



## **Nutritional Assessment of *Cassia tora* Leaves from Different Regions in Rajasthan**

**Mala Rathore<sup>1\*</sup> and Hemant Kumar<sup>2</sup>**

<sup>1</sup>*Non-Wood Forest Products Discipline, Silviculture and Forest Management Division, Forest Research Institute, P.O. New Forest, Dehradun, India.*

<sup>2</sup>*Non-Wood Forest Products Discipline, Silviculture and Forest Management Division, Arid Forest Research Institute, Pali Road, Jodhpur, India.*

### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author MR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author HK managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JABB/2019/v22i430129

#### Editor(s):

(1) Dr. James W. Lee, Department of Chemistry and Biochemistry, Old Dominion University, USA.

#### Reviewers:

(1) Adeyeye, Samuel Ayofemi Olalekan, Ton Duc Thang University, Vietnam.

(2) Rajaa Seghiri, Ibn Tofail University, Morocco.

(3) Rita Andini, Nanggroe Aceh Darussalam, Indonesia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/53839>

**Received 17 November 2019**

**Accepted 22 January 2020**

**Published 27 January 2020**

**Original Research Article**

### **ABSTRACT**

*Cassia tora* is a wild undershrub with edible leaves used by local people in the preparation of leaf based dish, commonly known as "sag". Nutritional analysis of leaves samples collected from different locations of Rajasthan was carried out so as to explore its potential for use as food supplement. Proximate analysis showed maximum fat (4.42%) and protein (15.34%) in samples from Banswara. Samples from Pali were rich in sugar (11.2%). Maximum ash (17.71%) and vitamin C (84.24 mg/100 g) was found in Dungarpur samples. The leaves were found to be a rich source of micronutrients. Results showed that these could be used as dietary supplement for rural and urban population.

**Keywords:** *Cassia tora*; edible leaves; leaf based dish; micronutrients.

### **1. INTRODUCTION**

*Cassia tora*, an annual herb, commonly known as *chakwad* or Wild Senna., belongs to the family

Leguminosae. It is found all over India especially in the states of Rajasthan, Uttar Pradesh, Madhya Pradesh, Orissa, Jharkhand, Bihar. In Rajasthan it grows in semi arid areas up to a

\*Corresponding author: E-mail: mala@icfre.org;

height of about 30 to 90 cm and has immense nutritional and medicinal value. It occurs along roadsides and in wastelands as a rainy season weed. Population authentication has been carried out of its samples from six states namely Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and Odisha [1]. The plant *Cassia tora* can be regarded as a poor man's food. It contains proteins, a small amount of fat, many minerals and natural fibers. Nutritional and biological evaluation of *Cassia tora* seeds has been carried out by Mahajan [2]. Raw seeds of *Cassia tora* contained 15% protein, 1% fat and 4% fiber, 71% carbohydrates. Some value added food products namely coffee, chutney, breads of different types were prepared by supplementing *Cassia tora* seeds. These products were found acceptable as per the organoleptic evaluation [3,2]. Leaves of Chakvad are traditionally used in preparation of "Sag" a leafy vegetable [4]. The amino acid profiles of the samples revealed high protein quality of the vegetable [5].

Different parts of the plant (leaves, seed, and root) are known for their medicinal importance [6,7]. As such it is not only useful in solving food problems of the poor, it is also useful as a digestion and metabolism corrective substance and as a liver and cardio tonic. The dried seeds powder is given to cure asthma [8]. *Cassia tora* seeds when fed to rats resulted in a decrease in blood cholesterol. Seeds and leaves were found to contain a number of chemical constituents [9,10]. Antinutritional factors like phytic acid, trypsin inhibitors and tannins were also present in seeds [2]. No work on nutritional analysis of leaves samples from Rajasthan has been reported till date. Hence leaves were analysed from different areas of Rajasthan so as to study the variation in nutrients and identify the region with maximum nutrient content.

