Varietal differences in proximate composition of selected commonly consumed vegetables of Bangladesh

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Abstract

Vegetables are considered as protective food due to their diverse nutrient content and wide range of health benefits they exert. Being plant origin, nutrient composition of vegetables depends on botanic and cultivar's origin, geographical area, climate and others. Present study was carried out to estimate the proximate composition of 17 varieties of commonly consumed vegetables: Sweet Pumpkin, Radish, Tomato, Brinjal and Bottie gourd. All samples were collected from the research field of Bangladesh Agricultural Research Institute (BARI), which is involved in development of new varieties through a standard cultivation system. The moisture, protein, fat, TDF, ash and carbohydrate content were estimated. The moisture content in selected samples ranges from 86.86% (Brinjal: Begun-3) to 96.74% (Radish: Mula-3), protein from 0.45% (Tomato-14) to 1.73 (Brinjal: Begun-10, Begun-6), fat from 0.02% (Radish: Mula-2) to 0.62% (Brinjal: Begun-3), ash from 0.39% (Sweet pumpkin: Mishtikumra-1) to 8.14% (Tomato-14), TDF from 0.22% (Bottle gourd: Lau-2) to 4.31% (Brinjal: Begun-Uttara), available carbohydrate from 0.75% (Brinjal: Begun-3) to 7.67% (Radish: Mula-3) and energy from 9.98 Kcal/100g (Brinjal- Begun-3) to 46.26 Kcal (Radish: Mula-3). The differences in nutrient content among different varieties varied from around 4-37% for Sweet pumpkin, 3-44% for Radish, 2-74% for Tomato, 8-94% for Brinjal and 17-51% for Bottle gourd. The present findings indicate that nutrient composition differs to a large extent due to the variation in varieties which in fact allows people to choose desired variety while planning diet and also allows to link nutrition and agriculture sectors for better nutritional status of the population. However, further research work should be carried out on other nutrient content of such different species to reveal the complete nutritional profile in terms of variation.

Key words: Vegetables, Proximate composition, Varietal differences, Agriculture.

Introduction

Vegetables and fruits constitute a major part of balanced diet and exert wide range of health benefits. Epidemiological studies have shown that diets rich in vegetables and fruits significantly reduce the incidence of chronic diseases such as cancer and cardiovascular disease[1,2] and increasing their consumption is a practical approach for the prevention of chronic diseases[3]. Studies have confirmed the health benefits of higher consumption of fruits and vegetables; while low intake of fruits and vegetables has been estimated to cause about 19% of gastrointestinal cancer, 31% of ischemic heart disease and 11% of stroke[4]. The World Health Organization and Food and Agricultural Organization (2003) recommended the daily consumption of at least 400 g of fruits and vegetables for the prevention of heart disease, cancer, type-2 diabetes and obesity. The protective role of vegetables and fruits are thought as a result of nutrients present in their food matrix which define the quality of particular food.

In recent years, there has been a great deal of research on the proximate composition of commonly consumed vegetables in Bangladesh. Couples of research works have already been done with specific vegetables. But new high yielding varieties of vegetables have been developed by utilization of modern technology of different agricultural research institutes of Bangladesh. And it becomes necessary to determine and compare the nutritive values of these new varieties and recommend varieties with highest nutritive value for production, marketing and consumption. The present study made an attempt to estimate and compare the proximate value of commonly consumed fruits and vegetables of Bangladesh grown for Standard Cultivation Practice by BARI. The result of this study will provide valuable information and will enrich not only nutritional area but also agricultural and public

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health sector as well. No such study has been found to be conducted with this specific issue in Bangladesh.

Methods and materials

Selection, collection and preparation of samples: Seventeen latest varieties of five vegetables, viz., Sweet pumpkin, Radish, Tomato, Brinjal and Bottle gourd, cultivated in the research field of BARI by following standard cultivation practice were selected. In the middle of the harvesting seasons, samples were collected as fresh as possible and processed for laboratory analysis.

