NUTRITIONAL COMPOSITION OF SOME WILD EDIBLE FLOWERS USED BY THE RURALS/TRIBAL'S OF MAHOBA DISTRICT, UTTAR PRADESH

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***Abstract:** Edible flowers are commonly used in human nutrition and their consumption has increased in recent years. They are known to be excellent source of nutrients such as carbohydrates, proteins, fats, vitamins and minerals, dietary fibers and food energy. The aim of this study was to ascertain the nutritional composition and the content of selected three wild edible flowers which can be used as an efficient alternative bio- source of nutrition. The result revealed that flowers of Madhuca indica reported the highest value of carbohydrate (33.90 mg/100g), riboflavin (44.12 mg/100g) and fiber (97 %) where as flowers of Cassia fistula showed the highest values of fat (1.93 %), thiamine (17.54 mg/l), niacin (32.01 %), vitamin C. (4.72 %), carotenoid (20.29 mg/5g), moisture (7.2 %) and energy content (145.27 Kcal/100g). On the other hand flowers of Moringa oleifera were reported to contain highest values of protein (1.27 g/100g) and calcium (2987.91 ml/l) among all the selected flowers. These WEPs species were identified as promising species of emergency food at the time of crop loss, food shortage and chronic malnutrition.*

***Key words:** Wild edible flowers, nutrition, carbohydrates, Mahoba.*

I. INTRODUCTION

Wild food is often termed as emergency food, as apparently it implies the absence of human interference and management, but in fact such food plants, result from the co-evolutionary relationship between man and environment. According to Food and Agriculture Organization WEPs are defined as “plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystem and can exist independently of direct human action” (Heywood, 1992).

Edible flowers have been eaten as part of human nutrition since ancient times, as they are considered plant foods with medicinal properties and hence beneficial effects for human health. Their consumption has been reported for centuries and includes flowers of different species like *Cassia fistula, Madhuca indica* and *Moringa oleifera* – that are consumed as ingredient in different meals, foodstuffs, salads, drinks and even serves as food fodder for cattle.

II. MATERIALS AND METHODS

1. Study site and sample collection

Mahoba district of Uttar Pradesh is located at 25.280 N latitude and 79.870' E longitude. It has an average elevation of 214 meter (702') above sea level. The majority of the population living here is tribal which depends on WEPs largely from food to shelter and also for their income. The study is carriedout during 2013-2015 through frequent field trips in various localities including daily and weekly markets of Mahoba district (U.P.) India. Plants were collected, photographed, identified and voucher specimens prepared for the herbarium. Ethnobotanical information about wild edible flowers was gathered through personal observations and discussions with the local people of the area. Identification was done with the authentic books and flora (Maheshwari, 1963). The ethnobotanical information about the collected wild edible plants is given in Table- 1.

Table- 1 : Selected wild edible flowering plants and their ethnobotanical information

S.N.	Botanical name	Local name	Family	Mode of use
1.	*Cassia fistula*, Linn.	Amaltas	Leguminosae	Cooked as vegetable
2.	*Madhuca indica*, J.F.Gmel.	Mahua	Sapotaceae	Eaten fresh/ dried, drink
3.	*Moringa oleifera*, Lam.	Sahajan	Moringaceae	Cooked as vegetable

2. Chemical analysis

(i) Plants samples for nutritional analysis:

A total of 3 wild edible flowers, were analyzed for the 12 nutritional parameters viz. carbohydrates, fat, protein, thiamine, riboflavin, niacin, ascorbic acid, carotenoid, calcium, fiber, moisture and food energy and were found with highest use value index (UVI). The selected species were applied with various standard methods as mentioned below. Samples are shade dried and grinded into powder which are used as voucher samples. Herbarium was identified and deposited for authenticity by the experts of Botany department, MGCGV, Satna (M.P.).

(ii) Proximate nutrient analysis:

All analysis were performed at dry matter basis (DM) and all the reagent used in this study were of analytical grade. All the tests were performed by following standard methods as referred in Indian Pharmacopoia (IPC, 2014) and Quality control herbal drug (Mukherjee, 2006).

Preparation of extract

Boil 2 g of powdered sample and make the supernatant unto 100 ml with distilled water. Filter the mixture through Whatman paper no. 41. Perform the tests taking filterate in specific amount

Estimation of carbohydrates

It is performed by Monta Gomery's (1957) spectrophotometric method and carried out in 2 steps.

(i) Sugar estimation-

Prepare 10 % homogenate of the sample in 80 percent ethanol. Centrifuge at 2000 rpm for 15 minutes. The supernatant obtained is made up to known volume. Take 0.1 ml aliquot, add 0.1 ml of 80 % phenol and 5 ml concentrated sulphuric acid, cool and then read the absorbance at 490 nm.

