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Physiochemical study of some perennial fruits and vegetables available in local market of Bangladesh

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Abstract

Fruits and vegetables are generally valued for their rich content of vitamins and minerals. The chemical composition such as moisture, ash and total vitamin C content of five vegetables (potato, pumpkin, carrot, green papaya, bitter gourd) and five fruits (mango, lemon, cucumber, pineapple, tomato) were examined methodically in this investigation. The investigation is performed by gravimetric and thermo-gravimetric methods which occurred by using oven, muffle furnace and titrating instrumentation. The result indicated that moisture content varied from 75.33% to 95.80%, ash content varied from 0.19% to 1.21% and vitamin C content varied from 9.1 mg/ml to 55.66 mg/ml in the selected samples. These outcomes conclusively hint that moisture content is highly presented in tomato, ash content is high in mango and vitamin C is high in lemon. Moisture content is used for the quality factor of some products like jams and jelly sugar crystallization and food packaging. Ash content measures the minerals in the food and minerals are very essential elements for the body. Vitamin C is the master of extraction and determination of ascorbic acid in food products and it's a complete deficiency that results in scurvy.

Keywords: Perennial vegetables and Fruits; Moisture; Ash content; Vitamin C; Gravimetric method

1. Introduction

Vegetables and fruits provide colour, flavour and nutrients to our diets. They are more often most attractive and health-promoting when used as fresh. A large number of perennial vegetables and fruits were grown in Bangladesh have a high nutritional value and play an important role in human well-being [1] and also enriched in antioxidant, vitamins, minerals and dietary diversification [2]. The regular consumption of sufficient amount of vegetables and fruits could help to prevent crucial long-term diseases. Vegetables and fruit are important source of natural antioxidants which provide safety against various types of diseases and other health reimbursement [3]. High consumption of vegetables and fruits lessened the threat of chronic degenerative diseases is well recognized [4-7]. Vegetables and fruits are adored for their contents of vitamins, minerals, dietary fiber, and bioactive compounds. Vitamins are very important for the control of body chemical reactions. Vitamin C is a highly efficient antioxidant is essential for the production of collagen and neurotransmitter, norepinephrine which affects mood. Recent research also suggests that vitamin C is involved in the metabolism of cholesterol to bile acids, which may have implications for blood cholesterol levels and the incidence of gallstones [8]. Moreover, new cultivars of vegetables and fruits with high-yielding characteristics are constantly poured into the agriculture system of the country with no or negligible information on their nutrient composition. This is a concern of the food and nutrition profession personnel working on the improvement of the nutrition status of our population. This work was aimed to screen a number of selected fruits and vegetables consumed in the local diet in Bangladesh with respect to their proximate composition and vitamin C content.

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2. Materials and methods

2.1. Sample collection

Fresh samples of five vegetables, namely, Potato (*Solanum tuberosum*), Pumpkin (*Cucurbita pepo*), Carrot (*Daucus carota*), Green Papaya (*Carica papaya*) and Bitter gourd (*Momordica charantia*) and five fruits include Cucumber (*Cucumis sativus*), Lemon (*Citrus limon*), Mango (*Mangifera indica*), Pineapple (*Ananas comosus*) and Tomato (*Solanum lycopersicum*) were purchased from local market in Kushtia, Bangladesh.

2.2. Sample preparation

All the samples were washed properly with tap water to remove any soil and other dust particles, rinsed with deionized water and dried under shade to avoid direct contact with the sun.

2.3. Proximate Composition

2.3.1. Moisture Content

1.0 g of each of the samples was accurately weighed in an already weighed cleaned and dried porcelain crucible. The crucible was allowed in an oven at 100-105 °C for 6-12 hours until a constant weight was obtained. The crucible was then placed in a desiccator for 30 minutes to cool. After cooling, the crucible was weighed again [9].

$$\text{Moisture content (\%)} = \frac{W1 - W2}{W3} \times 100$$

Where,
W1 = Initial weight of sample before drying,
W2 = final weight of sample after drying,
W3 = weight of the sample.

