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Comparative Evaluation of Nutritive Value of Some Fruits Available in North-East India

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North East India is endowed with affluent genetic diversity of plant sources. The present work is undertaken to investigate the nutritive value of some common and less common fruits available in North-East India. Nutrition value of five fruits namely *Malus domestica* (apple), *Pyrus communis* (pear), *Emblica officinalis* (Indian goose berry), *Docynia indica* (crab apple), *Rhus semialata* (Chinese gall) were evaluated. Results showed that Chinese gall has highest nutrition value (446 cal/100g) followed by Indian goose berry, pear, crab apple and apple. Chinese gall and crab apple usually uncommon and only confined to the remote and rural areas of North East region of India. The study concluded that the fruits like Chinese galls, crab apple are the very rich source of nutrition and these fruits can be the alternative of costly fruits like apple, pear available in market to meet the nutritional demand of individual in lower socio-economic region. Cultivation of such fruits also could beneficial for economic growth of individual and region.

Keywords: *Malus domestica*, *Pyrus communis*, *Emblica officinalis, Docynia indica*, *Rhus semialata*, Nutritive value

Introduction

Human health is maintained by the complex interaction of multiple functional, exogenous components like nutritional status, environment, socio-economic condition, genetic variation, presence of diseases, lifestyle, etc. Nutrition is considered as a backbone of human life, development and good health across the whole life span (World Health Organization, 2006). Intake of fruits and vegetables is always beneficial for human health. Fruits and vegetables play a significant role in human nutrition. Fruits are the rich source of vitamins, minerals, antioxidants, trace elements, fibres, etc. Number of researches have shown that consumption of fruits and vegetables may defend human health is an intriguing way. Fruits and vegetables in the

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daily diet have been strongly connected with reduced risk for several diseases like cancer, diabetes, cardiovascular diseases, and other chronic diseases (Kalt, 2002).

Unfavourable socio-economic conditions of individuals are also linked with malnutrition and less healthy dietary habits. This leads to the increased prevalence of diet-related chronic diseases and obesity. Consumption of fruits is usually less in individuals with a lower socio-economic status. Individual with lower income and education have less healthy dietary habits, partly due to their concern for price and familiarity (Konttinen et al., 2013). Our surroundings and forests are the rich source of number of fruits and vegetable which are not popular and not investigated thoroughly till now, but may have great therapeutic/nutritive value. Investigation on those fruits and vegetables could be helpful to popularise them in view of their therapeutic/nutritive importance. This present work is aimed to investigate the nutritive value of some common and uncommon fruits available in North-East India.

Material and Methods

Plant Material

Five fruits of plants namely *Malus domestica* (apple), *Pyrus communis* (pear), *Emblica officinalis* (Indian goose berry)*, Docynia indica* (crab apple), *Rhus semialata* (Chinese gall) were selected in this study. The details of these fruits are given in Table 1. *Malus domestica*, *Pyrus communis* were obtained from the local market of Guwahati, India. Ripe fruits of *Emblica officinalis, Docynia indica*, *Docynia indica* obtained from the different villages of North East India.

Processing of fruits

The fruits were collected and cleaned to remove unwanted material. The fruits were cut into pieces and allowed to dry in room temperature for 4-5 weeks in shed. The dried fruits were grind into fine powder, which were used to determine the nutritive value. Ash content, moisture content, crude fat, carbohydrate and protein value were estimated.

Determination of ash content

Five gram of each powder sample was taken in a pre-weighed silica crucible and dried completely in an oven for an hour at 100ºC. The crucible was heated on low temperature till the sample was charred completely and then heated in a muffle furnace at 600ºC until white or gray ash is obtained with constant weight. The content was cooled in a desiccator and then content was weighed again. The ash content is the weight of the ash determined. The percentage ash content is calculated using the following formula (Kashif & Ullah, 2013),

Ash (%) = [Weight of the ashed sample (g) / Weight of the sample taken (g)] x 100

