Identification and Characterization of the Nutritional as Well as Anti-Nutritional Components of Minor Fruits

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Introduction

Jammu & Kashmir has typical temperate climate which makes it suitable for production of fruits and vegetables. There are some minor fruits and vegetables which are still underutilized. The minor fruits taken up during the current study were Cherry (Prunus avium) and Quince (Cydonia oblonga). The minor vegetables taken up during the current study were Madaan Handh (Taraxacum officinale) and Sustchal (Malva neglecta).

Material and Methods

The minor fruits (Cherry & Quince) and vegetable (Handh & Sustchal) were collected from their growing centres during their ripening periods. The extraction process was carried out in different solvents (Methanol, Ethanol, Acetone & Water) and at different temperatures (40, 50, 60°C). Proximate composition, nutritional composition and antioxidant potential of the selected minor fruits and vegetables were evaluated.

Antioxidant potential of the selected minor fruits and vegetables were determined by using methods like ABTS, FRAP, CUPRAC & DPPH using standard protocols for their determination. For ABTS assay, the procedure followed the method of Arnao et al. [1] with some modifications. The DPPH assay was done according to the method of Brand-Williams et al. [2] with some modifications. The FRAP assay was done according to Benzie and Strain [3] with some modifications. The CUPRAC assay was done according to Resat et al. Phytochemicals like total phenol content (TPC), total flavonoid content (TFC), β- Carotene concentration, ascorbic acid concentration & tannin concentration were also determined by following standard protocols. The total phenol content (TPC) was determined by Folin & Ciocalteu reagent method. The total flavonoid content (TFC) was determined by aluminum chloride Colorimetric method [4]. The tannin content was determined by Folin and Ciocalteu method. The ascorbic acid content was determined according to method of Klein and Perry [5]. The β- carotene concentration was determined according to method of Nagata and Yamashita [6].

Results & Discussion

Handh, sustchal, quince and cherry extracts were found to be effective in scavenging radicals in different solvents. The antioxidant activities against ABTS were correlated with the concentration, chemical structures and polymerization degrees of antioxidants [7,8].

The differences in total phenolic compound content may be due to the different polarity of the organic solvents used and their mixtures, which selectively extract individual phenol compound [9]. The difference in the polyphenolic content of plant fruits is due to the different genotype, habitat conditions and ripeness of the fruits reported by Orhan et al., [10] and also found the other factors such as altitude, light, temperature and content of nutritive matter in the soil, can influence phenylpropanoid metabolism. Increased temperature promotes solvent extraction by enhancing both diffusion coefficients and the solubility of polyphenol content. Increase in solubility of polyphenol contents was also reported by Wang et al. [11], who found increasing temperature favored the release of bound polyphenol in a sample with the breakdown of cellular constituents of plant cells which leads to increased cell membrane permeability. Addition of water is known to cause the plant material to swell there by allowing the solvent to penetrate more easily in the solid matrix and increase extractability. Although it is not an easy task to select a unique solvent for the analysis of a diverse group of phenolics due to vastly varying chemical structures, and to different conditions in isomerization and hydrolysis, alcoholic extraction (using MeOH or EtOH) has been the usual approach to handling solid samples [12]. A minimum of 70% methanol has
been reported to in activate polyphenol oxidases, which are widely distributed in plants, and to allow maximum recovery of flavonoids, such as monomeric flavan-3-ols (catechin or epicatechin).

This study showed that *Taraxacum officinale* and *Cydonia oblonga* contain high percentage of carbohydrate which makes it a good source of human energy. The ABTS, DPPH, FRAP and CUPRAC assays gave comparable results for the antioxidant activity measured in different solvent extracts of *Prunus avium*, *Cydonia oblonga*, *Taraxacum officinale* and *Malva neglecta* extracts. The various assays showed high reproducibility, were simple, rapidly performed and showed the highest correlation with both ascorbic acid and total phenolic. Therefore, it would be appropriate technique for determining antinutrient activity in these minor fruits and vegetables. Ascorbic acid and phenolic are the major contributors to antinutrient activity in fruits. *Taraxacum officinale* is important source of cichoric acid with potential application as radical scavengers and metal reducing activity. Therefore, this complex of biologically active substance offers many future applications in field of herbal medicine and nutrition for production of healthy food with well pronounced healthy effect.