(ii) Starch estimation-

Prepare 10 % homogenate of sample in 80% ethanol. Centrifuge at 2000 rpm for 15 min. Add 4ml distilled water to the residue, heat on water bath for 15 minutes. To each of sample add 3 ml of 52% perchloric acid and centrifuge at 2000 rpm for 15 minutes. Make supernatant up to a known volume. Take 0.1 ml aliquot add 0.1 ml of 80% phenol 5 ml concentrated sulphuric acid and then read absorbance at 490 nm.

Estimation of fat

Take 40 g homogeneous mass (m0), add 10 g anhydrous sodium sulphate, mix and transfer to cellulose thimble. Plug thimble with fat free cellulose wool and fill it to three-fourth full. Add 3-5 glass beads into extraction flask and weight it. Note the result (m1). Heat flask and pour 350 ml of *n-hexane*. With the help of Soxhlet extractor collect the extract in *n-hexane*. Now cool the flask and weight it (m2). Calculate total fat content H in per 100g of sample by the formula-

$$H = \frac{m2 - m1}{m0}$$

Where, m0= initial mass of sample,
m1=mass of clean extraction flask containing glass beads.
m2= mass of flask containing extracted liquid and glass beads.

Estimation of protein-

It is performed by following the methods of Lowery *et al.* (1951) using BSA as the standard. Homogenize 100 mg sample with 3ml of 10 % trichloro acetic acid. Centrifuge it at 10,000 rpm. Discard supernatant. Treat pallets obtained with 3 ml 1N sodium hydroxide. Centrifuge again at 5000 rpm for 5-10 minutes. Take 0.5 ml obtained supernatant, add 5 ml of reagent containing 2 % sodium carbonate solution and 2 % sodium potassium tartarate solution. After 15 minutes add 5 ml Folin and Ciocalteu's phenol reagent. Cool down and measure absorbance at 700 nm.

Estimation of thiamine-

Dilute 20 ml of sample containing 0.1 g of thiamine hydrochloride to 100 ml with 0.1 M hydrochloric acid (HCl) and further dilute 5.0 ml to 100 ml with water. *Test Solution-* A 0.005 w/v solution of thiamine mononitrate in 0.005 M HCl. A stainless steel column 10 Cm× 4.6 mm, packed with octadecylsilane bonded to porous silica (5 μm). Prepare mobile phase solution by dissolving 1g of sodium heptane sulphonate in a mixture of 180 ml of methanol and 10 ml of triethyl- amine, diluting in 1000 ml water and pH 3.2 with orthophosphoric acid. Keep flow at 2 ml per minute and measure the absorbance at 244 nm by spectrophotometer.

Estimation of riboflavin-

Weigh 65.0 mg sample, take in a amber glass of 500 ml, suspended in 5 ml water. Dissolve 5 ml of 2 M sodium hydroxide (NaOH). Add 100 ml of water. 2.5 ml glacial acetic acid and dilute to 500 ml with water. Take 20 ml solution, add 3.5 ml of 1.4 % w/v solution of sodium acetate and dilute to 200 ml with water. Keep it in dark and measure the absorbance at 444 nm.

Estimation of niacin-

Pipette 20 ml of 0.1 N NaOH into the flask, add 2 drop of phenolphthalein solution and titrate with 0.1 N HCl until solution is just colorless. Note burette reading. Weight 0.25 g sample, dissolve in 50 ml CO2 free water and titrate with 0.1 N sodium hydroxide (NaOH) using phenol red solution as indicator. The difference between titrations represents amount of NaOH required.

Estimation of ascorbic acid-

It is measured using 2, 6- dichoro indophenol as an indicator dye in a titration method.Take 50 mg sample and transfer to 259 ml water to 250 ml volumetric flask. Add 20 ml meta- phosphoric acetic acid solution. Dilute with water to 250 ml. Pipette 10.0 ml of sample into a Erlemeyer flask. Add 5 ml meta-phosphoric acetic acid solution until a pink color persists for 5- 10 seconds. Repeat it with a mixture of 5.5 ml metaphosphoric acid solution and 15 ml of water. Calculate the difference in each ml of injection from standard 2,6- dichoro indophenol solution.

Estimation of carotenoid-

Take 0.1 gm/ml sample in flask, add 1 ml of lipophilic layer of hexane. Add 0.5 ml of NaCl and centrifuge for 15 minutes at 4500 Rpm. Now take 0.1 ml of supernatant, add 0.9 ml hexane and check absorbance at 460 nm.

Estimation of calcium-

It is determined by titrating sample solution with Ethylene Diamine Tetra Acetic Acid (EDTA) of known volume and concentration. Pipette 20 ml sample into 250 ml flask. Add 2 ml of 1 N sodium hydroxide solution into sample and maintain pH between 12 -13. Add drops of ammonium

purpurate indicator (0.5 g) and sodium chloride (100 g) until it turns to pink color. Now fill the burette 0.02 M EDTA solution. Titerate sample against EDTA till pink color changes to purple.