Table 1. Description of fruits used in the present study

Biological Source	Common Name	Description	Medicinal Importance
Malus domestica (Family: Rosasae)	Apple (E)	In grows in different parts of the world like China, Europe, some part of India like Jammu & Kashmir, Himachal. In some parts of North East India apple cultivated but in lower level. The cost of apple is usually high.	Intake of apple can reduce the risk of some cardiovascular disease, cancers, asthma, and metabolic diseases. Apple is the rich source of antioxidant and vitamins (Boyer & Liu, 2004).
Pyrus communis (Family: Rosasae)	Peer (E), Naspati (H)	Peer mainly grows in Europe, Northern Africa, West Asia (Punjab, Himachal Pradesh, Kasmir), China, Iran, Japan and Central Asia. The cost of pear in the market of North East India is usually high.	It is a good source of many nutrients and phytochemicals, including fiber, potassium, vitamin C and antioxidants. Consumption of peer could be useful to avert cardiovascular disease, cancer and to promote gut heath. Experimental studies suggested the possible benefit of peer in regulation alcohol metabolism, ulcers, and maintain lipid profile (Reiland & Slavin, 2015).
Emblica officinalis (Family: Euphorbiaceae)	Indian goose berry (E), Amla (H), Amalaki (B / A)	Amla is available throughout India. It grows in tropical and subtropical parts of Ceylon, Burma, Malay Peninsula and China. It usually grows in North East part of India and commonly available in market in relatively low cost.	Amla is used in Ayurveda and other traditional medicinal system of India including folk medicine. It is rich source of biomolecules, nutrients, minerals. Potential role of amla in cancer, diabetes, liver diseases, cardiovascular diseases, ulcer, anaemia, cytoprotection, caugh and GIT diseases has been investigated (Khan, 2009).
Docynia indica (Family: Rosaceae)	Crab apple (E), Sohphoh (K), Heitoop (M)	The plant found in Eastern Himalayan region, Nepal, Bhutan, China and different states of India including North East region. The fruits are consumed by local people.	Very limited work carried out using the plant. Few experimental studies suggested that fruits of the plant is effective in obesity and reduce body weight. The fruits also exhibited antibacterial activity (Loan et al, 2011; Sharma, 2013)].
Rhus semialata (Family: Anacardiaceae)	Chinese gall (E), Sohma (K), Omoshi (M)	The plant grows Assam, Meghalaya, Nagaland, Sikkim, Darjeeling of India. The plant is also found in China, Japan. The fruits are consumed by local people.	Less number of investigations has been carried out using the plant. Laboratory experiment showed that fruits of the plant have antidiarrhoeal and antimicrobial activity (Sharma, 2013; Bose et al., 2008).

E, English; H, Hindi; B, Bengali; K, Khasi; M, Manipuri; A, Assamese.

Determination of moisture content

Two gram of powdered fruit material was taken in pre-weighed flat bottom dish and kept in a hot air oven overnight at 100-110ºC, so that the sample was completely dried. Sample was cooled in a desiccator and weighed again. The moisture content (%) was determined using the following formula (Krishnamurthy & Sarala, 2012),

Moisture (%) = $[(W_S - W_{DS})/ W_S] \times 100$

W_s - Weight of the sample taken; W_{DS} - Weight of the dried sample.

Estimation of crude fat

Two gram sample (dried moisture free powder) was extracted with n-hexane (80 ml) in Soxhlet extractor. The extraction was continued for 8 hours, solvent was evaporated from round bottom flask and weight of round bottom flask with extract was determined. The crude fat content (%) was calculated using the following formula (Kashif & Ullah, 2013),

Fat (%) = $[(W_{RBE} – W_{RB})/ W_S] \times 100$

W_{RBE} - Weight of the round bottom flask with extract; W_{RB} - Weight of empty round bottom flask; W_S- Weight of sample taken.

Determination of crude protein

The crude protein was estimated using micro Kjeldahl method (Shahnawaz et al., 2009). Two gram sample was mixed with 30 ml concentrated sulfuric acid in a Kjeldahl flask followed by the addition of potassium sulphate (10 g) and copper sulphate (1 g). The mixture was heated gently and then strongly at the end of frothing. The mixture was heated for another hour once the solution became colorless or clear. The solution was cooled and diluted with distilled water. The mixture was transferred in 800 ml Kjeldahl flask, few pieces of zinc (granulated) and 40% caustic soda (100 ml) was added. The flask was joined with the splash heads of the distillation apparatus. In next step, of 0.1 N sulphuric acid (25 ml) was taken in the receiving flask and distilled. The completion of the reaction was checked after two-thirds of the distillation of liquid. The flask was disconnected and titrated against 0.1 N caustic soda solution for estimation of Kjeldahl nitrogen, methyl red was used as indicator. This in turn gave the protein content. Nitrogen was determined using the formula,

N (%) = [{1.4(V2-V1) x Normality of HCl}/Ws] x 250

Ws – Weight of the sample.