Preparation of Laboratory Sample: Food samples were subjected to standard laboratory processing methods to make homogenous. After removing portions of samples for the analysis of moisture and ash, rest were oven dried, grinded to powder, sieved to get even-sized particles and stored in air-tight cellophane zip lock bag followed by desiccation until analysis.

Analytical method (Proximate Analysis): AOAC International approved standard methods were employed as analytical methods for the determination of moisture, ash, protein and fiber content[5, 6]. Total fat was estimated by Soxhlet extraction process[7]. Available carbohydrate was determined by difference[8] and the energy was calculated by using the conversion factors of protein, fat, carbohydrate and dietary fiber[9,10]. Analysis for all parameters was performed with homogenate sample in triplicate.

Mean and Standard deviation for all proximate nutrients were calculated by using MS Excel, 2010. To find out differences between the values for each nutrient in varieties of analyzed vegetables lowest value was subtracted from highest. The difference was then expressed as percentage of the division by highest value.

Result and Discussion:

Proximate compositions of analyzed varieties of selected five vegetables are shown in Table 1. The present study demonstrates that the moisture content was generally high in samples with a range of 86.86% in Begun-3 (variety of Brinjal) to 97.19% in Mula-2 (variety of Radish). It is noticed that the water content varies slightly within the varieties (Figure1). The high moisture content of these vegetables lends great impact on energy density as water adds substantial weight to the food without adding energy. Hence, this group of foods provides consumers a better satiety without increasing their energy intake.

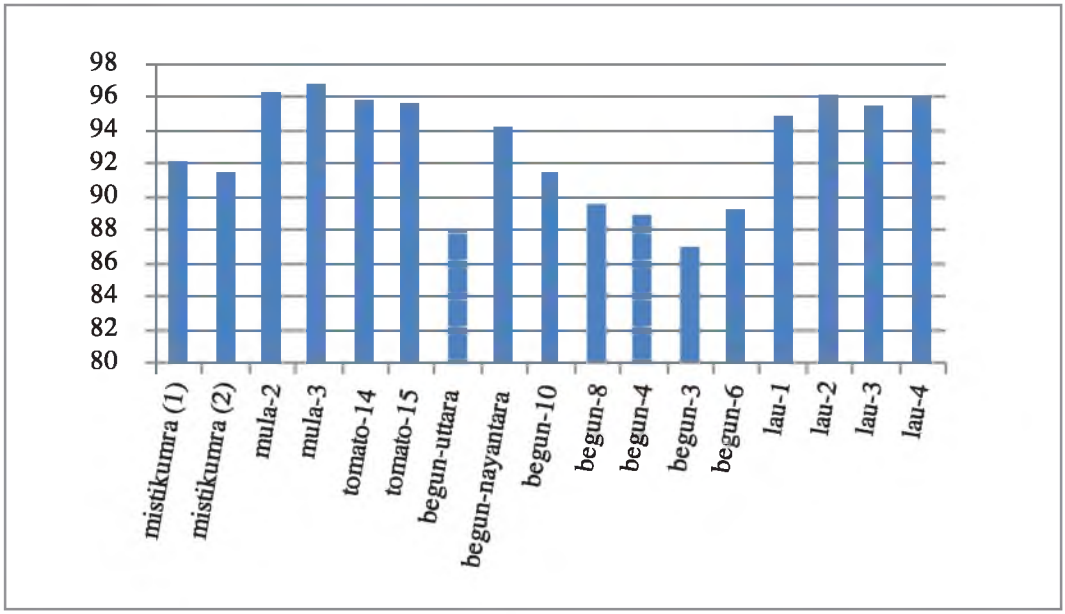

Figure 1: Moisture content (g/100g) in different varieties of vegetables.

