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Original Article

BROMATOLOGICAL AND MINERAL ASSESSMENT OF *CLITORIA TERNATEA* LINN. LEAVES

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ABSTRACT

Objective: Wild plants are valuable source of a wide range of primary and secondary metabolites. The bromatological and mineral analysis of edible plants plays an important role in assessing their nutritional significance. In present work analyzed bromatological composition and mineral elements of *Clitoria ternatea* (Blue and white variety) leaves.

Methods: The evaluation was carried out by following the AOAC guidelines, 1990. Micronutrients analysis carried out by method of Toth *et al*. (1948) in both variety of *C. ternatea*.

Results: The highest amount of ash (9.5±0.23%), crude fiber (8.77±0.12%), crude protein (17.36±0.33%) and carbohydrates (489.24±2.83 KJ) was found higher in leaves of white variety. Among the various macronutrients estimated in the plants, nitrogen (2.77±0.05 g) was present in highest quantity, followed by potassium (1.42±0.05g), calcium (0.66±0.02g) and phosphorus (0.57±0.03g) per 100g.

Conclusion: The leaves of both varieties showed significant amount of crude protein, crude fiber, ash, carbohydrates and minerals such as potassium and iron which helps to develop pharmaceutical products and also as a fodder or feed for livestock.

Keywords: Bromatological analysis, Mineral contents, *Clitoria ternatea*.

INTRODUCTION

Wild plants are major constituents of rural livelihoods. Recently a lot of interest is currently being focused on the possibilities of exploiting the vast numbers of less familiar plant resources existing in the wild. All human beings require a number of complex organic/inorganic compounds in diet to meet the need for their activities. Wild plants are valuable source of a wide range of primary and secondary metabolites, which are used as pharmaceuticals agrochemicals, flavours, fragrances, colours, biopesticides and food additives. The important constituents of diet are carbohydrates, fats, proteins, vitamins, minerals and water [1]. The quality of a food depends upon the presence of relative concentration of various nutrients such as proteins, fat, carbohydrate, vitamins and minerals. The carbohydrates, fats and proteins are sometimes referred to as proximate principles and form the major portion of the diet while minerals play an important role in the regulation of the metabolic activity in the body [2]. The bromatological and mineral analysis of edible plants plays an important role in assessing their nutritional significance. There is a relationship between the element content of the plant and its nutritional status.

The determination of mineral elements present in plants is important because the concentration and type of minerals present must often be specifying the level of a food. Minerals also play a very significant role against a variety of degenerative diseases. Some minerals are essential to a healthy diet (e.g. Calcium, Phosphorus, Potassium and Sodium) where as some can be toxic (e.g. Lead, Mercury, Cadmium and Aluminium). It is clear that mineral nutrition is important to maintain good health [3].

The *Clitoria ternatea* L. (Blue and white variety) is ornamental perennial climber with conspicuous blue or white flowers; it is commonly called 'Gokarn'. It is a highly palatable forage legume, generally preferred by live stock over other legumes. It is well known medicinal plant used by many herbal practitioners to treat many diseases. Almost all parts of this plant are reported to have medicinal properties. Leaves of this plant has been using traditionally to treat urinary troubles, eye swelling, night blindness, scabies, dropsy, antipyretic and skin diseases etc.[4-7]. Many of the medicinal values are evaluated by many workers such as Anti-diabetic [8], Anti-compulsive [9], Anti-bacterial [10], Hepato protective [11] Antihelmintic [12] and many more. The leaves of *Clitoria ternatea* var. *ternatea* L. (Blue variety) and *Clitoria ternatea* var. *pilosula* Wall. (White variety) were subjected to bromatological and mineral analysis. The present study moisture, dry matter, ash, protein, fat, fiber, carbohydrate and energy were analyzed while essential nutrients analysis likes N, K, Na, P, Ca, Mg, Cu, Fe, Mn and Zn were scrutinized.

MATERIAL AND METHOD

Collection of Plant Material

The both varieties of *C. ternatea* were collected in flowering stages during frequent visits in the month of June–November from various places of Kolhapur district. The local floristic keys were used for determining the species. The collected material was placed in a polythene bag to prevent loss of moisture during transportation to the laboratory.

Sample Preparation

The plants were washed thoroughly until no extraneous material remained. They were blotted till the excess moisture absorbed, air dried and weighted to obtain fresh weight. The sample used for mineral analysis was washed using double deionised water. Then the plant materials cut into small pieces and placed in paper envelop and dried in the oven at 40^0C until constant weight was obtained. After complete drying the sample was ground to a fine powder by using an electric grinder. The sample was packed into airtight sample bottles and used for the nutrient analysis. All analyses were conducted in duplicate by using analytical grade reagents.

