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Nutritional Assessment of Some Important Medicinal Plants Used by Nyishi Tribes of Arunachal Pradesh

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Abstract

In Arunachal Pradesh, major tribal populations are dependent on natural resources for their daily needs. Most of the tribal populations have their own rich traditional wealth in general and medicinal plant wealth in particular — which is used in numerous ailments. Due to the scarcity of supply, and also lack of knowledge about the nutraceutical supplements, most of the tribal population are dependent on the plant-reservoir as their dietary supplements. In continuation of the study on ethnobotanical plant used by Nyishi tribes, in this paper we present the nutritional analysis of seven important medicinal plants used by Nyishi tribes of Arunachal Pradesh. Experimental finding reveal that out of 7 medicinal plant species *viz*., *Curcuma caesia* Roxb. Rhizome (38.8% in 100mg of extract), *Bixa orellana* L. seed (16.7% in 100mg of extract) and *Mesua ferrea* L. stem bark (13.9% in 100mg of extract) have high percentage of carbohydrate, *Curcuma caesia* Roxb. Rhizome (2.62%) and *Acmella paniculata* (Wall. ex DC.) R.K.Jansen leaf (2.53%) have low perventage of protein and *Acmella paniculata* (Wall. ex DC.) R.K.Jansen flower (11.4%) and *Mesua ferrea* L. flower (10.35) have high percentage of crude fibre. The present study revealed that the investigated medicinal plant species exhibited potent nutritional values and may be further used for the preparation of nutraceutical supplements after sufficient evaluation.

Key words: Folk medicine, Nyishi tribe, Medicinal plants, nutraceutical supplements, Arunachal Pradesh.

Introduction

Arunachal Pradesh (AP), located in the easternmost state of India is one of the major tribal states. Approximately 26 tribes and 110 sub-tribes are inhabitants of this province. The state has varied climatic conditions and its geographical area is dominated by mountainous and hilly regions (*Shankar, R.,* 2011). The tribal population is rich in culture and folklore medicinal systems. It has been reported that the people of AP are completely dependent on the forests and use a wide range of plants in their daily life *(Srivastava, R.C., and Nyishi community, 2010)*. Indigenous food constantly play a major role in the health conditions of the different tribes present in different parts of the region. The intention behind nutritional assessment of a particular tribe is to find out the actual facts about nutrition and health of the tribal people. Every tribal population have its exclusive food habits (Mandal, H., Mukharjee, S. and Dutta, A., 2010). One of the major tribe of AP is the

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Nyishi tribe which was earlier known as *Daffa*. These people preserve rich cultural traditions and they are very much proud on their cultural heritage. The elderly people of this tribe have a vast knowledge of the medicinal plants to be used in numerous disease symptoms *(Srivastava, R.C., and Nyishi community, 2010).* Nyishi tribe is extremely affluent in plant based medicinal knowledge among the tribes of AP. One of the well-known districts of the AP is Papum Pare which is also known for its rich traditional knowledge and cultural heritage. The tribal population mostly depends on natural food supplements for nutrition as well as medicine. Keeping this in view, the authors have explored the medicinal plants for the study of their nutritional value. The scarcity of modern health care systems is also responsible for the villagers in the remote areas of the district to depend on local traditional practitioners and folk medicine. Nyishi tribes are resident of the regions of Itanagar, Naharlagun, Chessa, Nirjuli, Doimukh villages circle from the Papum Pare district of AP. In an earlier study we have also explored the ethnobotanical wealth and medicinal plants used by Nyishi tribes of AP in various ailments (*Tripathi et al.,* 2017). In the present study, we have investigated the nutritional attributes of some of the plants used by Nyishi tribes.

Materials and Methods

Collection of plants

As per the information obtained from local medicine men and folk healers we have selected different parts of seven plant species, namely aerial part of *Amaranthus spinosus* L. (Amaranthaceae) accession no.3231, seeds of *Bixa orellana* L. (Bixaceae) accession no. 3229, rhizomes of *Curcuma caesia* Roxb. (Zingiberaceae) accession no. 3234. Leaves and flowers of *Acmella paniculata* (Wall. ex DC.) R.K.Jansen syn. *Spilanthes paniculata* Wall. ex DC. (Compositae) accession no.3238. Stem bark and flowers of *Mesua ferrea* L. (*Calophyllaceae*) accession no.3232, bark of *Saraca asoca* (Roxb.) Willd**.** (Caesalpinioideae) accession no.3233 and fruits of *Solanum viarum* Dunal (Solanaceae) accession no.3236. The plants were collected from Nirjuli, Naharlagun Karsingsa area of Papum Pare district and identified by the authors and authenticated with the help of local flora. Herbarium was prepared and preserved in the Herbarium of Regional Ayurveda Research Institute, Itanagar.