## 2. MATERIALS AND METHODS

Reconnaissance survey was carried out in various parts of Rajasthan and on interaction with local people, forest Department officials, University professors and places for collection of selected plants were identified. Leaves were collected from four places: Pali, Udaipur, Dungarpur and Banswara. Leaves were washed with water to remove dirt and foreign materials and dried in shade. Finally these were ground, and stored in neatly labelled air tight containers for further use.

**Nutritional analysis:** All the chemicals used in the study were of analytical grade and procured

from Merck. The standards were procured from SIGMA.

**Proximate analysis:** Moisture, ash, total dietary fibre (TDF), crude protein, sugar (TSS) and fat were analyzed as per AOAC [11] methods. Moisture was determined by drying a representative 2 g sample in an oven with air circulation at 60-80°C for 3 h. Ash content was determined by the incineration of sample in a muffle furnace at 600°C for 6 h until the ash turned white. Total Dietary fibre determined by assay kit (SIGMA). It is a combination of enzymatic and gravimetric methods. Samples were gelatinized with heat stable  $\alpha$ -amylase and then enzymatically digested with protease and amyloglucosidase to remove the protein and starch present in the sample. Ethanol is added to precipitate the soluble dietary fibre. Crude protein was determined by the Kjeldahl method. Nitrogen content was multiplied by 6.25 to give total protein content. Fat was determined by extraction in a Soxhlet apparatus. Total Sugar content was estimated by phenol-sulphuric acid method.

**Mineral analysis:** Mineral (Cu, Zn, Fe, Mn, Mg) content was determined by wet digestion method using Atomic Absorption Spectrophotometer (AAS, Perkin Elmer). Digestion of plant material was carried out in a digestion tubes using a mixture of HNO<sub>3</sub> and 70% HClO<sub>4</sub>. Concentration of elements K, Ca & Na was determined by flame photometer (Systronics). Standards were prepared by suitable dilution of the stock standard solutions for each element. Selenium was estimated by ICPMS (Thermofischer).

## 3. RESULTS AND DISCUSSION

Proximate analysis of *Cassia tora* showed that it contained significant quantities of essential nutrients. Nutrient content was better compared to some common vegetables reported by previous workers [12,13,14]. Determination of moisture content and leaf size showed that it was almost same from all the places. However, average weight was higher of leaf samples from Dungarpur (Table 1). Ash content was found to vary from 14.63% to 20.48% in samples from Pali, 12.4% to 20.19% in samples from Udaipur, 14.11% to 21.62% from Dungarpur and 14.3% to 19.73% in Banswara samples (4.42%). Maximum ash was obtained in Dungarpur samples (17.71%) (Table 2). Fat content was found to vary from 3.27% to 4.05% in samples from Pali, 2.74% to 4.34% in samples from Udaipur, 3.3%

to 3.72% from Dungarpur and 3.93% to 5.12% in Banswara samples. Maximum fat content was obtained in samples from Banswara (4.42%) (Table 3). Sugar content varied from 9.78% to 13.58% in samples from Pali, 8.59% to 13.24% in samples from Udaipur, 9.35 to 12.66 from Dungarpur and 8.01 to 11.65 in Banswara samples. Maximum sugar content was obtained in samples from Pali (11.2%) (Table 4). Protein content varied from 9.62% to 17.36% in samples from Pali, 11.1 to 17.44% in samples from Udaipur, 13.07% to 16.9 in samples from Dungarpur and 13.9% to 15.15% in samples from Banswara. Samples from Banswara had higher mean protein content (15.34%) (Table 5). Vitamin C content was found to vary from 48% to 86.02% in samples from Pali, 58 to 86.02 mg/100

g in samples from Udaipur, 72.2 to 107.52 mg/100 g from Dungarpur and 68 to 107.52 mg/100 g in Banswara samples. Vitamin C content was maximum in samples from Dungarpur (84.24 mg/100 g) (Table 6).

