Research Article

PROXIMATE BIO-CHEMICAL AND NUTRITIVE COMPOSITION IN LOCAL GENOTYPES OF PRUNUS TRIFLORA OF MANIPUR, INDIA

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ABSTRACT

The North-East state Manipur, India is a powerhouse of many wild flora and fauna. Varied ranges of wild edible Prunus triflora genotypes commonly known as plum are found in valley and hill districts of the region. Each fruit has distinctive physiological habitat and geographical characteristic. However, to the best of our knowledge no biochemical evaluation has been carried out of these fruits from this region. Four populations of wild Prunus triflora genotypes (Imphal kalenhaikha, Senapati maohickha, Ukhrul applenix, Ukhrul mangomix) were selected as source for study to estimate bio-chemical contents using standard protocols. The selected site differed in respect to their altitudes ranging from 750 -2740 m above msl. Proximate analysis revealed that the Prunus triflora genotype of Senapati maohickha have highest amount of total soluble sugar, reducing sugar, total soluble protein and antioxidant activity of 34.67 ± 0.65 mg/100g, 23.65±2.22 mg/100g, 5.66±0.23 mg/100g, 1.6±0.8 mg/100g, respectively. While the genotype of Ukhrul applenix showed high value of 16.51± 5.9 mg/100g non-reducing sugar. Ascorbic acid content was highest in Imphal kalenhaikha having 13.19±0.9 mg/100g of fresh weight among the genotypes. Significant correlation was achieved between ascorbic acid and antioxidant activity in all the genotypes. Our study showed that wild Prunus triflora is a potential source of nutrition and a food containing health-giving additives like functional food. Therefore, popularizing and bringing into mainstream cultivation of these fruit need initiation.

Keywords: Prunus triflora, biochemical contents, districts, Manipur

INTRODUCTION

Prunus triflora generally known as plum are rich and good source of sugar, carotene, good source of fiber, essential vitamins, and minerals and low in fat. It is a delicious juicy fruit prized both for its exquisite fresh fruit flavor and in the fruit preservation industry for preparation of jam, chutney, salad, pie, fruit cake and drinks. Dried forms of plums are known as Prunes and are high in antioxidant content. Consumption of plums help in the production and absorption of iron in body, which lead to growth of healthy tissues, prevent muscular degeneration and any other infection of the eye in the long run 1. Manipur, one of the states in North-East India has two distinct topographical zones namely hill and valley regions. The state is endowed with rich biodiversity having many wild flora and fauna belonging to different families. Prunus triflora commonly known as plum are locally known as kalenhaikha in Imphal valley, Maohickha in Senapati and Mangomix and Applenix in Ukhrul hill districts. They are widely available in both natural habitat and home garden in different districts having varied range of elevation. The Imphal valley having 750 m above mean sea level (msl) represents a sub-tropical humid climate with temperature ranging from 0°C to 36°C. The Prunus triflora genotype found in the Imphal valley have different color skin and fruit size types viz. red, green, yellow and small in size. Among them, the red color skin and small size type is favored by the people. Senapati hill district located in the northern part of Manipur has altitude ranging from 1061 to 1788 m above msl. The district has sub-tropical to temperate type of climate with temperature ranging from a minimum of 3.36°C to maximum of 34.14°C. The genotype found in this district is locally known as Maohickha and red in color with large fruit size. Ukhrul hill district located at an elevation ranging from 388 to 2740 m above msl is adjacent to Myanmar. The district has sub-tropical monsoon type to alpine type with average annual temperature varying from 3°C to 30°C. Two types of Prunus triflora genotype namely Applenix and Mangomix are found in the district. The Applenix has red color skin type while Mangomix has yellow color skin type in both flesh and skin. The people of Manipur consume these fruits unaware of its rich nutritional values. There is no proper orchard for modern cultivation and post harvest technology for unification of these wild fruits, making in such circumstances the importance of these fruits having incredible potential are left in the mercy of nature. Until now no work has been done to study the biochemical parameters of these wild Prunus triflora genotypes of Manipur. Thus, the present investigation represents nutritional screening of these wild Prunus triflora which can be popularized as dietary supplements or functional food. Further, this information will be beneficial to promote propagation and utilization of the fruit in Manipur, India in near future.

MATERIALS AND METHODS

The handpicked, matured and healthy fruits of uniform size, free from pest and diseases, bruises and blemishes were selected from different districts of Manipur. The experiment was conducted in the Plant Physiology laboratory of the Department of Life Sciences, Manipur Central University, Canchipur, Manipur during 2009-11.
Method of fruits collection:
1. All the fruit samples were harvested at matured stage from different districts of Manipur growing naturally.
2. Same fruit samples were used from the respective fruit plant during the course of study.