Table 1: Proximate composition (Moisture, Protein, Fat, Ash and TDF) of selected varieties of vegetables

Sample	Variety	Moisture (g/100g)	Protein (g/100g)	Fat g/100g)	Ash (g/100g)	TDF (g/100g)	CHO (g/100g)	Energy (Kcal/100g)
Sweet	Misti kumra-1	91.98±0.18	1.51±0.10	0.01±0.00	0.39±0.05	0.99±0.00	5.05	29.06
pumpkin*	Misti kumra-2	91.35±0.17	1.42±0.02	0.10±0.00	0.61±0.05	0.89±0.00	5.63	30.872
Raddish*	Mula-2	97.19±0.21	1.21 ±0.01	0.02 ±0.00	0.46±0.03	0.77±0.00	1.35	11.99
	Mula-3	96.74±0.08	1.31±0.01	0.04±0.02	0.47±0.04	0.70±0.67	0.75	9.98
Tomato*	Tomato- 14	95.68±0.07	0.45±0.00	0.07±0.00	8.14±0.05	0.49±0.00	2.96	15.23
	Tomato- 15	95.65±0.16	1.71±0.01	0.12±0.00	7.36±0.03	0.50±0.00	1.71	15.70
Brinjal*	Begun uttara	87.94±0.13	1.81±0.01	0.17±0.00	0.63±0.03	4.31±0.01	5.14	37.95
	Begun- 10	91.46±0.48	1.73±0.00	0.20±0.00	0.87±0.19	3.56±0.00	2.18	24.56
	Begun-8	89.50±0.38	1.70±0.00	0.15±0.00	0.73±0.04	3.43±0.01	4.49	32.99
	Begun-4	88.84±0.08	1.66±0.01	0.43±0.00	0.73±0.21	3.33±0.01	5.02	32.21
	Begun-3	86.86±0.25	1.66±0.01	0.62 ±0.00	1.53±0.70	1.66±0.01	7.67	46.26
	Begun-6	89.15±0.09	1.73±0.01	0.32±0.00	0.89±0.04	1.73±0.01	6.19	38.02
Bottle	Lau-1	94.74±0.04	1.11±0.01	0.06±0.00	1.65±0.00	0.28±0.05	2.16	16.90
gourd*	Lau-2	96.00±0.09	1.21±0.01	0.04±0.00	0.82±0.00	0.22±0.02	1.72	13.74
	Lau-3	95.37±0.00	1.31±0.01	0.04±0.00	1.00±0.00	0.28±0.00	2.01	15.64
	Lau-4	95.97±0.26	1.34±0.01	0.07±0.00	0.83±0.00	0.23±0.03	1.58	13.92

*each value is expressed as mean± SD of triplicate analysis for each variety

**values are expressed as per 100 g fresh weight.

Generally protein and fat content of different vegetables is not greater than 3.5g/100g and 1 g/100 g respectively (potter 1976). The findings of study were found to be in compliance with the fact that the protein contents of analyzed samples were varied from 0.45g to 1.73g. Two varieties of Brinjal (Begun-10 and Begun-6) possessed the higher protein value whereas one of the Tomatos (Tomato-14) had the lowest. The overall fat content of selected vegetables was less than 1g per 100g Edible Portion that ranges from 0.01g (Misti kumra-1, variety of sweet pumpkin) to 0.62g (Begun-3, variety of Brinjal). The total dietary fiber varied from 0.22g to 4.31g. Lau-2 (variety of bottle gourd) contained the lowest and the Begun- Uttara (variety of Brinjal) possessed the highest TDF amount.

The available carbohydrate in samples ranged from 0.75g in Mula-3 to 7.67g in Begun-3 (variety of Brinjal). Calorie values, in present study, were found to have a wide range in different varieties. It was noticed that the Brinjal varieties contained relatively higher calorie value. The highest and lowest energy values were found in Begun-3 (46.26Kcal/100g) and Mula-3 (9.98Kcal/100g) respectively.

The contents of nutrients of selected vegetable samples, in present study, show wide-ranged variation within the varieties. Considering pumpkin, radish and tomato the percent variations, between two varieties of each vegetable, were around 6%, 8%, 74% for protein; 4%, 37%, 42% for fat; 9%, 10%, 2% for TDF and 10%, 44%, 42% for available carbohydrate (Figure 2, 3, 4).

