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NUTRITIONAL EVALUATION OF THE RHIZOME OF Maranta arundinacea (L.)

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The rhizome of Maranta arundinacea (L.) has traditionally been eaten by the tribal Kanikars in Kanyakumari District. The data on the chemical composition, nutritional attributes and the anti-nutritional contents of the rhizome of Maranta arundinacea (L.) are not readily available. The proximate composition, total protein, total starch, total sugars, in vitro starch digestibility, in vitro protein digestibility and certain anti-nutritional contents of the rhizome of Maranta arundinacea (L.) have been analysed.

ANTINFLAMMATORY ACTIVITY OF Abelmoschus ficulneus

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Abelmoschus ficulneus Weight. and Arn. (Syn: Hibiscus ficulneus) Linn. is a herbaceous, prickly, annual bush, indigenous to the hotter parts of India. The flowers and dry pods of the plant have been taken up for the work and the polyphenolic constituents isolated were characterized by spectral studies such as UV, ¹H and ¹³C NMR. The isolated flavonoids were tested for anti-inflammatory activity by both in...
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15. HERBS ARE NATURAL REMEDIES FOR GOOD HEALTH

RANI VIJAYA, C. and SARADA, T.
Dept. of Zoology, Sri Parasakthi College, Courtallam.

More and more people are curing their illnesses with the herbal treatments and natural preventives that have been effectively used for thousands of years. Herbs play a significant role, especially in modern times. When the damaging effects of food processing and over medication have assumed alarming proportions. most herbs have little or no harmful side effects.

Allium sativum: Garlic has been highly valued for centuries all over the world for its health-building qualities. Hippocrates, the father of medicine (460-357 B.C.) recommended the use of this herb in infectious disease, and intestinal disorders. In herbal medicine, garlic has been traditionally used for asthma, deafness, leprosy, worms, liver and gall bladder trouble. Clinical experiments in recent times proved that garlic juice has most beneficial effect on the entire body system. In Ayurveda, a decoction of garlic boiled in milk is considered a wonderful drug for tuberculosis. It is used in the treatment of asthma, digestive disorders, high blood pressure, cancer, whooping cough, skin disorders, wounds and ulcers. It is also used both as food and seasoning agent in the preparation of soups, sauces and pickles.

Piper nigrum: Pepper is one of the oldest and most important of all spices. It is known as the King of Spices Pepper was mentioned by Theophrastis in 372 - 287 B.C. Pepper is a native of the Western Ghats of India. It is a stimulant, aromatic and digestive tonic. Pepper has a stimulating effect on the digestive organs and produces and increased flow of saliva and gastric juices. Pepper is beneficial in the treatment of cold, fever, amnesia, coughs, impotency, muscular pains and pyorrhoea.

16. HERBS THAT HEAL - NATURAL REMEDIES FOR GOOD HEALTH

SRIDEVI, T. and SARADHA, T.
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The practice of herbal medicine dates back to the very earliest periods of known human history. There is evidence of herbs having been used in the treatment of diseases and for revitalising body systems in all ancient civilizations. Plants were the mainstay of medicine and credited with mystical and supernatural powers of healing. In India, records indicate that herbs have been in use for treating diseases since ancient times.

Gingiber officinale: Ginger is a perennial herb and used as medicine in India from Vedic period. Ancient physicians used it as a carminative or anti flatulent. Ginger is widely used in local medicines in India and Far East. Ginger is available in two forms, fresh and dried. Both forms are effective. Ginger is extremely useful in the treatment of dyspepsia, vomiting, pain in stomach, cough, cold, impotency and Respiratory disorders. In western countries, it is widely used in biscuits, cakes, puddings, soups and pickles. The essential oil from the rhizomes is used in the manufacture of essence and in perfumes.

Myristica fragrans: Nutmeg is the dried kernel of the seeds of an evergreen tree. It has a strong aroma with a slightly bitter taste. The tree grows in Indonesia, Malaysia, Sri Lanka and West Indies. Nutmeg contains as essential oil and saponin. It was used in the preparations of various medicines in ancient times. It is used in the treatment of digestive disorders, insomnia, dehydration, Skin disorders, Rheumation. Nutmeg should be taken in very small doses. The ripe seeds of the fruit contains a volatile oil.

