysis of *Terminalia bellerica* (Bahera) and *Artocarpus heterophyllus* (Jackfruit) leaves

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### Abstract

In this present study leaves of *Terminalia bellerica* and *Artocarpus heterophyllus* were collected in order to carry out proximate analysis. The present study revealed the percentage proximate composition of *Terminalia bellerica* leaves that contain dry matter ( $86.20 \pm 1.12$ ), crude protein ( $13.10 \pm 1.33$ ), crude fat ( $2.5 \pm 0.28$ ), crude fibre ( $1.71 \pm 0.23$ ), NFE ( $74.9 \pm 1.33$ ), AIA ( $2.2 \pm 0.17$ ). While dry matter, crude fat, crude fibre, NFE, AIA content of *Artocarpus heterophyllus* leaves were found to be  $84.20 \pm 0.69$ ,  $2.5 \pm 0.10$ ,  $2.76 \pm 0.04$ ,  $65 \pm 2.18$ ,  $4.4 \pm 0.32$ , respectively. It was found that both the plant leaves are good source of calcium and phosphorus. Therefore, *Terminalia bellerica* and *Artocarpus heterophyllus* leaves have good nutritional value and hold their potential for value addition and nutraceutical development.

**Keywords:** *Artocarpus heterophyllus*, crude fiber, nitrogen free extract, proximate analysis *Terminalia bellerica*

### Introduction

*Terminalia bellerica* Roxb, belonging to Combrataceae family, commonly known as Bahera in Hindi is a deciduous tree found throughout Indian forests and plains. This plant has several health benefit effects as analgesic, astringent, brain tonic, expectorant and laxative [1]. It is chiefly used for fever, leprosy, diarrhea, and piles. It also exhibits bronchodilatory, antispasmodic, anti-asthmatic, hypoglycemic, wound healing, spermicidal activities. They contain tannin,  $\beta$ -sitosterol, gallic acid, ellagic acid, ethyl gallate, and chebulic acid in various proportions [2].

The *Artocarpus heterophyllus* (Jackfruit) is a species of tree of the mulberry family Moraceae. It is native to Western Ghats of India, Malaysia and also found in central and eastern Africa, south-eastern Asia, Florida, Brazil, Australia and many Pacific Islands [3]. *Artocarpus heterophyllus* possesses known anti-bacterial, anti-fungal, anti-diabetic, anti-inflammatory, antioxidant and anti-helminthic activities [4]. The leaves are believed to be effective in the treatment of asthma, ringworm infestation, diabetes and gall stones. Leaves are thought to possess wound healing, anti-syphilitic, vermifuge activity and to induce lactation in women and domesticated animals [5].

## 2. Materials and methods

### 2.1 Apparatus

In the present experiment the apparatus used are Spatula, Filter Paper, Water bath, Oven, Beaker, Test tubes, Sieve, Funnel, Measuring cylinder, Hand grinder, Sample bottle, Detergent Aluminium foil etc.

### 2.2 Sample collection

The fresh leaves of *Terminalia bellerica* were collected from various parts of Assam, India.

### 2.3 Sterilization of glass wares

All glass wares used in the study were washed with detergent, rinse with distilled water and air dried. They were also sterilized on hot air oven and wrapped with aluminium foil before sterilization.

## 2.4 Sample preparation

The plant samples were dried under shade and grinded into fine powder followed by transferring to airtight containers with proper labelling for future use.

## 2.5 Proximate analysis

The proximate analyses (moisture, fibre, ash, fats, proteins and carbohydrates) of all the samples were determined in triplicates as per the standard technique of AOAC [6].

## 2.6 Moisture Content

Two gram of sample was taken in a flat-bottomed dish and kept overnight in an air oven at 100 – 110 °C and weighed. The loss in weight was regarded as a measure of moisture content.

## 2.7 Crude fibre (CF) Content

Two gram of moisture and fat-free material of each sample was treated with 200 ml of 1.25 % H<sub>2</sub>SO<sub>4</sub>. After filtration and washing, the residue was treated with 1.25 % NaOH. It was filtered, washed with hot water and then 1 % HNO<sub>3</sub> and again with hot water. The washed residue was dried in an oven at 130 °C to constant weight and cooled in a desiccator. The residue was scraped into a pre-weighed porcelain crucible, weighed, ashed at 550 °C for two hours, cooled in a desiccator and reweighed.