The protein content was determined by conversion of nitrogen percentage to protein,

Protein (%) = N% x Conversion factor (6.25)

Determination of carbohydrate content

The percentage of carbohydrate content was calculated by the following formula (Krishnamurthy & Sarala, 2012),

Carbohydrate (%) = 100 – (% moisture + % protein + % fat + % ash)

Calculation of nutritive value

At the end of all estimation the nutritive value of each fruit was calculated by following formula (Krishnamurthy & Sarala, 2012),

Nutritive Value = (4 x protein %) + (9 x fat %) + (4 x carbohydrate %)

Results and Discussion

Ash value, moisture content, fat content, protein content and carbohydrate content of the different fruits were estimated. The results are tabulated in Table 2. Result showed that apple contains high percentage ash value (19%) and Indian goose berry has minimum percentage of ash value (4.6%). Among the five fruits pear has high percentage of moisture content (20.5%) followed by apple (16%). The present work shows that Chinese gall contain 18% of crude fat and 1.00 % of crude protein which is highest among all fruits. Carbohydrate content of the fruits was also determined and found that gooseberry contains the highest percentage of carbohydrate (82.5%) followed by chinese gall (70.1%). Nutritive value of each fruit was calculated using specific formula and result showed that chinese gall (*R. semiliate*) has highest nutrition value (446 cal/100g) followed by Indian goose berry (*E. officinalis*), pear (*P. communis*), crab apple (*D. indica*) and apple (*M. domestica*).

Human needs a number of macro and micro-nutrients. Macronutrients like carbohydrate, protein, fat or lipid, and micronutrients such as vitamins, minerals, water and fiber are essential for normal growth and well-being. Obviously, our food is mainly obtained from plant and animal sources. Fruits are major component of diet and considered as key source of important nutritional composition. Consumption of fruits and vegetables has long been associated with number of health benefits (Kalt, 2002; Shahnawaz et al., 2009; Asha et al., 2013). Interest in nutritional value of fruits has been increasing as recent findings suggested the association of number of diseases with lack of consumption of fruits. Frequent intake of fruits is associated with lower risk of cancer, cardiovascular diseases, obesity and other chronic diseases (Kalt, 2002). Variation in nutrient content is vital as it can affect the health. In market, different fruits are available such as apple, pear which are regarded as very good for health, but high cost of such fruits are considered as a major hindarance in the consumption of such fruits by the people in lower socio-economic group. Nutritional value determination is only one of the parameter to screen the overall health benefit of the fruits. Thus detail study is needed to find the other effect/composition of fruits, but evaluation of nutritional value will give an idea about the potential health benefit of fruits. In present study it was observed that amla has good nutritional value. The plant is also readily available in this region and the fruits are recognised for their medicinal value since ancient time. Thus commercial cultivation of the plant and promotion of such fruits readily in market could be useful. North-east India is a gold mine of plant species. A number of indigenous and folk plants and their fruits are unknown or little known to the outer world. Lack of awareness of their potential,

market demand is another problem in promotion of such fruits (Verma et al., 2012). Chinese gall and crab apple are two fruits which are not available usually in market. Although, our study showed that chinese gall has better nutritional value compared to other fruits included in this investigation like apple, pear, etc. Crab apple also has good nutritional value. Thus promotion of such fruits which are restricted in some areas of North-East India could be useful to meet nutritional demand of people with lower socio-economic class and scientific promotion, cultivation and utilisation of such fruits could be helpful for economic improvement of the people and India's North East region.

Conclusion

The present study concluded that fruits like chinese galls, crab apple are rich source of nutrition. These fruits can be an alternative of costly fruits available in market to meet the nutritional demand of individuals, particularly from lower socio-economic conditions. The cultivation of such fruits will also be beneficial for economic purpose.

Table 2. Nutritional value of different fruits

Fruit	Ash content (%)	Moisture content (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Nutritive value (cal/100g)
Malus domestica (Apple)	19.0	8.0	2.0	0.67	62.33	270.0
Pyrus communis (Pear)	12.8	14.5	5.0	0.55	67.15	315.8
Emblica officinalis (Indian goose berry)	12.0	20.5	9.0	0.60	57.90	315.0
Docynia indica (Crab apple)	5.4	5.5	18.0	1.00	70.10	446.0
Rhus semialata (Chinese galls)	4.6	8.0	3.0	1.90	82.50	364.6

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