Bromatological analysis

The moisture content, ash, crude fat, crude protein and crude fiber were determined in accordance with the standard methods of the AOAC [13]. Crude fat was determined by exhaustively extracting samples in a soxhlet apparatus using anhydrous diethyl ether as the solvent. Crude protein determination involved the use of routine kjeldhal nitrogen assay (N x 6.25). Crude fiber estimates were obtained from the loss in weight on ignition of dried residue following the digestion of fat free sample with 1.25% each of sulphuric acid and sodium hydroxide solution under specified condition. Reducing sugar, total Sugar and starch were estimated according to the method described by Nelson [14].Carbohydrate

content was determined by summation of total sugar and starch. Energy was calculated by using the general Atwater factor of 4 kilocalorie (kcal) per 'g' protein, 9 kcal per 'g' fat and 4 kcal per 'g' carbohydrate. These conversion factors were multiplied by 4.186 in order to obtain energy values in kilojoules (kJ) [15].

Mineral analysis

The minerals, such as K, Na, P, Mg, Ca, Fe, Mn, Cu and Zn were determined by the atomic absorption spectrophotometric method. The samples, which were digested in acid solution of HNO3 and perchloric acid [16], were passed through atomic absorption spectrophotometry (AAS) using different lamps and caliberated or different micronutrients. Potassium and sodium was determined through flame photometer after acid digestion. Phosphorus was determined spectrophotometrically using the vendates solution [17].

RESULTS AND DISCUSSION

Bromatological analysis

The results of bromatological composition of Blue and white variety leaves are shown in

Table 1. In bromatological analysis, the parameters determined were moisture content, ash crude fat, crude protein and crude fiber as well. Many primary metabolites are acts as precursors or pharmacologically active metabolites in bioactive compounds [18]. Plant produces various primary metabolites such as lipid, protein, starch, sugars, phenol. The ash content, which is an index of mineral contents found 8.73±0.22% in blue variety and 9.5±0.23% in white variety. The crude fiber in white variety is of 8.77±0.12% was more than the blue variety (8.45±0.05%). The presence of fiber in the diet is necessary for digestion and for elimination of wastes. The contraction of muscular walls of the digestive tract is stimulated by fiber, thus counteracting constipation [19]. The World Health Organization (WHO) has recommended an intake of 22-23kg of fiber for every 1000 K.cal. of diet [20]. Crude fat is slightly different in both varieties i.e.5.5±0.1 and 5.23±0.07 (blue and white leaves) respectively. A dietary pattern containing low-fat and high fiber products has been associated with reduced risks of breast cancer [21&22]. Proteins are the primary components of living things. The presence of higher protein level in the plant points towards their possible increase food value or that a protein base bioactive compound could also be isolated in future [23]. In the present study, protein level was found in leaves of blue and white variety is 14.99±0.43 and 17.36±0.33% respectively. Carbohydrates are the main energy reserves in the plant foods. In all organisms carbohydrates makes building blocks of cells and it supplies potential energy to maintain life.

Table 1: Bromatological analysis of leaves of blue and white variety

S. No.	Parameters	Blue variety Leaves	White variety Leaves
1.	Dry matter (%)	25.49±0.64	28.56±1.44
2.	Moisture (%)	74.51±0.38	71.44±0.32
3.	Total ash (%)	8.73±0.22	9.5±0.23
4.	Crude fiber (%)	8.45±0.05	8.77±0.12
5.	Crude fat (%)	5.5±0.1	5.23±0.07
6.	Crude protein (%)	14.99±0.43	17.36±0.33
7.	Reducing sugar (g/100g)	0.036±0.001	0.033±0.001
8.	Total sugar(g/100g)	0.042±0.0001	0.040±0.001
9.	Starch(g/100g)	0.038±0.001	0.043±0.002
10.	Carbohydrate(g/100g)	0.080±0.002	0.083±0.002
11.	Energy (KJ)	459.60±9.20	489.24±2.83

N. B. 1. Values are means of three determinations ±S.D. (n=3), 2. Carbohydrate calculated by difference., 3. Energy calculated by using Atwater factors.

