

## PHYTOCHEMICAL STUDIES ON *BOSWELLIA SERRATA* ROXB. EX. COLEB. FRUITS

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*Boswellia serrata* Roxb. ex. Coleb. is occasionally found along the hill slopes. Young fruits are pickled, especially by Barri community of Amravati region and is said to be useful in treatment of arthritis. Leaf extract is used in toothpaste and soaps. Resin from bark is used in Ayurvedic medicines. Nutritional studies include estimation of crude protein, lipids, ascorbic acid, phenols, anthocyanin, lycopene, carotenoids, chlorophyll, carbohydrate, starch, reducing sugar and non-reducing sugar, total nitrogen, protein (from nitrogen), crude fat and crude fibre in fresh tissue as well as dry tissue. Ash analysis was also done for minerals. Bioactive components, possessing medicinal properties, were also tested.

**Keywords:** *Boswellia serrata*; Fruits; Phytochemical studies.

*Boswellia serrata* Roxb. ex. Coleb. was occasionally found along the hill slopes. Young fruits were pickled, especially by Barri community of Amravati region. The pickle was said to be useful in treatment of arthritis. The gum resin was widely used in Ayurvedic medicine for the treatment of inflammatory diseases, including those affecting the gastrointestinal tract e.g. diarrhea, dysentery and inflammatory bowel disease. The anti-inflammatory activity of gum resin has been confirmed by experimental and clinical studies<sup>1</sup>. The clinical studies have shown that *B. serrata* gum resin was effective in patients with (grades I and II) ulcerative colitis<sup>2</sup>. Anti-tumor activity of gum was proved by Tsukada<sup>3</sup> in mice. It also inhibits inflammation on topical application<sup>4</sup>. Its anti-arthritis activity was conformed by Lewis and Austen<sup>5</sup>. However, the ethnic nutritional and medicinal claim of fruits of *B. serrata* needs to be properly evaluated.

For analysis, fresh material as well as dry material was used. Nutritional analysis was done following Thimmaiah<sup>6</sup> and Sadasivam and Manickam<sup>7</sup>. Ash analysis was carried out quantitatively as well as qualitatively<sup>8-9</sup>. Bioactive compounds were detected as prescribed by Peach and Tracey<sup>10</sup>, Harborne<sup>11</sup>, Gibbs<sup>12</sup>, Chabra<sup>13</sup>, Evans<sup>14</sup>, Kokate<sup>15</sup> and Kulkarni and Apte<sup>16</sup>.

The values of nutrients obtained were converted into per 100 gm fresh weight of tissue (Table 1). These fruits were not used in dry form. Minerals form an important part of nutrition. Mineral content was estimated in terms of ash yield. Ash analysis was done for

nutritionally important elements as well as following pharmacognostic parameters (Table 2, 3, and 4). Tissue was also screened for the presence of fifteen different bioactive compounds (Table 6).

Gopalan<sup>17</sup> has reported nutritive values of some common Indian foods. To understand the nutritional status of *B. serrata* studied here, the values obtained were compared with the values available for three common fruits used in Indian diet (Table 5). Estimation of crude protein has been done. However, all the values available for protein were calculated from total nitrogen content, therefore, here also protein value was calculated from nitrogen for comparison, which was much more than crude protein value. Protein content was higher than fruits of *Ficus*, Dates and Pipal figs. The maximum crude fat found (1.5gm/100gm) in fresh tissue was near about equal to Pipal figs. The mineral content was found 1.4gm/100gm in fresh tissue, which was near about in Dates (fresh) and Pipal figs. The calcium was found to be minimum *i.e.* 28mg/100gm fresh tissue, which was equivalent to that in Dates. *B. serrata* fruits were richer in phosphorus and iron content. Carotene was found to be 25 mg/100 gm, near about same to that of Dates. The ascorbic acid (vit. C) was found to be 2.52 mg/100 gm *i.e.* near about same to that of Dates.

The fruits were screened for 15 bioactive compounds. However, only four were found to be present. Flavanones and simple phenols present in the fruits must be imparting anti-oxidant property. Presence of

**Table 1.** Nutrients per 100 gm fresh tissue.

1. Moisture content	82.5 %
2. Crude protein	1.825 gm
3. Total lipids	2.346 gm
4. Ascorbic Acid (vit. C)	14.4 mg
5. Total Phenols	3.175 gm
6. Anthocyanin	1.313 gm
7. Lycopene	4.99 mg
8. Carotenoids	25 mg
9. Chlorophyll	
i) Chlorophyll – a	6.48 mg
ii) Chlorophyll – b	7.41 mg
iii) Total chlorophyll	13.88 mg
10 Total carbohydrate	11.81 gm
11 Starch	0.75 gm
12 Reducing sugar	15.05 gm
13 Non-reducing sugar	0.89 gm
14 Total Nitrogen	1.05 gm
15 Protein (From Nitrogen)	6.56 gm
16 Crude fat	1.55 gm
17 Crude fibre	0.34 gm

