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DETERMINATION OF MORPHOLOGICAL AND PHYTOCHEMICAL COMPOSION OF DIFFERENT VEGETABLES

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ABSTRACT

The present study was determined the morphological and phytochemical compositions of four vegetables available in the south-western region of Bangladesh. The study was laid out in Completely Randomized Design (CRD). There was found a significant variation among the vegetables in relation to vegetative characteristics. The higher values were found from Pumpkin in respect of total weight (1355 g) and Broccoli (285 g) among the four selected vegetables. The highest length (27.93 cm) was observed in Yard long bean. The highest width (24.93 cm) was recorded in Pumpkin. The highest vitamin C (61.22 mg /100 g),flavonoid (5.50 g) and carotenoid (0.5988 mg /100 g) were recorded from Pumpkin. Thehighestanthocyanin (0.1135 mg /100 g) was found in Broccoli. The overall observation indicates that vegetables are rich in nutrients.

KEYWORDS: Vitamin-C, Carotenoid, Anthocyanin, Flavonoid,Completely Randomized Design

Phytochemicals are chemical compounds that occur naturally in plants (phyto means "plant" in Greek).There may be as many as 4,000 different phytochemicals (Linus Pauling Institute, 2014).Each color food has a different type of phytochemicals that helps your immune system function properly. Phytochemicals are naturally occurring chemicals produced by plants. They are biologically active and may affect your health, however, unlike vitamins and minerals, they're not considered to be essential nutrients(Rasooli I 2011).Foods containing phytochemicals are already part of our daily diet. Some foods, such as whole grains, vegetables, beans, fruits and herbs, contain many phytochemicals. The meaning of "vegetable" as a "plant grown for food" was not established until the 18th century(John 1993). Vegetable is important for nutritional, financial, and food security in Bangladesh.

The local name of Pumpkin is “Mistikumra” and scientific name is *Cucubrita maxima*.It is a popular summer to rainy season vegetable, good source of carbohydrate, vitamin A and C, and minerals. The bright orange color of pumpkin is a dead giveaway that pumpkin is loaded with an important antioxidant, beta-carotene. Pumpkins are, however, rather hardy, and even if many leaves and portions of the vine are removed or damaged, the plant can very quickly re-grow secondary vines to replace what was removed (Orzoleke*t al*, 2008).

The local name of yard long bean is borboti(Bangladesh), bora (West Indies), daugok (China), *Pole sitao* (Philippines), etc. and scientific name is *Vigna unguiculata*, sub. Sesquipedalis. The yard long pods are actually legumes belonging to the Fabaceae family. Fresh beans contain a good amount of vitamin C. Vitamin C is a powerful water-soluble antioxidant and when adequately provide in the diet, it helps build immunity against infections, help maintain blood vessel elasticity,and offer some protection from cancers.

The word broccoli comes from the Italian plural of broccolo, which means "the flowering crest of a cabbage. Broccoli is often boiled or steamed but may be eaten raw (Betty. 2013).Like other species of the *Brassica* family, broccoli is a rich source of health promoting phytochemicals (Bahorun *et al*, 2004 and Chun *et al*, 2005).Epidemiological studies have shown an inverse association between the consumption of Brassica vegetables and the risk of cancer (Day *et al*, 1994). This protective effect has largely been attributed to the complement of phytochemicals, in broccoli which include the vitamins C and E, the flavonolsquercetin and kaempferol, the carotenoids *b*-carotene and lutein, and the glucosinolates(Podse,2007).Broccoli contains vitamins B1, B2, B3, B6, iron, magnesium, potassium, and zinc too. It also provides fiber and is low in calories.

The scientific name of turnip is *Brassica rapa*. Based upon several dozen studies involving cruciferous

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vegetables as a group, cancer prevention appears to be a standout area for turnip greens when summarizing health benefits(Ambrosone and Tang, 2009).As an excellent source of vitamin C, vitamin E, beta-carotene, and manganese, turnip greens provide highest level support for four conventional antioxidant nutrients. But the antioxidant support provided by turnip greens extends far beyond these conventional nutrients and into the realm of phytonutrients. Like chronic oxidative stress and chronic weakened detox ability, chronic unwanted inflammation can significantly increase our risk of cancers and other chronic diseases (especially cardiovascular diseases) (Banerjee *et al*, 2009).