17. STUDIES ON THE WILD EDIBLE TUBERS OF KANYAKUMARDISTRICT, TAMILNADU

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Tuber crops, a cheap source of food are rich in nutrients, vitamins and minerals. They play a major role in sustaining people during famine. The Kanikkars inhabiting the forests of Kanyakumari use wild tubers for food and medicine. The wild edible plants can be used as food, raw material for extraction of starch, medicine, animal feed and manure. The Lesser known rhizomatos plants and tuberous root crops such as Maranta arundinacea, Dioscorea alata, D. bulbifera, D. oppositifolia, D. pentaphylla etc. substitute their diet as well as treat their ailments.

About 12 wild edible tubers belonging to 4 families along with their mode of treating various ailments are listed.

18. ɾɔŋpɪlɪkɛmɪkuǐ ɲʊkɪdɪmũ ɐ ámbɛn

1. ɾaŋ Gɛɾɛmɪ
2. ɾaŋ ɛmpiyɛm, ɾaŋ ɪɫɛm.
CHEMICAL ANALYSIS OF THE RHIZOME OF

MARANTA ARUNDINACEA (L.)

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ABSTRACT

The tribal Kanikkars in Kanyakumari district consume the rhizome of Maranta arundinacea (L.). The information on the chemical analysis, nutritional attributes and the anti-nutritional properties of the rhizome of Maranta arundinacea (L.) are not readily available. The proximate composition, total protein, starch, sugars, in vitro starch digestibility, in vitro protein digestibility and certain anti-nutritional properties of the rhizome of Maranta arundinacea (L.) were analysed.

The crude protein content was 13.13%, crude lipid 1.12%, crude fibre 6.48% and ash 2.10%. The rhizome was found to be a rich source of total starch. The in vitro protein digestibility and in vitro starch digestibility of the rhizome were 4.38 units and 6.12 units respectively. The anti-nutritional principles like total free phenolics, tannins, hydrogen cyanide, total oxalate, amylase inhibitor activity and trypsin inhibitor activity were also analysed.

INTRODUCTION

Tuber crops, a cheap source of food play a major role in sustaining people during famine. They accumulate starch in the enlarged underground part. One among such tuber crop accumulating starch in the underground rhizome is Maranta arundinacea commonly called Arrow root, belonging to the family Marantaceae. This plant is an erect, perennial herb, indigenous to tropical America. It has been widely distributed throughout the tropical countries like India, Srilanka and West Indies.

The rhizome contains maximum amount of starch but the rhizome are more fibrous and the starch is difficult to extract. Arrow root starch is a fine, white powder, tasteless and odourless when dry and is valued as a food for infants, invalids and convalescents. Very little information is available on the chemical composition of wild tubers and rhizomes (Karnick, 1971; Shenoy et al., 1990, Rajyalakshmi and Geervani, 1994 and Nassar, 1999).

In this context, in the present investigation, an attempt has been made to understand the chemical composition and anti-nutritional factors of the rhizome, Maranta arundinacea (L.) with a view to assess the chemical and nutritional quality.
MATERIALS AND METHODS

The rhizome of *Maranta arundinacea* (L.) were collected from Thalaikkumalay, Kanyakumari District, Tamil Nadu. Soon after collection, the rhizome were sun dried and stored.

Moisture content was determined by the method of Rajaram and Janardhanan (1990). The rhizome were powdered in Willeymill 60 mesh size and stored in screwcap bottles at room temperature for further analysis. Nitrogen content was estimated by the microkjeldahl method (Humphries, 1956) and crude protein was calculated \((\text{N}\times6.25)\). The contents of crude lipid, crude fibre and ash were estimated by AOAC (1975) methods. Nitrogen free extract (NFE) were obtained by difference (Muller and Tobin, 1980). The energy value of the rhizome was estimated (KJ) by multiplying the percentages of crude protein, crude lipid and NFE by the factors 16.7, 37.7 and 16.7 respectively (Siddhuraju et al., 1996).

The total soluble protein content of the extract was estimated by the method of Lowry *et al.*, (1951). The total starch and total sugar content were determined by the titrimetric method of Moorthy and Padmaja (2002). The *in vitro* protein digestibility and *in vitro* starch digestibility were determined by the method of Padmaja (2001).

The antinutritional compounds, total free phenolics (Bray & Thorne, 1945), tannins (Burns, 1971), oxalate (AOAC, 1984) and hydrogen cyanide (Jackson, 1967), amylase inhibitor activity (Rekha and Padmaja, 2002) and trypsin inhibitor activity (Sasikiran and Padmaja, 2003) were quantified.