**Table 2.** Ash values per 100 gm dry tissue.

a. Ash yield	8 gm
b. Water soluble ash	57 %
c. Water insoluble ash	43 %
d. Acid soluble ash	82 %
e. Acid insoluble ash	18 %
f. Sulphated ash	35 %

**Table 5.** Contents per 100 gm fresh tissue.

Phytonutrient	<i>Ficus</i> * (Fruits)	Dates* (fresh)	Pipal* (Figs)	<i>Boswellia</i> (fruit)
Moisture Content (gm)	88.1	59.2	62.4	82.5
Protein (gm)	1.3	1.2	2.5	6.5
Fat (gm)	0.2	0.4	1.7	1.5
Mineral (gm)	0.6	1.7	2.3	1.4
Crude Fibre (gm)	2.2	3.7	9.9	0.3
Carbohydrate (gm)	7.6	33.8	21.2	11.81
Calcium (mg)	80	22	289	28
Phosphorus (mg)	30	38	89	109
Iron (mg)	1.0	0.96	—	157.5
Carotene	162 µg	26 µg	—	25 µg
Ascorbic Acid	5 mg	3 mg	—	2.52 mg

\**Ficus carica*, Dates - *Phoenix sylvestris*, Pipal figs - *Ficus religiosa*

**Table 3.** Qualitative ash analysis.

1 Sulphur	++
2 Calcium	+++
3 Magnesium	++
4 Iron	
Test a –	+
Test b –	+
5 Sodium	+
6 Chlorine	+
7 Phosphorus	+
8 Aluminium	+
9 Manganese	–
10 Copper	–
11 Nickel	–

**Table 4.** Quantitative ash analysis per 100 gm dry tissue.

1 Phosphorus	6.25 gm
2 Iron	0.9 gm
3 Potassium	0.075 gm
4 Calcium	0.16 gm
5 Sodium	0.48 gm

Table 6. Bioactive compounds.

Sr. No.	Test	Response	Intensity	Inference
1.	Irridoids			
	a) Acubin Test	No Colour	-	Absent
	b) Harpagide	No Colour	-	Absent
2.	Alkaloids			
	a) Mayer's reagent	Brownish Purple ppt	-	Absent
	b) Dragendorff's reagent	Yellow Colour	-	Absent
	c) Wagner's reagent	Wine Red Colour	-	Absent
3.	Anthraquinones			
	Test - a	White ppt	-	Absent
	Test - b	White ppt	-	Absent
	Test - c	No Colour	-	Absent
4.	Cardenoloide			
	Test - a	Light Green	-	Absent
	Test - b	Brownish Red Ring	-	Absent
5.	Flavanoids			
	a) Shinoda Test	No Colour		Absent
	b) Flavanonol Test	No Colour		Absent
	c) Flavanol Test	No Colour		Absent
	d) Flavone, Flavonol, & Flavanone Test	Dark Orange	++	Flavanone
	e) Rao & Sheshadri Test	Greenish Yellow	-	Absent
6.	Leucoanthocyanin	Pink Colour	-	Absent
7.	Simple Phenolics			
	Test - a) With FeCl <sub>3</sub>	Green	++	$\beta$ -naphthol
	Test - b) Addition of NaOH	Red Colour	++	Catechol
	Test - c) Excess FeCl <sub>3</sub>	Light Red	-	Hydraquinone Absent
8.	Steroids / Triterpenoid			
	Test - a)	Light Orange Colour	-	Absent
	Test - b) Salkawaski Test	Cherry Red Colour	++	Unsaturated steroids
9.	Tannins			
	Test - a) Tannin	No Colour	-	Absent
	Test - b) Pseudo-Tannin	No Colour	-	Absent
10.	Saponins			
	Test - a)	No Froth	-	Absent
	Test - b) Fatty and Organic acids	No Froth	-	Absent
11.	Juglone Test	White ppt	-	Absent
12.	Emodins	Watery Gelly	-	Absent
13.	Polyoses	Pink Colour	-	Absent
14.	Polyuronoids	Blood Red	-	Absent
15.	Anthracene Glycosides	No Colour	-	Absent

unsaturated steroids must be playing a definite role in the treatment of arthritis, as is believed by Barri community. Richness in phosphorus and iron can make it a good support in combating anemia. It was also a good source of protein and carotene, richer than Dates.

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