Bangladesh is one of the over populated country in the world where most of the people live below the poverty line. It is difficult to fulfill their nutritional demands. To meet the nutritional demand of the people of Bangladesh, vegetable crops can play a vital role as a source of vitamins, minerals and other nutrients. The climate of Bangladesh is suitable for vegetable crops production and it is cultivated widely (Azad, 1994).By determining the physical and chemical characteristics of these vegetables it can be possible to obtain its nutritive value and other characteristics. Such types of findings will be used to increase the production of it by inspiring the farmers and other concern people.

Experimental

The study on photochemical composition of vegetables was carried out during the period from December, 2015 to March, 2016. In the experimentfour types of vegetable were studied which collected randomly from south western region of Bangladesh. The experiment was laid out in Completely Randomized Design (CRD). After collecting the vegetables were kept in ambient temperature (25^0C) for the study of Morphological and phytochemical composition.

The vegetables weight was measured by an electric balance. Length and width of thevegetables were estimated to determine the vegetables size by a measuring tape from base to apex. The values of these parameters were taken in centimeter (*cm*). Width of the vegetable was measured by measuring tape in three places diagonally and their average value was taken.

The methods for the estimation of vitamin C, Carotenoids, Anthocyanin, Flavonoids, of vegetables pulp were followed as described by Saini *et al.* (2006). The data were analyzed by fresh weight basis.

Estimation of vitamin C content

50 mg of 2,6-dicholorophenol indophenol is weighted and taken in a beaker.42 mg sodium bicarbonate (Na_2HCO_3) is added to it. Itis then dissolved in little amount of distilled water and the volume is made up to 200 ml with distilled water. For standardized of dye solution 5 ml of standard ascorbic acid solution was taken in a clean beaker to which 5 ml of 3% meta phosphoric acid solution was added with the help of a pipette. This solution was titrated against the dye till a faint pink color was obtained which persisted for more than 15 seconds.A known amount of vegetablesflesh was weighed and blended it with equal weight of 3% meta phosphoric acid for 3 to 4 minutes. A known amount of this slurry was used in a 100 ml volumetric flask and volume was made by adding 3% meta phosphoric acid. This juice was filtrated through a fast filter paper (Whatman No. 42). After that the burette was filled with standardized 2, 6-dichlorophenol, indophenols dye reagent.10 cc of filtered solution was taken in a conical flask and titrated immediately against standard dye solution, till faint pink color was observed which persisted for not less than 15 seconds.

$$Vitamin - c\ (mg\ per\ 100gm) = \frac{e \times d \times b}{c \times a} \times 100$$

Where,a = Weight of sample, b = Volume made with Meta phosphoric acid, c = Volume of aliquot taken for estimation, d = Dye factor (0.5/average burette reading), e = Average burette reading for sample

Estimation of Carotenoids of Vegetables Pulp

A known amount of finely cut vegetablessample was weighed by an electric balance.Thevegetablessample was mixed well into a clean mortar.The tissue sample was grinded to a fine pulp with addition of 20 ml of 80 % acetone.It was centrifuged at 5000 rpm for 5 minutes and transferred the supernant to a 100ml of volumetric flask.The residue was grinded with 20ml of 80% acetone, centrifuged and transferred the supernant to the same flask. The procedure was repeated until the residue was colorless. The pestle and mortar were washed thoroughly with 80 % acetone and the clear washing was collected in the flask.The volume was made to 100 ml with 80% acetone.The absorbance was read at 510 nm and 480 nm against blank.

$$mg\ (carotenoids) \Big/ g\ (tissue)$$

$$= 7.6\ (A.480) - 1.49\ (A.510) \times \frac{V}{1000 \times 10}$$

Where, A= Absorbance of the specific wave length, V=Final volume of the Carotenoids in 80% acetone, W= Fresh weight of the tissue extracted

Estimation of Anthocyanin of Vegetables Pulp

Anthocyanin is extracted with ethanolic-hydrochloride and the intensity of the color appeared is measured calorimetrically. From the reading, the amount of the pigment present is determined.A known amount of tissue sample by weight was taken. This was extracted with ethanol hydrochloric acid mixture. It was allowed to stand overnight at a temperature of about 4°C. After extraction, the mixture was filtered through filter paper (Whatman No.1). The extraction was repeated for maximum recovery of the pigment.The extract was then made up to 15 ml with the solvent.15 ml of aliquot from the above extract was taken. It was filtered through fine (milli-pore) filter paper.The filtered aliquot was maintained in darkness for about 2 hours with cover of the container.This was then made up to 25 ml with the solvent (for color measurement). The optical density (O.D.) value of the solution was then measured through 535nm wavelength in a colorimeter against blank.

