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Research Article

NUTRITIONAL AND PHYTOCHEMICAL ASSESMENT OF WILD EDIBLE FRUIT OF *AEGLE MARMELOS* (LINN.) USED BY THE TRIBES OF BHIWAPUR TAHSIL NAGPUR DISTRICT, INDIA

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ABSTRACT

Objectives: Wild edible plants play an important role in human life and are the vital constituent of the traditional diet. People of the Bhiwapur Tahsil are very close to the nature, wild fruits like *Aegle marmelos* (Bael), which is one of the natural resources in the Tahsil. They have a direct dependence on the wild plants for their sustenance. Owing to the easy accessibility, the fruits are very commonly utilized by the tribal populations and travelers.The present investigation aimed to assess the nutritional and phytochemical analysis of ripened fruits of a popularly known medicinal plant *A. marmelose.*

Methods: The study includes the estimation of ash content, protein, carbohydrate (sugar), vitamins and mineral contents (Cu, Fe, Mn, Zn, Ca, Na, K) of Bael fruit. The water extract was screened for the qualitative phytochemical analysis.

Results: The fresh fruits were found a rich source of protein (6.91±0.11 g/100 g), carbohydrate (22.55±0.15 g/100 g) fiber (7.26±0.23 g/100 g) and energy (133.14 Kcal/100 g). The fruits were found to contain high calcium (86.69±0.01 mg/100 g) content and may be considered as a rich source to facilitate the rehabilitation of bone problems in the human being. The Na/K and Zn/Cu ratio were found to be 0.012 and 12.26 may attribute the medicinal properties in cardiovascular disorders. The water extract showed the presence of carbohydrates, proteins, sterols, alkaloids, glycosides, saponins, polyphenols, and flavonoids.

Conclusion: The nutritional and phytochemical analysis reveals that the fruits are not only acting as supplementary foods, but is the tonic requirements of the tribal's and deprived of poor Bhiwapur Tahsil.

Keywords: *Aegle marmelos*, Bhiwapur, nutritional, Phytochemical, Tribal.

INTRODUCTION

The evidence of man's dependency on plants for his survival can be demonstrated by palaeo-ethnobotanical findings from prehistoric archaeological sites [1]. In many tropical countries rural people traditionally harvest wide range of leaf of vegetables, roots, tubers and fruits because of its cultural uses, as a food supplement labeled as "famine" or "hunger" food. Plants not only provide the edible fruits, but also have their importance in providing fodder, fuel and medicines. They play a significant role in the food and nutrient security of rural poor tribal's. Gathering of wild fruits is a common practice even today. These are often, and the only fruits consumed as tribal cannot afford cultivated commercial fruits as grapes, orange, pomegranate, apple, etc. The wild edible species are mostly gathered by the tribal, rural communities and forest dwellers for consumption value and taste during festivals. The general information, edibility and therapeutic properties of these wild fruits, their safety data and nutritional composition are in negligence [2].

Some wild fruits have been identified to have better nutritional value than the one that are cultivated [3]. As a result, in recent years, a growing interest has emerged to evaluate various wild edible plants for their nutritional features [4,5]. By taking into consideration present study, was designed to evaluate the nutritional and phytochemical traits of Bael fruits from Bhiwapur Tahsil.

METHODS

Study area and fruits collection

The study area is situated between the 20°35' and 21°44' N latitudes and between 75°53, and 80° East longitudes and is spread over the area of 61323.62 hectares of land. It includes 106 villages with a tribal population of 83,164 (2001). The tribal communities that fall in the villages are Banjara, Gond, Mana, Dhivar and Pardhi, of which Gond tribes are dominant. The vegetation is of deciduous type with a rainfall in the average 45 inches [6] (Fig. 1).

Field survey, collection of fruits and its related data were carried out during the period of April 2011-2013, in different seasons. The specimens were identified by carefully matching them in the herbarium and authentically certified, by the Department of Botany Hislop College, Nagpur (Specimen no. 3254). Ethnic informers were consumed to locate and collect the plant along with the other informants. Useful information was gathered by interviewing the local people and elderly persons. Naturally growing wild ripe fruits were collected from the study area, outer cover, seeds were removed. The fruit pulp was shade-dried, pulverized, and coarse powder was utilized for their phytochemical and nutritional analysis (Fig. 2).

Mineral contents

To prepare the sample for mineral analysis, the ripe fruits were oven dried, pulverized to fine powder and used for dried ashing. In each case the powdered fruits were taken in a pre-cleaned and constantly weighed silica crucible and heated in a muffle furnace at 450°C till there was no evolution of smoke. The crucible was cooled at room temperature in a desiccator and carbon-free ash was moistened with concentrated sulfuric acid and heated on a heating mantle till fumes of sulfuric acid ceased to evolve. The crucible with sufated ash was then heated in a muffle furnace at 600°C till the weight of the content was constant (~2- 3 hrs). 1 g of sulfated ash obtained above was dissolved in 100 ml of 5% HCl to obtain the solution ready for determination of mineral

elements through atomic absorption spectroscopy (AAS) and flame photometry (FPM). Standard solution of each element was prepared and calibration curves were drawn for each element using AAS/FPM [7,8].