The reducing sugar and total sugar is higher in blue variety leaves and starch and carbohydrate is more in white variety leaves. This may be used for dietary supplements. The energy value was estimated within range of 459.60-489.24 kJ, which is an indication that it could be an important source of dietary calories. Shekhawat and Vijayvergia [24] were studied the primary metabolites of *Clitoria ternatea* leaf. They observed 2.60±0.40 mg/g dry weight starch and 58±0.48 mg/g dry weight protein. In present work, lower starch and higher protein is recorded than the previous author. Ponnuswamy and Wesely [25] were evaluated the primary metabolites of *C. ternatea* leaf. They observed the total sugar 37.01 mg/100g, protein 9.62mg/100g, carbohydrate 32.41mg/100g and total ash 9.95 mg/100g. In present work total sugar, protein, carbohydrate and total ash shows higher value than the previous author. Deka et al. [26] were carried out proximate analysis of primary metabolites in different parts of *C. ternatea*. They reported the total ash 10.93±0.29, crude protein 33.36±0.23, crude fiber 14.45±0.09 mg/100g DW. In present investigation leaves of both variety shows higher value than the previous author. Nasrullah et al. [27] worked on nutritive evaluation of forage plants grown in south Sulawesi, Indonesia. They reported the crude protein 18.28±5.10%, crude fiber 26.45±8.32% and ash 8.87±3.49% in *C. ternatea*. In present work, observed lower value of crude protein, crude fiber and ash than the previous author.

Mineral analysis: Plant are rich in minerals are good source of medicine. Mineral analysis of a plant gives the idea of possibility whether the plant should be used for any medicinal purpose. The results of the minerals estimation of leaves of blue and white variety is presented in table 2. This study shows that copper was the least abundant in both variety. In this study contained remarkably high amount of nitrogen and potassium (›500mg/100g dry weight). The high content of Potassium can be utilized beneficially in diets of people who take diuretics to control hypertension and suffer from excretion of potassium through the body fluid [28]. In addition, minerals such as calcium and magnessium are necessary for growth, skeletal development and other vital processes within the body. In the present study, Iron is 6.33±0.35 and 5.3±0.32 mg/100g DW observed in blue and white variety leaves. Iron is useful for the prevention of anemia and other related diseases [29]. In present work recorded 2.23±0.12 and 1.80±0.10 mg/100g DW copper in blue and white variety leaves. Zinc plays a role in protein synthesis, normal body development and recovery from illness. In present investigation blue variety and white variety leaves was 4.43±0.15 and 3.60±0.10 mg/100g DW zinc recorded. Manganese plays a role in energy production and in supporting the immune system. It also works with vitamin K to support blood clotting and with B complex vitamins to control the effects of stress [30]. In present study, 3.24±0.13 and 3.71±0.16 mg/100g DW manganese was recorded in blue and white variety leaves respectively. Mahala et al. [31] were studied the nutritive value of leguminous plants. The *C. ternatea* was one of them. They observed Ca (1.2%), K (18.7%), Na (1.1%), Mg (6.9%) and P (0.4%) in *C. ternatea*. In present investigation shows slightly difference in minerals values than minerals studied by previous author. Kapoor and Purohit [32] evaluated the mineral contents from some fabaceous plant species of Rajasthan desert. The *C. ternatea* is one of them. They reported Ca (1.01±0.06%), P (0.44±0.14%), K (0.78±0.69%) and Na (0.94±0.67%). In present work value of Calcium, Phosphorus, Potassium and Sodium observed slightly different than previous author.

Table 2: Mineral analysis of leaves of blue and white variety

S. No.	Mineral Elements	Blue variety Leaves	White variety Leaves
1.	N (g/100g DW)	2.39±0.07	2.77±0.05
2.	Na(g/100g DW)	0.27±0.006	0.34±0.012
3.	K (g/100g DW)	1.60±1.42	1.42±0.05
4	Ca(g/100g DW)	0.78±0.025	0.66±0.02
5	Mg(g/100g DW)	0.58±0.02	0.65±0.04
6	P(g/100g DW)	0.65±0.03	0.57±0.03
7	Fe(mg/100g DW)	6.33±0.35	5.3±0.32
8.	Cu(mg/100g DW)	2.23±0.12	1.80±0.10
9.	Zn(mg/100g DW)	4.43±0.15	3.60±0.10
10.	Mn(mg/100g DW)	3.24±0.13	3.71±0.16

N.B.1. Values are means of three determinations ±S.D. (n=3)

CONCLUSION

The present study indicates that leaves of both variety of *Clitoria ternatea* showed significant value of ash, crude fiber, crude protein and carbohydrate thus these plants may be used in the production of pharmaceutical products. It also observed sufficient amount of mineral contents, hence these plants may be useful as feed and fodder for the livestock. The maximum amount of nitrogen, potassium and phosphorus in leaves, it might be in future the plant used as green manure.

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