Anti-nutritional factors (ANFs) are compounds which reduce the nutrient utilization or food intake of plants or plant products used as human foods or animal feeds and they play a vital role in determining the use of plants for humans and animals. They are defined as those substances generated in natural food stuffs by the normal metabolism of species and by different mechanisms which exert effects contrary to optimum nutrition. Antinutritional factors were determined in the selected minor fruits and vegetables by various methods. The various antinutritional factors present in the selected fruits and vegetables were oxalates, phytates, saponins, tanins, total polyphenols and trypsin inhibitor units. Oxalates were determined by Abaza et al [13], phytates by Davies and Reid [14], Tanins by Folin-Ciocalteu method [15], total polyphenols by Swain and Hills (1959), saponins by Edeoga et al [16] and trypsin inhibitor units by Hajela et al [17]. The antinutritional factors present in these minor fruits and vegetables generally bind to various mineral elements and components of body leading to numerous side effects on bodies of human beings. According to Ladeji [18], oxalate can bind calcium present in food thereby rendering calcium unavailable for normal physiological and biochemical role like maintenance of strong bones, teeth, cofactor in enzymatic reaction, nerve impulse transmission and blood clotting process in the blood. According to Oke (1966), a phytate diet of 1-6% over long period decreases bioavailability of mineral elements in gastric animals. Phytic acid can bind to mineral elements such as zinc, manganese, iron and magnesium to form complexes that are indigestible thereby decreasing the bioavailability of these elements for digestion. High saponin level has been associated with gastroenteritis manifested by diarrhoea and dysentery [19]. Though most of the fruits possess low tannin levels, it imposes an astringent taste that affects palatability, reduces food intake and consequently body growth. It also binds to the both exogenous and endogenous proteins including enzymes of the digestive tract thereby by affecting the utilization of protein [20,21]. Though all the selected minor fruits and vegetables contain these types of analyzed antinutrients, they are highly recommended for consumption.

The selected minor fruits and vegetables have tremendous potential but yet not fully exploited to contribute to food security and poverty alleviation. Their nutritive value is high but the utilization is limited due to the presence of antinutritional factors. In order to increase their nutritive value, the antinutrients are to be eliminated or the antinutrients are neutralized by various methods. There are various methods for the elimination or neutralization of antinutrients like blanching, processing methods, chemical treatments, extrusion processes, gamma ray irradiations and ionizing radiations. Blanching, chemical and gamma ray irradiation treatments were used for the neutralization or elimination of the determined antinutrients. It was found that the antinutrients were neutralized to a greater extent by the used methods.

High performance liquid chromatography (HPLC) was also performed on the extract samples of the selected minor fruits and vegetables in order to characterize them intern of chemical and technico-functional characteristics. Chromatography of solutions of standards and test solutions were performed by using HPLC. The test samples were correlated with the standards and showed good correlation among themselves. The test samples showed abundant number of peaks in their chromatograms confirming the presence of different types of compounds present in these plants. The various compounds found in these fruits and vegetables were chlorogenic acid, p-coumaric acid, ferulic acid, vanillic acid, chicoric acid, catechin, gallic acid, caffeic acid, cyaniding-3-glucoside, epicatechin, hydroxycinnamic acid, etc. Quantification of various compounds identified in the selected minor fruits and vegetables was achieved by the absorbance recorded in the chromatograms relative to external standards. The correlation showed good results and the compounds were identified and characterized.

*Taraxacum* has been used for centuries as a traditional medicine in the relief and treatment of several diseases. This is due to the presence of sesquiterpenes, saponins, phenolic compounds, flavonoids and sugars. It can be used as diuretic, antioxidant, chologogue, antibiotic, choleretic, angiogenic and anti-carcinogen. The identification of choline in *Taraxacum* roots is related to its action as anti-cancer agent [22]. The use of *Taraxacum* as a source of bioactive compounds is still underestimated and the efforts are still going on for obtaining its medicinal phytochemical investigation to the maximum extent.

**Conclusion**

The study revealed that there is a significant difference (*P < 0.05*) in the proximate and mineral compositions of minor fruits and vegetables. The most remarkable finding of this study is that these indigenous minor fruits and vegetable were found to be a potent source of vital nutrients like crude fiber, ash, calcium, and iron and can be recommended as a remedy to alleviate malnutrition in the country. Interestingly, the high antioxidant potency of these minor fruits implies the potential of this plant as an alternative source of natural antioxidants and therefore, its cultivation and consumption is encouraged as additional source of minerals to the diet of the indigenous people. Therefore, these minor fruits and vegetables can be employed in fortification, formulation and supplementation of other food materials.

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**References**