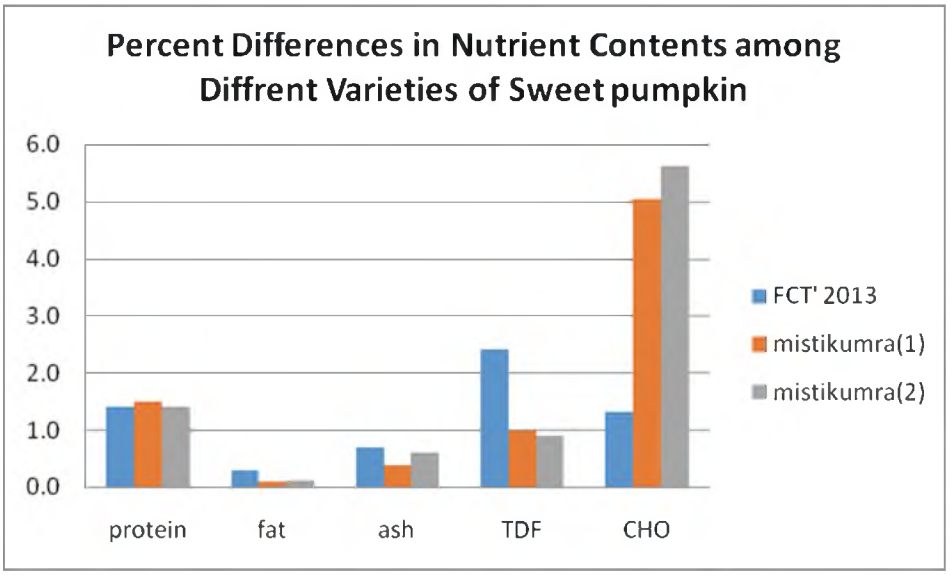

Figure 2: Varietal differences in proximate composition for Sweat pumpkin.

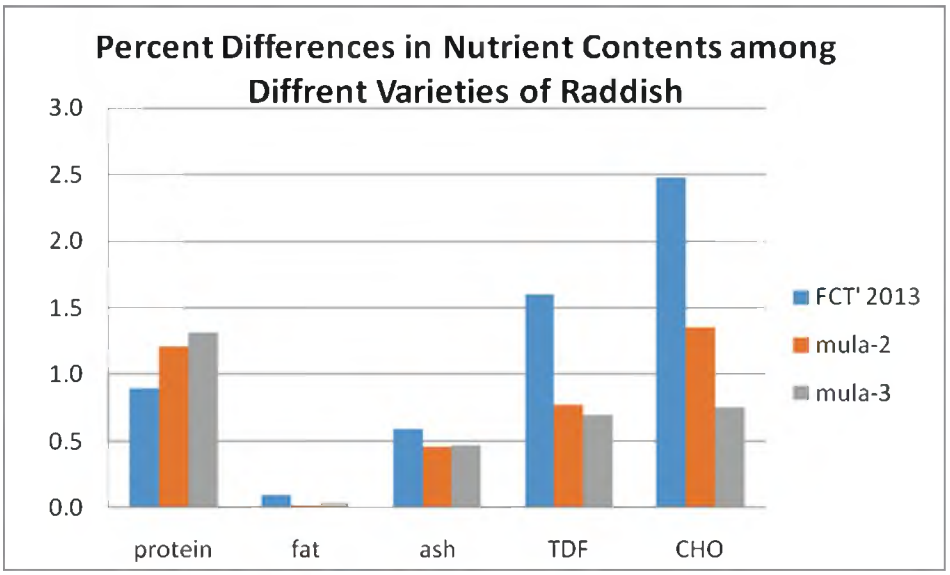

Figure 3: Varietal differences in proximate composition for Radish.

Additionally, seven varieties of brinjal differ extensively in terms of each analyzed nutrients with the highest in available CHO (94%), fat (87%), TDF (62%) in brinjal varieties (Figure 5). Moderate percent differences were observed among four varieties of bottle gourd with a range of 17% for protein to 51% for TDF (Figure 6). In this study one of the noticeable findings was the disparity between analyzed value and existing value in food composition Table 1 for proximate nutrient composition of each variety of five selected vegetables (Figure 2-6).