Nutritional evaluation

Estimation of total carbohydrate by Anthrone method

The estimation of carbohydrate in all the plant material was carried out by Anthrone method (*Yemm, E.W.,* and *Willis, A. J.* 1954). Carbohydrates in the powdered material of the plants were first hydrolyzed into simple sugars using dilute HCl. In hot acidic medium, glucose is dehydrated to hydroxymethyl furfural. This compound, with anthrone forms a green coloured product with an absorption maximum at 630nm. Initially 100mg of the sample was taken into a boiling tube. Then it is hydrolyzed by keeping it in a boiling water bath for 3 hours with 5 mL of 2.5N-HCl and cooled to room temperature. This was neutralized with solid sodium carbonate until the effervescence ceases and the volume was made up to 100mL and centrifuged if necessary. Six concentrations of different volumes of 0, 0.2, 0.4, 0.6, 0.8, and 1 mL of the working standard glucose of 10mL taken from stock solution of 100mg glucose in 100mL water and two volumes of 0.5mL & 1mL aliquots from each sample were taken. From the graph of the concentration (x-axis) versus absorbance (y-axis) of glucose concentrations, a straight line characteristics graph was obtained. From this graph we obtained the mg of glucose at the respective absorbance at different concentrations of the samples. Taking this amount of glucose corresponding to the test sample, the percentages of total carbohydrate in the plant samples were calculated (*Yemm, E.W.,* and *Willis, A. J.*, 1954).

Estimation of crude protein

Crude protein was estimated as described by *Kjeldahl* Methods (*Ishwaran, V.,* 1980). A quantity of product containing 100 mg plant sample weighed into a micro digestion flask, then 0.5 g catalyst mixture (*i.e.,* 32 gm of potassium sulphate with 5g of red mercuric oxide) and 2.5 ml concentrated H_2SO_4 was added. This was heated with a small flame until frothing cease and then heated until the solution is clear. It was cooled and 8ml distilled water was added to it. The solution was transferred to the distillation apparatus and the flask was rinsed with 3 portion of 2ml distilled water. After that, 15ml sodium hydroxide/sodium sulphide mixture was added and steam distillation was done with 2ml boric acid. 10ml distillate was collected, and an additional 2ml was distilled. The outside of the condenser tube was rinsed and titrated the content of the flask with 0.01N H_2SO_4. Total Nitrogen (N) was calculated (*Kjeldahl* Methods.) as:

$$Total Nitrogen\% = \frac{1400(V_1 - V_2)N}{W} \times 100$$

Where W = Let weight (in mg) of sample used,

V_1 = Volume (in ml) of H_2SO_4 used in test,

V_2 = Volume (in ml) of H_2SO_4 used in blank,

N = Normality of H_2SO_4

The crude protein was estimated as:

$$Crude\ protein = Total\ nitrogen(\%) \times factor(6.25) \times 100$$

Estimation of crude fibre

Defatting was done by extraction of 2g powdered material with petroleum ether to remove fat. The dried material was boiled with 200ml of H_2SO_4 for 30 min. It is then filtered through muslin cloth and washed with boiling water until washings were no longer acidic. The obtained solution was boiled with 200ml of NaOH (of 0.313±0.005 *N*) for 30 min and filtered through muslin cloth and then washed with 25ml of boiling 1.25% H_2SO_4 (of 0.255±0.005 *N*), three 50ml portion of water and 25ml of 95% ethyl alcohol. The residue was removed and transferred to porcelain dish (pre-weighted dish W_1), the residue was dried for 2 h at 130˚C, the dish was cooled in a desiccator and weighed (W_2), further ignited for 30 min at 600˚C and than cooled in a desiccator and weighed (W_3) (*Chopra, S. L.* and *Kanwar, J. S.,* 1991). The crude fibre was then calculated using formula:

$$\%\ of\ Crude\ fibre = \frac{(W_2 - W_1) - (W_3 - W_1)}{W} \times 100$$

Results and Discussion

The obtained results revealed that the plants used by Nyshi tribes possesses potential nutritional contents. The results also showed that rhizomes of *Curcuma caesia* exhibited highest carbohydrate content (38.8% in 100mg of sample) followed by *Bixa orellana* seeds (16.7% in 100mg of sample), *Mesua ferrea* stem bark (13.9 % in 100mg of sample) and *Saraca asoca (*bark) (8.96% in 100mg of sample). On the other hand, lowest carbohydrates content were found to be present in *Solanum viarum* (fruit) (4.04% in 100mg of sample) *Acmella paniculata* (leaf) (2.46% in 100mg of sample) followed by *Amaranthus spinosus*. It was also revealed that *M. ferrea* stem bark has higher carbohydrate content than its flower, similarly flower of *A. paniculata* had more carbohydrates than leaf of the same plant. The detailed results are presented in figure 1.