$$Total\ Absorbance\ value\ of\ the\ sample\ (per\ 100g) = \frac{e \times b \times c}{d \times a} \times 100$$

Where, a = Weight of sample, b = Volume made for color measurement, c = Total volume made, d = Volume of aliquot taken for estimation, e = Volume for 535 nm

Anthocyanine (mg/100g) = Total absorbance/98.2

Estimation of Flavonoids of Vegetables Pulp

10 g of sample was taken and crushed finely.100 ml of 80% methanol was added and kept it in a water bath for 10 hours at 40^0C.The whole solution was filtered through a filter paper.The filtrate was transferred to a crucible and then evaporated to dryness over a water bath at room temperature.The final finding was weighed as flavonoids.

Statistical Analysis

The collected data were statistically analyzed by Analysis of variance method. Duncan's Multiple Range Test (DMRT)was used to compare the means of different parameters and the means were calculated by using "MSTATC" program in computer.

RESULTS AND DISCUSSION

In the study four selected vegetables were studied to determine their Morphological and Phytochemical compositions (given below)

Vegetables Name			Area of collection
(In English)	(In Bangali)	(In Scientific)	
Pumpkin	Mistikumra	*Cucubrita maxima*	Gollamari bazar, Khulna, Bangladesh
Yard long Bean	Borboti	*Vigna unguiculata*	Gollamari bazar, Khulna, Bangladesh
Broccoli	Broccoli	*Brassica oleracea* var.	Moylapota bazar, Khulna, Bangladesh
Turnip	Salgom	*Brassica rapa*	Moylapota bazar, Khulna, Bangladesh

Data on Morphological characteristics of three vegetables are presented in (Table 1). The morphological characteristics of four vegetables are described based on quantitative characteristics in this study.

Morphological Compositions

The maximum weight was observed from Pumpkin while the minimum weight was in yard long bean. (Table1). Various length of vegetable occurred due to the variation of vegetable shape and size. Yard long

bean was the longest vegetable while the minimum length was observed in Turnip. (Table1). But, the broadest vegetable was found in Pumpkin followed by Broccoli while the narrowest was measured in Yard long bean followed by Turnip.

Table 1: Morphological characteristics of vegetables

Name of Vegetables	Weight (g)	Length (cm)	Width (cm)	Skin Color
Pumpkin	1355ab	20.68b	24.93a	Orange
Yard long Bean	16a	27.93b	0.65a	Deep Green/purple
Broccoli	285a	16.83a	11.17a	Green, violet
Turnip	235b	2.53a	3.7a	White with purple Ground
Average	472.7	16.99	10.11	
Level of Significance	Significance	Significance	Non-significance	
Coefficient of variation	8.81%	7.17 %	23.987%	

Phytochemical Compositions

The highest vitamin C was found in Pumpkin followed by Yard long bean.The lowest amount of ascorbic acid was observed from Turnip which was statistically similar to Broccoli (Table 2& Figure-1). For the carotenoids content of vegetable pulp, the maximum amount was found in Pumpkin while the minimum amount was observed in Turnip (Table 2& Figure-2). In case of flavonoid content, highest flavonoids observed in Pumpkin while the lowest found in Broccoli (Table 2& Figure-1). The highest amount of anthocyanin was observed from Broccoli but least amount of anthocyanin was from Turnip (Table 2& Figure-2).

Table 2: Chemical characteristics of four Vegetables

Name of Vegetables	Vitamin C(mg/100g)	Carotenoid (mg/100g)	Flavonoid (g)	Anthocyanin (mg/100g)
Pumpkin	61.22f	0.5988e	5.50c	0.0104a
Yard long bean	50.96a	0.0031a	0.16d	0.0145a
Broccoli	24.64a	0.0117a	0.22b	0.1135a
Turnip	19.55c	0.0045b	0.16a	0.0053a
Average	39.09	0.1545	1.51	0.0360
Level of Significance	Significance	Significance	Significance	Non-significance
Coefficient of variation	6.49%	17.97%	24.43%	23.32%

Note: In a column figures having similar letters do not differ significantly whereas figures having dissimilar letters differ significantly as per DMRT And S for significant & NS for Non-significant.