The ascorbic acid (Vitamin C) content was estimated titrimetrically using 2,6-dichlorophenol indophenol (2,6-DPIP) dye method from fresh fruits samples. Ascorbic acid content was calculated as (mg/100g) edible portion. The antioxidant activity was examined by using the chemical assays of DPPH using ascorbic acid as standard. The reaction mixture consisted of .004 % DPPH methanol with 50-250 µg/mL of the fruits extracts in methanol was incubated for 30 min at dark at 37°C and absorbance was read against a blank at 517 nm. Percentage inhibition was determined by comparison with a methanol treated control group. The percentage of DPPH decoloration was calculated as follows:

\[
\text{Percentage DPPH decoloration} = \left(1 - \frac{\text{O.D. Sample}}{\text{O.D. Control}}\right) \times 100
\]

The degree of decoloration indicates the free radical scavenging efficiency of the fruits and the IC\textsubscript{50} value shows the potential of antioxidant activity which was correlated by plotting graph of concentration sample vs percentage of DPPH inhibition. Method of \textsuperscript{5,6} were used for estimation of total soluble sugar, reducing sugar and non-reducing sugar. The total soluble protein was estimated using Lowery et al., 1951\textsuperscript{7}. All the above experiments were repeated three times and expressed as a means of three determinations. Correlation coefficient analysis between vitamin C and antioxidant activity was done with Pearson Correlation Coefficient. Statistical analysis was conducted using SPSS version 12.0.

### Table 1: Proximate biochemical profile and Correlation analysis of Prunus triflora genotypes from different districts of Manipur

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Samples genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imphal kaleheikha</td>
</tr>
<tr>
<td>Antioxidant activity IC\textsubscript{50} mg/ml</td>
<td>1192.8±3.9\textsuperscript{a}</td>
</tr>
<tr>
<td>Vitamin C mg/100g FW</td>
<td>13.19±0.9\textsuperscript{a}</td>
</tr>
<tr>
<td>Total soluble sugar mg/100g</td>
<td>6.63±0.43\textsuperscript{a}</td>
</tr>
<tr>
<td>Reducing sugar mg/100g</td>
<td>1.05±0.23\textsuperscript{a}</td>
</tr>
<tr>
<td>Non-reducing sugar mg/100g</td>
<td>5.42±0.41\textsuperscript{a}</td>
</tr>
<tr>
<td>Protein mg/100g</td>
<td>4.45±0.39\textsuperscript{a}</td>
</tr>
<tr>
<td>Correlation coefficient between vitamin C and antioxidant activity (p&lt;0.05)</td>
<td>-0.633</td>
</tr>
</tbody>
</table>

Here, FW-fresh weight and all values are means ± SD of triplicate of three biological samples and different superscript in column differ significantly at (p<0.05) level.

### Table 2: Geographical location and physical characteristic of wild Prunus triflora of Manipur

<table>
<thead>
<tr>
<th>Districts</th>
<th>Local name</th>
<th>Elevation (MSL)</th>
<th>Fruit colour</th>
<th>Fruit size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imphal valley</td>
<td>Kaleheikha</td>
<td>750</td>
<td>Red</td>
<td>Small</td>
</tr>
<tr>
<td>Senapati hill</td>
<td>Maoheikha</td>
<td>1061-1788</td>
<td>Red</td>
<td>Large</td>
</tr>
<tr>
<td>Ukhrul hill</td>
<td>Applemix</td>
<td>388-2740</td>
<td>Red</td>
<td>Medium-large</td>
</tr>
<tr>
<td>Ukhrul hill</td>
<td>Mangomix</td>
<td>388-2740</td>
<td>Yellow</td>
<td>Medium-large</td>
</tr>
</tbody>
</table>

Figure 1: Morphological characteristics of different genotypes of Prunus triflora found in valley and hills districts of Manipur. (a)Imphal valley Prunus triflora locally known Kaleheikha (b) Senapati Prunus triflora locally known Maoheikha (c) Ukhrul Prunus triflora locally known Applemix; (d) Ukhrul Prunus triflora locally known Mangomix
RESULTS AND DISCUSSION