Estimation of fiber-

Extract 2 g of sample with ether. Add 200 ml of 1.25 % sulfuric acid to extract drug and boil the mixture for 30 minutes under reflux in a 500ml flask. Filter mixture, wash residue with boiling water. Again boil the mixture for 30 min. under reflux with 1.25 % sodium hydroxide. Filter liquid, wash residue, dry at 110º to constant weight. Calculate the difference between weight of dry residue and incinerated residue. It represents the weight of crude fiber.

Estimation of moisture-

Weight 2 g of sample in tared, evaporating dish. Oven dry it at 103±2ºC for 4-5 hrs. Cool it and weight. Continue drying and weighing at one hour interval until difference between two successive weighing remains not more than 0.25 %. Calculate the loss on drying % by mass.

$$\% \text{ Moisture content} = \frac{W1 - W2}{W1} \times 100$$

Where, W1= sample weight before heating,
W2= sample weight after heating

Estimation of energy-

Total energy in Kcal/100g was calculated by following the methods as described by FAO (2003).

$$\text{Energy} = 4 \times \% \text{ protein} + 9 \times \% \text{ fat} + 4 \times \% \text{ carbohydrates}$$

III. RESULTS AND DISCUSSION

The research findings pertaining to the following nutritional parameters are presented in Table- 2

Proximate nutritional analysis in selected flowers:

The flowers are said to be a good source of nutrients. *Madhuca indica* is a life saving plant species as nutrient analysis of carpels of *Madhuca indica*, J.F. Gmel. showed highest carbohydrates (33.90 mg/100g), riboflavin (44.12 mg/100gm), fiber (97%) and lowest values of fat (1.65%), protein (0.48 g/100gm), thiamine (13.68 mg/l), calcium (2037.16 ml/l), carotenoid (6.11 mg/5gm) and moisture content (5.46%) among all the investigated flowers. The values are sufficient to match the Recommended Dietary Allowances (Anonymous, 1980).

Thus the flowers are good source of nutritional components. The flowers of *Cassia fistula*, L. showed the highest fat content (1.93 %), thiamine (17.54 mg/l), niacin (32.01 %), Vitamin C (4.72 %), carotenoid (20.29 mg/5gm), moisture (7.2 %) and total energy (145.27 Kcal/100g) and lowest values of carbohydrates (23.06 mg/ 100g), riboflavin (1.93 mg/100gm) and fiber content (85.19 %) among all the investigated flowers. Jain and Tiwari (2012) reported total sugar (8 %), lipid (23.73 %) and crude protein (13-13 %).

Protein is one of the important part of human nutrition that supports growth but is also important for maintenance and repair of body tissues. The Flowers of *Moringa oleifera*, Lam. has highest protein (1.27 g/100g) and calcium values (2987.91 ml/l) but recorded for least values of niacin content (15.49 %), vitamin C (1.57 %) and Total energy (129.78 kcal /100g), among all the selected flowers. Jain and Tiwari (2012) reported 13.23 % of total sugar, in the flowers of *M. oleifera* and these flowers also serves as good source of income (Kumar *et al*., 2014)

Table-2: Proximate nutritional composition of selected wild edible flowers

S.N.	Nutritional Parameters	*Cassia fistula*, Linn.	*Madhuca indica*, J.F. Gmel.	*Moringa oleifera*, Lam.
1	Carbohydrates (mg/100g)	23.06	33.90	30.90
2	Fat content (%)	1.93	1.65	1.74
3	Protein content (gm/100g)	1.13	0.48	1.27
4	Thiamine value (mg/l)	17.54	13.68	15.32
5	Riboflavin (mg/100g)	1.93	44.12	32.91
6	Niacin content (%)	32.01	17.23	15.49
7	Vitamin C. (%)	4.72	1.62	1.57
8	Calcium content (ml/l)	2139.02	2037.16	2987.91
9	Carotenoid (mg/5gm)	20.29	6.11	9.12
10	Fiber value (%)	85.19	97	94.44
11	Moisture content (%)	7.2	5.46	6.21
12	Energy value (Kcal/100g)	145.27	137.70	129.78

IV. CONCLUSION

On account of their nutritional status, these plants can be recommended as food for outer world besides their main consumers to fight against malnutrition and food scarcity. These flowers were found as the rich source of carbohydrates, fats protein and vitamins. The result highlighted significance of 3 wild edible flowers as a cheap source of nutrient for rural poor and nutrient analysis focuses the rich nutritional composition of indigenous plants and their scope to be used as an alternative source of bio-nutrients and dietary supplement. Thus, results suggest that flowers of Cassia *fistula,*L., *Madhuca indica,* J.F. Gmel. and *Moringa oleifera,* Lam. have strong potential to be utilized as famine food and can be used to alleviate hunger and chronic malnutrition.

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