## 2.8 Crude fat Content

Two gram of dry of each sample was extracted with petroleum ether at 60-80 °C in a Soxhlet apparatus for about 6-8 h. After boiling with petroleum ether, the residual petroleum ether was filtered using Whatman no. 40 filter paper and the filtrate was evaporated in a pre-weighed beaker. Increase in weight of the beaker was measured as the weight of crude fat.

**2.9 Ash Content:** Five gram of each leaf sample was weighed in a silica crucible and heated in muffle furnace for about 5-6

h at 500 °C. It was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (ash become white or grayish white). The weight of ash was measured.

## 2.10 Crude protein (CP) Content

The crude protein was determined using micro Kjeldahl method. The total protein was calculated multiplying the evaluated nitrogen by 6.25 [6].

## 2.11 Acid insoluble ash (AIA)

It was estimated by adding 25 ml of 10 % HCl to the weighed ash content of a sample. This was covered with a water- glass and boiled gently over a low flame for 5 min. This was then filtered and washed with hot distilled water. The residue from filter was returned to the crucible and ignited until it was carbon free after which it was weighed.

## 2.12 Nitrogen free extracts (NFE)

It was calculated by subtracting the sum total of moisture, ash, EE, CP and CF from the original sample weight.

## 2.13 Mineral content

Calcium and phosphorus contents were determined from the ash samples.

## 2.14 Statistical analysis

All the experiments were performed in triplicates and the results were expressed as mean values ± standard error (SE). Data obtained from the experiment were analysed by using standard method.

## 3. Result and discussion

The proximate constituent of *Terminalia bellerica* and *Artocarpus heterophyllus* are presented in the Table 1 and 2, respectively.

**Table 1:** Proximate analysis of *Terminalia bellerica* leaves

Name of the plant	DM (%)	CP (%)	CF (%)	EE (%)	TA (%)	NFE (%)	AIA (%)	Ca (%)	P (%)
<i>Terminalia bellerica</i>	86.20 ±1.12	13.1±1.33	1.71±0.23	2.5±0.8	7.7±0.13	74.9±1.33	2.2±0.17	2.8±0.15	0.37±0.05

**Table 2:** Proximate analysis of *Artocarpus heterophyllus* leaves

Name of the plant	DM (%)	CP (%)	CF (%)	EE (%)	TA (%)	NFE (%)	AIA (%)	Ca (%)	P (%)
<i>Artocarpus heterophyllus</i>	84.2±0.69	15.3±0.68	2.76±0.04	2.5 ±0.10	14.4±1.12	65±2.18	1.10±.32	0.47±0.09	0.52±0.05

The present study revealed that *Terminalia bellerica* leaves contain higher amount of dry matter and NFE as compared to *Artocarpus heterophyllus* leaves. On the other hand, *Artocarpus heterophyllus* leaves are rich in protein (15.3 %), crude fibre (2.76 %) and total ash (14.4 %) while the protein, crude fibre and total ash content of *Terminalia bellerica* was observed as 13.1 %, 1.71 % and 7.7 %, respectively. It was observed that *Artocarpus heterophyllus* leaves had the moisture content of 16.80 % [7]. In a study, the protein, ash and CF value of *Artocarpus heterophyllus* was found to be 21.17 %, 16.40 % and 6.55 %, respectively [8]. On the other hand a study was carried out to investigate the proximate principles of *Terminalia chebula*. It revealed that *Terminalia chebula* contains 51.66 % moisture, 1.20 % protein, 6.90 % crude fibre, 3.90 % ash and 3.60 % crude fat [9]. Mineral content of leaves of both the species were also analysed. It was observed that percentage (%) of calcium was found to be higher in *Terminalia bellerica* leaves (2.8) as compared to

*Artocarpus heterophyllus* leaves. But the phosphorus percentage (%) was found to be higher in *Artocarpus heterophyllus* (0.52) when compared with *Terminalia bellerica* (0.37).

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