The present study reveals variation in the chemical compositions of vegetables that could be a result of different cultivation methods as well as environmental conditions. The values of current study may serve as a useful means for selecting appropriate food rich in particular nutrient to ensure balanced diet which will be in accordance with consumer's physical and clinical condition and also provide information to select variety for cultivation on the basis of nutrient composition as well as, yield and other production factors.

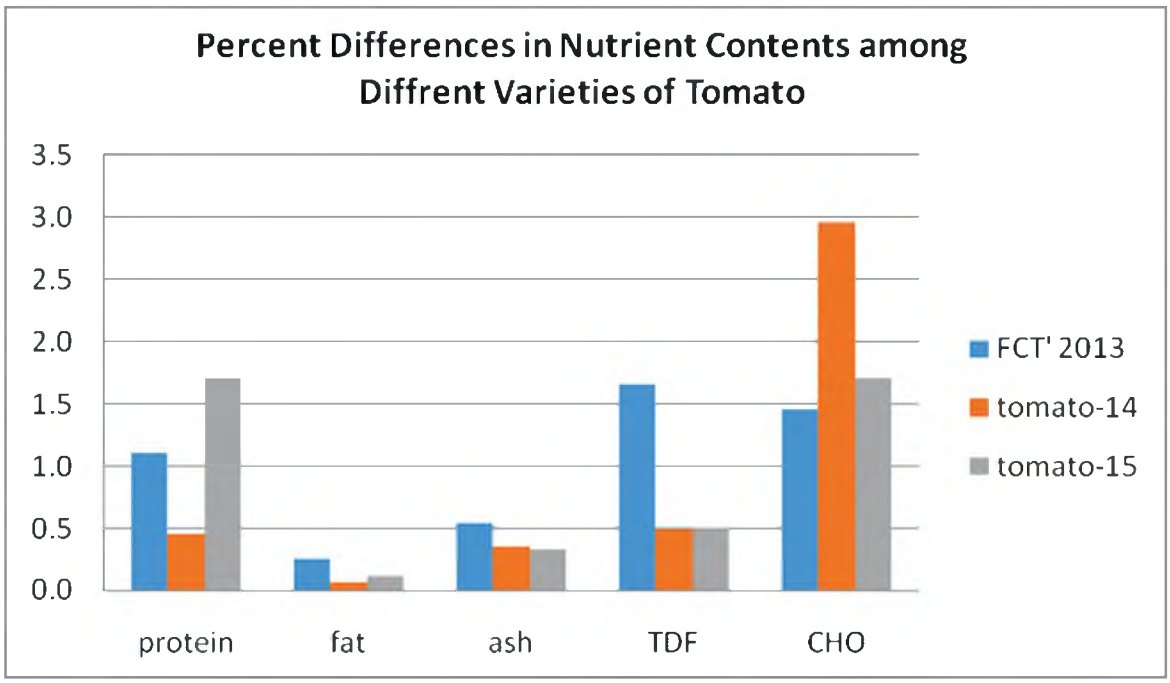

Figure 4: Varietal differences in proximate composition for Tomato.