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of the rhizome of *Maranta arundinacea*. The results obtained in this study broadly agree with the data from elsewhere (Coursey 1967, Vimala 1995). The moisture content although considerably high the rhizome can be used effectively after drying and purifying. The crude protein content is somewhat similar to that of other tubers, *Dioscorea* species (St.Vincent 1887, Rajyalakshmi and Geervani 1994 and Coursey, 1967). The calorific value indicates that people of all age can consume it as their food.

The soluble protein, starch, total sugar content,, *in vitro* protein digestibility and *in vitro* starch digestibility of the rhizome of *Maranta arundinacea* are given in table 2. Arrow root cannot contribute sufficiently to the recommended daily protein requirement of 23 to 56 g (National Research Council, 1974), but it supplies almost pure starch. The total starch content is found to be higher than that of the tubers like *Dioscorea oppositifolia*, *D. bulbifera*, *D. pentaphylla* and *D. hispida* (Rajyalakshmi and Geervani, 1994); *Amorphophallus campanulatus* (Parkinson, 1984) and *Ipomoea batatus* (Truong *et al.*, 1986).

The total sugar content of the investigated rhizome was relatively lower than other tubers like *Ipomoea batatus* (AVRDC, 1983); *Colocasia esculenta* (Yamashite and Yoshikawa, 1973) and *Manihot esculentum* (Ketiku and Oyenuga, 1970). The *in vitro* starch digestibility is found to be lower than the other tubers like *Dioscorea oppositifolia*, *D. bulbifera*, *D. pentaphylla* and *D. hispida* (Rajyalakshmi and Geervani, 1994).
The protein quality is affected by factors that interact with the intestinal tract such as protease inhibitors, phytate, lectins, tannins and saponins that reduce protein digestibility and amino acid absorption. These substances unless destroyed by heat or by some other suitable treatment can exert adverse physiological effects when ingested by man and animals (Liener, 1994).

On the contrary, it has been suggested that consumption of low levels of certain anti-nutrients may produce health benefits while avoiding some of the adverse effects associated with their large intake (Thompson, 1988). In view of this, in the present investigation an attempt has been made to detect the presence of certain anti-nutritional factors such as total free phenolics, tannins, total oxalate, hydrogen cyanide, trypsin inhibitor activity and amylase inhibitor activity (Table 3).

The content of total free phenolics of *Maranta arundinacea* appears to be lower than the earlier reports in the tubers of *Ipomoea batatas* (Adelusi and Ogundana, 1987); *Dioscorea esculenta*, *D. alata*, *D. rotundata* (Babu et al., 1990); Sundaeresañ et al. (1990) and *Manihot esculenta* (Babu et al., 1990). The investigated rhizome contain less tannin when compared with other earlier reports in the tubers of *Dioscorea alata*, *D. cayenensis*, *D. rotundata* and *D. esculenta* (Udoessien and Ifon, 1992). The hydrogen cyanide level is found to be lower when compared with the earliest results obtained in the tubers of *Manihot utilissima* and *M. palmata* (Oke, 1975), *M. esculenta* (Nambisan and Sundaeresañ, 1990) and in the tubers of *Dioscorea alata*, *D. cayenensis*, *D. rotundata* and *D. esculenta* (Udoessien and Ifon, 1992).

The level of total oxalate in the rhizome of *Maranta arundinacea* is very low when compared with the level in the Yam species like *Dioscorea alata*, *D. cayenensis*, *D. rotundata* and *D. esculenta* (Esuabana, 1982). \(\alpha\)-amylase occurs widely in plant and animal kingdom. Inhibitors of these enzymes are implicated to have a major role in the regulation of plant metabolism, animal digestion of carbohydrate and insect resistance mechanism of plants. The \(\alpha\)-amylase inhibitor content is lower in the analysed rhizome than the other *Dioscorea* species like *D. oppositifolia*, *D. bulbifera*, *D. pentaphylla* and *D. hispida* (Rajyalakshmi and Geervani, 1994).

Trypsin inhibitor activity was low when compared with other species like *Dioscorea alata*, *D. rotundata* and *D. esculenta* (Sasikiran et al., 1999).

A trypsin inhibitor with low molecular weight capable of inhibiting trypsin, \(\alpha\)-chymotrypsin and enterokinase has been reported from arrowroot by Rao et al. (1983).

Based on the above findings, rhizome of arrowroot are reported as a good source of starch, protein, sugar and fibre and they are capable of making valuable contributions to human diet in their areas of production. As all the anti-nutritional compounds are found only in a low level in this rhizome it can be recommended to both rural and urban people for its wide utilization.