Nutritive value

Moisture content

The fully ripe fruit pulp was cut into small pieces and moisture content was examined by air oven method at 105°C and till to get the constant weight. The loss in weight was regarded as a measure of moisture content [9].

Ash content

For the determination of ash content, 10 g of dried powdered sample was weighed in a quartz crucible. The crucible was heated first over a low flame till all the material was completely charred, followed by heating in a muffle furnace for about 3-5 hrs at 600°C. It was cooled in a desiccator and weighed to ensure completion of ashing. To ensure completion of ashing, it was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (ash became white or grayish white). Weight of ash gave the ash content [9].

Fat content

Fat content was determined by extracting 2 g dried sample with petrol in a Soxhlet extractor, heating the flask on a heating mantle for about 6 h till a drop taken from the drippings left no greasy stain on the filter paper. After boiling with petrol, the residual petrol was filtered using Whatman no. 40 filter paper and the filtrate was evaporated in a pre- weighed beaker. Increase in weight of beaker gave crude fat [10].

Protein content

The protein was determined using micro Kjeldahl method. 2 g of oven- dried material was taken in a Kjeldahl flask and 30 ml conc. H_2SO_4 was added followed by the addition of 10 g potassium sulfate and 1 g copper sulfate. The mixture was heated first gently and then strongly once the frothing had ceased. When the solution became colorless or clear, it was heated for another hour, allowed to cool, diluted with distilled water and transferred to a 800 ml Kjeldahl flask, washing the digestion flask. Three or four pieces of granulated zinc, and 100 ml of 40% caustic soda were added and the flask was connected with the splash heads of the distillation apparatus. Next 25 ml of 0.1 N sulfuric acid was taken in the receiving flask and distilled. When two-thirds of the liquid had been distilled, it was tested for completion of reaction. The flask was removed and titrated against 0.1 N caustic soda solution using methyl red indicator for determination of Kjeldahl nitrogen, which in turn gave the protein content [11].

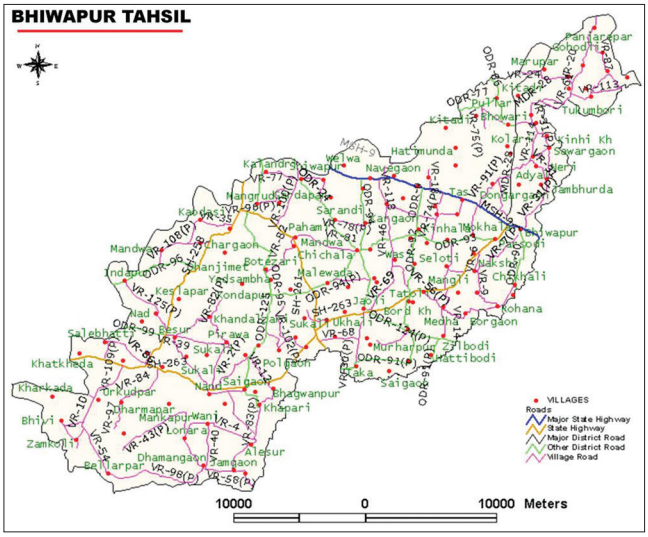

Fig. 1: Map of Bhiwapur Tahsil, District Nagpur, Maharashta, India

Fig. 2: Aegle marmelos tree and fruits

Fiber content

The crude fiber content was determined to be reported along with the nutritive value. For determination of crude fiber, the estimation was based on treating the moisture and fat-free material with 1.25% dilute acid, then with 1.25% alkali, thus imitating the gastric and intestinal action in the process of digestion. Then, 2 g of moisture and fat-free material was treated with 200 ml of 1.25% H_2SO_4. After filtration and washing, the residue was treated with 1.25% NaOH. It was the filtered, washed with hot water and then 1% HNO_3 and again with hot water. The residue was ignited, and the ash weighed. Loss in weight gave the weight of crude fiber [10,12].

Percentage carbohydrate was given by 100 − (percentage of ash + percentage of moisture + percentage of fat + percentage of protein) [11].

Nutritive value was finally determined by: Nutritive value = 4′ percentage of protein + 9′ percentage of fat + 4′ percentage of carbohydrate [11].

Extraction and phytochemical screening

The decoction of dried coarse powder was prepared at 80°C for about 2 hrs and lyophilized to get the dried water extract. The extract was screened for the presence of different primary and secondary metabolite using different phytochemical tests [13].

