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Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.elsevier.com/locate/apjtb

Original article http://dx.doi.org/10.1016/j.apjtb.2015.11.004

Nutritional quality and safety aspects of wild vegetables consume in Bangladesh

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ARTICLE INFO

Article history:
Received 14 Sep 2015
Received in revised form 14 Oct 2015
Accepted 5 Nov 2015
Available online 18 Dec 2015

Keywords:
Wild vegetables
Nutritional quality
Mineral contents
Heavy metals
Safety aspects

ABSTRACT

Objective: To evaluate the nutritional composition, including major minerals, essential trace elements and toxic heavy metals of five different wild vegetables Dhekishak (*Dryopteris filix-mas*), Helencha (*Enhydra fluctuans*), Kalmishak (*Ipomoea aquatica*), Patshak (*Corchorus capsularis*) and Shapla stem (*Nymphaea stellata*) and their safety aspects.

Methods: Proximate parameters moisture, ash, fat, fiber, protein, carbohydrate and energy; major minerals Na, K, Ca and Mg; trace elements Fe, Zn and Cu; and toxic heavy metals Pb, Cd, Cr, Ni and Hg were evaluated in the selected wild vegetables using the standard food analysis techniques.

Results: The results from nutritional analysis showed that all the wild vegetables used in this study had a low content of crude fat and high content of moisture, ash, crude protein, crude fiber, carbohydrate and energy having the recommended dietary allowances. The vegetables were also rich in major minerals Na, K, Ca and Mg, sufficient in essential trace elements Fe, Cu and Zn while the heavy metals Pb, Cr and Ni were detected higher in amount in all the vegetables except Patshak than the limits recommended by Food and Agriculture Organization/World Health Organization. The heavy metals Cd and Hg were not detected in any vegetable.

Conclusions: The outcome of this study suggests that the wild vegetables have very good nutritional potential to meet the recommended dietary allowances, but special awareness should be taken for public health concern about the high level of Pb, Cr and Ni which exceed the Food and Agriculture Organization/World Health Organization recommended limits for the metals in vegetables.

1. Introduction

Vegetables are the fresh and edible parts of herbaceous plants. It may include roots, stems, leaves, fruits or seeds of the plants that can be eaten as raw and/or cooked form. Vegetables are a major part of daily food intake by human with their main dishes all over the world. It is the cheapest and most readily available source of foods that can contribute significantly to human nutrition and health. It is well known for their essential biochemicals and nutritional importance as they contained good amounts of proteins, fats, carbohydrates, vitamins and minerals [1,2]. Besides these, moisture, fiber, ash and energy provided by individual vegetable are important for good health and prevention of diseases. It plays an important role in the balanced diet and advised to intake more that may reduce the risk of diseases like cancer, coronary heart attack, diabetes, *etc.* [3,4]. The traditional wild vegetables have also some medicinal value like antibacterial and anticancer activity, which makes it a valuable addition to the diet [5].

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Peer review under responsibility of Hainan Medical University. The journal implements double-blind peer review practiced by specially invited international editorial board members.

Foundation project: Supported by Bangladesh Council of Scientific and Industrial Research (BCSIR) with the approved No. 1766(F).

The nutritional status of Bangladesh is quite alarming with a great number of populations suffering from malnutrition. The household consumption survey showed that the average per capita consumption of vegetable in Bangladesh is about 166 g, well below the minimum level of 200 g [6]. The extent of micronutrient deficiency in Bangladesh is far greater than energy malnutrition. About 60% of the total populations suffer from various micronutrient deficiencies, which is increasingly recognized as the cause of serious health problems. Vegetables are the major part of daily food intake by human population all over the world that play an important role in the diet and make it balanced. Green leafy vegetables are excellent sources of micronutrients, so the consumption of these may contribute to meet the nutritional requirement and to overcome the micronutrient deficiency at minimum cost [2,7]. However, these vegetables contain both essential and toxic metals over a wide range of concentration, and have several toxicological effects on the human body [8].