2.3.2. Ash Content

An empty, cleaned and dried porcelain crucible was placed in a muffle furnace at 600 °C for an hour, cooled in a desiccator and weighed. 1.0 g of the sample was measured in the crucible. The crucible and its content were placed in a muffle furnace at 550 °C for 2-4 hours. The appearance of gray white ash indicated the complete oxidation of all organic matter in the sample. After the formation of the ash, the crucible together with the ash was cooled in a desiccator and weighed [9].

$$\text{Ash (\%)} = \frac{W1 - W2}{W3} \times 100$$

Where,
W1= Weight of empty crucible,
W2 = Weight of crucible + ash,
W3 = Weight of the sample.

2.3.3. Determination of Vitamin C

The content of vitamin C in different samples was determined by iodometric titration method [10]. Ascorbic acid reacts with iodine solution to form dehydroascorbic acid and iodide ions (I^-). At the end point of titration, the color of indicator (starch) charges from colorless to dark blue. Titration was repeated with further aliquots of sample solution until concordant results (titers agreeing within 0.1 ml) were obtained.

3. Results and discussion

3.1. Moisture Content

The graphical presentation of percentage of moisture content of different samples is given in bar diagram of Figure 1. The figure shows the moisture content per gram of prepared sample in the decreasing order from tomato to potato indicating greatest amount of water in tomato (95.80%) and lowest amount in potato (75.33%). Moisture content of any food is an index of its water activity and is used as a measure of stability and susceptibility to microbial

contamination [11]. The high moisture content in vegetables makes them vulnerable to microbial attack, hence spoilage [12]. This high moisture content also implies that dehydration would increase the relative concentrations of other food nutrient and therefore improve the shelf-life and preservation of the fruits [13]. There is also need to store the fruit in cool condition if they are to be kept for a long period without spoilage especially in the tropics were wastage of vegetable crops is estimated to be around 50% due to high moisture content [12]. The average moisture content holding capacities were found to be dependent on the nature of the plant and environment [14].

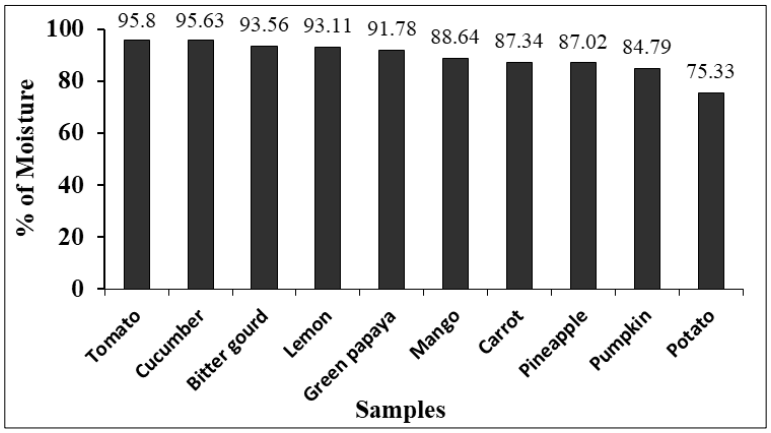

Figure 1 The Percentage of moisture content of different samples

3.2. Ash Content

Ash contain all the important nutritional ingredients especially minerals, both micro and macronutrients, which are very important for the normal physiological functions of the body [14]. Lienel [15] observed that ash content is an important tool in evaluating nutritional quality of food since and which also indicates the general mineral contents of foods. The ash content of the different samples ranged from 0.19% to 1.21% per gram of sample is shown in Figure 2, which indicated the amount of micronutrient composition in the samples.