RESULTS AND DISCUSSION

Nutritional analysis

The importance and awareness of nutrition are public health issues, has resulted in the increasing demand of knowledge of the biochemical nutrients of foods. Carbohydrates and sugars highly contribute for energy (133.14 Kcal/100 g) signify the role of bael fruit as a good source of nutrition. About 14 elements are essential to human health, deficiency of which creates a health problem. Human bodies daily need more than 100 mg of major minerals (N, P, K, Ca, Mg, Na) and <100 mg of minor minerals (Cu, Fe, Zn, Mn, Co, Br, Si) [14]. The processing methods produce Na and K ratio <1 which is in accordance with the recommended ratio [15]. As per the results of mineral analysis, the Na/K found 0.012

Table 1: Nutritional analysis of Bael fruits pulp

Nutritional characteristics (DW)	Result
Total ash (g/100 g)	2.63±0.07
Moisture (g/100 g)	58.95±0.12
Protein (g/100 g)	6.91±0.11
Fat (g/100 g)	1.70±0.17
Fiber (g/100 g)	7.26±0.23
Sugar (g/100 g)	6.38±0.09
Carbohydrate including sugar (g/100 g)	22.55±0.15
Copper (mg/100 g)	1.29±0.01
Iron (mg/100 g)	3.32±0.03
Manganese (mg/100 g)	1.53±0.03
Zinc (mg/100 g)	15.82±0.02
Calcium (mg/100 g)	86.69±0.01
Sodium (g/100 g)	0.02±0.07
Potassium (mg/100 g)	1.66±0.09
Calorific value (Kcal/100 g)	133.14

Each value represents the mean±standard deviation of three determinations (n=3) on dried weight of fruit pulp (DM) basis. DW: Dry weight

Table 2: Preliminary phytochemical analysis of Bael fruits water extract

Phytoconstituents	Test	Observations	Aqueous extract
Alkaloids	Dragendroff's	Orange color ppt produced	+
Alkaloids	Mayer's Test	Cream colored ppt produced	+
Alkaloids	Wagner's test	Reddish brown color ppt produced	+
Flavonoids		Magenta (brick) red color produced	+
Proteins	Biuret test	Violet or purple color produced	+
Proteins	Millon's test	Red color produced	+
Carbohydrates	Molisch's test	Red or dull violet color produced	+
Carbohydrates	Fehling's test	Yellow or red color ppt produced	+
Phytosterols	Liebermann-Burchard test	Dark red or pink color produced	+
Glycosides	Baljet test	Yellow to orange color produced	+
Glycosides	Keller–Killiani test	Two layer reddish brown color produced, in upper layer turns bluish green colour produced	+
Phenols	Ferric chloride test	Deep blue or black color produced	+
Saponins	Foam test	Persistent form produced	+

Where (+) and (-) indicate the presence and absence of phyto-constituents respectively

which is within the recommended ratio for good human health. The fruit contains a high content of potassium act as an electrolyte for maintaining the homeostasis and act as power generator inside the cells of human body. Calcium is the second highest mineral (86.69±0.01) present in Bael fruit which is reported, very essential in muscle contraction, oocyte activation, building strong bones and teeth, blood clotting, nerve impulse, transmission, regulating heartbeat and fluid balance within cells [16]. The other important minerals (Fe, Cu, Zn and Mn) were found in the range of 1.29±0.01-15.82±0.02 (Table 1). Excessive ratio of zinc to copper (>16) from dietary sources causes imbalance in their bioavailability and has been linked to increased risk of cardiovascular disorders [17]. The less Zn/Cu ratio (12.26) in Bael fruit may contribute its several therapeutic applications. The nutritional analysis revealed that the fruit is not only acting as supplementary food, but is the tonic requirement of the tribal's, and deprived of poor Bhiwapur.

Phytochemical analysis

The phytochemical screening of water extract from the dried ripe fruits of *Aegle marmelos* revealed the presence of major bioactive compounds including phyto-sterols, carbohydrate, protein, alkaloids, glycosides, polyphenols, flavonoids and saponins, which may retain a wide range of pharmacological actions (Table 2).

CONCLUSION

The result highlighted the significance of wild fruit as a cheap source of nutrient for the rural and tribal people. It brings into focus the rich nutritional composition of the fruit and the scope for their use as an alternative source of bio-nutrition. The mineral analysis indicated the scope of using wild edible fruit for the dietary supplement. It has valuable ingredients as micro-minerals (Fe, Cu, Zn and Mn) and macro- minerals (Ca, NA and K). Many other fruits of the forest, therefore, need to be analyzed, which could help in selecting promissory species for inclusion in agro and farm-forestry and re-forestration programs. Plantation of wild fruit helps to sustain the wild animals. There is a need to explore more wild fruits that will add new dimensions toward traditional management and conservation of plant wealth.

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