In recent decades, a resurgence of interest has focused on wild edible plants for their nutritional and medicinal values to broaden the diversity of the human diet [9,10]. In many developing countries, rural or tribal people traditionally harvesting a wide number of wild vegetables without any cultivation due to cultural uses, taste habits or food shortage [11]. Nowadays wild vegetables have become a commercial crop with increasing market potential due to their nutritional importance, absence of residues from pesticides or fertilizers [12]. A lot of work has been done on the nutritional composition, functional properties, and toxic heavy metal contents of various types of edible vegetables [13–16]. Many wild vegetables are also traditionally using with staple food in both urban and rural areas of Bangladesh. The wild vegetables traditionally used as food that enhance the taste and color of the diets but scientific data on the nutrients and chemical composition of those wild vegetables still unknown in our country, and people do not have adequate knowledge on whether those are beneficial or not and have any toxic effect or not. Food safety is a major public concern nowadays. Considering the potential toxicity, persistent nature and cumulative behavior of heavy metals, frequent consumption of wild vegetables, safety aspect of foods and the awareness of the people, much research work is still needed to be done on wild vegetables grown in Bangladesh. Thus the study was designed to analyze the nutritional composition, minerals content and toxic heavy metals of the traditionally used wild vegetables available in the city markets of Bangladesh that is a public health concern about the safety aspects.

2. Materials and methods

2.1. Collection of wild vegetables

Certain commonly consumed wild vegetables were collected from different locations of the city markets, Bangladesh. The unedible portions of the vegetables were removed prior to analysis and a composite sample was prepared. The details of the wild vegetable species, local names and parts of vegetables used for analysis were shown in Table 1.

2.2. Sample preparation

The freshly collected raw vegetables were washed up with tap water thoroughly to remove the attached dust particles, soil, unicellular algae, *etc*. Then they were washed with distilled water and finally with deionized water. The washed vegetables were dried with blotting paper followed by filter paper at room temperature to remove surface water. The vegetables were immediately kept in desiccators to avoid further evaporation of moisture from the materials. After that the vegetables were chopped into small pieces they were oven dried at (55 ± 1) °C. Then the vegetables were crushed into fine powder using a porcelain mortar and pestle. The resulting powder was kept in air tight polythene packet at room temperature until further analysis.

2.3. Nutritional analysis of wild vegetables

The nutritional composition of the powdered vegetable sample was analyzed as follows in our laboratory following the standard food analysis methods described in the Association of Official Analytical Chemists (AOAC) [17].

2.3.1. Determination of moisture content

Moisture content was determined by oven-dry method as the loss in weight due to evaporation from sample at a temperature of (100 ± 2) °C. The weight loss in each case represented the amount of moisture present in the sample.

$$\text{Moisture}(\%) = [(\text{Weight of original sample} - \text{Weight of dried sample}) / \text{Weight of original sample}] \times 100$$

2.3.2. Determination of crude protein

The crude protein content was determined following the micro Kjeldahl method [17]. Percentage of nitrogen (N) was calculated using the following equation.

$$\text{Nitrogen}\ (\%) = [(S - B) \times N \times 0.014 \times D \times 100] / (\text{Weight of sample} \times V)$$

where, D is Dilution factor, T is Titration value = (S–B), W is weight of sample, 0.014 is the constant value. Crude protein was obtained by multiplying the corresponding total nitrogen content by a conventional factor of 6.25. Thus crude protein (%) = % of N × 6.25.

2.3.3. Determination of crude fat

Crude fat was determined by the Soxhlet extraction technique followed by AOAC [17]. The fat content of the dried samples can easily extract into organic solvent

Table 1
Edible wild vegetable used in the study.

Local name	Botanical name	Family	Parts used
Dhekishak	*Dryopteris filix-mas*	Polypodiaceae	Stems and leaves
Helencha	*Enhydra fluctuans*	Compositeae	Leaves, young plant parts
Kalmishak	*Ipomoea aquatica*	Malvaceae	Leaves and tender stems
Patshak	*Corchorus capsularis*	Convolvulaceae	Leaves and tender stems
Shapla	*Nymphaea stellata*	Nymphaceae	Stems