**ACKNOWLEDGEMENT**

The author wishes to express her sincere thanks to Dr.S.Edison, Director, CTCRI, Sreekariyam, Thiruvananthapuram, and Dr.G.Padmaja, Head, Division of Crop Utilization, CTCRI for offering training in their institute.
Table 1: Proximate composition of the rhizome of *Maranta arundinacea*<sup>a</sup>

<table>
<thead>
<tr>
<th>Components</th>
<th>g/100 g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>78.08</td>
</tr>
<tr>
<td>Crude protein (Kjeldhal Nx6.25)</td>
<td>13.13</td>
</tr>
<tr>
<td>Crude lipid</td>
<td>1.12</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>6.48</td>
</tr>
<tr>
<td>Ash</td>
<td>2.10</td>
</tr>
<tr>
<td>NFE (Nitrogen free extract)</td>
<td>77.17</td>
</tr>
<tr>
<td>Calorific value (KJ100⁻¹ DM)</td>
<td>1550.23</td>
</tr>
</tbody>
</table>

<sup>a</sup>Mean of triplicate determinations expressed on dry weight basis.

Table 2: Soluble protein, starch, total sugars, *in vitro* protein digestibility and *in vitro* starch digestibility of the rhizome of *Maranta arundinacea*<sup>a</sup>

<table>
<thead>
<tr>
<th>Components</th>
<th>g/100 g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soluble protein</td>
<td>1.242</td>
</tr>
<tr>
<td>Starch</td>
<td>64.29</td>
</tr>
<tr>
<td>Total sugars</td>
<td>3.27</td>
</tr>
<tr>
<td><em>Invitro</em> protein digestibility units*</td>
<td>4.38</td>
</tr>
<tr>
<td><em>Invitro</em> starch digestibility units**</td>
<td>6.11</td>
</tr>
</tbody>
</table>

<sup>a</sup>-Mean of triplicate determinations expressed on dry weight basis.

* 1 Unit = g aminoacid released per 100g tuber (DM basis)

** 1 Unit = mg reducing groups /hr /g sample

Table 3: Antinutritional factors of the rhizome of *Maranta arundinacea*<sup>a</sup>

<table>
<thead>
<tr>
<th>Components</th>
<th>g/100 g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total free phenolics</td>
<td>0.09</td>
</tr>
<tr>
<td>Tannins</td>
<td>0.76</td>
</tr>
<tr>
<td>Oxalate</td>
<td>0.43</td>
</tr>
<tr>
<td>Cyanogens (mg/100 g)</td>
<td>0.05</td>
</tr>
<tr>
<td>Amylase inhibitor activity AIU/g soluble protein</td>
<td>1.69</td>
</tr>
<tr>
<td>Trypsin inhibitor activity TIU/g soluble protein</td>
<td>4.40</td>
</tr>
</tbody>
</table>

<sup>a</sup> - Mean of triplicate determinations expressed on dry weight basis.
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PC/P1

Chemical composition and nutritive value of tannia (Xanthosoma sagittifolium (L.) Schott.)

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The corms of tannia, Xanthosoma sagittifolium (L.) Schott., are rich in calories and nutrients and hence play a major role in sustaining people during famine and also as a vegetable in the daily dietary regime of many Indians. The corms and cormels of tannia have traditionally been eaten by the tribal Kanikkars in Kanyakumari District. The proximate components viz., total protein, starch, sugars, in vitro starch digestibility and in vitro protein digestibility and certain anti-nutritional components of the corm of Xanthosoma sagittifolium were analysed. The crude protein content was 8.75%, crude lipid 7.42%, crude fibre 7.48% and ash 4.53%. The corms were found to be a rich source of total starch. The in vitro protein digestibility (IVPD units) and in vitro starch digestibility (IVSD units) of the corm were 5.09 units and 118.94 units, respectively. The anti-nutritional principles like total free phenols, tannins, hydrogen cyanide, total oxalate, amylase inhibitor activity and trypsin inhibitor activity were also analysed.

PC/P2

Pharmacological properties of Amorphophallus paeoniifolius

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Amorphophallus paeoniifolius is a tuber crop which is used in indigenous medicine for the treatment of inflammatory conditions, haemmorhoids and rheumatism. The pharmacological properties of tuber extracts from wild Amorphophallus were examined for anti-microbial, anti-inflammatory, analgesic and antioxidant activity. Antimicrobial activity was tested against six bacterial and two fungal strains. Acetone and ethanolic extracts inhibited all bacterial