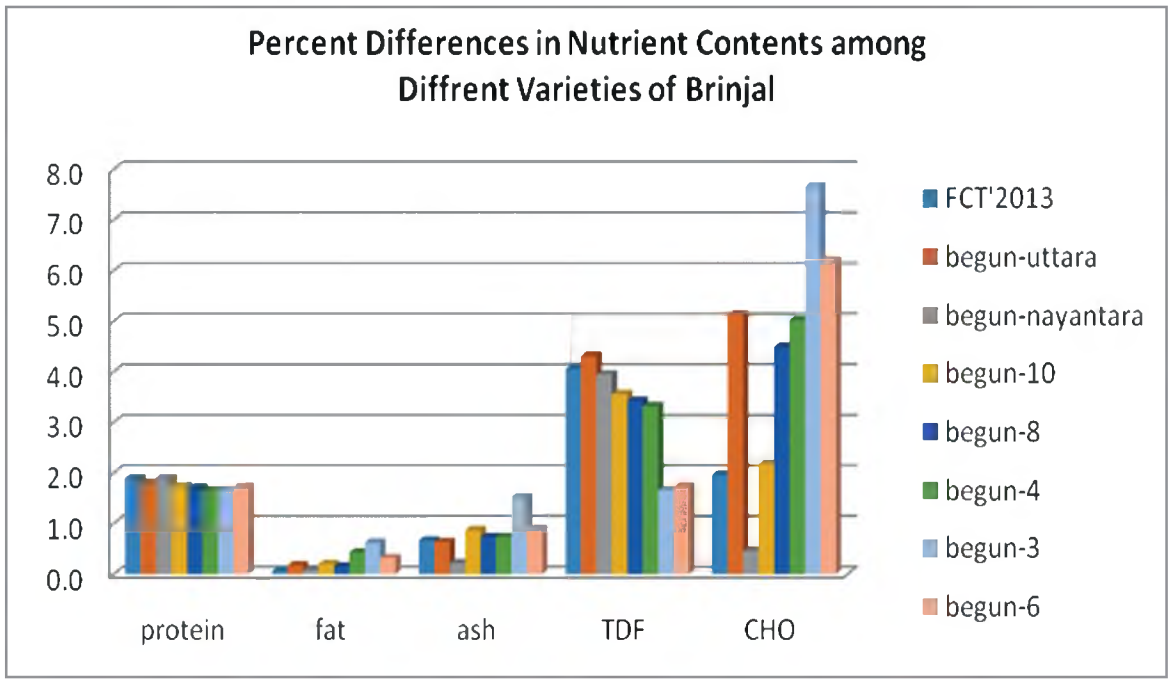

Figure 5: Varietal differences in proximate composition for Brinjal.

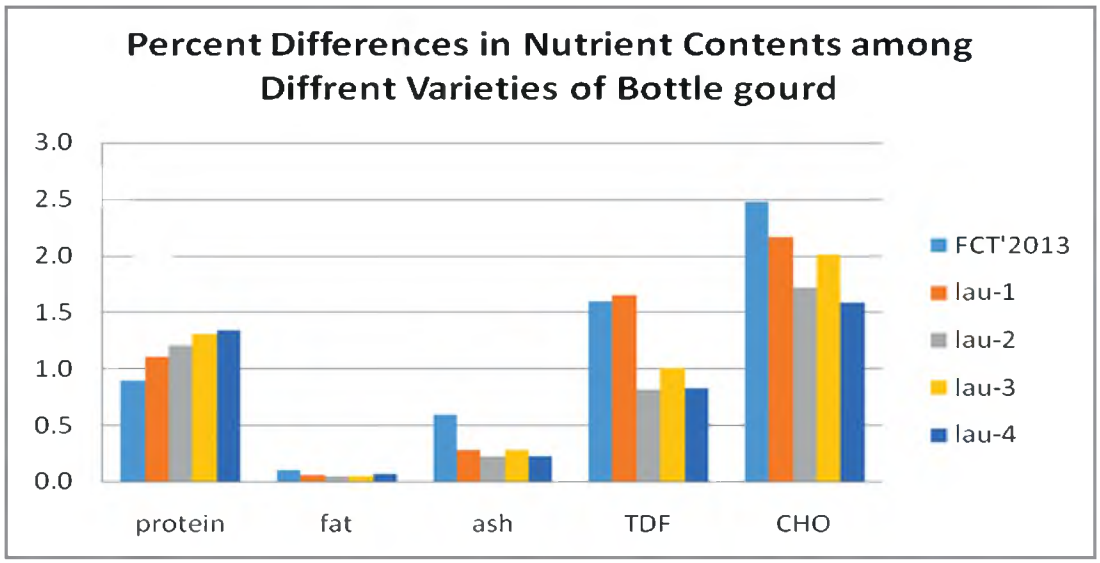

Figure 6: Varietal differences in proximate composition for Bottle gourd.

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