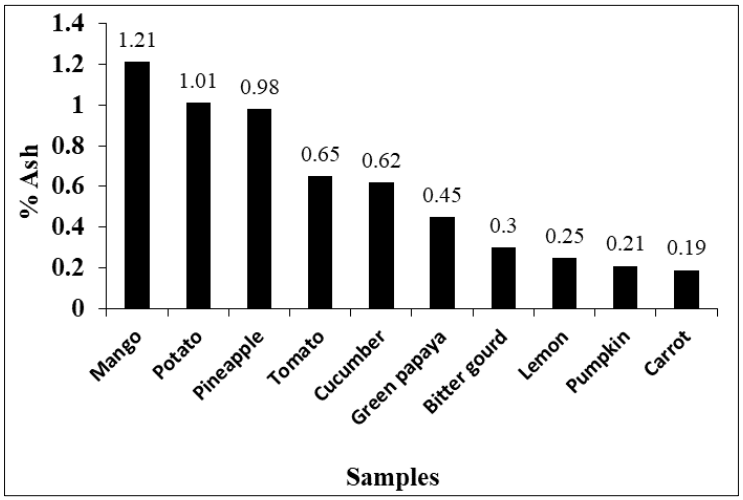

Figure 2 The Percentage of ash content of different samples

3.3. Vitamin C content

Vitamin C is defined as the generic term for all compounds exhibiting the biological activity of L-Ascorbic Acid. Vitamin C is the most important vitamin in fruits and vegetables. Vitamin C or L-ascorbic acid, or simply ascorbate (the anion of ascorbic acid), is an essential nutrient for humans and certain other animal species [16]. The ascorbic acid content of the fruits and vegetables were determined by titrimetric analysis and results are summarized in Figure 3. Results presented in Figure 3 indicates that the highest content of vitamin C to be present in lemon (55.66 mg/ml), and lowest in the case of potato (9.1 mg/ml). It is also observed that mango, cucumber and tomato showed almost similar vitamin C content among the fruits. In the case of vegetables, carrot, green papaya and bitter gourd showed almost similar

vitamin C content. Based on the above findings it can be suggested that one can select a particular fruit or vegetable for the daily requirement of vitamin C depending upon the availability in market and upon the age group of an individual. The recommended daily requirement for vitamin C according to FAO [17] is between 45.83 mg/day to 68.50 mg/day for both male and female adults between the ages of 19 to 65 years.

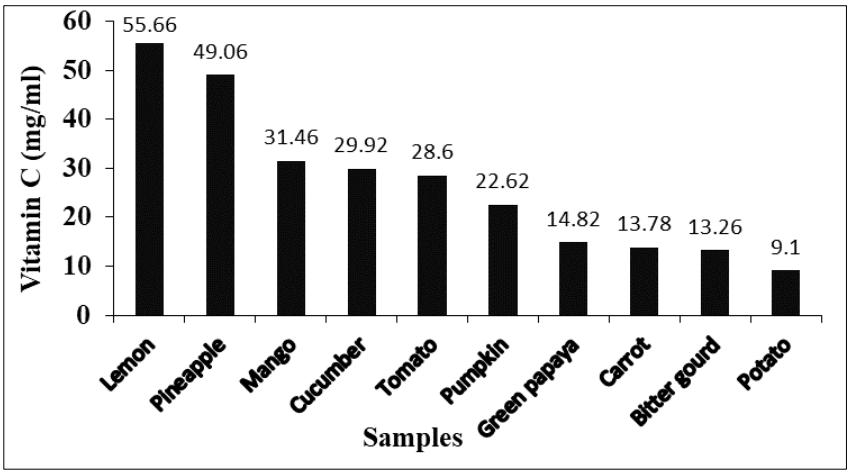

Figure 3 The vitamin C content of different samples

4. Conclusion

Present study indicates that available vegetables and fruits of Bangladesh are affluent sources of proximate nutrients and as well as water soluble vitamins. This study will help the people to maintain their dietary requirements of nutrients through consumption of available vegetables and fruits. Regular intake of vegetables and fruits may alleviate the prevalence of nutrient deficiency problem from Bangladesh and this information will enrich the food composition database for Bangladesh which is essential for health, nutrition and food policy program planning.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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