Nutrient content determined from leaf samples from Nigeria [5] showed protein content 11.63%, lipids 2.02%, ash 9.86%. Misra & Misra [15] have found *Cassia tora* leaves from south Odisha to contain moisture 85%, crude protein 49 mg/g, total sugar 54.67 mg/g, fat 0.013 mg/g, vitamin C, 0.791 mg/g. Kumar, et al. [16] have also analysed leaf samples from Kerala and found that *C. tora* exhibited higher protein (5.28 g/100 g), fiber (1.76 g/100 g) and fat (0.92 g/100 g) vitamin C content (151.79 mg/100 g) than

**Table 1. Moisture content (%) and morphological parameters of leaves**

Region	Pali	Udaipur	Dungarpur	Banswara
Moisture Content	70.55	70.6	71.99	70.58
Av. Wt of 10 leaves	1.34	1.78	1.85	1.43
Av. length	4.54	4.96	4.43	4.2
Av. width	2.62	2.14	2.35	2.4

**Table 2. Ash content (%) of leaves**

Year\Region	Pali	Udaipur	Dungarpur	Banswara
2011	14.63	13.55	14.11	14.3
2012	14.8	12.4	17.4	10.8
2013	20.48	20.19	21.62	19.73
Mean±SE	16.63±1.92	15.38±2.42	17.71±2.17	14.94±2.59

**Table 3. Fat content (%) of leaves**

Year\Region	Pali	Udaipur	Dungarpur	Banswara
2011	4.24	3.01	3.3	5.12
2012	3.27	2.74	3.56	3.93
2013	4.05	4.34	3.72	4.21
Mean ±SE	3.85±0.29	3.36±0.49	3.52±0.12	4.42±0.35

**Table 4. Sugar content (%) of leaves**

Year\Region	Pali	Udaipur	Dungarpur	Banswara
2011	9.78	8.59	9.35	8.01
2012	10.25	8.94	9.35	8.87
2013	13.58	13.24	12.66	11.65
Mean±SE	11.2±1.19	10.25±1.49	10.45±1.1	9.51±1.09

**Table 5. Protein content (%) of leaves**

Year\Region	Pali	Udaipur	Dungarpur	Banswara
2011	10.12	11.1	16.9	15.15
2012	17.36	17.44	13.07	16.98
2013	9.62	11.37	14.1	13.9
Mean±SE	12.36±2.5	13.3±2.07	14.69±1.14	15.34±0.89

**Table 6. Vitamin C content (mg/100 g) of leaves**

Year\Region	Pali	Udaipur	Dungarpur	Banswara
2011	62.2	66.84	72.2	71.7
2012	86.02	86.02	107.52	107.52
2013	48.0	58.0	73.0	68.0
Mean±SE	65.4±11.09	70.28±8.27	84.24±11.64	82.4±12.6

**Table 7. Content of micro and macro elements present in leaves**

	Cu mg/ 100 g	Zn mg/ 100 g	Fe mg/ 100 g	Mn mg/ 100 g	Mg mg/ 100 g	P mg/ 100 g	K g/ 100 g	Ca g/ 100 g	Na g/ 100 g
<b>Cassia tora</b>									
Pali	2.5	5.7	16.45	3.4	150.8	0.435	1.21	2.19	0.02
Udaipur	0.55	3.2	8.15	3.1	134.8	0.840	0.85	2.24	0.07
Dungarpur	0.35	1.9	5.25	1.85	185.8	0.510	0.89	3.75	0.06
Banswara	0.30	1.9	4.5	1.85	108	0.425	0.83	1.91	0.03

amaranth and low nitrate and oxalate content. Our results for samples from Rajasthan showed that leaves contained much higher fat, protein and ash contents as compared to samples from Nigeria, Odisha and Kerala. Vitamin C content was, however, less than the samples from Kerala. These variations may be due to comparatively dry climate conditions in Rajasthan.

Minerals serve as co-factors for many metabolic functions and so are important in the diet. The *Cassia tora* leaves contained adequate levels of important minerals. These were found to be rich source of iron and calcium (Table 7). Kumar, et al. [16] analysed leaf samples from Kerala showed Cu (0.43 mg/100 g), Mn (2.67 mg/100 g), Zn (1.4 mg/100 g) and Fe (6.6 mg/100 g). Rajasthan samples from Pali and Udaipur region contained higher amounts of these minerals.