The four populations selected for bio-chemical evaluation of Prunus triflora genotypes are illustrated in Table I, and geographical and morphological characteristic in Table II and Fig.1. Study sites from the region are depicted in Figure 2. From our investigation the highest bio-chemical composition was found in wild Prunus triflora genotype of Senapati maohieika than the other three Prunus triflora viz. Imphal kalenheikha, Ukhrl applemix and mangomix. The fruit of Senapati maohieika were found to have 34.67mg/100g, 23.65mg/100g, 5.66mg/100g and IC50666.3μg/ml of total sugar, reducing sugar, and protein and antioxidant activity respectively. In non-reducing sugar, Ukhrl applemix has showed higher value of 16.51mg/100g followed by Senapati maohieika genotype having 10.97mg/100g. While ascorbic acid content was high in genotype of Imphal Kalenheikha having 13.19 mg /100g followed by Senapati Maohieika having 13.03mg/100g of fresh weight. Significant correlationship (p<0.05) between vitamin C and antioxidant activity was observed in Ukhrl applemix and Imphal kalenheikha genotypes with r = -0.695 and -0.633 while moderate correlationship was obtained in Senapati maohieika and Ukhrl mangomix. The experimental findings of Manipur wild Prunus triflora genotypes growing in different altitude exemplify potent amount of vitamin C content in Imphal Kalenheikha and Senapati Maohieika as wild plum species plants grown at higher altitude are tolerant to extremes heat, cold, alkaline soils and drought9. As matured fruit sample has been selected for the vitamin C analysis there might be the possibility of more vitamin C synthesized in both the genotypes as ascorbic acid content (AAC) also increases as the fruit ripens which is due to the breakdown of starch to glucose that is used in the bio-synthesis of glucose (-6-) phosphate10,11,12. The higher amount of vitamin C content in Imphal kalenheikha genetic material from remaining genotypes might also be the result of perpetual synthesis of vitamin C from its precursor till the development of chocolate tint colour on the ground surface of fruit13. Primary antioxidant properties are generally measured by DPPH assay (expressed as IC50). The (IC50) values are defined as the concentration of the extracts causing 50% inhibition of absorbance. The degree of discoloration in the assay indicates the scavenging potential of the sample antioxidant resulting in a decrease in absorbance at 517nm14. From the investigation, the same reflection was obtained in Senapati Maohieika genetic material resulting lower IC50 value 666.7 μg/ml among the genotypes. Hence, the more rapidly the absorbance decreases, more potent the antioxidant activity of the extract15. These may also be attributed to the essence of DPPH assay that the antioxidant reacts with the stable free 1, 1-Diphenyl-2-picrylhydrazyl (deep violet color) and converts it to 1, 1-Diphenyl-2-picrylhydrazine with a yellow color. It is known that fruit ripening continues after harvest and this process leads to significant changes in the contents of the antioxidant10, thereby opting Senapati Maohiheika of potential antioxidant source. Very less antioxidant activity was depicted in Impal Kalenheikha and Ukhrl Applemix and Mangomix genotypes. It may be because this fruits do not have a potent primary antioxidant. Ascorbic acid (Vitamin C) the most well known antioxidant, is an important molecule in plant tissues to protect plants against oxidative damage resulting from the oxidant metabolites of photosynthesis, aerobic processes and substance responsible for antioxidant activity16,17. In our finding from the four wild plum genotypes, significant correlationship was obtained in Ukhrl Applemix and Impal Kalenheikha with ‘r’ value as -0.695, and -0.633 respectively indicating high relationship between vitamin C and antioxidant activity. A reasonable amount of ascorbic acid present in Senapati Maohieika and Ukhrl Mangomix resulted in moderate correlation ship with ‘r’ values as -0.579 and -0.5 which may be attributed to the presence of some other antioxidants phytochemicals18. But the relationship obtained in all the genotypes is comparatively high then those observed in cornelian cherry (Cornus mas L.) having (r = 0.322 and r = 0.316)19 which can be suggested that the vitamin C present in this genotypes might have an active role in their antioxidant property. The red skin Senapati Maohiheika genetic material (Fig.1) has the maximum amount of total soluble sugar followed by the red color skin type of Ukhrl Applemix. High amount of sugar content in Senapati Maohiheika fruits might be attributed to translocation of photosynthates from leaves to fruits and hydrolysis of starch into simple sugars and conversion of acids into sugars too7. These findings are in close conformity with the results reported in plum20. Sugars in fruits almost invariably increased in amount due to hydrolysis of polysaccharides21. High content of reducing sugar in Senapati Maohiheika genotype
could be in accordance with the finding that the reducing sugars continued to increase throughout the development of plum fruit and that increase in content of reducing sugar was gradual throughout the development period of plum fruit. The level of non-reducing sugars was found to be the maximum in Ukhrul Applexim genetic material. This might be due to translocation of sugar from leaves to the fruit. Similar finding was observed in peaches.

Normal ripening of pome fruits is a highly coordinated process of biochemical differentiation involving directed protein synthesis and suggested that the protein synthesized early in the ripening process are in fact enzymes required for the ripening. This is revealed in our finding showing higher soluble protein content in Senapati Maoheikha genotype with 5.66 mg/100g which confirms to the speculation that the increase in protein content may be the result of synthesis of specific enzyme involved in the ripening processes. The plum found in remaining districts genotypes also showed reasonable amount of total protein contents having 5.41mg/100g, 4.45 mg/100g, and 3.41 mg/100g in Ukhrul Applexim, Imphal Kalaheikha and Ukhrul Mangomix, respectively. Thus, the information related to the significant variability of these bio-chemicals indicated different nutritive values among the wild Prunus triflora genotypes as observed in the present studies found in Manipur. However, to the best of our knowledge no study has been carried out in nutritional profiling of these different plum fruits from the region. Further, utilization in the breeding program so as to develop plum genotypes with higher nutritional potential according to different target habitat is encouraging. Over and above, these fruits will be of beneficial priority as they possessrich sources of nutritive values from the present study and commercialization initiated.

REFERENCES


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