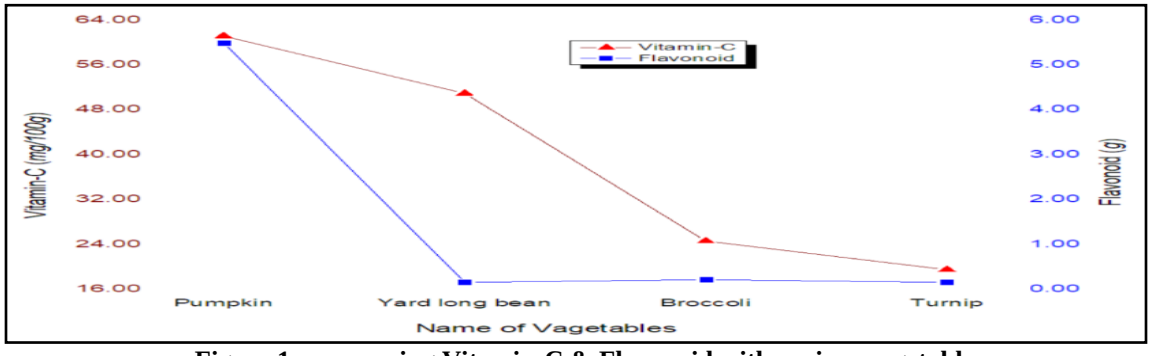

Figure 1: comparing Vitamin-C & Flavonoid with various vegetables

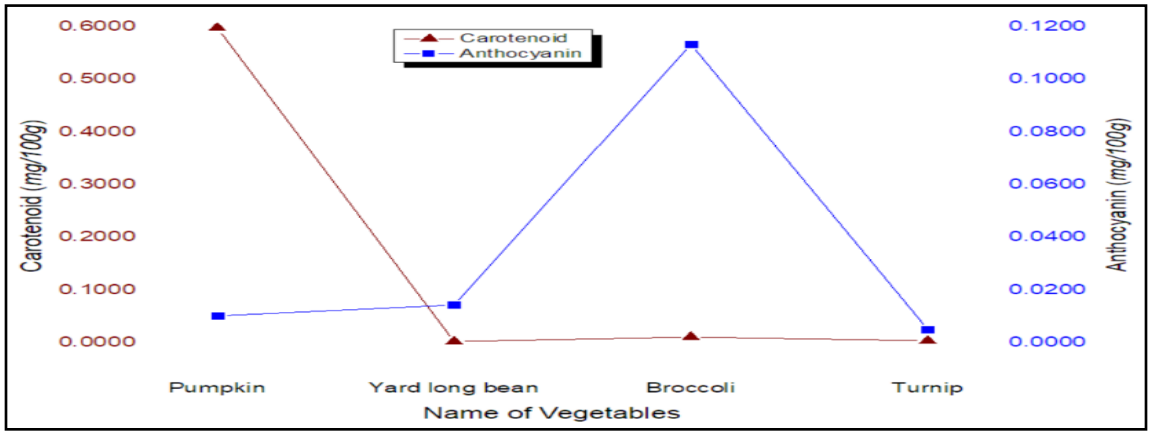

Figure 2: comparing Carotenoid& Anthocyanin with various vegetables

CONCLUSION

Physical characteristics of vegetables were determined under quantitative characters such as weight of fruit, length of fruit, and width of fruit. Chemical characteristics of selected vegetables were estimated based on some parameters that were vitamin C, carotenoid, anthocyanin, and flavonoid content of vegetables juice and pulp. From the findings of the present study it might be reasonably concluded that:

The better performance was found by Pumpkin in respect of total weight of vegetables among the four selected vegetables.On the basis width better performance was observed from Pumpkin and Broccoli. Yard long Bean was found better performance in consideration of the highest length.

It was observed from the data of chemical analysis of vegetables that Broccoli was found better performance in respect of highest value. On the basis of highest vitamin C and Flavonoids content was observed from Pumpkin. The better performance was recorded from Broccoli in respect of anthocyanin content. At the concluding point it can be said that the criteria for theselection of the vegetables may be weight, length, and width of the vegetable. Most of the physical characters were superior in Pumpkin. By considering chemical characteristics content of vegetable pulp of Broccoli and Pumpkin were mostly superior. Besides the characteristics which were experimented in this investigation some other characteristics such as reducing and non-reducing sugar, riboflavin, phenol content of the vegetable pulp of the above mentioned vegetables is needed for the selection, consumption as well as cultivation. Every vegetable content more or less Phyto-nutrients. So, the last point of the study it can be added that if the cultivation and formulation of vegetable is increased it will help to fulfill the estimated demands both on the nutrition and economy.

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