#### 4. CONCLUSION

*Cassia tora* is an important traditional source of leafy vegetable which has many medicinal uses. Our results showed that *Cassia tora* from Rajasthan is rich in almost all the nutrients as compared to samples from other parts of India and Nigeria. It can thus contribute towards food and nutritional security during food scarcity occurring mainly in Rajasthan. It is easily accessible to the local communities for use. But the current level of its consumption is very low. Its importance in diet can be increased by nutritional education and marketing for achieving acceptability of the community towards its consumption.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Kumar V, Roy BK. Population authentication of the traditional medicinal plant *Cassia tora* L. based on ISSR markers and FTIR analysis. Sci Rep. 2018;8:10714.
2. Mahajan N. Study on nutritional and biological evaluation of *Cassia tora* seeds and development of value added food products, PhD thesis. Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Himanchal Pradesh; 2013.
3. Jain SK. Dictionary of Indian Folk Medicines and Ethnobotany. 2nd ed. Deep Publications, New Delhi; 1991;14.
4. Kar A, Borthakur SK. Wild vegetables of Karbi-Anglong district-Assam. Natural Product Radiance. 2008;7(5):448-460.
5. Kubmarawa D, Magomya AM, Yebpella GG, Adedayo SA. Nutrient content and amino acid composition of the leaves of *Cassia tora* and *Celtis integrifolia*. International Research Journal of Biochemistry and Bioinformatics. 2011; 1(9):222-225.
6. Pawar HA, D'mello PM. *Cassia tora* linn.: An overview. IJPSR. 2011;2(9):2286-2291.
7. Shadab M, Shamsi S, Ahmad I. *Cassia tora* Linn.: A medicinal herb for skin diseases. J. Emerging Tech. and Innovative Res. 2019;6(3):97-101.

8. Punjani BL, Kumar V. Traditional medicinal plant remedies to treat cough and asthmatic disorders in the Aravalli ranges in North Gujarat, India. *Journal of Natural Remedies*. 2002;2(2):173–178.
9. Rai MK, Pandey AK, Acharya D. Ethno-medicinal plants used by gond tribe of bhanadehi, District Chhindwara, Madhya Pradesh. *Journal of Non-timber Forest*. 2000;7(3/4):237-241.
10. Suradkar VB, Wankhade BB, Dabbe PG. Phytochemical analysis of some contents of *Cassia tora* and *Xanthium strumarium* plant seeds. *International Journal of Advanced Research in Science, Engineering and Technology*. 2017;4(4): 3727-3731.
11. A.O.A.C. Official method of analysis of the A.O.A.C (W.Hortwitz) 13<sup>th</sup> Edition Washington D.C. P. 1990;858.
12. Nwaogu LA, Ugowindu CO, Mgbenena AI. Studies on the nutritional and phytochemical composition of *Amaranthus hybridus* leaves. *Bio Res*. 2006;4:28-31.
13. Aletor MVA, Adeogun OA. Nutrient and Antinutrient components of some tropical leafy vegetables. *Food Chem*. 1995;53: 375-376.
14. Ifon ET, Bassir O. The nutritive value of some nigerian green vegetables part 1; Vitamin and mineral content. *Food Chem*. 1979;5:253- 267.
15. Misra S, Misra MK. Nutritional evaluation of some leafy vegetable used by the tribal and rural population of south Odisha, India, *J. Nat.Product and Plant Res*. 2014;4(1): 23-28.
16. Kumar TP, Indira V, Sankar M. Nutritional evaluation of wild leafy vegetables consumed by tribals in the wayanad district of Kerala. In *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*. 2013;85 (1):93–99.

© 2019 Rathore and Kumar; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
The peer review history for this paper can be accessed here:  
<http://www.sdiarticle4.com/review-history/53839>