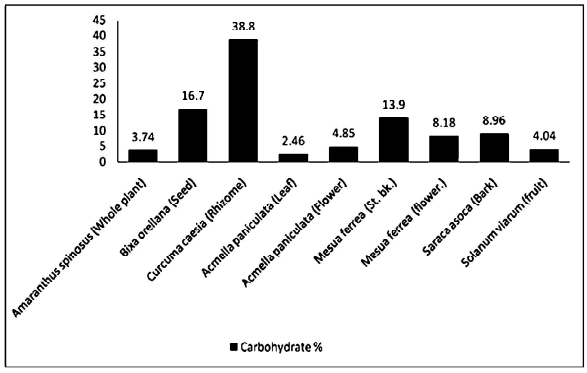

figure 1

Production of carbohydrates in plants occurs by photosynthesis. Carbohydrates play an essential role in providing carbon skeletons for organic compounds of plants and is also vital as energy source and energy storage components (*Trouvelot et al.,* 2014). Emerging role of carbohydrates as signalling molecules, resembling hormones, are also evident (*Trouvelot et al.,* 2014; *Koch, K. 2004; Sheen et al., 1999 and Rolland et al., 2002).*

Crude protein was also present in all the investigated plants and it ranged between 2.53%-12.86%. Most of the plants possessed a high amount of crude protein except for the rhizome of *C. caesia* and the leaf of *A. paniculata*. On the other hand, *C. caesia* had the highest carbohydrate content (fig 1). Highest crude protein was found in *S. viarum* followed by *B. orellana*. The details are presented in figure 2.

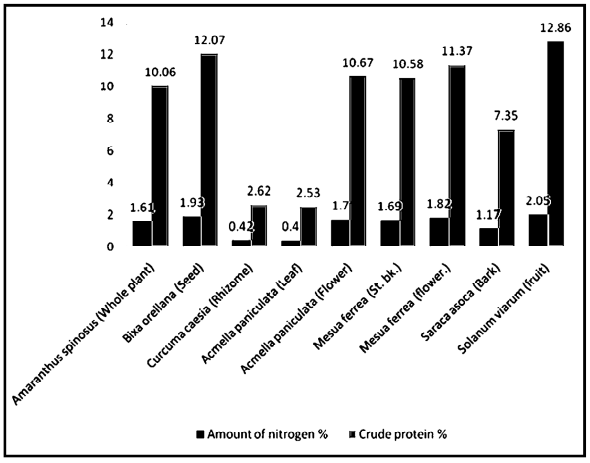

figure 2

Uses of dietary fibre are emerging in last few decades due to their potential positive effects against various health problems which leads to development of a potential market and food industry (*Chau, C.F.* and *Huang, Y.L.* 2003). The study has revealed that a good amount of crude fibre content was present in all the plants studied. The highest fibre content was in the range of 0.9% to 11.4%. Highest fibre was present in *A. paniculata* flower followed by *M. ferrea* flower and *A. paniculata* leaf. The lowest fibre content was found in *C. caesia*. The details are illustrated in figure 3.

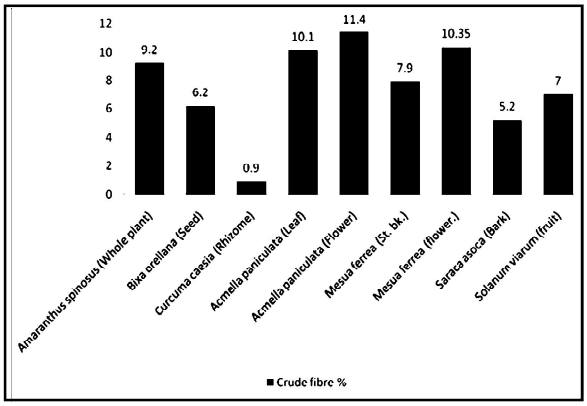

Figure 3. Graphical representation of crude fibre content in the plants used by Nyishi tribes

Diet having substantial fibre, cereals, fruits and vegetables are believed to be beneficial for a healthy life. Such diet has the potential to decrease the risk of numerous diseases due to their effect on faecal bulk enhancement, plummeting intestinal transit time, cholesterol & glycaemic levels etc. (*Beecher, GR.,* 1999 and *Mangal, et al*., 2017). Our study clearly showed that the plants used by Nyishi tribe have significant amount of nutritive potential. Further studies are required to explore other dietary nutrients like macro and micro nutrients for better understanding of the nutritional qualities of these plants.

Conclusion

The folk healers and tribes of Papum Pare district of Arunachal Pradesh are using many plants as

medicine and food. Experimental observation revealed that these medicinal plants have high nutritive value. These are rich nutritional source of Carbohydrate, Protein and Crude fibres. Nutritional analysis of such other medicinal plants is suggested for further studies because indigenous medicinal plants are the key to healthcare management for populations in remote and hilly areas of Arunachal Pradesh (Northeast, India) and other too.

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